



Environmental and Social Impact Assessment

Manzanillo Energy Consortium Power Plant Project

ESIA - Final Version

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Consortium Manzanillo Energy



Manzanillo Energy Consortium Power Plant Project

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EXECUTIVE SUMMARY

The Environmental and Social Impact Assessment (ESIA) for the project "Manzanillo Energy Consortium Power Plant" also known as "Block 2 project", was commissioned by Manzanillo Energy Consortium Inc., which was awarded the development of this project and is integrated by the companies Coastal Petroleum Dominicana, S.A., Manzanillo Energy, S.A.S. and Lindsayca, Inc. The project will be located adjacent to the industrial facilities of the Port of Manzanillo, in the municipality of Pepillo Salcedo, Montecristi province, Dominican Republic. Manzanillo Energy Consortium Inc. is a commercial company organized in accordance with national laws, with National Taxpayer Registry (RCN) No. 1-32-80572-2 and Commercial Registry No. 1019MC, with its registered office located at Kilometer 2 of the Copey Highway, Super 8 by Wyndham Manzanillo Hotel, 1st level, municipality of Pepillo Salcedo, province of Montecristi, Dominican Republic, telephone (809) 735-0000 and (829) 331-6604. The company is represented by Mrs. Elianne García Peña with Identity and Electoral Card No. 402-2489125-5.

Manzanillo Energy Consortium, Inc. contracted the services of the multinational engineering and environmental firm AECOM to prepare the Environmental and Social Impact Assessment (ESIA) for the development of the power plant and transmission line, within the Environmental and Social Sustainability framework, incorporating the International Finance Corporation (IFC) Performance Standards, the Equator Principles, the World Bank's Environmental, Health, and Safety (EHS) Guidelines, and the guidelines specified in Annex II and III of the Organization for Economic Cooperation and Development (OECD).

At the national level, the ESIA for the "Manzanillo Energy Consortium Power Plant" project was submitted to the Ministry of the Environment and Natural Resources (MIMARENA) for evaluation in accordance with the Terms of Reference issued by communication identified as DEIA-2033-2023 on September 6, 2023.

This document was prepared in accordance with the guidelines established in the Performance Standards on Environmental and Social Sustainability of the Finance Corporation (IFC) and national and international standards and guidelines, such as: The Equator Principles, the World Bank's EHS guidelines, and the Organization for Economic Cooperation and Development (OECD) Annex II and III guidelines to ensure project compliance with those of the international agency that will finance the project.

Categorization

The Manzanillo Energy Consortium Power Plant project is classified nationally as **Category A** and therefore requires an environmental and social impact assessment based on MIMARENA's terms of reference. These terms of reference are given when the project to be developed is registered with MIMARENA, with the general description and permits from the municipalities.

Aligned with the standards of the Equator Principles, the International Finance Corporation (IFC), and the Organization for Economic Cooperation and Development (OECD), the **Category A** classification signifies that the project is anticipated to pose potentially significant adverse environmental and social risks and/or impacts. These impacts are characterized by their diversity, potential irreversibility, or their unlikely but consequential nature. Such a classification underscores the importance of conducting a detailed and thorough assessment process to identify, evaluate, and mitigate these potential risks and impacts. It reflects the project's complexity and the critical need for meticulous planning and robust management strategies to

address the environmental and social challenges it may present. This approach ensures that the project not only complies with national and international standards but also promotes sustainable development practices that minimize harm to the environment and local communities.

Applicable Legal Framework

The applicable national legal context is listed below:

- Constitution of the Dominican Republic.
- Organic Law of the National Development Strategy (Law 01-1).
- Penal Code of the Dominican Republic.
- Labor Code of the Dominican Republic (Law No. 16-92).

Environmental legislation in force in the Dominican Republic

- Law (64-00) General Law of Environment and Natural Resources.
- General Law of Integral Management and Co-processing of Solid Waste.
- Sector Law No. 202-04 on Protected Areas.
- Law (333/2015) Sectorial Law on Biodiversity.
- Law No. 318 of April 26, 1972, which creates the Museum of the Dominican Man.
- Law No. 564 of September 27, 1973, for the protection and conservation of National Ethnological and Archaeological objects.
- Law No. 41-00. Year 2000. Creates the Ministry of Culture of the Dominican Republic.
- Decree No. 571-09 that creates several national parks, natural monuments, biological reserves, scientific reserves, marine sanctuaries, wildlife refuges, Boca de Nigua national recreation area and the Alto de Jimenoa National Monument. It establishes a buffer or sustainable use zone of 300 m around all conservation units that have the generic categories of the World Conservation Union, provides for a national inventory of several wetlands, and creates a 250 m buffer zone around the reservoirs of all the country's dams.
- Decree No. 297-87 of June 3, 1987, declaring all caves, caverns, and other subway cavities as Natural Heritage.
- Decree No. 264-06 which declares of national interest the use of natural gas.
- Decree No. 3-24 of January 8, 2024, in its Article 1, declares of high national interest the promotion and development of traditional and renewable sources of electricity generation projects to be executed in the territory of the Dominican Republic to supply the growing demand of electricity and maintain the stability of the national electric service.
- IUCN Red List of Threatened Species, Bird Life International.
- List of Endangered, Threatened or Protected Species of the Dominican Republic (Red List).
- Red List of the Vascular Flora of the Dominican Republic.
- Environmental Standard on Groundwater Quality and Subsoil Discharges.
- Environmental Standard on Surface and Coastal Water Quality (NA-CASC-12).
- Environmental Technical Regulation on Control of Discharges to Surface Water, Sanitary Sewage, Coastal Waters and Reuse of Treated Wastewater (MA-VGA-RT-003-2023).
- Environmental Regulation for Noise Protection (NA-RU-001-03).
- Natural Gas Regulations.
- Environmental Standard for the Management of Non-Hazardous Solid Waste (NA-RS-001-03).
- Compendium of Regulations and Procedures for Environmental Authorizations in the Dominican Republic.

- Environmental Technical Regulations for Air Quality.
- Environmental Technical Regulations for the Control of Air Pollutant Emissions from Fixed Sources.
- Regulation for Archaeological Investigations, 2011.
- Regulation for the Integral Management of Used Oils.
- Regulation for Safety and Health at Work.
- Regulation for Safety and Fire Protection of the Dominican Republic R-032.
- Regulation and Procedure for Public Consultation in the Environmental Impact Assessment Process.
- Resolution No. 0010/2018, which provides the regulations for the management of the buffer zones of the conservation units of the national system of protected areas (SINAP) of the Dominican Republic.
- Resolution 02-2014 that incorporates the considerations of adaptation to the effects of climate change in environmental management from the Environmental Impact Assessment process.
- Guide for conducting Social Impact Assessments (SIA) within the Environmental Impact Assessment (EIA) process).

International conventions adopted by the Government of the Dominican Republic

- Convention on Wetlands (RAMSAR).
- Convention on the Protection of Biological Diversity.
- United Nations Framework Convention on Climate Change.
- Vienna Convention for the Protection of the Ozone Layer.
- Montreal Protocol on Substances that Deplete the Ozone Layer.
- World Cultural and Natural Heritage Convention.
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); approved by Resolution No. 550 of June 17, 1982.
- Basel Convention on Hazardous Wastes.
- The Convention for the Protection of the Flora, Fauna, and Natural Beauties of the countries of the Americas, included in national legislation through Resolution 662 of 1965.
- Fundamental Conventions of the International Labor Office (ILO).

International Regulations

- Equator Principles Guidelines (included in Equator Principles 4)
 - Principle 1: Review and categorization.
 - Principle 2: Environmental and social assessment.
 - Principle 3: Applicable environmental and social standards.
 - Principle 4: Environmental and social management system and Equator Principles Action Plan.
 - Principle 5: Stakeholder commitments.
 - Principle 6: Grievance mechanism.
 - Principle 7: Independent review.
 - Principle 8: Contractual commitments.
 - Principle 9: Independent monitoring and reporting.
 - Principle 10: Reporting and transparency.

- IFC Performance Standards (PS).
 - PS 1: Environmental and social risk assessment and management.
 - PS 2: Labor and working conditions.
 - PS 3: Resource efficiency and pollution prevention.
 - PS 4: Health, safety, and community protection.
 - PS 5: Land acquisition and involuntary resettlement.
 - PS 6: Biodiversity conservation and sustainable management of living natural resources.
 - PS 7: Indigenous peoples.
 - PS 8: Cultural heritage cultural.
- World Bank Environmental, Health and Safety Guidelines.
- Annex II and III Guidelines of the Organization for Economic Cooperation and Development Common Approaches.

Analysis of Alternatives

The evaluation of environmental and social impacts for any project under the Environmental and Social Sustainability Framework if the IFC, necessarily includes a thorough analysis of alternatives. This process is critical for identifying the most environmentally sustainable and regulation-compliant methods of achieving the project's objectives. For the Manzanillo Energy Consortium Power Plant project, particular attention was devoted to comparing various cooling system alternatives for the thermoelectric power plant, aiming to harmonize the project's goals with environmental preservation and adherence to both national and international best practices and standards within the industry.

It's imperative to note that alternatives concerning the project's location were not considered, as the Terms of Reference (ToR) had already designated a specific site for the project's development. Nonetheless, considerable analysis was dedicated to the positioning (layout or disposition) of the associated transmission line, which forms an integral component of the project.

In this context, the project assessed three (3) cooling system alternatives for the plant, along with two (2) layout options for the transmission line, detailed as follows:

Cooling System

Wet Cooling System Utilizing Seawater: This option proposes the use of seawater to supply a cooling tower, where a thermal exchange between seawater and air would occur to provide the necessary cooling for the thermoelectric plant. This method leverages the abundant seawater resources available but requires careful consideration of marine biodiversity and water quality impacts.

Wet Cooling System Using Well Water: This alternative considers extracting water from an underground well system to serve the cooling needs. While potentially reducing the impact on marine ecosystems compared to seawater cooling, it raises concerns about groundwater resource sustainability and potential land use conflicts.

Dry Cooling System (Air Cooling without Water): This option eliminates the need for water by utilizing air to cool the system. Although significantly reducing water usage and its associated environmental impacts, this method might require more energy and could be less efficient in hot climates.

Transmission Line

In alignment with the environmental and social considerations outlined for project, the evaluation of transmission line alternatives focused on minimizing ecological disruption while adhering to the project's sustainability and efficiency goals. Two distinct pathways for the transmission line were thoroughly analyzed, with both options strategically designed to circumvent environmentally sensitive and protected areas, thereby reducing potential impacts on these critical habitats.

- Alternative 1: This option avoids nearby protected and environmentally sensitive areas. By circumventing these regions, the alternative aims to minimize ecological disturbances and preserve the integrity of these valuable ecosystems. This choice reflects a commitment to environmental stewardship, ensuring that the project does not contribute to the degradation of protected landscapes and their biodiversity.
- Alternative 2: this alternative is also located outside protected areas and offers a more compact design that does not intersect with the Manzanillo-Copey Road. By opting for a shorter route, this option potentially reduces the project's environmental footprint and minimizes disruptions to local communities and traffic flow. The avoidance of major roadways further exemplifies the project's dedication to minimizing its impact on the existing infrastructure and the natural environment.

In evaluating the project alternatives, a multidimensional analysis encompassing technical feasibility, social and environmental impacts, and commercial viability was conducted. This holistic approach ensured that the selection process was informed by a balanced consideration of each alternative's potential benefits and drawbacks across these critical dimensions. This assessment led to the selection of Alternative 1 for the cooling system, attributed to its technical capabilities, positive social and commercial implications, and manageable environmental footprint that offers scope for effective mitigation. Similarly, Alternative 2 was chosen for the transmission line due to its minimal interference with local infrastructure, reduced ecological disturbance, and strategic avoidance of protected areas, reflecting a commitment to environmental stewardship and social responsibility. These selections illustrate a methodical approach to decision-making, prioritizing comprehensive, balanced outcomes in line with the project's sustainability objectives.

Project Description

The Manzanillo Energy Consortium Power Plant project features a state-of-the-art thermoelectric power plant with a net capacity of approximately 420 MW, primarily fueled by Liquefied Natural Gas (LNG), alongside a 345 kV electric transmission line stretching about 5 km to facilitate connection with the National Interconnected Electric System. It is clarified that as part of the International Public Bidding for New Generation No. EDES-LPI-NG-01-2021 in addition to Block 02 a second power plant (Block 01) was awarded with approximately 420 MW additional and an import terminal with regasification and storage of LNG to be installed on the land adjacent to the project on the north side, however, this work is outside the scope of this Environmental Impact Study. The aforementioned LNG import terminal with regasification and storage will supply LNG to both thermoelectric power plants.

The thermoelectric power plant is located specifically in the parcel with cadastral designation 211830311246, registration number 3000767108, in the municipality of Pepillo Salcedo, province of Montecristi. The total area of the parcel is 564,295.89m². The project will occupy an area of 111,134.19 m².

The forthcoming sections will enumerate the activities scheduled to be carried out across the various phases of the project's development.

Pre-construction phase:

The pre-construction phase of the Manzanillo Energy Consortium Power Plant project encompasses a sequence of meticulously planned steps, each designed to ensure that the project not only meets the necessary regulatory and environmental standards but also aligns with economic and technical feasibility criteria.

The Pre-construction phase encompasses the following activities which lays a solid foundation for the project, ensuring that all preparatory aspects are addressed with the utmost diligence and foresight.

1. Prequalification for the bidding process.
2. Preparation of non-invasive preliminary studies for bidding offer.
3. Preparation of the economic feasibility study.
4. Preparation and presentation of the bid offer.
5. Acceptance of the proposal and award of the project by the competent authorities.
6. Conceptual design of the project based on the studies carried out.
7. Coordination with the Ministry of the Presidency, stakeholders, and the Manzanillo Master Plan management team.
8. Proceedings for obtaining permits and certifications of no objection from the competent institutions.
9. Preparation of studies required for the detailed engineering of the project.
10. Preparation of the Environmental Impact Study.
11. Obtaining the Environmental License.

Construction phase:

The construction phase of the Manzanillo Energy Consortium Power Plant project represents a pivotal stage where planning and preparation transition into on-ground activities. This phase is marked by the following critical steps that ensure the project's infrastructure is constructed efficiently, sustainably, and in compliance with all relevant standards and regulations.

1. Mobilization of materials, equipment, and machinery to the project site.
2. Installation of temporary construction facilities.
3. Site preparation.
4. Construction of the thermoelectric power plant.
5. Construction of service infrastructure.
6. Construction of transmission line to the National Interconnected Electric System.
7. Connection to the National Electric Grid.
8. Hiring of temporary labor force.
9. Withdrawal of temporary facilities.
10. Transportation of leftover construction materials and waste.

Operation phase:

The operation phase of the project marks a critical transition from construction to the functional utilization of the infrastructure, focusing on the generation of electricity through efficient and sustainable practices. This phase encompasses a series of systematic activities aimed at

ensuring the smooth, safe, and environmentally responsible operation of the thermoelectric power plant and its associated electrical interconnection line.

1. Start-up and operations of the thermoelectric power plant and the electrical interconnection line.
2. Maintenance of facilities and equipment.
3. Handling and consumption of natural gas.
4. Handling and consumption of liquid fuel.
5. Management of hazardous and non-hazardous solid waste.
6. Generation and handling of oily waste.
7. Water consumption and treatment.
8. Generation and treatment of industrial and domestic liquid waste.
9. Insect, vector, and rodent control.
10. Handling of chemical products.
11. Hiring of permanent labor force.

Closure phase:

The closure phase of the project signifies the concluding chapter of the project's lifecycle, emphasizing the responsible and sustainable termination of operations. This phase is characterized by a series of diligently planned activities aimed at ensuring the site is decommissioned and rehabilitated in accordance with environmental best practices and regulatory requirements. The focus of this phase is oriented on minimizing the environmental footprint left by the project and ensuring that the transition is handled in a manner that safeguards both the local environment and community interests.

1. Decommissioning.
2. Solid (hazardous and non-hazardous), liquid and oily waste collection.
3. Transportation and final disposal of waste, as well as dismantled equipment.

Stakeholder Consultation Process

In September 2022, as part of the activities of the environmental and social impact study of Block 01, a previously arranged visit was made to the Municipal Council of Pepillo Salcedo, through which members of the EMPACA social research team met with the mayor of this municipality. This meeting was held on September 15, 2022, agreeing on the support of the city council to facilitate the EMPACA social team to contact all the social stakeholders in the municipality registered by the city council. At the same time, with this visit, information was collected that made it possible to identify and locate other potentially relevant actors. This information collected served as input for the verification of key actors of the Block 02 project.

During October 3, 4 and 5, 2023, members of the EMPACA social team visited Pepillo Salcedo to distribute invitations to the first public consultation and information session of the Block 02 project. This visit also served to collect essential data to identify and locate the key actors involved in the project, especially the landowners and residents near the future locations of the towers and transmission lines.

The first community information / participation and consultation session was conducted on Thursday, October 12, 2023, with attendance of 45 participants, representing, different organizations and institutions of the municipality, as well as landowners representatives.

In addition to holding the first meeting, during the following two days (October 13 and 14) two representatives of EMPACA's social team and a representative of AECOM's social team met with social actors, to conduct interviews and focus groups, particularly with representatives of fishermen, ranchers, beekeepers, ecotourism entrepreneurs and women, mainly from the Villa Ray neighborhood.

In accordance with the International Finance Corporation (IFC) guidelines for social impact assessment, two (2) sessions of public consultation and information disclosure were conducted on November 9 and 16, 2023, respectively.

The stakeholder mapping process identified a diverse group of 50 stakeholders, encompassing 23 from social entities, 13 from public sectors, and 14 from the economic domain. Reflecting on the insights gained from focus groups, surveys, and interviews, stakeholders were categorized into four distinct groups:

- Stakeholders who perceive the project's impacts as exclusively negative to the community and the environment.
- Community stakeholders anticipating employment opportunities without offering specific suggestions for its execution.
- Project supporters with constructive observations and suggestions for the project's execution.

Stakeholders that agree with the project execution but are directly impacted by its implementation.

Description of the environmental and social baseline

Geology

The study area in this regional context is located between the Northern Cordillera domain and the Cibao Valley domain, whose tectonics are conditioned by two fundamental factors at the plate scale: the displacement between the North American and Caribbean plates, and the oblique subduction of the island platform. The Cibao Valley domain corresponds to a basin of mainly Neogene age with a complex history within which at least four evolutionary stages can be distinguished.

According to the details shown in the geological map of the study area, the geological formations and sediments of the Quaternary are described below:

- Fm. Gurabo Fm. represented by marls with intercalations of sands and coralline limestones, and silty limestones with corals from the Lower Pliocene of the Neogene.
- La Isabela Fm. represented by reef limestones from the Middle-Upper Pleistocene of the Quaternary.
- High terraces represented by conglomerates with ferruginous patina of the Quaternary Pleistocene.
- Floodplain represented by Quaternary Holocene mudstones, sands, and gravels.
- Glaciers represented by Quaternary Holocene sands and gravels.
- Low marshes represented by gray to black silty-clay silts of the Quaternary Holocene.
- High marsh represented by Holocene Quaternary silts and fine sands.

- Beach and coastal strand represented by medium to fine sands of Holocene Quaternary age.
- Anthropic represented by Holocene Quaternary fills and Holocene Quaternary salt marshes.

The most relevant tectonic structures in the region correspond to faults with an approximate NW-SE and W-E direction.

Geomorphology

Reference is made to the relief in the study area considering its importance for the design of the works and as the element that conditions surface runoff. Generally speaking, the action of external agents on these peripheral elevated sectors results in a noticeably different expression. Thus, the modeling of the areas of the highest rocky massif in the south is the product of a long evolution of sedimentary and tectonic processes, generating a positive relief on which various weathering agents have acted, with greater or lesser effectiveness, highlighting those of a marine nature for the coastal area where the project will be located.

It is worth noting that in this coastal sector, anthropic transformations are intense, not because of their development but because of their influence on the modification of the natural dynamics of coastal ecosystems. Behind the strip of low coastal plain (marshes), with accumulation of sands, silts and muds, there is a first terrace or morpho structural step, which represents the geological-morphological evolution explained for the region, considered as a medium plain formed in limestones of the La Isabela Fm, with elevations above 15 m.

The morphology of the study area was analyzed through the spatial distribution of the morpho alignments, based on their regional manifestations due to their masking in the study area by the covering sediments.

Topography

The present relief of the zone is predominantly defined by a plain landscape with distinct elevational gradations delineating it as low to mid-level relief, devoid of any vestiges of its primal geomorphic features. Utilizing the topographic chart 5875-II Pepillo Salcedo, in conjunction with updates from field survey elevations, a relief profile for the study area was developed. This profile captures the present topographical characteristics and highlights the primary geomorphic discontinuities, which are significantly unnoticed due to extensive anthropogenic alterations and the dynamics of the coastal-marine environment.

Soils characterization

In the region associated to the project area, the deluvial soils are described as undeveloped d, accumulated from the processes of dragging from the southern mountain massifs and marine dynamics. On the other hand, some associations of clayey, brown soils have been observed, which accumulate in the medium and high plains sectors, mainly to the SW of the project, with low productive capacity, but with intense management actions to achieve agricultural vocation.

Based on the chemical parameters determined (concentrations of metallic elements), it is evident that in the areas where soils SO-1, SO-2, SO-3 and SO-5 are found, located in the medium and high plains, they have been affected by the influence of activities related to local industry and

traffic on embankments, which has been noticeable according to the remaining structures of the platforms where fuel deposits were located, among other works.

In the case of the SO-4 sandy soils, the difference in chemical parameters is notable, although some concentrations of metals stand out, suggesting anthropogenic activity (vehicular traffic circulation routes and work with boats), in addition to dragging by rainfall dynamics from higher adjacent sectors. In this low zone, there are several parameters that highlight the high predominant influence of the marine coastal environment on the plain.

Land use capacity

Two (2) soil formations are described in the study area. Additionally, the description of classes II and III has been included, which, although they do not occur in the study area, their location corresponds to surrounding sectors.

The edaphic formations are detailed below:

- Soft sandy silt with high organic matter content, high salinity and saturated. Substrate of mangroves and low, muddy coastal vegetation.
- Class II: arable soils, suitable for irrigation, with undulating topography and non-severe limiting factors. High productivity with good management.
- Class III: arable soils, suitable for irrigation; only with very profitable crops, with undulating topography and limiting factors of some severity. Medium productivity with intensive management practices.
- Class IV: soils limited for cultivation and not suitable for irrigation, except for very profitable crops. They present severe limiting factors and require intensive management practices.

Climatology

The determining factors of the climate in the region where the project will be located are the same as those that affect all the coastal regions of the north of the Dominican Republic.

For the region where the project is located, climatic information from the Monte Cristi station, situated 18 km northeast of the project area and possessing morphological characteristics similar to the zone of interest, was utilized. The data on meteorological variables from the station is reliable for the years between 1981 and 2022 and is managed by the National Meteorological Office (ONAMET).

Air temperature

Regarding the air temperature regime in the region where the project is located, it is typical of coastal areas. With average annual temperatures of 26.5 °C, with average maximum values of 31.7 °C and minimum values of 21.9 °C.

Relative humidity

The data referring to the relative humidity parameter indicates an annual average of 70.4%. During the rainy season, the values range between 67.0-73.0% and the months corresponding to the dry season between 68.0-73.0%.

Cloudiness

In the region, the average percentage of the sky covered with clouds has a significant variation over the course of the year. The clearest season extends from November to April, and the cloudiest month of the year is June, during which on average the sky is cloudy or mostly cloudy 73% of the time.

Hours of sunlight

The length of the day in the region varies throughout the year, with the shortest days in the month of December and the longest day in the month of June.

Water temperature

The average water temperature has significant seasonal variations throughout the year, with the hottest time of year being between the months of August and November, with an average temperature greater than 28°C.

Wind speed and direction.

The monthly average speed of the winds that predominate is 11.0 km/h. Regarding the wind direction, the predominant monthly mode is towards the east, although some slight deviations associated with the regional climate are reported. The very specific influence of northerly winds should be highlighted, with the influence of cold fronts.

Precipitation

The data from the available series indicate an average annual precipitation of 609.1mm. On the other hand, according to the information on the Isohyet Map of the average annual rainfall for the Dominican Republic, the average for the territory where the project is located is less than 800 mm.

Cyclones and hurricanes

The cyclone analysis was carried out based on information from records related to cyclones developed in the North Atlantic from 1851 to 2021, and taken from several websites, including the National Hurricane Center (NHC), Stormpulse, StormCarib, the INSTMET of Cuba and the website <https://agricultura.gob.do>. These records indicate a total of 62 cyclones that have hit the country in the period between 1950 and 2021.

Considering that the Dominican Republic, due to its position in the Western Caribbean (according to the zoning of the Caribbean Hurricane Network), is hit every year by tropical storms, it is important to describe the regional dynamics of these meteorological events.

Based on data on hurricanes and storms that occurred between the years 1851 and 2019, it can be seen that the greatest possibility of a tropical cyclone affecting the territory is in the month of September, followed by the months of August and October. According to data offered by NOAA's National Hurricane Center, the region has been hit by more than 40 extreme weather events between the last 168 years (1851-2019), considering those that have directly affected the territory.

Hydrology and Hydrogeology

Surface hydrology

The study area has its coastal front in a stretch of 980 m on the inner coast of Manzanillo Bay, in addition to 700 m to the east towards the inland waters of Estero Balsa and is not directly related to any hydrological basin of rivers in the region. However, its local hydrodynamic condition is not only influenced by its location, but also by the anthropic modifications in the periphery, where the following stand out:

- The facilities of the Port of Manzanillo to the west, built in the 1940s.
- The artificial embankment to the east, compacted, with a single culvert for the exchange of the mangrove with the sea, built in the 70s of the twentieth century.
- Earthworks on the surface of the rocky massifs to the south, which have modified their relief and therefore the dynamics of surface runoff and the quality of the rainwater that flows into the lowlands.

From a regional point of view, the most important hydrological elements are the Yaque del Norte River, more than 16 km to the NE of the study area, the Chacuey River 4.0 km to the east, and the Masacre River 1.7 km to the west. In the case of the first two rivers, their mouths correspond to low alluvial plains, with mangrove development, salt marshes and flooding conditions.

These surface waters in their current condition have been classified as class B surface waters according to the Environmental Standard for the quality of surface and coastal waters of the Dominican Republic, considering their extreme condition of confinement due to anthropic modifications, with no supply or recreational uses, and without any conservation or management criteria that would favor their improvement as coastal aquariums. Likewise, these are not surface waters that have been categorized for the preservation of flora and fauna habitat, regardless of whether local management plans and improvements in hydrodynamics are established in the future, and therefore conditions for classification with more restrictive quality requirements can be argued.

Hydrogeology

According to the hydrogeological zoning of the Dominican Republic, at regional scale, based on the INDRHI 1:250000 hydrogeological map, aquifers formed in Quaternary sediments and terrigenous rocks are distributed in the areas of the river basins and their flood valleys.

From a more detailed hydrogeological point of view regarding the study area, there were no wells located near the project area, nor groundwater emergences. In the project area, the thickness of the unsaturated zone is about 15-16 m, in the elevated massifs to the south of the La Isabela geological formation, with the influence of marine waters due to the altimetric relationship of the territory with the sea, the influence of marine aerosols, tidal levels and low rainfall. In the low plain it is evident that the normal flood levels coincide with the sea level and are directly related to the tidal levels.

Further south, towards the rocky massifs of the Gurabo geological formation, carbonate-terrigenous rocks have been described that coincide with the aquifers in low permeability rocks identified on a regional scale, and in the eastern sector of the town of Pepillo Salcedo, about 1.12

km west of the project area, a well (well PP) was located, used for irrigation of private agricultural plots in the surrounding area.

According to measurements of a well in Pepillo Salcedo, the groundwater table is of the order of 3.0-3.5 m deep, with a water column of 7.0 m and is exploited daily with a flow rate of 18 gpm for irrigation of small agricultural plots within the urbanized area. The mineralization measured in situ is moderate at 1.3 g/l, with acceptable hydrodynamics. In Table 6-35 the UTM coordinates of the PP well location and the physicochemical parameters measured in the groundwater are presented.

The quality of these groundwater is compared with the permissible limits of the Environmental Standard on quality of groundwater and discharges to the subsoil, class B, in an aquifer of low vulnerability due to its location in an urbanized area without a collection or treatment system. liquid waste.

Air quality

For the study area, 9 air quality measurement points were established, distributed in a manner that covered the territory of the project area and the route of the 345 kV transmission line, especially the adjacent urbanized sectors and areas of the city of Pepillo Salcedo. The factors analyzed were the concentrations of combustion gases under immission conditions (carbon monoxide CO, ozone O₃, nitrogen dioxide NO₂, sulfur dioxide SO₂, non-methane hydrocarbons HCNM, volatile compounds TVOC, formaldehyde HCHO and carbon dioxide CO₂) and the concentrations of particulate matter in the air (PM 2.5, PM 10.0 and total suspended particles).

In general, it is observed that the concentrations of particulate matter are at moderate levels, with some notable levels. These levels are characteristic of urbanized areas in rural zones, where the main emission sources are the usual socioeconomic activity and vehicular traffic. The RVA-9 point stands out, where the highest values were obtained, due to the circulation of heavy vehicles transporting material from the port.

In general terms, the concentrations of combustion gases under baseline environmental conditions, considered as criterion pollutants, remain below the limits established by national regulations and the WHO Air Quality Guidelines for short-term measurements. However, there is a tendency for these concentrations to exceed the recommended limits set by the WHO Air Quality Guidelines when compared with values for longer measurement periods. In the case of non-methane hydrocarbons (NMHC), in most of the points the average value is higher than the limit established in the national Environmental Technical Regulation; however, these gases are not considered criteria pollutants by this regulation. Carbon dioxide (CO₂) concentrations are reported at acceptable levels for sectors with anthropic activity.

Odors

During the field surveys, a general characterization of the odors perceived in the area was carried out by means of reconnaissance inspections to identify the odor sources. The results obtained in general were the following:

- Moderate odors from coastal edge to open sea.
- Odors of decomposing plant matter from inland mangrove sites.
- Slight odors of handling of fishing gear or fish remains.

- Low odors of rural sites, without anthropogenic activities, but with a perception of dust in the air.
- Moderate odors from the coastal edge to the open sea, but of low intensity and short duration.
- Low odors from the combustion of exhaust from a passing vehicle, and there is a moderate perception of dust in the air.
- Moderate odors from a variety of anthropogenic domestic activities.
- Smells of corrals and small livestock breeding, which are mixed with those generated in the houses.
- Low odors due to a variety of industrial anthropic activities, mainly due to moderate traffic on unpaved embankments.
- Low odors from the combustion of truck exhaust in hauling activities to or from the Port.

Noise levels

For the study area, 9 measurement points for noise levels were established, coinciding with the location of the measurement points for particulate matter and combustion gas concentrations. At each point, meteorological variables were measured throughout the duration of the environmental factor measurements.

In general, noise levels during daytime are moderate, and the logarithmic average in almost all of them remained below the permissible limit established by the Environmental Standard of the Dominican Republic. Only at points RVA-9, RVA-10 and RVA-11, the recorded values marginally exceeded the limit, caused by a greater circulation of heavy vehicles compared to the rest of the points. In the measurement summary data, maximum values are observed at several points above 70 dB(A), which were caused by local anthropogenic activity. At nighttime the calculated logarithmic average is higher than the permissible limit of the Environmental Standard in most points caused by anthropogenic activity and the circulation of heavy vehicles in these sites. Very similar to the daytime measurements, maximum level values above 70 dB(A) are observed, which were caused by particularities of the anthropic activity associated with these sites.

Vibration levels

At the scale of the study area, 8 measurement points of environmental vibrations were established that coincide with the measurement points of noise levels, and concentration of particulate matter and gases under immission conditions. The peak velocities obtained from the vibration events recorded during the measurements did not reach the value of 1 mm/s with frequencies between 1 - 65 Hz, which are too low to cause damage to the type of structure that predominates in the sectors to the west and in the east of the study area, which are buildings without reinforcement and with light roofs. In accordance with the requirements of BS 7385-2:1993 "Evaluation and measurement for vibration in buildings", transient vibrations that cause damage to light edifications, unreinforced buildings and residences must reach peak speeds greater than 15-20 mm/s with frequencies between 4 and 15 Hz, or 20-50 mm/s with frequencies higher than 15 Hz.

Vulnerability to natural hazards

Seismic hazard

The "IRIS Earthquake Navigator (IEB)", available as an interactive map, was used as a source of information to explore epicenters of seismic events. The data comes from several sources, primarily the US Geological Survey, and is stored in the main data files at the IRIS Data

Management Center in Seattle, WA, USA. From this information, it was possible to identify 10 earthquakes closest to the project area that occurred within the period between 1970 and 2022, where the highest magnitude recorded was 5 on September 3, 1987.

Hurricane hazard

To express this common behavior for the Caribbean Region, information from records related to cyclones developed in the North Atlantic from 1851 to 2020 has been used, and taken from various websites, including the National Hurricane Center (NHC), Stormpulse, StormCarib and the Cuban Institute of Meteorology (INMET), among others. The processing of the data shows the increase in the occurrence of events, that is, the tendency to increase the number of cyclones in each season, which mostly cross the Caribbean and, therefore, La Española.

An interesting fact is that 80% of the cyclones arrived between the months of August and September, therefore, these are the months where there is a greater danger of being affected.

In the last hurricane season, the Dominican Republic was affected by the passage of Hurricane Fiona, category 1, on September 19, 2022. This hurricane mainly affected the Eastern and Northeastern areas of the country, mainly the provinces of La Altagracia, La Romana, El Seibo, Hato Mayor, Monte Plata, Samaná, and María Trinidad Sánchez.

Hazard of sea penetrations

According to the Atlas de la Biodiversidad y los Recursos Naturales (MIMARENA, 2012), the northern region of the country, where the project is located, concentrates the highest number of earthquakes and these events can increase the possibility of sea penetrations.

Hazard of atmospheric electrical discharges

Increased wind speed, downpours and cloudy skies are most often the precursor signs of an approaching thunderstorm, however, with thunderstorm clouds nearby, thunderstorms can occur several kilometers away and can affect even if it is sunny and rain-free. Another factor that contributes significantly to the occurrence of thunderstorms is the high humidity at the surface.

It is important to mention that, in the project, these atmospheric indicators have been considered as a design element. It is recommended that attention be paid to the evolution of the phenomena and that emergency plans be activated in the case of personnel working and in the area of the generators.

Oceanographic studies

Bathymetric surveys

Although the block 02 project as such does not have elements in the marine zone, the information is considered due to the interdependence that exists between the block 01 and block 02 projects for the supply of LNG and the operations of the cooling system; Therefore, the data placed here comes from the study carried out on block 01 as secondary information.

Wind characterization

For the characterization of the wind in the project area and its influence on environmental conditions, we have used studies conducted by AKTIS as part of the project preparation and specific studies conducted by EMPACA, for the purpose of preparing the Environmental Impact Study.

To calculate wind duration and wind profile for operational conditions and non-cyclonic storms, AKTIS uses the Frøya formulation recommended by Veritas (2010). When in-situ measurements are not available. In addition to the annual characterization, AKTIS conducted a study of the seasonal wind behavior.

In general terms, the studies reveal the predominance of winds from the east and east-northeast, followed by east-southeast and northeast in very similar proportions. Wind speeds of 2.94 m/s are equaled or exceeded with a probability of 0.9, while winds with speeds equal to or greater than 3.81 m/s have a probability of 0.5.

Tides

For the characterization of the tides in the area, the present study is based on the results obtained by AKTIS during the preparation of the project, numerical simulations performed by EMPACA in order to elaborate the hydrodynamic model and instrumental measurements performed by EMPACA during a month-long oceanographic campaign (November 27 to December 28, 2022).

The record shows a maximum tidal amplitude of 1.0 meter between December 24 and 25, while the minimum amplitude occurred between December 16 and 17, with a travel of 0.43 meters. The daily displacement of the tidal cycle is approximately 55 minutes.

Usual waves in deep water

As in the description of wind and tides, the characterization of the usual waves in this study is based on the results presented by AKTIS during the design of the works and the specific studies developed by EMPACA. In general, the predominant waves have a significant height between 0.50 and 0.75 meters, with peak periods of 7.0 to 8.0 seconds, which accumulates 5.72% of the total waves.

Wave transformation (refraction - diffraction)

To describe the changes that waves undergo from deep water to the project area, this study is based on the results presented by AKTIS as part of the project preparation and also the results obtained by EMPACA using the wave bases of the hindcasting (reanalysis) WWIII and the integrated numerical simulation system TELEMAR-MASCARET.

AKTIS studies reveal that, while the waves generated by the local wind (sea) come preferentially from the northeast and north-northeast, the waves coming from deep waters and moving outside the wind generation zone (swell) suffer intense diffraction as they go around the coast and arrive at the area of interest from the northwest and north-northwest.

Hydrodynamic model (currents)

To describe the tide-independent circulation model (residual current), AKTIS used the public domain HYCOM (Hybrid Coordinate Ocean Model) data. HYCOM is a general circulation model that provides wind-derived fluxes and geostrophic fluxes with a system of vertical coordinates that are isopycnic in the open ocean. However, the isopycnic coordinates have a smooth transition to z-coordinates in the mixing layer, to coordinates that follow the terrain in the shallow regions, and back to z-coordinates in the very shallow waters.

The values calculated by AKTIS were validated with instrumental measurements from regional oceanographic buoys and measurement equipment installed by INDEMAR as part of the project studies.

According to the results of the simulation and instrumental measurements, the most important tidal currents in the area occur in the estuary zone and its channel of communication with the sea. In the beach area, the main currents are due to the coastal drift caused by the waves, while in the area where the pier will be built and where the industrial process water discharge will be located, the residual currents, particularly those generated by the wind, have a decisive influence.

Using the TOMAWAC and TELEMAC2D modules in an integrated manner, the formation of coastal currents was evaluated in the area of the beaches, the estuary and the deeper waters where the pier will be built. In general terms, the current velocity is more intense in the shallow areas where the waves break. These areas coincide with the reef bottoms and beaches.

Sediment transport

Using the TOMAWAC and TELEMAC2D modules in an integrated manner, the formation of littoral currents in the beach area, estuary, and deeper waters where the pier will be constructed was evaluated. Generally, the current speed is more intense in the shallow areas where wave breaking occurs. These areas coincide with reef bottoms and beaches.

Overall, this is a zone with low littoral transport rates, due to the configuration of the Manzanillo Bay. The scale of sediment transport presents maximum values of $9 \times 10^{-7} \text{ m}^2/\text{s}$, which translates into maximum transport rates for the nodes under usual conditions of $30 \text{ m}^2/\text{year}$. The highest transport rates occur in the reef zone, whereas, in the beaches and sheltered areas the magnitude is considerably lower. Under this scenario, the greatest changes occurring on the beaches are associated with extreme storms such as hurricanes or cold fronts of great intensity.

Thermal dispersion

It is known that the greater the energy of the currents, the greater the dilution and the lesser the impacts of thermal pollution. The results obtained confirm that as the energy increases (less probability of exceedance), better dilution values are achieved. In this way, the worst environmental scenario occurs for conditions exceeding 0.90. In this case, a greater extension of the surface thermal plume is observed but even under this scenario the discharge absolutely complies with the established environmental indicators.

The hydrodynamic characterization of the area, supported by numerical simulation, confirms compliance with environmental discharge standards by the project, under current design.

Effects of the project on the dynamics of the beaches

The dry beach profile is about 20 m wide and consists of sands ranging in grain size from $224.2 \mu\text{m}$ to $1,328.5 \mu\text{m}$. The finer sands are found on the beach extending east of the estuary, while the coarser sands are found on the western side of the harbor breakwater. To describe the beach dynamics and patterns of erosion, transport and sedimentation under project conditions, new simulations of the processes of wave transformation, current formation, sediment transport and relief evolution were carried out.

The hydrodynamic characterization of the area, supported by statistical bases, instrumental verifications, and the application of numerical models, indicates that the pier work will not have a permanent impact on the beaches or the functioning of the coastal system. Current erosion, transport and sedimentation patterns will not be altered and no modifications in the evolution of the coastline related to the works are expected.

Characteristics of seabed sediments

Three samples of sediments from the seabed were collected for analysis of their physical and chemical properties and the results reported that they are evidently sandy sediments, where the fraction of medium to fine sand predominates, while the fraction of silt and clay is very low. In the case of sample SE-3, its texture is clayey sand to sandy clay.

Characterization of the quality of marine waters

There is secondary information from the evaluation carried out in Block 01, in which seven samples of marine waters were collected for analysis of their physical and chemical properties. Additionally, the information has been complemented with a new sample (W-12) in Estero Balsa near the route of the 345 kV transmission line. The physicochemical and microbiological results of the coastal waters show a favorable state according to the limits established in the Environmental Standard for Surface and Coastal Water Quality for Class E coastal waters; however, at point W-8 (coastal sector south of the projected plant area) iron concentrations are detected that could be related to anthropic industrial activities in the area.

In sample W-12 (Estero Balsa near the route of the 345 kV transmission line), very high concentrations of total iron are detected, which could be related to anthropogenic activities in the area and because it is very shallow marine water on the shores of inland aquariums where it is common to dump waste of different genesis. In this same sample, shallow concentrations of total nickel are detected, also related to anthropic activities. The concentration of oils and fats are at high levels, above the limit established by the Environmental Standard (NA-CASC-2012, Class E). Total and fecal coliforms are slightly higher when compared to the reference environmental standard.

Climate change aspects

The estimate of GHG emissions for the construction stage is 14,194.32 Tn CO₂ eq and in the operational phase (25 years) it is 35,933,169.22 Tn CO₂ eq.

Vegetation

Three types of vegetation were identified in the Project area: secondary xerophytic vegetation in the area where the Block 02 facilities will be built and along the transmission line; grassland and secondary xerophytic vegetation in transition to mangrove along the transmission line.

In the project area, 106 species of vascular plants were identified, distributed in 43 families and 95 genera, including 4 endemics to Española Island, 94 native and 8 naturalized exotic species.

Eleven species protected by the Convention on International Trade in Endangered Species (CITES), the Red List of the World Conservation Union (IUCN, 2022) and the Red List of Vascular Flora in the Dominican Republic according to the criteria of the International Union for Conservation of Nature (JBN/MIMAREMA, 2016) were identified along the route of the power transmission line and in areas surrounding Block 02.

Fauna

During the rainy season for amphibians, a total of 2 species and 9 individuals were located; while in the dry season, 3 species and 15 individuals were identified.

At the reptile level, 12 species were recorded during the rainy season, while 11 species were reported during the dry season. In terms of the number of individuals, 47 were recorded during the rainy season, while 44 were recorded in the dry season, with 3 more individuals observed in the rainy season.

For terrestrial mammals, 6 species were recorded in both seasons, with 190 individuals in the dry season and 114 individuals in the rainy season, which gives a difference of 76 individuals more in the dry season. As for bats, 3 species were recorded during the dry season and 4 during the rainy season; the number of individuals recorded in the rainy season was 61 and 206 in the dry season, with 145 individuals more in the dry season.

The results for avifauna indicate that 92 species were recorded in the rainy season, while 84 species were recorded in the dry season. The abundance of individuals during the dry season was higher with 927, while in the rainy season it was 892 individuals.

Landscape

In the study area, six types of landscape were determined: interior plain of medium height, cleared; interior plain of medium height, urbanized; interior plain terrace with coastal edge, little anthropogenic influence; low floodplain (marsh); coastal strip of cumulative beach and marshes with mangroves (Estero Balsa).

Socioeconomic environment

The socioeconomic analysis was carried out for the municipalities of Pepillo Salcedo and Montecristi, located in the Montecristi province. The assessment of the socioeconomic environment was methodically structured around several foundational aspects:

- Demographics: Analysis of population size, density, distribution, and demographic trends.
- Economy: Examination of the local economic landscape, including primary industries, employment rates, and economic challenges.
- Public services and lifelines: Evaluation of accessibility and quality of essential services such as healthcare, education, utilities, and transportation.
- Cultural heritage: Identification and consideration of the region's cultural assets, traditions, and historical significance
- Relationship of the community with the environment: Insight into how the community interacts with, perceives, and values the local environment.

In relation to the participation and public information process of the project, this was composed of the following activities:

- Placing signs: Installation of informational signage to inform and direct participants during public engagement events.
- Community Preliminary Meeting: Organizing an initial meeting with the community to introduce the project, followed by two public hearings to foster open dialogue and gather feedback.
- Stakeholder analysis: Conducting a comprehensive analysis to identify and understand the interests, concerns, and expectations of various stakeholder groups impacted by the project.

Impacts

In the construction phase, 32 impacts were identified, of which 24 are negative (75%) and 8 (25%) are positive. In the operation phase, 33 impacts were identified, of which 24 (72%) are negative and 9 (28%) are positive. If compared to the construction phase, the proportion of positive impacts increases. It is highlighted that the negative impacts in the operation phase are of low, medium or moderate significance. Impacts of high or very high significance are all positive.

The following tables present a summary of the assessment of impacts identified for the construction and operation phases of the project.

Table 1. Construction phase impact assessment summary

Impact	Code	Type	Effect	Significance	Classification
Increase in the concentration of particulate matter due to construction activities and the transportation of materials.	A-1	(-)	D	24	LOW
Increase in noise and vibration levels due to construction activities and the transportation of materials.	A-2	(-)	D	38	MODERATE
Increase in gas concentration due to the operations of heavy equipment and trucks.	A-3	(-)	D	23	LOW
Change or effects on the climate due to the emission of greenhouse gases resulting from the operations of vehicles, heavy equipment and trucks.	CL-1	(-)	I	35	MODERATE
Possibility of soil contamination due to construction activities and deficiencies in the management of solid, liquid and oily waste.	S-1	(-)	D	14	LOW
Risk of soil contamination due to fuel and lubricant spills.	S-2	(-)	D	14	LOW
Disappearance of the vegetation cover and the loss of flora due to vegetation clearing for the construction of the works.	V-1	(-)	D	60	HIGH
Loss of habitat for fauna due to clearing.	F-1	(-)	D	48	MODERATE
Affectation to fauna due to construction activities that generate noise and dust and human presence.	F-2	(-)	D	27	MODERATE
Improvement of the quality of life and purchasing power of the workers who will build the Project and their families.	PB-1	(+)	I	53	HIGH
Possibility of inconvenience to residents due to increased noise and dust levels because of the Project's construction actions	PB-2	(-)	D	31	MODERATE

Impact	Code	Type	Effect	Significance	Classification
Possible exposure to diseases due to the influx of temporary or permanent labor.	PB-3	(-)	D	28	MODERATE
Risk of physical injury or loss of life to residents resulting from the use of force by Project security personnel.	PB-4	(-)	D	27	MODERATE
Risks of accidents occurring that cause physical injuries or loss of life to workers and residents as a consequence of the construction actions of the Project.	PB-5	(-)	D	29	MODERATE
Economic impact on beekeepers in the area due to land clearing.	PB-6	(-)	D	33	MODERATE
Loss of area for goat grazing due to clearing of project lands.	PB-7	(-)	I	32	MODERATE
Increase in demand and use of construction materials and other inputs.	CT-1	(+)	D	47	MODERATE
Creation of temporary jobs.	EC-1	(+)	D	57	HIGH
Increase in financial circulation and commercial activity in the province of Montecristi due to the contracting of services.	EC-2	(+)	D	42	MODERATE
Generation of income to the State and the City Council of the Municipality of Pepillo Salcedo for payment of taxes.	EC-3	(+)	D	51	HIGH
Temporary increase in demand for food services for Project workers.	EC-4	(+)	I	33	MODERATE
Temporary increase in demand for rooms in the municipality of Pepillo Salcedo for Project workers residing in distant areas.	EC-5	(+)	I	33	MODERATE
Generation of greater income for the sector of the population employed in the motoconcho transportation sector, which is the main means of transportation in the area.	EC-6	(+)	I	33	MODERATE
Increase in truck traffic on access roads.	TV-1	(-)	D	30	MODERATE
Risk of traffic accidents causing physical injury or loss of life to workers and residents on access roads.	TV-2	(-)	D	29	MODERATE
Possibility of deterioration of access roads due to the passage of trucks and equipment for transporting construction materials and equipment.	TV-3	(-)	I	14	LOW

Impact	Code	Type	Effect	Significance	Classification
Increase in demand for services provided by State entities during the construction phase of the work.	IS-1	(-)	I	46	MODERATE
Possibility of affecting unknown archaeological sites in the construction area of the works.	PC-1	(-)	D	26	MODERATE
Temporary increase in water consumption during the construction phase of the work.	RC-1	(-)	D	34	MODERATE
Temporary increase in the consumption of electrical energy and fuel during the construction phase of the work.	RC-2	(-)	D	41	MODERATE
Increase in consumption of loan materials.	RC-3	(-)	D	30	MODERATE
Possibility of deterioration of the landscape due to construction activities.	PS-1	(-)	D	28	MODERATE
Total impacts	32	(-) =24 (+) =8 (+/-) =0	D=24 I=8		L=5 M=23 H=4 VH=0

Source: Elaborated by EMPACA / AECOM, 2023

Table 2. Summary impact assessment of the operation phase.

Impact	Code	Type	Effect	Significance	Classification
Possibility of air pollution due to emissions of combustion gases into the atmosphere and suspended particles from the operations of turbines and emergency electricity generators.	A-4	(-)	D	29	MODERATE
Increase in noise and vibration levels due to the operations of the thermoelectric plant.	A-5	(-)	D	28	MODERATE
Possibility of air pollution from LNG leaks.	A-6	(-)	D	34	MODERATE
Change or effects on the climate due to the emission of greenhouse gases resulting from the operations of electricity generators.	CL-2	(-)	I	37	MODERATE
Possibility of soil contamination due to inadequate management of liquid, solid and oily waste.	S-3	(-)	D	14	LOW
Possibility of soil contamination due to fuel and lubricant spills.	S-4	(-)	D	14	LOW
Possibility of contamination of groundwater due to mismanagement of liquid waste.	AS-1	(-)	D	22	LOW

Impact	Code	Type	Effect	Significance	Classification
Possibility of modifying the quality of marine waters due to the discharge of cooling waters and industrial wastewater.	ASP-1	(-)	D	24	LOW
Loss of vegetation and partial elimination of flora by cutting and pruning to clear the transmission line easement strip.	V-2	(-)	D	25	LOW
Possibility of spread of vector and rodent pests due to poor management of solid waste.	F-3	(-)	D	18	LOW
Possibility of affecting fauna due to the use of chemicals to control vector and rodent pests.	F-4	(-)	D	21	LOW
Decrease in fauna caused by collisions of birds and bats with the towers and electrical conduction lines of the transmission line.	F-5	(-)	D	32	MODERATE
Detriment to fauna due to electrocutions of birds and bats due to the voltage of the transmission line.	F-6	(-)	D	32	MODERATE
Possibility of affecting marine biota due to the discharge of cooling waters into the sea.	BM-1	(-)	D	27	MODERATE
Possibility of affecting the population (workers and communities) due to the increase in the levels of gas emissions, suspended particles, noise, and vibrations due to the operations of the thermoelectric plant.	PB-9	(-)	D	34	MODERATE
Improvement of the quality of life and purchasing power of Project workers and their families.	PB-10	(+)	I	56	HIGH
Improvement in the public electricity service due to an increase in energy supply.	PB-11	(+)	D	70	HIGH
Possible exposure to diseases due to the influx of temporary or permanent labor.	PB-12	(-)	D	31	MODERATE
Risk of physical injury or loss of life to residents resulting from the use of force by Project security personnel.	PB-13	(-)	D	30	MODERATE
Risks of accidents that cause physical injuries or loss of life for workers during the operations of the thermoelectric plant and the electrical transmission line.	PB-14	(-)	D	32	MODERATE
Risk of accidents causing physical injury or loss of life to residents and visitors during the operations of the thermoelectric plant and the electrical transmission line.	PB-15	(-)	D	28	MODERATE

Impact	Code	Type	Effect	Significance	Classification
Generation of benefits for the population of Pepillo Salcedo through the execution of the Project Community Relations Plan.	PB-16	(+)	D	42	MODERATE
Risk of health effects to workers and residents from exposure to electromagnetic fields.	PB-17	(-)	D	28	MODERATE
Creation of permanent jobs.	EC-7	(+)	D	60	HIGH
Increase in financial circulation in the province of Montecristi.	EC-8	(+)	D	42	MODERATE
Increase in the flow of capital around the country's economy and tax collections by the City Council of the Pepillo Salcedo Municipality.	EC-9	(+)	D	40	MODERATE
Change of land use from idle to industrial.	US-1	(+)	D	36	MODERATE
Increase in the delivery capacity of electrical energy to the National Interconnected Electrical System.	SE-1	(+)	D	76	VERY HIGH
Increase in the efficiency of the country's energy system using cleaner technology with higher performance in electricity generation.	SE-2	(+)	D	52	HIGH
Increased demand for services provided by State entities during project operations.	IS-2	(-)	I	46	MODERATE
Increase in fuel and electrical energy consumption.	RC-4	(-)	D	41	MODERATE
Increased water consumption.	RC-5	(-)	D	44	MODERATE
Introduction of anthropic elements in the rural landscape.	PS-2	(-)	D	40	MODERATE
Total impacts.	33	(-) =24 (+) =9 (+/-) =0	D=30 I=3		L=7 M=21 H=4 VH= 1

Source: Elaborated by EMPACA / AECOM, 2023

Environmental, social and health and safety management program

The Environmental, Social, Health and Safety Management Program (ESHSMP) for the Manzanillo Energy Power Plant project was developed based on the impacts and risks identified and is comprised of preventive, mitigation, and compensation measures to address these impacts and risks.

The ESHSMP is consistent with the environmental laws and regulations of the Dominican Republic, as well as the Environmental and Social Sustainability Performance Standards and the IFC Environmental, Health and Safety Guidelines.

The following are the programs and subprograms for implementation of the measures during the construction and operation phases of the project:

Subsection	Program/Plan
8.1	Program of preventive, mitigation, and environmental and social compensation measures.
8.2	Environmental monitoring program.
8.3	Relationship plan with stakeholders.
8.4	Grievance mechanism, claims, and suggestions for the community.
8.5	Adaptation plan to the effects of climate change.
8.6	Health and safety plan at work.
8.7	Grievance mechanism, claims, and suggestions for project workers.
8.8	Community health and safety plan.
8.9	Emergency preparedness and response plan.
8.10	Decommissioning plan.
8.11	Safety, health and environmental education plan for workers and the community.

Source: Elaborated by EMPACA / AECOM, 2023

The program of preventive, mitigation and environmental and social compensation measures is divided into several plans. Each plan includes the following:

- Impacts to which the plan is directed.
- Objective.
- Measures to implement.
- Indicators of performance.
- Goals for performance indicators.
- Execution team
- Supervisor.
- Responsible.
- Location for the implementation of the measures.
- Monitoring frequency.
- Implementation time.
- Required records.
- Associated costs.

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1. INTRODUCTION

Manzanillo Energy Consortium Inc. (CME), integrated by the companies Coastal Petroleum Dominicana, S.A., Manzanillo Energy, S.A.S. and Lindsayca, Inc. is the consortium that was awarded the development of the project Manzanillo Energy Consortium Power Plant (Block 02), to be in the municipality of Pepillo Salcedo, Montecristi province, near the industrial facilities of the Port of Manzanillo.

This project was initiated through public bidding by the Ministry of Energy and Mines of the National Government of the Dominican Republic, aiming to enhance efficiency and meet the electricity supply demand in the Dominican Republic.

In adherence to both local and international best practices, conducting an Environmental and Social Impact Assessment (ESIA) is mandatory prior to initiating any project activities. This ESIA is designed to comprehensively understand the territorial context, encompassing biological, physical, and socio-economic systems in operation before the project begins. Subsequently, it evaluates the potential impacts of the project activities on the existing conditions. The culmination of this study leads to the issuance of an environmental license or authorization, as stipulated by Law 64-00 (General Law on Environment and Natural Resources) and the Environmental Assessment Process Regulation (2014). Manzanillo Energy Consortium, Inc. commissioned EMPACA, S.R.L, a local consulting firm (registration code in the list of environmental service providers No. F-00-016 of the Ministry of Environment and Natural Resources of the Dominican Republic), to conduct the environmental and social impact study (ESIA) of the project, under local requirement of the Dominican Republic. In turn, AECOM was contracted to develop the ESIA in compliance with international standards.

This chapter outlines the background, justification, purpose, and scope of the project, followed by the methodology used to prepare the ESIA and its respective categorization.

1.1 Project background

1.1.1 Context of the project

The Ministry of Energy and Mines of the National Government of the Dominican Republic, in order to ensure efficiency and meet the demand for electricity supply services in the Dominican Republic, called for bids (No. EDES-LPI-NG-01-2021) for the 840 MW electricity generation project comprised of two blocks of 420 MW each. This study focuses on Block 02; meanwhile, the construction of Block 01, situated to the north of Block 02, is planned but falls under the purview of a different developer and is not covered by this Environmental and Social Impact Assessment.

The Manzanillo Energy Consortium Power Plant project (Block 02) will be located in the municipality of Pepillo Salcedo, province of Montecristi, Dominican Republic. It will generally consist of the following components: a 420 MW power plant and an electrical transmission line to the National Interconnected Electrical System (SENI).

The power plant will occupy an area of 111,134.19 m². The associated power transmission line will extend over roughly 5 km with an easement zone of approximately 60 m wide, for a total area of approximately 300,000 m². This project is expected to be completed in 36 months and will have a total investment of USD\$ 550,000,000.00.

1.1.2 Objectives of the project

The primary goal of this project is to efficiently meet the current demand for electrical energy across the Dominican Republic, while simultaneously enhancing the resilience of the country's energy sector. This dual-focused objective is pursued through two key strategies.

Firstly, the project aims to diversify the energy supply by incorporating liquefied natural gas (LNG) into the energy mix. This approach is intended to reduce reliance on a singular source of energy, stabilize energy prices, and lessen the environmental impact compared to traditional fossil fuels. The introduction of LNG as an alternative energy source is expected to bolster the reliability and sustainability of the national energy supply.

Secondly, the selection of the project's location is strategically designed to take advantage of natural geographical features that offer protection against hurricanes, a crucial consideration given the region's susceptibility to such natural disasters. This strategical advantage not only ensures a more stable and reliable energy supply, but also diminishes the likelihood of extensive repair costs and operational downtimes following adverse weather conditions, enhancing the resilience of the country's energy infrastructure against environmental challenges.

1.2 Project justification

Dominican Republic recorded a production of 18.6 TWh of electricity in 2020; fossil fuels accounted for almost 85 % of production, followed by hydro (6.68 %), wind (6.11 %), solar (1.64 %) and biofuels (0.90 %). The country has faced a notably higher frequency of power outages in comparison to other countries in Latin America and the Caribbean, significantly affecting its socio-economic progress and the quality of life of its inhabitants.

The root causes of these outages can primarily be traced back to the deteriorating condition of the transmission and distribution infrastructure, which has struggled to keep pace with modern demands. Although the nation possesses adequate generation capacity, recurrent service interruptions at power plants exacerbate the reliability issues of the electrical system. At present, the supply of electricity in the Dominican Republic does not meet the demand of the population and constitutes an obstacle for the integral development of all sectors of the country. The average electricity demand registered during 2020 was approximately 2000 MW, with tourist areas experiencing significantly higher demand than other regions. This escalating demand has required the involvement of the private sector through the granting of generation and distribution concessions, aiming to bridge the gap between supply and demand of electricity.

The Manzanillo Energy Consortium Power Plant project (Block 02) is strategically positioned to tackle these enduring challenges head-on by:

Boosting Electricity Supply: The project is committed to augmenting the national grid's capacity with efficient and reliable electricity generation. This enhancement is critical for meeting the flourishing demand across the Dominican Republic, ensuring that both residential and commercial sectors have access to the power they require for growth and daily operations.

Economic Revitalization: By sourcing materials locally and generating employment opportunities throughout the construction and operational stages, the project promises to inject vitality into the local economy. The creation of jobs, both direct and indirect, will foster economic activity in the region, contributing to its overall development.

Strategic Development Integration: Aligning with the Manzanillo Master Development Plan, this project seeks to amplify the regional infrastructure improvements, thereby facilitating the expansion of the tourism and commercial sectors. The vision is to position Manzanillo as a key economic hub within the Dominican Republic, leveraging strategic infrastructure enhancements to spur comprehensive regional development.

1.3 Purpose, scope, and methodology of the environmental and social impact assessment study

1.3.1 Purpose

The primary purpose of this study is to conduct a detailed research and evaluation of potential impacts and risks to natural resources, alongside the physical, biotic, and social components, that may result from the project's execution. Key to this endeavor is to perform a thorough analysis of the project area's territorial dynamics, which necessitates understanding the interconnections between environmental attributes and human activities. This comprehensive understanding will enable the identification of how the project may influence these components, considering both immediate and long-term effects.

From this analysis, the Environmental, Social, and Safety Management Plan (ESSMP) will be devised. It outlines strategies to prevent, mitigate, or correct any adverse impacts, and where necessary, propose compensation measures for unavoidable negative outcomes. This plan will be rooted in a nuanced appreciation of the project's potential effects on the territorial dynamics, ensuring that interventions are both effective and sustainable. This approach highlights the significance of a profound territorial insight as a cornerstone for the project's environmental and social management, ensuring compliance with regulations and fostering sustainable development within the project's area of influence.

Additionally, the ESSMP will incorporate a comprehensive plan that establishes the mechanisms for tracking and monitoring the environmental and social measures adopted, ensuring a proactive management and response to any contingencies that emerge throughout the project's lifespan.

The Environmental and Social Impact Study of the project was carried out in strict compliance with the provisions of Law 64-00 on the Environment and Natural Resources and its regulations; the environmental regulations of the Dominican Republic; the international agreements of which the country is signatory, and the performance standards on environmental and social sustainability of the International Finance Corporation.

1.3.2 Scope

The ESIA presents the following scope:

- **Systems and Vulnerability:** Evaluate the capacity and vulnerability of natural and social systems that may be utilized or impacted by the project. This assessment aims to understand the resilience of these systems to change and their ability to continue providing essential services to the community and environment.
- **Impact Analysis:** Identify and scrutinize the impacts generated by the project during construction, operation, and maintenance phases. This analysis should cover both direct and indirect effects on the physical, biotic, socio-economic, and visual environments, providing a foundation for developing mitigation strategies.
- **Environmental and Social Management Plan:** Present a comprehensive plan detailing preventive, corrective, compensatory, and mitigative measures to address any negative impacts identified. This plan should ensure the project's environmental management is conducted at an optimal level, aligning with international performing standards best practices.
- **Compatibility and Cumulative Impact Assessment:** Review public or private projects currently operating in the project's area of influence, to evaluate compatibility and the potential cumulative impacts. This step ensures that the project aligns with regional development plans and considers the combined effects of existing and future activities.
- **Resource Utilization Analysis:** Collect and analyze data on the natural resources that will be used, affected, or depleted by the project during its construction, operation, and maintenance phases. This detailed analysis is intended to foster sustainable utilization of resources and mitigate environmental harm.
- **Monitoring Plan Design:** Develop a plan to monitor the effectiveness of the Environmental, Social, and Safety Management Program's activities. This plan should outline specific indicators, methodologies, and frequencies for monitoring to ensure ongoing compliance and adaptability.
- **Contingency Planning:** Formulate a contingency plan based on the identification and evaluation of potential accidents or risks not anticipated or outside the normal scope of the project's development and operation. This plan should detail response strategies for various scenarios to minimize adverse outcomes associated with project activities.

1.3.3 Methodology

The methodology employed for conducting the environmental and social assessment of the project utilizes a combination of custom designed procedures, checklists, and matrices. Leveraging in-depth knowledge of the study area, this approach facilitates the identification of sources of impact and environmental sensitivities. The process entails the following components:

Technical Description: This component involves a detailed exposition of the project's technical components as provided by the project developer. It includes a comprehensive outline of the activities planned for each phase of the project, encompassing construction, operation, and maintenance. Additionally, this section presents the technological improvements and innovations proposed for the project, highlighting how these advancements contribute to the project's efficiency, sustainability, and reduced environmental impact. This thorough documentation ensures a clear understanding of the project's technical scope and its developmental blueprint.

Environmental and Social Baseline: This section analyzes the physical, natural and socio economic components based on secondary sources (Atlas of Biodiversity and Natural Resources, 2012, National Population and Housing Census, 2010, survey of the components of the physical,

natural and human environment of Block 01 carried out between October and December 2022 and January and February 2023, among others); along with primary sources such as field visits, sampling of surface and marine water quality, soils, sea floor sediments, air quality, noise and vibration levels, characterization of terrestrial flora and fauna and marine biota, surveys of the population, interviews and focus groups with stakeholders involved in the development of the project, which will be affected by the work that will be carried out for the construction of the project.

Impact Identification: This component involves a systematic examination of the interconnections between the project's key elements and the surrounding environmental and social context to identify potential impacts. This process aims to identify impacts that could arise during the construction, operation, and decommissioning phases of the project. This comprehensive approach ensures that all possible effects on the environment and local communities are considered.

Impact Evaluation: Once potential impacts (direct, indirect and cumulative) have been identified, they are thoroughly evaluated using a range of criteria, including their magnitude, duration, frequency, and reversibility. This evaluation process employs quantitative and qualitative methods to ascertain the significance of each impact, categorizing them based on their intensity and the extent to which they can be mitigated. This structured assessment aids in prioritizing impacts for management and forms the basis for developing a strategic response to potential environmental and social challenges.

Mitigation Measures: Based on the outcome of the impact evaluation, specific mitigation measures are proposed to address each identified impact. These strategies are designed to avoid, minimize, rectify, or compensate for the adverse effects of the project on the environment and local communities. Mitigation measures may include technological solutions, habitat restoration, and community support programs. The objective is to reduce the project's environmental footprint and enhance positive outcomes wherever possible.

Residual Impact Assessment: After proposing mitigation measures, the assessment process identifies residual impacts—those impacts that are expected to remain despite efforts to mitigate. This step involves evaluating the extent of unavoidable impacts and their potential implications for the environment and local communities. Understanding residual impacts is critical for developing additional management strategies, informing stakeholders, and fulfilling regulatory requirements.

Monitoring and Evaluation: A comprehensive monitoring and evaluation program is established to track the effectiveness of the implemented mitigation measures and to monitor the project's ongoing environmental and social activities. This program includes setting up indicators for key impacts, establishing baseline conditions, and specifying thresholds that trigger corrective actions.

The specific methodologies were developed in each of the chapters of the environmental and social impact assessment study.

1.3.4 Structure and Contents of this Report

This document comprises ten chapters listed below:

Non-technical executive summary that concisely presents the key findings and recommended actions. This section is designed to provide a clear and accessible overview of the most critical aspects of the study for readers who may not have a technical background, ensuring that the essential conclusions and actions are communicated effectively.

- Chapter 1: Introduction. This chapter briefly sets out the context of the study and the history of the project.
- Chapter 2: Legal Framework. This chapter describes the legal and regulatory framework in which the project operates, as well as the international framework observed during the project's lifecycle.
- Chapter 3: Analysis of Alternatives. This chapter provides a detailed technical description of the various alternatives proposed for the project scheme. It evaluates the criteria used to determine the selection of the least impactful option, ensuring a comprehensive analysis of potential environmental and social impacts to identify the most sustainable and viable solution.
- Chapter 4: Project Description. This chapter presents the technical description of the project.
- Chapter 5: Stakeholder Involvement. This section presents the consultation activities conducted during the study, detailing the comprehensive process that includes the identification of stakeholders, organization of public forums, formation of focus groups, and conducting interviews with key social stakeholders. This multi-faceted approach ensures a broad and inclusive engagement strategy, aiming to gather diverse perspectives and insights to inform the project development effectively.
- Chapter 6: Environmental and Social Baseline. This section outlines the current baseline of both the environmental (encompassing physical and biological elements) and socioeconomic components within the project's area of influence. It provides a comprehensive overview of the pre-existing conditions, serving as a foundation for evaluating the potential impacts and formulating mitigation strategies. By establishing a detailed baseline, this analysis ensures a thorough understanding of the area's ecological dynamics, biodiversity, and social fabric, crucial for assessing changes attributable to the project and guiding sustainable development practices.
- Chapter 7: Evaluation of the main environmental and social impacts. This chapter presents the findings of identified environmental and social impacts. By analyzing data from the environmental and social baseline alongside stakeholder consultations, this section offers a detailed examination of how the project could affect physical, biological, and socioeconomic components within the project area of influence. The analysis follows a robust methodology that incorporates both quantitative measures and qualitative insights, ensuring a holistic understanding of the project's implications on the environment and local communities.
- Chapter 8: Environmental, Social and Health Management Program (ESHMP). This section presents the measures for prevention, correction, compensation, and mitigation strategies of the impacts generated to ensure optimal environmental management.
- Chapter 9: Conclusions and recommendations. This chapter highlights the main features of the study and reports the observations of the consulting team for the continuation of the project.

- Chapter 10: References
- Annexes

1.3.5 Challenges faced during the execution of the study.

During the preparation of this study, several elements and situations were presented that are mentioned below:

- Lack of a clear definition at the end of the rainy season, which delayed the field missions of the biological component, scheduled for the dry season. It is noted that, although there were differences between the data from both seasons, to characterize this component more accurately, information from the field survey conducted in February 2023 was also taken as a reference.
- The vegetation within the area designated for the Block 02 power plant has already experienced disturbances prior to the commencement of fieldwork. This challenge underscores the importance of assessing the current ecological conditions to accurately identify the baseline state of the environment and the potential incremental impact of the project.

Given that the project is in its preliminary design stages, there is a limitation in the specificity of details regarding certain aspects. This constraint highlights the need for a flexible and adaptive approach to environmental and social impact assessments, allowing for refinements as the project's design evolves and more information becomes available.

- The country pre-electoral process influences consultation spaces, at both national and local level, as well as within the social organizations, which are at time affected by disputes caused by the interest of each party to promote, openly or veiled, their candidates. This fact could have influenced some public entities (municipalities, educational, health and civil registry entities) to show reservations regarding full collaboration in the collection of relevant socioeconomic baseline information.
- Limited participation of Haitian nationals in the survey activity, as its execution coincided with an increase in the deportation of Haitian nationals in irregular conditions, together with the fact that the national population and housing census for the decade 2020-2030 would be carried out soon.

1.4 Categorization of the environmental and social impact assessment study

At the local standard level – Dominican Republic

Through the General Law of the Environment and Natural Resources (Law 64-00) and the Regulation of the Environmental Assessment Process of September 22, 2014, the Ministry of the Environment and Natural Resources (MIMARENA) establishes four (4) categories of projects, which are defined by the potential they have to impact the environment and natural resources. The table below defines each of the categories:

Category	Description	Requirement
A	A project is classified in this category when it can produce adverse impacts on the environment, either due to its characteristics or because it is located in, or near environmentally sensitive areas, the magnitude and extent of which must be determined during the study. This type of project includes preventive, mitigating and/or compensatory measures for the identified impacts, establishing the Environmental Management and Adaptation Program necessary for the project to be executed.	Environmental Impact Study, as established by Law 64-00.
B	A proposed project is classified in this category when the impacts are well known or moderate, and whose effects can be eliminated or minimized through the adoption of necessary mitigation, prevention, or compensation measures, which are established in the Environmental Management and Adaptation Program.	Environmental Impact Statement (DIA), as established by Law 64-00.
C	A proposed project is classified in this category if the result of its diagnosis indicates that these impacts are well known or that its execution does not cause significant negative environmental impacts.	Establish the corresponding mitigation measures to comply with existing environmental regulations, as established by Law 64-00.
D	A proposed project is classified in this category if the result of its diagnosis indicates that human activities are classified as having low environmental impact or low environmental risk.	Compliance with existing environmental regulations, as established by Law no. 64-00.

The Manzanillo Energy Consortium Power Plant project is classified as Category A, which requires an environmental and social impact assessment based on the MIMARENA terms of reference. These terms of reference are given when the project to be developed is registered, in said entity, with the general description and permits of the municipalities.

At the level of international standards

The Equator Principles, in Principle 1, and the Social and Environmental Sustainability Policy of the International Finance Corporation (IFC), establish the categorization of projects as a requirement to obtain international financing. The determined categories are the following:

Category A: project with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible, or unprecedented.

Category B: project with limited potential adverse environmental and social risks or impacts that are few, generally site-specific, largely reversible, and easily addressed through mitigation measures.

Category C: project with minimal or no adverse environmental and social risks or impacts.

Category FI: projects involving investments in financial institutions (FIs) or through delivery mechanisms involving financial intermediation. This category is divided into the following subcategories:

- **FI-1** refers to cases where an FI's existing or proposed portfolio includes, or is expected to include substantial financial exposure to business activities with significant potential adverse environmental or social risks or impacts that are diverse, irreversible or unprecedented.
- **FI-2** in these cases an FI's existing or proposed portfolio includes, or is expected to include business activities that have limited potential adverse environmental or social risks or impacts that are few, generally site-specific, largely reversible, and readily addressed through mitigation measures; or includes a very limited number of business activities with potential adverse environmental or social risks or impacts that are diverse, irreversible, or unprecedented.
- **FI-3** refers to cases where an FI's existing or proposed portfolio includes financial exposure to business activities that predominantly have minimal or no adverse environmental or social impacts.

For its part, the Organization for Economic Cooperation and Development (OECD) classifies projects as follows:

Category A: Projects included in this classification have the potential to produce significant adverse environmental and/or social impacts that are diverse, irreversible and/or unprecedented. These impacts may affect a wider area than the sites or facilities that are the subject of the physical works. This category, in principle, includes projects in sensitive sectors or located in or near sensitive areas.

Category B: A project is classified in this category if its potential environmental and/or social impacts are less adverse than those of Category A projects. Generally, these impacts are few, are site-specific, few or none are irreversible, and mitigation measures are more readily available.

Category C: This classification is given to projects that have minimal or no environmental and/or social impacts.

Based on the above-described provisions of the Equator Principles, IFC and OECD criteria, the Manzanillo Energy Consortium Power Plant project is classified as a **Category A** project.

2. LEGAL FRAMEWORK

This chapter analyzes the national and international legislation and regulations that the Manzanillo Energy Consortium Power Plant project must comply with, in accordance with its actions and the characteristics of the environmental baseline of the area where it will be built and operated.

For the preparation of this chapter, a review and analysis of the corresponding laws, national and international, sectoral, and regional agreements was carried out, indicating the relevant aspects that the project will comply with. We also reviewed and studied the relevant regulations and standards governing environmental quality and land use at the local, national, and international levels that will govern the project's activities, including those related to climate change adaptation.

Legislation in force in the Dominican Republic

2.1.1 Constitution of the Dominican Republic

The Magna Carta of the Dominican Republic establishes in its Article 14: That the non-renewable natural resources found in the territory and maritime spaces under national jurisdiction, genetic resources, biodiversity and the radio electric spectrum are patrimony of the Nation.

Section IV is dedicated to collective and environmental rights, and establishes the following:

Art. 66: The State recognizes collective and diffuse rights and interests, which are exercised under the conditions and limitations established by law. Consequently, it protects:

- 1) The conservation of the ecological balance, fauna and flora;
- 2) Environmental protection;
- 3) The preservation of cultural, historical, urban, artistic, architectural, and archaeological heritage.

Art. 67: It is the duty of the State to prevent pollution, protect and maintain the environment for the benefit of present and future generations. Consequently:

- 1) Everyone has the right, both individually and collectively, to the sustainable use and enjoyment of natural resources; to live in a healthy environment, ecologically balanced and adequate for the development and preservation of the different forms of life, landscape and nature;
- 2) The introduction, development, production, possession, commercialization, transport, storage and use of chemical, biological and nuclear weapons and internationally banned agrochemicals, as well as nuclear waste, toxic and hazardous waste, are prohibited;
- 3) The State shall promote, in the public and private sectors, the use of non-polluting alternative technologies and energies;
- 4) In the contracts entered into by the State or in the permits granted involving the use and exploitation of natural resources, the obligation to conserve the ecological balance, access to technology and its transfer, as well as to restore the environment to its natural state, if this is altered, shall be included;
- 5) The public authorities shall prevent and control the factors of environmental deterioration, impose legal sanctions, impose strict liability for damage caused to the environment and natural resources, and demand their repair.

2.1.2 Organic Law of the National Development Strategy

In order to guarantee the Dominican population a set of civil, political, economic, social, cultural, sports, collective and environmental rights, Law 01-12 was issued, which covers from its enactment until December 31, 2030.

In accordance with this law, public policies will be articulated around four strategic axes and their objectives, which are defined in the following table. Table 2-1.

Table 2-1. Strategic axes of the National Development Strategy and their definitions

Strategic focus	Definition
First Axis, which seeks a Social Democratic Rule of Law.	A social and democratic rule of law, with institutions that act ethically, transparently, and efficiently at the service of a responsible and participatory society, guaranteeing security and promoting equity, governance, peaceful coexistence, and national and local development.
Second Axis, which seeks a Society with Equal Rights and Opportunities.	A society with equal rights and opportunities, in which the entire population is guaranteed education, health, decent housing and quality basic services, and which promotes the progressive reduction of poverty and social and territorial inequality.
Third Axis, which seeks a Sustainable, Integrating and Competitive Economy.	A territorially and sectorially integrated, innovative, diversified, plural, quality-oriented and environmentally sustainable economy that creates and deconcentrates wealth, generates high and sustained growth with equity and employment, takes advantage of and enhances local market opportunities and is competitively inserted in the global economy.
Fourth Axis, which seeks an Environmentally Sustainable Production and Consumption Society that adapts to Climate Change.	A society with a culture of sustainable production and consumption, which manages risks and the protection of the environment and natural resources fairly and effectively and promotes adequate adaptation to climate change.

Source: Ministry of Economy, Planning and Development, 2012

2.1.3 Penal Code of the Dominican Republic

Reference is made to the Penal Code of the Dominican Republic, because of its relation to the prohibition of discrimination. The following articles are of special interest:

Art. 309-1.- (Added by Law 24-97 of January 28, 1997 G.O. 9945). Violence against women is any action or conduct, public or private, due to their gender, that causes physical, sexual or psychological harm or suffering to women, through the use of physical force or psychological or verbal violence, intimidation or persecution.

Article 336.- (Added by Law 24-97 of January 28, 1997 G. O. 9945). Any distinction made between natural persons based on their origin, age, sex, family status, state of health, disabilities, customs, political opinions, trade union activities, occupation, membership or non-membership, real or supposed, of a particular ethnic group, nation, race or religion constitutes discrimination.

Any distinction made between legal entities based on origin, age, gender, family status, health status, disabilities, customs, political opinions, trade union activities, membership or non-membership or alleged membership or non-membership of an ethnic group also constitutes discrimination.

A nation, a race, or a particular religion of the members or of any of the members of the moral person.

2.1.4 Labor Code of the Dominican Republic

The Labor Code of the Dominican Republic (Law No. 16-92) is a document governing Dominican labor law, drafted by a labor drafting commission.

The main purpose of this code is to regulate the rights and obligations of employees and employers, workers and to provide the means to reconcile their respective interests, and to define the employment contract, that by which a person is obliged to render a personal service to another, under the immediate or delegated dependence and direction of the latter.

Fundamental Principles Labor Code.

Principle VII: Any discrimination, exclusion or preference based on sex, age, race, color, national extraction, social origin, political opinion, union membership or religious belief is prohibited, except for the exceptions provided by law for the protection of the worker. Distinctions, exclusions, or preferences based on the qualifications required for a particular job are not covered by this prohibition.

Art. 47.- Employers are prohibited:

Exercising actions against the employee that may be considered sexual harassment, or supporting or not intervening in the event that it is carried out by their representatives.

Art. 351.- All members of the Union, without distinction of age, sex, or nationality, have the equal right to attend the sessions of the General Assembly, to express their opinions therein and to vote on the resolutions that are regularly submitted.

Annexed to the labor code are the international conventions of the ILO approved by the National Congress of the Dominican Republic.

Convention concerning equal remuneration for men and women workers for work of equal value.

Approved by the National Congress, by means of Resolution No. 3592, promulgated on 6-30-53, Official Gazette No. 7584, dated 7-22-53.

Art 1: For the purposes of this Agreement:

a) the term "remuneration" includes the ordinary, basic, or minimum salary or wage, and any other emolument in cash or in kind paid by the employer, directly or indirectly, to the employee, in respect of the latter's employment.

b) the term "equal remuneration between male and female labor for work of equal value" means rates of remuneration fixed without discrimination as to sex.

Convention concerning Discrimination in Respect of Employment and Occupation

Art 1: For the purposes of this Convention, the term "discrimination" includes:

a) any distinction, exclusion or preference based on race, color, sex, religion, political opinion, national extraction, or social origin which has the effect of nullifying or impairing equality of opportunity or treatment.

Convention No. 122 concerning employment policy

Art 1: In order to stimulate economic growth and development, to raise the standard of living, to meet labor needs, and to solve the problem of unemployment and underemployment, each member shall formulate and carry out, as a major objective, an active policy designed to promote full, productive and freely chosen employment.

The indicated policy should aim to guarantee:

- a) that there will be work for all available and seeking work;
- b) that such work will be as productive as possible;
- c) that there shall be freedom to choose employment and that every worker shall have every opportunity to acquire the necessary training for suitable employment and to use in that employment such training and skills as he possesses, without regard to race, skin color, gender, religion, political opinion, national extraction, or social origin.

2.2 Legal documentation framing the development of the project.

The Environmental and Social Impact Study is accompanied by the following legal documentation:

2.2.1 Certificate of title deeds for the project lands

See Annex 1.

2.2.2 Cadastral map

See Annex 2.

2.2.3 International public bidding for new generation No. EDES-LPI-NG-01-2021 for the Purchase and Sale of Power and Associated Electric Energy through Long-Term Contracts of the Electricity Distribution Companies.

See Annex 3.

2.2.4 Legal documentation of the promoter company: Certificate of registration of legal entities in the National Registry of Taxpayers, Certificate of Mercantile Registration as a Corporation issued by the Chamber of Commerce and Production of Montecristi, Inc. and Minutes of the General Constitutive Assembly of Consortium Manzanillo Energy, S.A.

See Annex 4.

2.2.5 No Objection Certifications

- Pepillo Salcedo City Hall.
- Dominican Electricity Transmission Company ETED.
- Corporación Dominicana de Empresas Eléctricas Estatales. Authorization for access to the land.
- Ministry of Environment and Natural Resources. Permit for tree cutting and pruning with minimal impacts.
- Pepillo Salcedo Fire Department.
- Dominican Republic Civil Defense.
- Naval Command of Port Captaincy and Maritime Authority of the Dominican Republic.

See Annex 5.

2.3 Environmental legislation in force in the Dominican Republic

This section analyzes the national legislation and regulations that may limit the development of the project:

- Law (64-00) General Law of Environment and Natural Resources.
- General Law of Integral Management and Co-processing of Solid Waste.
- Sector Law No. 202-04 of Protected Areas.
- Law (333/2015) Sectorial on Biodiversity.
- Law No. 318 of April 26, 1972, which creates the Museum of Dominican Man.
- Law No. 564 of September 27, 1973, for the protection and conservation of National Ethnological and Archaeological objects.
- Law No. 41-00. Year 2000. Creates the Ministry of Culture of the Dominican Republic.
- Decree No. 571-09 creates several national parks, natural monuments, biological reserves, scientific reserves, marine sanctuaries, wildlife refuges, Boca de Nigua national recreation area and the Alto de Jimenoa National Monument. It establishes a buffer or sustainable use zone of 300 m around all conservation units that have the generic categories of the World Conservation Union, provides for a national inventory of several wetlands, and creates a 250 m buffer zone around the reservoirs of all the country's dams.
- Decree No. 297-87 of June 3, 1987, declaring all caves, caverns, and other subway cavities as Natural Heritage.
- Decree No. 264-06 which declares the use of natural gas to be of national interest.
- Decree No. 3-24 of January 8, 2024, in its Article 1, declares of high national interest the promotion and development of traditional and renewable sources of electricity generation projects to be executed in the territory of the Dominican Republic to supply the growing demand for electricity and maintain the stability of the national electric service.
- IUCN Red List of Threatened Species, Bird Life International.
- List of Endangered, Threatened or Protected Species of the Dominican Republic (Red List).
- Red List of the Vascular Flora of the Dominican Republic.
- Environmental Standard on Groundwater Quality and Groundwater Discharges.
- Environmental Standard on Surface and Coastal Water Quality (NA-CASC-12).
- Environmental Technical Regulation on Discharge Control in Surface Water, Sanitary Sewage, Coastal Waters and Reuse of Treated Wastewater (MA-VGA-RT-003-2023).
- Environmental Standard for Noise Protection (NA-RU-001-03).
- Natural Gas Regulations.
- Standard for the Environmental Management of Non-Hazardous Solid Waste (NA-RS-001-03).
- Compendium of Regulations and Procedures for Environmental Authorizations in the Dominican Republic.
- Air Quality Technical Environmental Regulations.
- Environmental Technical Regulations for the Control of Air Pollutant Emissions from Fixed Sources.
- Archaeological Research Regulations, 2011.
- Regulation for the Integral Management of Used Oils.

- Occupational Health and Safety Regulations.
- Regulation for Safety and Fire Protection of the Dominican Republic R-032.
- Regulations and Procedure for Public Consultation in the Environmental Impact Assessment Process.
- Resolution No. 0010/2018, which provides the regulations for the management of the buffer zones of the conservation units of the national system of protected areas (SINAP) of the Dominican Republic.
- Resolution 02-2014 incorporating considerations of adaptation to the effects of climate change in environmental management from the Environmental Impact Assessment process.
- Guidance for conducting Social Impact Assessments (SIA) within the Environmental Impact Assessment (EIA) process.

2.3.1 Environmental legislation and regulations for environmental impact assessments

The Environmental Impact Study for the Consortium Manzanillo Energy Power Plant was prepared taking into consideration the provisions of the following articles of the **General Law (64-00) on the Environment and Natural Resources**:

In order to prevent, control and mitigate possible impacts on the environment and natural resources caused by works, projects and activities, the environmental evaluation process is established with the following instruments (those corresponding to the project are marked in bold):

- 1) Environmental impact statement (EIS);
- 2) Strategic environmental assessment;
- 3) **Environmental impact study;**
- 4) Environmental report;
- 5) **Environmental license;**
- 6) Environmental permit;
- 7) Environmental audits; and
- 8) **Public consultation.**

Art. 40. The project, infrastructure work, industry, or any other activity that by its characteristics may affect, in one way or another, the environment and natural resources, shall obtain from the Secretariat of State for the Environment and Natural Resources, prior to its execution, the environmental permit or license, according to the magnitude of the effects it may cause.

Art. 41. The projects or activities that require the presentation of an environmental impact assessment are the following:

- 1) Ports, docks, waterways, breakwaters, jetties, canals, shipyards, shipbreaking yards, marine terminals, reservoirs, dams, dikes, irrigation canals and aqueducts;
- 2) **High voltage electric transmission lines and their substations;**
- 3) **Hydro and thermoelectric power plants and nuclear generation plants;**
- 4) Airports, bus and rail terminals, railways, highways, roads and public roads;

- 5) Urban development and human settlements projects; urban regulation plans;
- 6) Industrial plants, including sugar, cement, liquor, brewery, paper, chemical, textile, construction materials, metallic equipment and products, leather and hide tanning, gas, halogen, hydrazine and acid production;
- 7) Agro-industries and slaughterhouses, breeding stables, dairy and fattening of animals of industrial dimensions;
- 8) Agrarian transformation plans, agricultural and livestock plantations, rural settlements, including those executed in accordance with the Agrarian Reform laws;
- 9) Mining projects, including oil and peat; exploration or prospecting, removal of topsoil and crust, exploitation, construction and operation of wells, tailings dams, tailings processing plants, refineries and waste disposal;
- 10) Extraction of aggregates (rocks, gravels and sands);
- 11) Installation of oil pipelines, gas pipelines, mining pipelines and other similar pipelines;
- 12) Projects for commercial tree plantations, sawmills and timber processing plants;
- 13) Projects for the exploitation or cultivation of hydrobiological resources and their processing plants;
- 14) Importation, production, formulation, transformation, use, commercialization, storage, transportation, disposal, recycling or reuse of toxic, noxious, explosive, radioactive, flammable, corrosive or reactive substances and others of evident danger;
- 15) Environmental sanitation systems, such as sewage and drinking water systems, sewage and industrial, domestic and municipal toxic waste treatment plants, sanitary landfills, submarine outfalls, solid, liquid or gaseous effluent treatment and disposal systems;
- 16) The execution of works, programs and activities in national parks and other protected areas;
- 17) The massive application of chemical products or combinations in urban areas or in areas larger than 100 hectares in rural areas;
- 18) Engineering works of any kind that are projected to be carried out in protection or water production forests and other fragile ecosystems, in cloud or rain forests, in high basins, in wetlands or in coastal areas;
- 19) Hotel or tourism development facilities, and
- 20) Industrial parks, maquiladoras or processing industries and free trade zones.

Paragraph II. The projects, facilities or works, both private and State, shall be subject to the system of environmental and social impact assessments.

Paragraph VI. When the State is the promoter, executor, or takes an active part in any of the development project plans, it shall contract the services of private consultants, or legal persons, in order to carry out the corresponding environmental studies and shall comply with the requirements established in the present law.

Art. 42. The environmental impact statement (EIS), the environmental impact study and the environmental report shall be paid for by the stakeholder in developing the activity, work, or

project, and shall be carried out by a technical team, multidisciplinary if necessary, and may be represented by one of the same. It will be a public document, subject to discussion, and those who prepare it must be registered for statistical and information purposes with the Secretary of State for the Environment and Natural Resources, who will establish the certification procedure for service providers of environmental statements, reports, studies, diagnoses, evaluations, and audits.

Art. 44. The environmental license and permit shall include the environmental management and adaptation program to be carried out by the person responsible for the activity, work or project, establishing the form of follow-up and compliance with it.

Paragraph. The environmental management and adequacy program, established in the present article, shall be made on the basis of the environmental parameters and indicators referred to in articles 78 and following of chapter I, title IV, of the present law. Until such time as these indicators and parameters are not definitively established, provisional parameters shall be used, and the Secretariat of State of the Environment and Natural Resources shall define a minimum percentage of reduction of the polluting potential, which shall be established in all environmental permits and licenses issued.

Art. 1 of the Compendium of Regulations and Procedures for Environmental Authorizations in the Dominican Republic states that the purpose of these regulations is to regulate the environmental authorization process established in the General Law on the Environment and Natural Resources, 64-00, in order to prevent, control and mitigate possible impacts on the environment and natural resources caused by works, projects and activities, as established in **Art. 38 to 55** of the aforementioned law.

2.3.2 Environmental legislation and air pollution regulations

For air pollution, Articles 92 and 93 of the General Law (64-00) on Environment and Natural Resources have been considered:

Art. 92. The Secretariat of State of the Environment and Natural Resources, in coordination with the Secretariat of State of Public Health and Social Assistance, and the municipalities, shall regulate the actions, activities or factors that may cause deterioration and/or degradation of the quality of the air or the atmosphere, in accordance with the provisions of this law, the sectorial law and the regulations on the protection of the atmosphere.

Art. 93. The Secretariat of State of the Environment and Natural Resources, in coordination with the Secretariat of State of Public Works and the municipalities, shall regulate the control of gas emissions and harmful and polluting noises caused by motor vehicles, electric plants, other internal combustion engines, boilers and industrial activities.

The **Environmental Technical Regulation on Air Quality** (MIMARENA, 2018), **Art. 6.** Air Quality Reference Values. The concentrations of pollutants shall not exceed the maximum immission values contained in Table 1 Air quality standards of the Regulation (see Table 2-2 below).

Table 2-2. Air quality standards

Criteria pollutant	Average time	Permissible limit ($\mu\text{g}/\text{Nm}^3$)
Total Suspended Particulates (TSP)	Annual	80
	24 hours	230
Particulate matter fraction (PM-10)	Annual	50
	24 hours	150
Particulate matter fraction (PM-2.5)	Annual	15
	24 hours	65
Sulfur Dioxide (SO_2)	Annual	100
	24 hours	150
	1 hour	450
Nitrogen Dioxide (NO_2)	Annual	100
	24 hours	300
	1 hour	400
Ozone (O_3)	8 hours	160
	1 hour	250
Carbon Monoxide (CO)	8 hours	10,000
	1 hour	40,000
Lead (Pb)	Quarterly	1.5
	Annual	2
Hydrocarbons (CH) (non-methane)	3 hours	160

Note 1. The unit expressed in the table is micrograms per normal cubic meter ($\mu\text{g}/\text{Nm}^3$).

Note 2. Only CH is not considered a criteria pollutant.

Note 3. The annual average of 98% of the pollutant measurements recorded at the monitoring stations will not exceed the annual permissible limits.

Source: Taken from Table 1, Article 6 of the Air Quality Environmental Technical Regulations (MIMARENA, 2018).

The **Technical Environmental Regulation for the Control of Emissions of Air Pollutants from Fixed Sources**, Table 1 of Article 8 (Table 2-3). In this case considering the use of natural gas, fuel oil and diesel.

Table 2-3. Air pollutant emission limit specifications for stationary sources.

Contaminant	Activity	Existing (mg/Nm^3)	New (mg/Nm^3)	Remarks
Sulfur Dioxide (SO_2)	Generation, transmission, and distribution of electric power	2000	1170	Any power. Based on dry flow and 15% O_2 . Thermal power plants using fuel oil, coal and petcoke blends.

Contaminant	Activity	Existing (mg/Nm ³)	New (mg/Nm ³)	Remarks
				Fuels 2% or less sulfur.
	Generation, transmission, and distribution of electric power	1000	585	Any power. Based on dry flow and 15% O ₂ . Fuels 1% or less sulfur.
Nitrogen Oxides (NO_x)	Generation, transmission, and distribution of electric power	1800	1460	Based on dry flow and 15% O ₂ . Thermal power plants using diesel.
	Generation, transmission, and distribution of electric power	2000	1850	Based on dry flow and 15% O ₂ . Thermal power plants using bunker (fuel oil).
	Generation, transmission, and distribution of electric power	280	220	Thermal power plants using natural gas
Particulate matter	Generation, transmission, and distribution of electric power	75	50	Power > 200 MW Thermal power plants and facilities using fuel oil and coal

Note: All units are milligrams per cubic meter at normal conditions (mg/Nm³) except where otherwise noted.

Source: Taken from Table 1, Article 8 of the Environmental Technical Regulations for the Control of Air Pollutant Emissions from Stationary Sources, Dominican Republic (MIMARENA, 2018).

2.3.3 Environmental legislation and regulations on noise pollution

For the control of noise pollution, the provisions of Articles 93, 114 and 115 of the **General Law (64-00) on Environment and Natural Resources** have been considered.

Art. 93. The Secretariat of State of the Environment and Natural Resources, in coordination with the Secretariat of State of Public Works and the municipalities, shall regulate the control of gas emissions and harmful and polluting noises caused by motor vehicles, electric plants, other internal combustion engines, boilers and industrial activities.

Art. 114. The Secretariat of State for the Environment and Natural Resources, in coordination with the municipalities and the municipal police, shall regulate the emission of noises and sounds that are annoying or harmful to the environment and health, in the air and in the residential zones of urban and rural areas, as well as the fixed or ambulatory use of loudspeakers.

Art. 115. The emission of noises produced by the lack of exhaust silencer or its defective operation, electric plants, motor vehicles, as well as the use in private vehicles of sirens or horns, which due to the nature of their utility correspond to police services, ambulances, fire trucks or maritime vessels, is prohibited.

Environmental Standard for Noise Protection (NA-RU-001-03) presents the maximum permissible noise emission levels in decibels (dB) (A). See Table 2-4.

Table 2-4. Maximum allowable noise emission levels

Area categories	External noise dB(A)	
	Daytime (7 AM - 9 PM)	Nighttime (9 PM - 7 AM)
Areas I: Tranquility Zones		
• Hospitals, health centers, libraries	55	50
• Offices and schools	60	55
• Zoo, Botanical Garden	60	55
• Quiet areas for habitat preservation	60	50
Areas II: Residential Zone		
• Residential area	60	50
• Residential area with surrounding industries or businesses	65	55
Areas III: Commercial Zone		
• Industrial Area	70	55
• Commercial area	70	55
Areas IV		
a) Roads with one or more lanes and a single track		
• Through Area I	60	50
• Through Area II	65	55
• Through Area III	70	60
b) Roads with two or more lanes and multiple lanes		
• Through Area I	65	55
• Through Area II	65	60
• Through Area III	70	65

Source: Environmental Standard for Noise Protection (NA-RU-001-03), Dominican Republic.

2.3.4 Environmental legislation and regulations for solid waste management

Law (64-00) General Law of Environment and Natural Resources in Art. 107. The placement, launching and final disposal of solid or liquid wastes, toxic or not, in places not established for that purpose by the competent authority is prohibited.

Paragraph I. Under no circumstances shall municipal landfills be allowed to operate in the vicinity of beds, springs, bodies of water, or in those places where runoff and infiltration may contaminate it.

Paragraph II. In order to establish and put into operation a municipal landfill, it shall be indispensable to carry out the pertinent environmental assessment study, as established in Article 38 and following of this law.

The Standard for the Environmental Management of Non-Hazardous Solid Waste (NA-RS-001-03) was also consulted, which addresses the following aspects:

4.1. Solid waste that is delivered or deposited in the public waste collectors becomes the responsibility and property of the municipality.

4.2. Solid waste management will be subject to sanitary control to avoid environmental impacts, such as contamination of soil and water (surface and subway), bad odors, breeding of disease vectors and other public nuisances.

4.5. The management and disposal of non-hazardous municipal solid waste is a contracted public service. The authorities in charge of solid waste management are obliged to maintain their responsibility in the provision of the service. The delegation of this responsibility should be carried out under criteria of transparency and always oriented towards the common good.

On the other hand, the **General Law on Integral Management and Co-processing of Solid Waste** aims to prevent the generation of waste and establishes the legal regime for its integral management to promote reduction, reuse, recycling, recovery and valorization.

2.3.5 Environmental legislation and regulations for water and its contamination

The General Law (64-00) of Environment and Natural Resources establishes in:

Art. 133. Prohibits the dumping of debris or garbage in riverbeds and streams.

In the **Surface and Coastal Water Quality Standard (NA-CASC)** MIMARENA (2012) in Table 2.1. of **Art. 8**, the quality parameters are established by class, whether surface or coastal waters (Table 2-5).

Due to the location of the project in the vicinity of the port of Manzanillo, Class G has been considered: Coastal waters destined for industrial, port and shipping activities as defined in **Article 7**, which classifies the receiving water bodies of surface waters and coastal waters.

Table 2-5. Maximum acceptable values of physical, chemical and biological parameters present in surface water bodies and coastal waters.

Parameter	Unit	Surface water			Coastal waters		
		Class A	Class B	Class C	Class E	Class F	Class G
Microbiological							
Total coliforms	MPN/100 ml	1000	1000	10,000	1000	10,000	10,000
Fecal coliforms	MPN/100 ml	400	1000	4,000	400	2,000	2,000
E COLI	MPN/100 ml						
Surfactants	mg/L	0.15	0.5	2	-	-	-
Chlorides	mg/L	250	250	1000	-	-	-
Color	U.pt-co	15	50	200	CN	CN	-
BOD ₅	mg/L	2	5	100	-	-	-
Fluorides	mg/L	0.7	1	3	1.5	1.5	-
Phosphorus PO ₄ -P	mg/L	-	-	-	0.4.	0.4	-
Total Phosphorus	mg/L	0.025	0.025	0.1	-	-	-
Grease and oil	mg/L	absent	1	20	1	1	1
NH ₃ -N	mg/L	0.5	0.5	-	0.5	0.5	-
NO ₃ N + NO ₂ -N	mg/L	10	10	-	15	20	-
Dissolved Oxygen	% Sat	>80	>70	>50	> 60	>50	>45
pH	-	6.5-8.5	1,000	5.0-10.0	7.5-8.5	7.5-8.5	-
Dissolved solids	mg/L	1,000	1000	5000			

Parameter	Unit	Surface water			Coastal waters		
		Class A	Class B	Class C	Class E	Class F	Class G
Floating Solid	mg/L	absent	absent	absent	absent	absent	absent
Sulfate	mg/L	400	400	5000	-	-	-
Sulfide	mg/L	0.002	0.002	-	0.01	0.01	-
ΔT	$^{\circ}C$	+/- 3	+/- 3	+/- 3	+/- 3	+/- 3	+/- 3
Metals							
Arsenic	mg/L	0.05	0.05	1	0.15	0.15	-
Aluminum	mg/L	5	5				
Barium	mg/L	1	2	10	1	1	-
Beryllium	mg/L	0.1	0.1				
Boron	mg/L	0.5	0.5	5	5	5	-
Cadmium	mg/L	0.005	0.005	0.05	0.005	0.005	0.005
Cyanide	mg/L	0.1	0.1	0.5	0.02	0.02	-
Cobalt	mg/L	0.2	0.2	0.5	-	-	-

Note: Classes D-I and D-2 are not included in this table since all their parameters must meet natural conditions, (-) indicates the absence of a standard value for that parameter in that class.

Parameter	Unit	Surface water			Coastal waters		
		Class A	Class B	Class C	Class E	Class F	Class G
Copper	mg/L	0.2	0.2	2	0.05	0.05	-
Hexavalent chromium, Cr6	mg/L	0.01	0.01	0.1	0.05	0.1	0.1
Total Chromium	mg/L	0.05	0.05	1	0.1	0.3	0.3
Iron	mg/L	0.3	0.3	3	0.3	0.3	-
Lithium	mg/L	2.5	2.5				
Manganese	mg/L	0.5	1	5	0.1	0.1	-
Mercury	mg/L	0.001	0.001	0.005	0.001	0.001	0.005
Molybdenum	mg/L	0.01	0.01				
Nickel	mg/L	0.1	0.1	-	0.008	0.008	-
Silver	mg/L	0.01	0.01	0.1	0.01	0.01	-
Lead	mg/L	0.05	0.05	0.5	0.05	0.05	-
Selenium	mg/L	0.01	0.01	0.5	0.01	0.01	-
Vanadium	mg/L	0.1	0.1				
Zinc	mg/L	0.05	0.05	0.1	0.05	0.05	-
RADIOACTIVITY							
Activity α	Bq/L	0.1	0.1	0.1	0.1	0.1	-
Activity β	Bq/L	1	1	1	1	1	
Biocides (Organochlorines and other persistent)							
Aldrin -Dieldrin	$\mu g/L$	0.0008	0.0008	-	0.0008	0.0008	-
Chlordane	$\mu g/L$	0.005	0.004	-	0.005	0.005	-
DDT and metabolites	$\mu g/L$	0.0003	0.0003	-	0.0003	0.0003	-
Endosulfan	$\mu g/L$	0.009	0.009	-	0.009	0.009	-
Endrin	$\mu g/L$	0.002	0.002	-	0.002	0.002	-
Heptachlor	$\mu g/L$	0.001	0.001	-	0.001	0.001	-
Lindane	$\mu g/L$	0.075	0.075	-	0.075	0.075	-
Methoxychlor	$\mu g/L$	0.02	0.02	-	0.02	0.02	-

Parameter	Unit	Surface water			Coastal waters		
		Class A	Class B	Class C	Class E	Class F	Class G
Mirex	µg/L	0.001	0.001	-	0.001	0.001	-
Pentachlorophenol	µg/L	7.9	7.9	-	7.9	7.9	-
Peruvian	µg/L	0.07	0.07	-	0.07	0.07	-
Toxaphene	µg/L	0.0002	0.0002	-	0.0002	0.0002	-
Biocides (Organo-phosphates, sulfuruses and other non-persistent)							
Azinphos-Methyl	µg/L	0.01	0.01	-	0.01	0.01	-
Chlorpyrifos	µg/L	0.04	0.04	-	0.006	0.006	-
Coumafos	µg/L	0.01	0.01	-	0.01	0.01	-
Diazinon	µg/L	0.00002	0.00002	-			
2-4 D	µg/L	4	4	-	absent	absent	-
Paraquat	µg/L	0.00001	0.00001	-	-	-	-
Diquat	µg/L	0.00007	0.00007	-	-	-	-

Note: Classes D-I and D-2 are not included in this table since all their parameters must meet natural conditions, (-) indicates the absence of a standard value for that parameter in that class.

Source: Taken from Table 2.1 of Article 8 of the Surface and Coastal Water Quality Standard, (MIMARENA, 2012).

Technical Environmental Regulations on Control of Discharges to Surface Water, Sanitary Sewage, Coastal Waters and Reuse of Treated Wastewater (MA-VGA-RT-003-2023) MIMARENA (2023). **Art. 7** indicates that industries that discharge their liquid waste into coastal waters will be governed by the provisions of Table 4, (Table 2-6). taking as a general reference what is established in Table A1, for waste discharges of any origin in surface and coastal waters (Table 2-7).

Due to the location of the project in the vicinity of the port of Manzanillo, Class G has been considered: Coastal waters destined for industrial, port and shipping activities as defined in **Art. 7** of the **Surface and Coastal Water Quality Standard (NA-CASC)** MIMARENA (2012), which classifies the receiving water bodies of surface and coastal waters where industrial wastewater will be discharged after treatment.

Table 2-6. Maximum allowable values for industrial discharges to surface waters.

Type of industry	Parameters	Maximum daily allowable values (mg/L, except pH and when another unit is expressly indicated.
Conventional thermal power plants	pH	6-9
	COD	250
	OD	4
	SST	50
	Fats and oils	10
	Ptot	1
	Residual Cl	0.2
	Cd	0.005

Type of industry	Parameters	Maximum daily allowable values (mg/L, except pH and when another unit is expressly indicated.
	Co	0.2
	Cr	0.5
	Cu	0.5
	Fe	1
	Ni	0.1
	Pb	0.05
	Va	0.1
	Zn	2
	Hc	5
	ΔT	3°C

Source: Taken from Table 4 of the Environmental Standard on Control of Discharges to Surface Water, Sanitary Sewage and Coastal Waters (MIMARENA, 2012).

Table 2-7. Reference of discharges in surface and coastal waters.

Parameter	Unit	Surface water			Coastal waters		
		Class A	Class B	Class C	Class E	Class F	Class G
General Parameters							
Surfactants	mg/L	0.5	1	2	0.5	2	2
Chloride	mg/L	250	500	5000	-	-	-
Total coliforms	MPN/100mL	2500	2500	10000	-	-	-
Fecal coliforms	MPN/100mL	400	1000	2000	1000	1000	5000
Color	U.Pt-Co	20	100	500	500	NA	NA
Electrical conductivity	$\mu S/cm$	1000	1000	2000	-	-	-
BOD5	mg/L	30	60	300	60	200	200
COD	mg/L	150	300	500	350	350	350
Phenols	mg/L	0.002	0.005	0.1	0.03	0.5	0.5
Fluorides	mg/L	0.7	1.7	5	1.5	5	5
Total phosphorus	mg/L	5	5	5	8	8	10
Fats and oils	mg/L	0.2	1	20	15	15	25
Total nitrogen	mg/L	20	30	50	40	-	-
NO3-N	mg/L	0.5	1	10	-	-	-
Dissolved oxygen (DO)	% Sat	80	70	50	45	45	45
pH	-	6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0
Dissolved solids	mg/L	1,000	1,000	3,000	-	-	-
Floating Solids	-	absent	absent	absent	absent	absent	absent
Settleable solids	ml/L	1	1	2	1	1	2
Suspended solids	mg/L	75	150	200	75	150	200
Sulfates	ml/L	200	400	1000	-	-	-
Sulfides	mg/L	0.05	0.5	2	0.5	1	2
Temperature	°C	35	35	35	-	-	-
ΔT	°C	± 3	± 3	± 3	± 3	± 3	± 3
Metals							
Arsenic	mg/L	0.05	0.1	0.2	0.1	0.2	0.4
Barium	mg/L	1	1	5	1	5	5

Parameter	Unit	Surface water			Coastal waters		
		Class A	Class B	Class C	Class E	Class F	Class G
Boron	mg/L	0.1	0.5	5	0.5	5	5
Cadmium	mg/L	0.05	0.1	0.1	0.05	0.1	0.2
Cyanide	mg/L	0.05	0.1	0.2	0.1	0.5	1
Copper	mg/L	1	2	6	2	4	6
Total Chromium	mg/L	0.5	1	2	0.5	1	2
Hexavalent	mg/L	0.05	0.1	0.5	0.05	0.5	0.5
Iron	mg/L	0.5	1	10	0.5	1	10
Manganese	mg/L	0.5	1	5	0.1	1	5
Mercury	mg/L	0.005	0.01	0.05	0.01	0.01	0.05
Nickel	mg/L	1	2	6	2	2	4
Lead	mg/L	0.1	0.2	0.5	0.05	0.1	0.5
Silver	mg/L	-	-	-	0.01	0.1	0.1
Selenium	mg/L	0.01	0.2	0.2	-	-	-
Zinc	mg/L	1	1	10	1	10	20
Radioactivity							
Activity α	Bq/L	N	N	0.1	0.1	0.1	0.1
Activity β	Bq/L	N	N	0.25	1	1	1
Biocides							
Organochlorines	mg/L	0.05	0.05	0.05	0.05	0.05	0.05
Organophosphates	mg/L	0.1	0.1	0.1	0.25	0.25	0.25

Note: Classes D-I and D-2 are not included in this table since all their parameters must meet natural conditions, (-) indicates the absence of a standard value for that parameter in that class.

Source: Taken from Table A.1 of Annex I of the Environmental Standard on Control of Discharges to Surface Water, Sanitary Sewage and Coastal Waters (MIMARENA, 2012).

The **Environmental Standard on Groundwater Quality and Groundwater Discharges** establishes in Table 6.2 of **Article 34**, the maximum values of physical, chemical and biological parameters present in groundwater (Table 2-8).)

Table 2-8. Maximum values of physical, chemical and biological parameters present in groundwater (Complete application of the Standard).

Parameter	Unit	Types of Groundwater		
		Class A		Class B
		A-1	A-2	
Bacteriological Quality				
Total Coliforms	MPN/100 ml	100	1000	2400
Fecal Coliforms	MPN/100 ml	3 (Number in consecutive samplings)	100	<1000 (Number in consecutive samples)
Chemical Parameters of Health Importance				
Inorganic				
Antimony	mg/L	0.005	0.005	0.005
Arsenic	mg/L	0.05	0.05	0.05
Barium	mg/L	1	1	2.0
Boron	mg/L	0.5	0.5	0.5
Cadmium	mg/L	0.005	0.005	0.005
Cyanide	mg/L	0.1	0.1	0.1
Copper	mg/L	0.2	0.2	0.2

Parameter	Unit	Types of Groundwater		
		Class A		Class B
		A-1	A-2	
Hexavalent chromium	mg/L	0.01	0.01	0.01
Total Chromium	mg/L	0.05	0.05	0.05
Fluoride	mg/L	0.7	1.0	1.5
Mercury (total)	mg/L	0.001	0.001	0.001
Molybdenum	mg/L	0.01	0.01	0.01
Nickel	mg/L	0.1	0.1	0.1
Nitrate (NO ₃)	mg/L	10	10	10
Nitrite (NO ₂)	mg/L	3.0	3.0	3.0
Lead	mg/L	0.05	0.05	0.05
Selenium	mg/L	0.01	0.01	0.01
Organic				
Benzene	µg/L	5	5	7
Polychlorinated Biphenyls (PCB)	µg/L	1	1	1
Vinyl chloride	µg/L	2	2	2
Dichlorobenzenes	µg/L	75	75	75
Dichloroethane	µg/L	5	5	10
Dichloroethylene	µg/L	7	7	7
Dichloromethane	µg/L	5	5	10
Ethylbenzene	µg/L	50	50	100
Polynuclear aromatic hydrocarbons (PAH)	µg/L	0.7	0.7	1
Phenolic Substances	µg/L	1	1	1
Tetrachloroethylene	µg/L	5	5	10
Carbon Tetrachloride	µg/L	2	2	5
Trichloroethane	µg/L	200	200	200
Trichloroethylene	µg/L	5	5	5
Trichlorobenzene	µg/L	5	5	10
Toluene	µg/L	50	50	100
Xylene	µg/L	50	50	50

Source: Taken from Table 6.2 of Article 34 of the Environmental Standard on Groundwater Quality and Discharges to the Subsoil (Ministry of Environment and Natural Resources, 2004).

The Environmental Standard on Groundwater Quality and Subsoil Discharges establishes in Table 7.2 of Article 43, the maximum limits for discharges of type II and III pollutant sources, according to different levels of intrinsic vulnerability of aquifers (Table 2-9).

Table 2-9. Maximum limits for discharges of type II and III pollutant sources, according to different levels of intrinsic vulnerability of aquifers.

Parameter	Limits Max. discharge at High Vuln. (mg/l)	Limits Max. discharge at Mean Vuln. (mg/l)	Limits Max. discharge at Low Vuln. (mg/l)
PH	6.0-8.5	6.0-8.5	6.0-8.5
Cyanide	absent	0.2	0.2
Chloride	250	250	
Fluoride	1.5	5.0	
N-Nitrate +			
N-Nitrite	10	15	
Sulfates	250	500	
Sulfides	-	5.0	
Oils and Fats		10	10
Benzene	0.01	0.01	
Pentachlorophenol			
Tetrachloroethene		0.04	0.04
Toluene	0.7	0.7	
Trichloromethane		0.2	0.2
Xylene	0.5	0.5	
Aluminum	5.0	20.0	
Arsenic	0.01	0.01	
Boron		0.75	3.0
Cadmium		0.002	0.002
Copper		1.0	3.0
Hexavalent Chromium		0.05	0.2
Iron		5.0	10.0
Manganese		0.3	2.0
Mercury		0.001	0.001
Molybdenum		1.0	2.5
Nickel		0.2	0.5
Lead		0.05	0.05
Selenium		0.01	0.02
Zinc		3.0	20.0
Total Nitrate			
Kjeldahl		10.0	15.0
BOD ₅	35	50.0	100
COD	130	250.0	400
SST	35	50.0	50.0
Fats and Oils	10.0	10.0	10.0
N-NH ₄	10.0	10.0	20.0
P _{tot}	2.0	3.0	3.0
N _{tot}	18.0	30	30
Total Coliforms (MPN/100ml)	400	1000	1000

Parameter	Limits Max. discharge at High Vuln. (mg/l)	Limits Max. discharge at Mean Vuln. (mg/l)	Limits Max. discharge at Low Vuln. (mg/l)
ÄT	3 °C	3 °C	3 °C
Chlorine Residual	0.05	0.05	0.05

Source: Taken from Table 7.2 Article 43 of the Environmental Standard on Groundwater Quality and Discharges to the Subsoil (Ministry of Environment and Natural Resources, 2004).

2.3.6 Environmental legislation and regulations for soils and soil contamination.

Regarding soils, the project will comply with the provisions of Art. 90 of the General Law (64-00) on the Environment and Natural Resources, which states that, in order to avoid soil contamination, the following is prohibited: depositing, infiltrating or burying contaminating substances, without prior compliance with the established norms.

The General Law on Integrated Management and Co-processing of Solid Waste was also consulted, in particular the concept of urban solid waste.

2.3.7 Legislation and environmental regulations for conducting social impact assessments.

For the characterization of the socioeconomic environment, the stakeholder analysis, and the evaluation of the socioeconomic impacts of the project, the Guide for the Conduct of Social Impact Assessments of the Ministry of the Environment and Natural Resources was taken into account.

2.3.8 Environmental legislation and regulations for public consultations

The public consultation process will be carried out based on the **Regulation and Procedure for Public Consultation in the Environmental Assessment Process (MIMARENA, 2014)**.

The purpose of these regulations is to regulate the public consultation process within the environmental evaluation and to establish its procedure in accordance with the provisions of the General Law on Environment and Natural Resources (64-00), Chapter IV, **Article 38**, Paragraph 8, in order to guarantee citizen participation in the environmental evaluation process of any project, infrastructure work, industry or activity.

Art. 7 of the Regulations establishes that the Public Consultation Process is made up of five (5) possible and non-exclusive participation instruments:

- a) Information and/or dissemination of the project.
- b) Public views.
- e) Stakeholder analysis.
- d) Observations on the environmental studies.
- e) Public hearing.

2.3.9 Legislation and regulations for the conservation and protection of cultural heritage

The archaeological survey was conducted in compliance with current legislation regarding archaeological sites:

Law No. 318 of April 26, 1972, which creates the Museum of the Dominican Man, which will be in charge of everything related to Anthropological, Ethnological and Pre-Columbian Archaeological Research in the Dominican Republic. Likewise, this Museum shall issue permits for archaeological excavations in accordance with the provisions of Law No. 318 of June 14, 1968, modified by the present Law.

Law No. 564 of September 27, 1973, for the protection and conservation of National Ethnological and Archaeological objects. This law specifies that any kind of work whose purpose is the exploration, location or discovery of archaeological objects must be carried out under the supervision and control of the Museum of the Dominican Man; and that any person or scientific institution wishing to carry out research aimed at locating archaeological objects must obtain a special permit or contract from the Museum of the Dominican Man prior to the same, which will indicate the terms and conditions to which the work must be subject, the obligations contracted by the explorers, as well as their commitment to cover the expenses of the Museum's inspection personnel, with the understanding that the archaeological objects that are located will become the exclusive property of the Dominican State.

Decree No. 297-87 of June 3, 1987, in which all caves, caverns and other subway cavities are declared Natural Heritage, prohibiting all alteration and destruction of their physical characteristics, as well as the extraction of any kind of natural or cultural materials from their interior, and the introduction of waste and objects of any kind that may alter the existing ecological balance conditions. It authorizes the National Museum of Natural History and the Museum of the Dominican Man to issue certifications on those caves, caverns and subway cavities that are of no interest due to lack of cultural and natural values.

Law No. 41-00. Year 2000. Creates the Ministry of Culture of the Dominican Republic. Modifies several laws and decrees of the Dominican cultural field.

General Law on Environment and Natural Resources No. 64-00, of August 18, 2000. Among other things, it declares of national interest the conservation, restoration and sustainable use of natural resources, the environment and the assets that make up the natural and cultural heritage.

2.3.10 Environmental legislation and regulations for the protection of protected areas

The EIA took into account the provisions of **Sectoral Law No. 202-04 on Protected Areas** in the following articles:

Art. 37.- The National System of Protected Areas is formed by all the protected areas of public property and use established by means of the present law or other legal and/or administrative pieces, with the corresponding conservation categories, surfaces, locations and limits, described below:

Category II: National Parks to National Park

23) Mangroves of Estero Balsa, with the limits and area described below: the starting point is established at UTM coordinates 213700 ME and 2181375 MN from where the delimitation continues in a straight line in a southwestern direction until reaching UTM coordinates 213575 ME and 2181350 MN from where the delimitation continues in a southwestern direction bordering all the wetlands and mangroves located east of the town of Manzanillo until reaching UTM coordinates 213325 ME and 2179450 MN from where the delimitation continues in a southeastern direction bordering all the wetlands and mangroves located east of the town of Manzanillo until reaching UTM coordinates 213325 ME and 2179450 MN from where the delimitation continues in a southeastern direction the delimitation continues in an easterly direction bordering all the

wetlands and mangroves on the southern end until reaching UTM coordinates 219150 ME and 2179300 MN from where the delimitation continues in a northerly direction bordering all the mangroves located to the west of the road that connects Monte Cristi with Dajabón until reaching UTM coordinates 213750 ME and 2193000 MN from where the limit continues in an east-northeasterly direction bordering in a southerly direction until reaching UTM coordinates 213750 ME and 2193000 MN. Northeast bordering to the South.

The forest located between Punta Luna and the Yaque del Norte River until it reaches UTM coordinates 219100 ME and 2195400 MN, continuing along the latter until its mouth at UTM coordinates 218000 ME and 2195900 MN, which coincides with the coastline, from where the delimitation continues in a southwesterly direction along the aforementioned coastline passing by Punta Lina until it reaches UTM coordinates 211925 ME and 2187550 MN. Lina until reaching UTM coordinates 209500 ME and 2107350 MN from where the delimitation continues in an easterly direction in a straight line until reaching UTM coordinates 211925 ME and 2187550 MN from where the delimitation continues in a southerly direction along the coastline bordering all the mangroves and wetlands passing by the Boca de las Ensenadas de Toití.

Boca de Yagua and Boca de Topián until touching the starting point located at UTM coordinates 317700 ME and 2181375 MN. The polygon described above encloses an area of approximately 81 km². See Estero Balsa Mangrove National Park Map (MIMARENA, 2010).

Category IV: Habitat/Species Management Areas Wildlife Refuges

52) Saladilla Lagoon, with the limits and surface described as follows: the starting point is established at UTM coordinates 210808 ME and 2180654 MN, on the mouth of the Masacre River on its eastern margin, it continues predominantly towards the south-southeast for a distance of 12.39 km over the border between the Dominican Republic and Haiti, until reaching the point with UTM coordinates 211939 ME and 2172858 MN, which is located at the crossing of said border with the political-administrative division. over the border between the Dominican Republic and Haiti, until reaching the point with UTM coordinates 211939 ME and 2172858 MN, which is located at the intersection of the referred border with the political-administrative division of the provinces of Monte Cristi and Dajabón from where it continues over the latter in a predominantly eastern direction, although changing direction, eventually, for a distance of 5.844 Km. until reaching the point with UTM coordinates 211939 ME and 2172858 MN, which is located at the intersection of the referred border with the political-administrative division of the provinces of Monte Cristi and Dajabón. 844 km until reaching the point with UTM coordinates 216929 ME and 2171843 MN, which is located 600 meters west of the Monte Cristi-Dajabón highway. Up to this point, the mangroves and forest surrounding the wetland complex of the Yabacoa and Saladilla lagoons are protected. From this point the boundary continues in a northerly direction parallel to the road, separated from it by a distance of 600 meters to the west, for a distance of 5.709 km until reaching the point with UTM coordinates 217943 ME and 2177232 MN, which is 250 meters southwest of the Copey-Manzanillo road, from where the boundary continues west-northwest parallel to the road for a distance of 5.931 km until reaching the point with UTM coordinates 212729 ME and 2178898 MN.

From this point it continues in a predominantly northwest direction parallel to the aforementioned boundary, maintaining a distance of 60 meters for a distance of 3.425 km until reaching the point of UTM coordinates 211093 ME and 2180732 MN, which is located on the coastline on the beach of Manzanillo 300 meters east-northeast of the mouth of the Masacre River. From this point the boundary continues west-southwest along the coastline for a distance of 300 meters until reaching the point of UTM coordinates 210808 ME and 2180654 MN, which was the starting point. The

described polygon encloses an area of approximately 5.29 Km². See Laguna Saladilla Wildlife Refuge Map (MIMARENA, 2010).

Decree No. 571-09 creates several national parks, natural monuments, biological reserves, scientific reserves, marine sanctuaries, wildlife refuges, Boca de Nigua National Recreation Area and the Salto de Jimenoa National Monument. It establishes a buffer or sustainable use zone of 300 meters around all conservation units that have the generic categories of the World Conservation Union; provides for a national inventory of several wetlands; and creates a 250-meter buffer zone around the reservoirs of all the country's dams.

Art. 33.- A buffer or sustainable use zone of 300 meters is created around all the conservation units that have the generic categories of the World Conservation Union that go from I to IV, with the purpose of guaranteeing the integrity and/or restoration of the resources and values that are kept under protection in them.

Resolution No. 0010/2018, which provides the regulations for the management of the buffer zones of the conservation units of the national system of protected areas (SINAP) of the Dominican Republic.

Art. 5.- Currently, some conservation units do not have management plans and others that do have management plans only have a buffer zone of 300 meters without including a study to define the buffer zone they really need. The following is a basic description of the permitted uses in the buffer zones already defined by decree, according to the category of each protected area, keeping in mind that these regulations can be modified once the corresponding detailed studies have been completed and formally incorporated into the Management Plan of each conservation unit.

PARAGRAPH I: Permitted uses and activities in the buffer zones of protected areas belonging to Category I Strict Protection Areas: research infrastructure related to the protected area, bridle paths, beekeeping, artisanal fishing.

PARAGRAPH II: Permitted uses and activities in the buffer zones of protected areas belonging to Categories II, III and IV, corresponding to National Parks, Natural Monuments and Habitat/Species Management Areas: bridle or forest roads, beekeeping, research infrastructure, artisanal fishing, camping, infrastructure to support public use facilities, recreation and leisure, tourist visitation centers of maximum one height (4 meters high), of less than two heights (6 meters high) always in accordance with the guidelines of the Management Plan.

See Annex 6 Map showing the location of protected areas with respect to the project.

2.3.11 Environmental legislation and biodiversity protection regulations

For the location of the project has been considered:

Law (64-00) General Law of the Environment and Natural Resources

Art. 138. The destruction, degradation, lessening or diminution of natural ecosystems and species of wild flora and fauna, as well as the collection of flora and fauna specimens without the due authorization of the Secretariat of State for the Environment and Natural Resources is prohibited.

Art. 140. In relation to the species of flora and fauna declared as threatened, endangered or in danger of extinction by the Dominican State or by any other country, in accordance with the international treaties subscribed by the Dominican State, hunting, fishing, capture, harassment,

mistreatment, death, traffic, import, export, trade, manufacture or elaboration of handicrafts, as well as illegal exhibition and possession are prohibited.

Art. 144. The introduction into the country of species or specimens of exotic fauna and flora is prohibited:

- 1) May harm natural ecosystems or endemic and native fauna and flora;
- 2) May become a pest;
- 3) May endanger the life or health of human beings or other living species; and
- 4) May serve as objects or active participants in hunting activities, violent competitions, bets of any kind, tournaments or races, which involve or tend to the elimination, slaughter, mistreatment, harassment or torture of the single specimens involved or their offspring.

Art. 156. The destruction of native forests is prohibited.

World Conservation Union Red List (IUCN, 2011); Red List of the Vascular Flora of the Dominican Republic (2016) and CITES, 2023.

In the Table 2-10 lists the protected species of flora by the Red List of the World Union for Conservation of Nature (2011), Red List of the Vascular Flora of the Dominican Republic (2016) and CITES, (2023) in particular in the route of the 345 kV power line.

Table 2-10. Protected species of flora along the route of the 345 kV power line.

Family/species	Common name	CITES Appendices II (2023)	IUCN (2011)	LRFV (2016)
AVICENNIACEAE				
<i>Avicennia germinans</i>	Mangle prieto		LC	VU
CACTACEAE				
<i>Harrisia divaricata</i>	Pitajaya	X		EN
<i>Opuntia taylorii</i>	Mulito de pollo	X		VU
<i>Pilosocereus polygonus</i>	Cayuco	X	LC	VU
<i>Lemairocereus histrix</i>	Cayuco	X		
<i>Selenicereus pteranthus</i>		X		
COMBRETACEAE				
<i>Conocarpus erectus</i>	Mangle botón		LC	VU
<i>Laguncularia racemosa</i>	Mangle blanco		LC	VU
FLACOURTIACEAE				
<i>Casearia illicifolia</i>	Chicharron			CR
ZYGOPHYLLACEAE				
<i>Guaiacum officinale</i>	Guayacan	X	EN	VU
<i>Guaiacum sanctum</i>	Vera	X		VU
Abbreviations used				
CITES (2023): International Convention on Trade in Endangered Species of Flora and Fauna, Appendix II.				
LRFV (2016): National Red List of the Dominican Republic according to IUCN criteria.				
IUCN (2011): International Union for Conservation of Nature: (EN), Endangered; (CR), Critically Endangered; (VU), Vulnerable; and (LC), Least Concern.				

Source: EMPACA, 2023.

For the amphibian group, two species *Osteopilus dominicensis* and *Rhinella marina* were reported, which according to the Red List of the World Conservation Union (IUCN, 2022) and the Red List of Endangered, Threatened or Protected Species of Fauna of the Dominican Republic (MIMARENA, 2018), are not included as threatened species.

In the case of reptiles according to the Red List of the World Conservation Union (IUCN, 2022), none of the observed species of this group is threatened, but in the Red List of Endangered, Threatened or Protected Fauna Species of the Dominican Republic, (MIMARENA, 2018) one species (*Chilabothrus striatus*) was identified with the category of Vulnerable (VU). The other species: are very common throughout the island being found mainly throughout the lowlands of the Dominican Republic. According to the Red List of the World Conservation Union (IUCN, 2022), the species located in the study area are included in this list as species of Least Concern (LC).

For bats in the case of the Red List of Endangered and Threatened Fauna Species in the Dominican Republic, (MIMARENA, 2018) one of the four species the *Erophylla bombifrons*, is listed as a threatened species, under the category of Vulnerable (VU). The other three species are not listed as threatened species and are listed as Not Evaluated (NE).

All terrestrial mammal species identified in the project area are introduced species.

According to the Red List of the World Conservation Union (IUCN 2022), of the group of birds, the species *Patagioenas inornata*, is in the category of Near Threatened (NT), the other species are in Least Concern (LC), which is equivalent to being out of danger.

In the case of the Red List of Endangered and Threatened Species Fauna of the Dominican Republic (MIMARENA, 2018) two of the species located in the area: *Patagioenas inornata* (Paloma Ceniza), and *Setophaga petechia* (Canario de Manglar) are in the category of Vulnerable (VU). The other species are in the Not Evaluated (NE) category.

Sectorial Law on Biodiversity, No. 333-15

Art. 16.- Conservation plans. Biodiversity management will be carried out mainly through conservation and sustainable use plans, designed according to the classification system of endemic, native, migratory and introduced species, by category of use and conservation, established in this law.

Art. 20.- Participation. Biodiversity management shall be carried out with a broad and direct participation of the sectors and actors involved and interested, and particularly the local communities, in accordance with the nature and purpose of the action.

2.3.12 Environmental legislation and regulations on climate change

Resolution 02-2014 incorporating considerations of adaptation to the effects of climate change in environmental management from the Environmental Impact Assessment process.

FIRST: TO INCORPORATE, as it is hereby INCORPORATED hereinafter, on a mandatory basis, the considerations of adaptation to the effects of climate change in environmental management, starting with the environmental impact assessment process administered by the Ministry of the Environment and Natural Resources.

SECOND: In the same order, INTEGRATE, as appropriate, in the Environmental Studies and the Environmental Management and Adaptation Program (PMAA), through the corresponding Terms

of Reference (ToR), the considerations for adaptation to the effects of climate change on the environmental factors and aspects related to projects or activities.

THIRD: ORDER, as hereby ORDERED, that in all Environmental Studies, estimates of the impacts that the effects of climate change will have on the particular project or activity to be developed, as well as the measures to be taken to prevent or control the impacts of these effects on the activity or project in question, be presented and reported in the corresponding Environmental Management and Adaptation Programs (PMAA) and Environmental Compliance Reports (ICA).

2.3.13 Environmental legislation on occupational risk and contingency management

In the Contingency Plan of this ESIA, critical risk points were identified in the event of technological or natural disasters, based on the provisions of Law No. 147-02 on Risk Management.

2.3.14 Occupational health and safety legislation and standards

The provisions of the Occupational Health and Safety Regulations were taken into consideration when establishing measures for the prevention of occupational accidents.

In addition, the design of the fire protection system and the fire prevention and firefighting measures were based on the provisions of the **Dominican Republic's Fire Safety and Protection Regulation R-032**.

2.3.15 Natural gas regulations

The use of natural gas has been declared of high national interest by the Dominican State through **Decree No. 264-06**, due to its social, economic, and environmental interest. By means of this decree, its massive use is encouraged, promoting it as an alternative to liquid fuels derived from petroleum.

2.4 International conventions adopted by the Government of the Dominican Republic

The environmental law considers the international agreements signed by the country, approved by resolutions of the National Congress, which are also binding for projects carried out in the national territory. Among these and for the project are the following:

- Convention on Wetlands (RAMSAR).
- Convention on the Protection of Biological Diversity.
- United Nations Framework Convention on Climate Change.
- Vienna Convention for the Protection of the Ozone Layer.
- Montreal Protocol on Substances that Deplete the Ozone Layer.
- World Cultural and Natural Heritage Convention.
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); approved by Resolution No. 550 of June 17, 1982.
- Basel Convention on Hazardous Wastes.
- The Convention for the Protection of the Flora, Fauna, and Natural Beauties of the countries of the Americas, included in national legislation through Resolution 662 of 1965.

The following international agreements were analyzed for this project due to their impact on the project:

2.4.1 Fundamental Conventions of the International Labor Office (ILO)

The Declaration of the International Labor Office (ILO) establishes the fundamental principles and rights that guarantee the rights of human beings at work. This declaration applies to all countries that belong to the ILO, as is the Dominican Republic, which has ratified twenty-three (23) of the twenty-seven (27) ILO conventions.

The ILO conventions with which the Project must comply, and the implications of each one are explained in Table 2-11.

Table 2-11. Conventions of the International Labor Office with which the project must comply.

Agreements	Definition
Convention on Freedom of Association and Protection of the Right to Organize.	All workers and employers have the right to freely form and join associations that promote and defend their professional interests.
Convention concerning the Application of the Principles of the Right to Organize and Collective Bargaining.	
Convention Concerning Forced and Compulsory Labor.	It imposes an obligation on ILO Member States to eliminate forced labor and to ensure freely chosen and non-threatening employment relationships.
Convention concerning the Abolition of Forced Labor.	
Convention on Minimum Age for Admission to Employment.	The minimum age for admission to employment should not be lower than the age of completion of compulsory schooling, and in no case should it be below 15 years of age.
Convention concerning the Prohibition and Immediate Action for the Elimination of the Worst Forms of Child Labor.	The worst forms of child labor include inhumane practices such as slavery, human trafficking, debt bondage and other forms of forced labor, prostitution, and pornography, forced recruitment of children for military purposes, and their use in illicit activities such as drug trafficking.
Convention Concerning Equal Remuneration for Men and Women Workers for Work of Equal Value.	The principle of equality at work implies that all individuals should have the same opportunities to fully acquire the theoretical and practical knowledge, training and skills required for the economic activities they wish to carry out.
Convention Concerning Discrimination in Respect of Employment and Occupation.	Discrimination in the workplace denies opportunities to individuals and deprives society of what they can, or could, bring to it. It can affect men or women based on sex, race or skin color, national or social origin, religion or political opinion.

Source: International Labor Organization

2.4.2 Ramsar

The Convention on Wetlands (Ramsar) is an intergovernmental treaty that provides a framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

A fundamental commitment of Ramsar contracting parties (member states) is to identify suitable wetlands and include them in the List of Wetlands of International Importance, also known as the Ramsar List. Each contracting party must have at least one Ramsar site.

The convention currently has 172 contracting parties (Member States), 2,471 wetlands of international importance, with a total area of 256,192,356 ha.

The Ramsar Convention entered into force in the Dominican Republic on September 15, 2002.

The Dominican Republic currently has 6 sites designated as Wetlands of International Importance (Ramsar sites), with an area of 225,173 hectares. These are:

- The Montecristi Wetlands and the Northwest Line.
- The Manglares del Bajo Yuna National Park.
- Wetlands of the Laguna Redonda and Limón Wildlife Refuge, Miches and Ría Maimón.
- Laguna Cabral or Rincón Wildlife Refuge.
- Jaragua Wetlands.
- Enriquillo Lake.

In Figure 2-1 shows the location of Ramsar sites in the Dominican Republic.

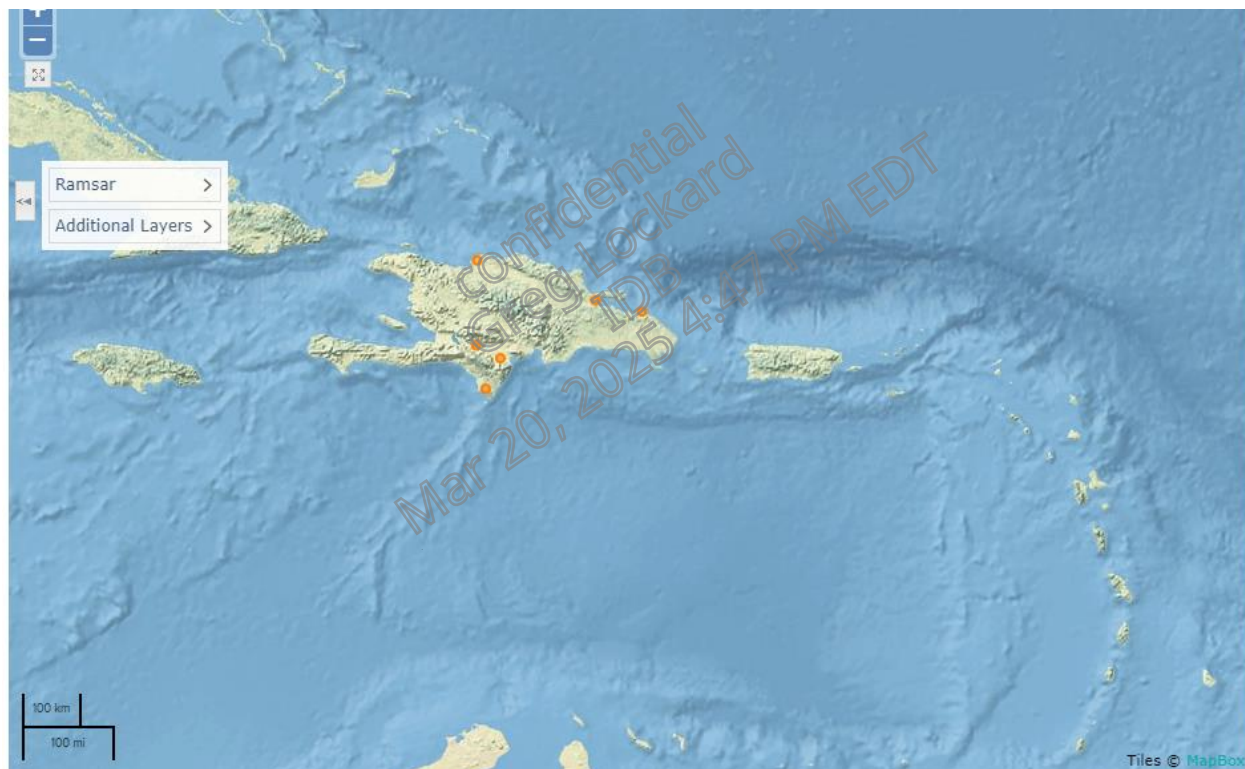


Figure 2-1. Ramsar Sites in the Dominican Republic

Source: <https://rsis.ramsar.org/>.

The closest Ramsar site to the Project is Los Humedales de Montecristi y la Línea Noroeste (Montecristi Wetlands and the Northwestern Line) (Figure 2-2).

This site is composed of several protected areas and associated wetlands such as the Montecristi Underwater National Park, the Buen Hombre wetlands, the Cayos Siete Hermanos Wildlife Refuge, the Estero Balsa mangrove area, and the Laguna de la Saladilla. It comprises a number of ecosystems including lagoons, mangroves, marshes, estuaries, swamps, dry shrub forests,

and coral reefs. In addition, the site is home to a large proportion of the most representative coral reefs in the Dominican Republic. It is home to a considerable population of endangered sea turtles (*Eretmochelys imbricata* and *Chelonia mydas*). Also, four important bird species use the site for breeding (*Anous stolidus*, *Onychoprion fuscatus*, *Thalasseus sandvicensis* and *Onychoprion anaethetus*). The site supplies local communities with fresh water and food, and supports flood control, groundwater recharge and climate change mitigation. Both the coral reefs and mangroves in the area support a local fishery that provides a livelihood for many of the area's inhabitants. The main threats affecting the ecological character of the site are river channelization and regulation, proliferation of invasive species, lack of garbage and solid waste management, agricultural and forestry effluents, and droughts.

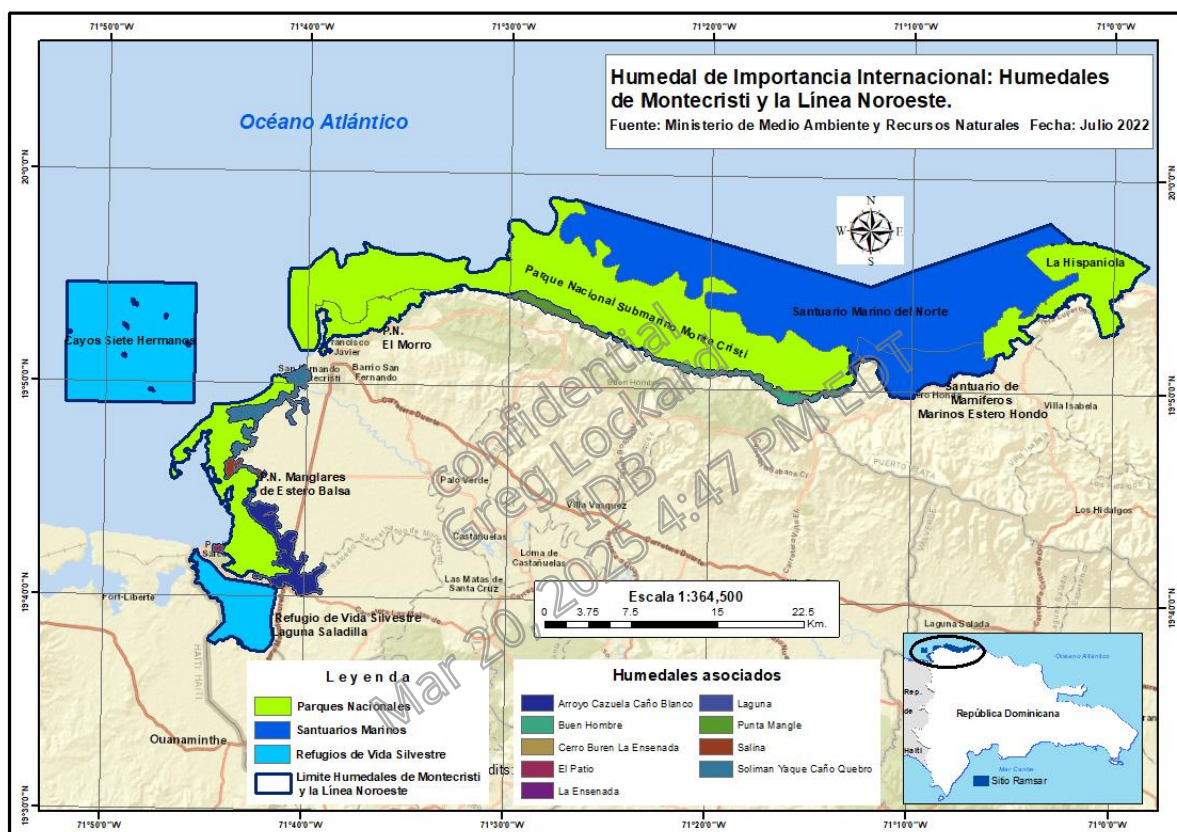


Figure 2-2. Wetland of international importance: Wetlands of Montecristi and the Línea Noroeste.

Source: <https://rsis Ramsar.org/>.

2.4.3 1992 Rio de Janeiro Convention on the Protection of Biological Diversity

The Convention on Biological Diversity is the international instrument for "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising from the utilization of genetic resources", which has been ratified by 196 countries.

Its general objective is to promote measures leading to a sustainable future. The Convention on Biological Diversity covers biological diversity at all levels: ecosystems, species, and genetic resources. It also covers biotechnology, among other things, through the Cartagena Protocol on Biosafety.

The Dominican Republic participated in the Earth Summit held in Rio de Janeiro, Brazil, and signed the Convention on Biological Diversity that same year. Subsequently, the Convention was ratified by the country on November 25, 1996. By signing the convention, the country has committed to be part of a global effort to protect habitats, species, and genes, to seek sustainable forms of resource use, and to ensure that the benefits obtained from the use of ecosystems, species and genetic resources are equitably distributed (Ministry of Environment and Natural Resources, 2011).

2.4.4 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international agreement between governments. Its purpose is to ensure that international trade in specimens of wild animals and plants does not threaten the survival of species.

CITES is an international agreement to which States and regional economic integration organizations voluntarily adhere. States that have acceded to the Convention are known as Parties.

The Dominican Republic joined CITES on December 17, 1986, and it entered into force on March 17, 1987.

Threatened wild flora species according to Appendix II of the CITES 2023 Red List were located in the Project area, these are: Mulito de pollo, *Opuntia taylori*; Pitajaya, *Harrisia divaricata*; *Selenicereus pteranthus*; Cayuco, *Lemaireocereus hystrix*; Cayuco, *Pilosocereus polygonus*; Guayacán, *Guaiacum officinale* Vera, *Guaiacum sanctum*.

For birds the species protected in CITES Appendix II (2022) are: *Buteo jamaicensis*, *Pandion haliaetus*, *Tyto alba*, *Tyto glaucops*, *Athene cunicularia*, *Falco sparverius* and *Falco columbarius*.

The rest of the terrestrial fauna groups do not have species protected by CITES.

2.4.5 United Nations Framework Convention on Climate Change

The objective of the Convention is to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The Convention establishes a general framework for intergovernmental efforts to address the challenges posed by climate change.

The Dominican Republic signed the United Nations Framework Convention on Climate Change at the Rio Summit in 1992. On October 7, 1998, the government ratified the convention and assumed the commitment to prepare its national communications in accordance with Art. 12 (Ministry of Environment and Natural Resources, 2004). So far, three national communications have been prepared for the United Nations Framework on Climate Change. The third one was published in 2018.

2.4.6 Convention for the Protection of the Ozone Layer

Scientific confirmation of the depletion of the ozone layer prompted the international community to establish a cooperative mechanism to take measures to protect the ozone layer. This was formalized in the Vienna Convention for the Protection of the Ozone Layer, which was approved and signed by 28 countries on March 22, 1985.

The Vienna Convention for the Protection of the Ozone Layer aims to encourage Parties to promote cooperation through systematic observation, research, and exchange of information on

the impact of human activities on the ozone layer and to adopt legislative or administrative measures against activities that may have adverse effects on the ozone layer.

2.4.7 Montreal Protocol on Substances that Deplete the Ozone Layer

The Vienna Convention empowered the United Nations Environment Program (UNEP) to develop a protocol that would include control measures to restore the ozone layer. As a result of the negotiations, the Montreal Protocol on Substances that Deplete the Ozone Layer, a global environmental agreement that regulates the consumption and production of ozone-depleting substances, known as ODS, was signed in 1987.

The Montreal Protocol on Substances that Deplete the Ozone Layer to the Vienna Convention entered into force in 1989 and in response to technological advances, the Protocol has been adjusted six times and amended four times.

Both the Convention and the Protocol (including four amendments) have universal participation. They aim to enforce limits on the production and consumption of the main chemicals that destroy the earth's protective ozone layer. The Protocol also contributes to global efforts against climate change, since most of the ozone-depleting substances eliminated in the Protocol are also potent greenhouse gases.

The National Congress of the Dominican Republic issued Resolution No. 59-92 approving the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer, and the country became a member on May 18, 1993.

2.4.8 World Heritage Convention

The Convention concerning the Protection of the World Cultural and Natural Heritage, adopted by the General Conference of UNESCO on November 21, 1972, is an international instrument for the identification, protection, conservation, presentation and transmission of the world's cultural and natural heritage to future generations.

Under the Convention, States Parties undertake to take such measures as may be necessary for the protection of their heritage and to engage in international cooperation activities. The Convention refers to cultural and natural heritage in general, and also to certain specific properties to which the World Heritage Committee has attributed Outstanding Universal Value and which are therefore inscribed on the World Heritage List.

The Dominican Republic approved the ratification of this convention through Resolution No. 233 dated October 16, 1984.

The country has had the Colonial City of Santo Domingo as a world cultural heritage site since 1990. It also has 14 properties included in the World Heritage Tentative List, which are:

- Montecristi.
- Pueblo Viejo National Historical and Archaeological Park, La Vega.
- Parque Nacional del Este.
- National Historical and Archaeological Park of La Villa de La Isabela, Puerto Plata.
- Former Great House of Palavé.
- Old Diego Caballero Sugar Mill.
- Historic Center of Puerto Plata.
- City of Azua de Compostela.
- Boca de Nigua sugar mill.

- Engombe sugar mill.
- Nuestra Señora de Monte Alegre or La Duquesa sugar mill.
- Sanate sugar mill.
- Jacagua, Villa de Santiago.
- Jaragua National Park.

It also has two manifestations of intangible cultural heritage, which are:

- 2003: Cofradía Congos Villa Mella.
- 2019: Dominican bachata music and dance.
- 2016: The music and dance of merengue in the Dominican Republic.
- 2008: The cultural space of the Brotherhood of the Holy Spirit of the Congos of Villa Mella.
- 2008: The Cocolo dance theater tradition.

2.5 International standards

In addition to complying with national environmental and social protection requirements, project implementation must also follow the guidelines established in international standards. Therefore, the ESIA, ESMP and ESMS must comply with the following international standards and guidelines.

- Equator Principles Guidelines (included in Equator Principles 4).
- IFC Performance Standards.
- World Bank Environmental, Health and Safety Guidelines.
- Guidelines of Annexes II and III of the Organization for Economic Cooperation and Development (OECD) Common Approaches.

Each of these standards is described below:

2.5.1 Equator Principles

The Equator Principles are a risk management framework that has been adopted by 118 financial institutions in approximately 37 countries to support certain investment decisions by applying environmental and social standards to identify, assess and manage the environmental and social risks of projects. These guidelines are based on the International Finance Corporation's (IFC) Performance Standards (PS) on social and environmental sustainability and the World Bank's Environmental, Health and Safety Guidelines.

These principles are intended to serve as a baseline and framework for financial institutions to identify, assess and manage environmental and social risks when financing projects. Therefore, the promoters of the Consortium Manzanillo Energy Power Plant project are committed to implementing the Equator Principles through their internal policies, procedures, and international and social standards.

The Equator Principles were first published in 2003, with updates in 2006, 2013 and the most recent one issued on October 18, 2019, which came into force in October 2020 and consists of 10 basic principles detailed below:

Table 2-12. Equator Principles

Ecuador Principle	Description
Principle 1 - Review and categorization	When a project is proposed for financing, EPFI, as part of its internal environmental and social review and due diligence, will categorize the project based on the magnitude of potential environmental and social risks and impacts, including those related to human rights, climate change and biodiversity. Such categorization is based on IFC's environmental and social categorization process, which establishes the following categories: (A)- projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible, or unprecedented; (B) projects with limited potential adverse environmental and social risks or impacts that are few in number, generally site-specific, largely reversible, and readily addressable through mitigation measures; and (C) projects with minimal or no adverse environmental and social risks or impacts.
Principle 2 - Environmental and social assessment	For all Category A and where applicable Category B projects the financial institution will require the client to undertake an assessment process to address, to the satisfaction of the financial institution, relevant environmental and social risks, and impacts. The assessment documentation shall propose measures to minimize, mitigate and offset adverse impacts in a manner relevant and appropriate to the nature and scale of the proposed project, and include assessments of potential adverse human rights impacts and climate change risks as part of the ESIA or other assessment.
Principle 3 - Applicable environmental and social standards	The assessment process must first address compliance with relevant laws, regulations and permits established by the host country regarding environmental and social issues. EPFIs operate in a variety of markets: some with strong environmental and social governance, legal systems and institutional capacity designed to protect their people and the environment; and some with evolving technical and institutional capacity to manage environmental and social issues.
Principle 4 - Environmental and Social Management System and Equator Principles Action Plan	For all projects classified in categories A and B, the financial institution will require the client to develop or maintain an Environmental and Social Management System (ESMS). In addition, the client will prepare an Environmental and Social Management Plan (ESMP)

Ecuador Principle	Description
	to address the issues raised in the assessment process and incorporate the actions necessary to comply with applicable standards.
Principle 5 - Stakeholder Commitments	For all category A and B projects, EPFI will require the client to demonstrate effective stakeholder engagement as an ongoing process in a structured and culturally appropriate manner with affected communities and, where relevant, other stakeholders. For projects with potentially significant adverse impacts on affected communities, the client will conduct an informed consultation and engagement process. The client shall tailor its consultation process to the risks and impacts of the project; the phase of project development; the language preferences of the Affected Communities; their decision-making processes; and the needs of disadvantaged and vulnerable groups. This process should be free from external manipulation, interference, coercion and intimidation.
Principle 6 - Grievance mechanism	For all Category A and, as appropriate, Category B projects, EPFI will require the client, as part of the ESMS, to establish effective grievance mechanisms that are designed to be used by affected communities and workers, as appropriate, to receive and facilitate the resolution of concerns and complaints about the environmental and social performance of the project. Grievance mechanisms should be tailored to the risks and impacts of the project, and will seek to resolve concerns promptly, using an understandable and transparent consultative process that is culturally appropriate, easily accessible, without cost, and without retribution to the party that originated the problem or concern. Grievance mechanisms should not preclude access to judicial or administrative remedies. The client shall inform affected communities and workers about grievance mechanisms in the course of the stakeholder engagement process.
Principle 7 - Independent review	For all Category A and, where applicable, Category B projects, an independent environmental and social consultant, not directly associated with the client, will conduct an independent review of the assessment documentation, including the environmental and social management plans, environmental management system and stakeholder engagement process documentation, to assist the financial institution in

Ecuador Principle	Description
	exercising due diligence and assessing compliance with the Equator Principles.
Principle 8 - Contractual commitments	For all projects, where a client is not in compliance with its environmental and social covenants, EPFI will work with the client on corrective actions to bring the project back into compliance. If the client fails to restore compliance within an agreed grace period, EPFI reserves the right to exercise remedies, including calling an event of non-compliance, as deemed appropriate.
Principle 9 - Independent Monitoring and Reporting	To assess the project's compliance with the Equator Principles and ensure monitoring and reporting after financial closing and throughout the life of the loan, the financial institution will require, for all Category A and, where applicable, Category B projects, the appointment of an independent environmental and social consultant, or require the client to engage qualified and experienced external experts to verify its monitoring information, which will be shared with the financial institution.
Principle 10 - Reporting and transparency	<p>The following client information requirements are in addition to the disclosure requirements of Principle 5. For all Category A and, where applicable, Category B projects:</p> <ul style="list-style-type: none"> • The client shall ensure that, at a minimum, a summary of the ESIA is accessible and available online and includes a summary of human rights and climate change risks and impacts where relevant; • The client will publicly report, on an annual basis, GHG emission levels during the operational phase of projects emitting more than 100,000 tons of CO2 equivalent per year; <p>EPFI will encourage the client to share project-specific commercially non-sensitive biodiversity data with the Global Biodiversity Information Facility (GBIF) and relevant national and global data repositories, using formats and conditions that allow such data to be accessed and reused in future research decisions and applications.</p>

Source: Prepared by AECOM, 2023 with information from Equator Principles.

The following table presents the requirements according to the Equator Principles for Categories A, B and C of a project.

Table 2-13. Equator Principles requirements in response to the classification of the project as category A, B or C.

Category	Customer requirements
A	<ul style="list-style-type: none"> • Prepare an environmental and social impact assessment report (ESIA). • Conduct an analysis of alternatives (when GHG emissions exceed 100,000 tons of CO₂ equivalent per year) and publish this information. • Develop an Environmental and Social Management Plan (ESMP). • Establish an Environmental and Social Management System (ESMS). • Conduct stakeholder engagement with project-affected communities. • Establish a grievance mechanism. • Disclose the environmental and social impact assessment report online. • Require an independent expert to review the project's compliance with international guidelines.
B	<ul style="list-style-type: none"> • Prepare an environmental and social impact assessment report (ESIA). • Conduct an analysis of alternatives (when GHG emissions exceed 100,000 tons of CO₂ equivalent per year) and publish this information. • Develop an Environmental and Social Management Plan (ESMP). • Establish an Environmental and Social Management System (ESMS). • Conduct stakeholder engagement with project-affected communities (follow-up required as appropriate). • Establish a grievance mechanism. • Disclose the environmental and social impact assessment report online. • Require an independent expert to review the project's compliance with international guidelines.
C	<ul style="list-style-type: none"> • Conduct an alternative analysis (when GHG emissions exceed 100,000 tons of CO₂ equivalent per year).

Source: Prepared by AECOM, 2023 with information from Equator Principles.

2.5.2 Organization for Economic Cooperation and Development, Common Approaches

The Dominican Republic is a member of the Organization for Economic Co-operation and Development (OECD). Since the mid-1990s, OECD members have shared information on their policies, practices, and experiences in addressing environmental and, more recently, social issues when granting officially supported export credits. The outcome of these discussions has been a series of OECD agreements and recommendations concerning the steps members should take to address the potential environmental and social impacts of projects for which official export credit support is sought.

The current agreement is the OECD Council Recommendation on Common Approaches to Officially Supported Export Credits and Environmental and Social Due Diligence (the "Common Approaches"), which was adopted on June 28, 2012, and revised by the OECD Council on April 6, 2016 (OECD/LEGAL/0393). This agreement establishes common approaches for conducting environmental and social due diligence to identify, consider and address potential environmental and social impacts and risks related to officially supported export credit applications as an integral part of Members' decision-making and risk management systems. Although an OECD Recommendation is not legally binding, it expresses the common position or will of all OECD members and can therefore represent an important political commitment for member governments. This Recommendation applies to all types of officially supported export credits for exports of capital goods and/or services, except exports of military equipment or agricultural products, with a repayment term of two years or more.

The Organization for Economic Cooperation and Development Annex II and III Guidelines, Common Approaches, April 2016, present the content of an Environmental and Social Impact Assessment report and the information to be provided for Category A and Category B projects.

This document indicates that members are expected to benchmark projects to be implemented against international standards as part of their environmental and social due diligence, such as the World Bank Group's Environmental, Health and Safety Guidelines, the latter of which are described in the following section.

2.5.3 World Bank Environmental, Health and Safety Guidelines

Environmental, Health and Safety (EHS) guidelines are technical reference documents with general and specific examples of Good International Industry Practice (GIIP). When one or more members of the World Bank Group are involved in a project, these EHS guidelines are applied in accordance with their respective policies and standards.

The general EHS guidelines are designed to be used in conjunction with the corresponding industry sector EHS guidelines, which provide guidance to users on EHS issues in specific industry sectors.

The following diagram shows how the general EHS guidelines are organized.

1. Environment	2. Occupational health and safety	3. Community health and safety	4. Construction and dismantling
<ul style="list-style-type: none"> • Atmospheric emissions and air quality • Energy conservation • Wastewater and environmental water quality • Water conservation • Waste management • Noise • Contaminated soils 	<ul style="list-style-type: none"> • Overall facility design and operation • Communication and training • Physical hazards • Chemical hazards • Biological hazards • Radiological hazards • Personal protective equipment (PPE) • Special risk environments • Surveillance 	<ul style="list-style-type: none"> • Water quality and availability • Structural safety of project infrastructure • Life and fire safety (L&FS) • Traffic safety • Hazardous materials transportation • Disease prevention • Emergency preparedness and response 	<ul style="list-style-type: none"> • Environment • Occupational health and safety • Community health and safety

Figure 2-3. World Bank guidelines on environment, health, and safety.

Source: World Bank, 2007

The EHS Guidelines contain performance levels and measures that are generally considered to be achievable at new facilities using existing technology at reasonable cost. The application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timeframe for achieving them.

The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each project based on the results of an environmental assessment that considers site-specific variables such as host country context, environmental assimilative capacity and other project factors.

Environmental, health and safety guidelines for liquefied natural gas (LNG) facilities. April 11, 2017. They include relevant information for LNG plants, related to transportation (sea and land), storage, regasification (including floating storage and regasification units), peak shaving terminals and LNG bunkering facilities, loading/unloading terminals.

In addition, the **Environmental, Health and Safety Guidelines for Electricity Transmission and Distribution** will be considered. **April 30, 2007.** It is emphasized that this guide is used as a reference because the project will have a power transmission line. This document provides relevant information on the transmission of electricity between a generation plant and a substation located within an electrical grid.

These guidelines are designed to be used in conjunction with the World Bank's general EHS guidelines document.

2.5.4 IFC performance standards and guidelines

Performance standards

IFC has defined eight (8) performance standards for project development that set out the criteria that a client financial institution must meet throughout the life of an investment. These standards provide a framework for understanding and managing a project's potentially high impact on environmental and social risks. The table below details each of the performance standards that will be considered in the development of this study.

Table 2-14. IFC Performance Standards

Performance Standards	Objectives
ND 1: Environmental risk assessment management and social	<ul style="list-style-type: none"> Identify and assess the environmental and social risks and impacts of the project. Adopt a mitigation hierarchy to anticipate and avoid or, where avoidance is not possible, minimize and, where residual impacts remain, offset, or compensate for risks and impacts to workers, affected communities and the environment. Promote the improvement of customers' environmental and social performance through the effective use of management systems. Ensure that complaints from Affected Communities and external communications from other stakeholders are appropriately responded to and managed. Promote and provide the means for appropriate engagement with Affected Communities throughout the project cycle on issues that could affect them and ensure that relevant environmental and social information is disclosed and disseminated.
ND 2: Labor and working conditions	<ul style="list-style-type: none"> Promote fair treatment, non-discrimination and equal opportunities for men and women in the recruitment process. Implement working conditions that ensure the health of workers, focusing on the specific needs and vulnerabilities of women, men and workers with disabilities. Establish, maintain, and improve the worker-employer relationship. Promote compliance with national employment and labor laws. Protecting workers. Promote safe and healthy working conditions and the health of workers. Avoid the use of forced labor.
ND 3: Resource efficiency and pollution prevention	<ul style="list-style-type: none"> Avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities. Promote a more sustainable use of resources, including energy and water. Reduce GHG emissions related to the project.

Performance Standards	Objectives
ND 4: Community health, safety, and security	<ul style="list-style-type: none"> • Anticipate and avoid adverse impacts on the health and safety of the Affected Community during the life of the project, under all circumstances. • Ensure that the safeguarding of personnel and assets is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to Affected Communities. • Identify and mitigate the risk of increased exposure of women in the communities to incidents of sexual harassment and assault and implement a grievance mechanism related to this risk.
ND 5: Land acquisition and involuntary resettlement	<ul style="list-style-type: none"> • Avoid, and where avoidance is not possible, minimize displacement by exploring alternative project designs. • Avoid forced eviction. • Anticipate and avoid, or where avoidance is not possible, minimize impacts. • (i) providing compensation for the loss of assets at replacement cost and (ii) ensuring that resettlement activities are carried out with adequate information disclosure, consultation, and informed participation of those affected. • Improve, or restore, the livelihood and standard of living of the displaced. • Improve the living conditions of the physically displaced by providing adequate housing with security of tenure at resettlement sites.
ND 6: Biodiversity conservation and living natural resource management	<ul style="list-style-type: none"> • Protect and conserve biodiversity. • Maintain the benefits of ecosystem services. • Promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities. • Identify the role and participation of men and women in the management, conservation, and efficient use of natural resources.
ND 7: Indigenous peoples	<ul style="list-style-type: none"> • Ensure that the development process promotes full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of indigenous peoples. • Anticipate and avoid adverse impacts of projects on Indigenous Peoples' communities, or when avoidance is not possible, minimize and/or compensate for such impacts. • Promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner. • Establish and maintain an ongoing relationship based on Consultation and Informed Participation (ICP) with Indigenous

Performance Standards	Objectives
	<p>Peoples affected by a project throughout the life cycle of the project.</p> <ul style="list-style-type: none"> • Ensure the Free, Prior and Informed Consent (FPIC) of the affected Indigenous Communities when the circumstances described in this Performance Standard occur. • Respect and preserve the culture, knowledge, and practices of indigenous peoples.
ND 8: Cultural heritage	<ul style="list-style-type: none"> • Protect cultural heritage from adverse impacts of project activities and support its preservation. • Promote the equitable sharing of the benefits derived from the use of cultural heritage.

Source: International Finance Corporation, 2012.

▪ Guides

Worker accommodation: processes and standards. IFC and EBRD Guidance Note. August 2009. This guidance note addresses the processes and standards that should be applied to the provision of worker accommodation. It covers appropriate standards for the construction and operation of worker accommodation.

3. ANALYSIS OF ALTERNATIVES

In this chapter, several alternatives related to the cooling system that the thermoelectric plant will use are compared.

It is necessary to clarify the following elements that were considered for the identification of project alternatives:

- ✓ No project location alternatives are analyzed since the request for the terms of reference to the Vice-Ministry of Environmental Management of the Ministry of Environment and Natural Resources was made after a prior definition of the land where the project will be built, imposed by the Dominican State as a sine qua non condition to qualify under the terms of the international public bidding for new generation No. EDES-LPI-NG-01-2021; this corresponds to a specific polygon within the plots owned by the Dominican Corporation of State Electrical Companies (CDEEE). However, in subsection 3.1.2 an analysis of the alternative related to the specific location (layout or disposition) of the transmission line that is part of the project is made.

Starting from the previous premises, it is analyzed how to achieve the objectives of the project, being compatible with the preservation and protection of the environment and complying with all national and international regulations established as good practices and commonly accepted for this type of industry.

Three alternatives related to the cooling system that the thermoelectric plant will use are analyzed for the Manzanillo Energy Consortium Power Plant Project. These alternatives are:

- Wet cooling system using sea water.
- Wet cooling system using well water.
- Dry cooling system (air cooling without water).

In addition, two alternatives related to the layout of the electrical transmission line are analyzed.

Criteria for selecting alternatives:

To compare the alternatives, their advantages and disadvantages are considered in the following aspects:

- Technical feasibility.
- Social impacts.
- Environmental impacts.
- Commercial feasibility (construction, operation, and maintenance cost).

3.1 Analysis of alternatives related to the cooling system of the thermoelectric plant.

Alternative 1: Wet cooling system using seawater. This cooling system would use seawater to feed a cooling tower where seawater and air interact to effect thermal transmission that results in the cooling required by the thermoelectric plant.

Advantages and disadvantages:

This alternative has the following advantages:

- Since Block 01 (LNG Terminal and Thermoelectric Plant) will need seawater in the process of heating the liquid natural gas for regasification, it is advantageous to use this cooled water in the thermal generation process which will then result in heated water, producing thermal efficiency and a reduction in the amount of water needed under typical conditions.
- Less visual pollution on the way to the sea since the facilities of Block 01 would be used.
- No negative impacts related to the overexploitation of subway aquifers, and no impact on groundwater quality.
- Efficiency in electricity production is greater, resulting in a smaller emissions footprint for each kilowatt generated.
- Lower construction costs, since the infrastructure for the intake and discharge of seawater from the Block 01 cooling system will be used, which is essential for regasification of liquid natural gas and for cooling the Block 01 thermoelectric plant, where it will only be necessary to expand the piping system to supply Block 02.
- Moderate operating costs

Its main disadvantages are:

- Negative impacts could be generated on the quality of coastal waters and marine biota if thermal changes in the discharged waters exceed 3°C.
- Negative impacts could be generated on the quality of coastal waters if the products used to ensure that crustacean fouling does not occur were not adequate.
- Negative impacts could be generated by the noise produced by the cooling tower, affecting the community, although it is less than that produced by the air-cooling system.

Alternative 2: Wet cooling system using well water. This alternative would require water from a system of underground wells.

Advantages and disadvantages:

This alternative has the following advantages:

- The efficiency in electricity production is greater and with this, a lower emissions footprint is produced for each kilowatt generated.
- Moderate operating costs.

- It does not require the construction of a seawater intake pipe or pumping facilities, which results in lower costs than if an exclusive intake were made to the sea and also less visual pollution in the same case.

Its main disadvantages are:

- Negative impacts on coastal water quality and marine biota could be generated in the event that the thermal changes in the discharged water exceed 3°C.
- Negative impacts could be generated by the noise produced by the cooling tower, although it is less than that produced by the air-cooling system.
- The water flow derived from the exploitation of deep aquifers would be very high, which could affect the availability of water in the subsoil.
- Negative environmental impacts on groundwater quality (increased presence of chlorides) could be caused by overexploitation of the aquifer.
- Lower efficiency in electricity production compared to the system where the infrastructure of Block 01 is used.
- Negative impacts on coastal water quality could be generated if the products used to ensure that crustacean fouling does not occur are not adequate.
- The water in the well system would eventually become very similar to seawater.

Alternative 3: Dry cooling system (air cooling without water).

This alternative has the following advantages:

- Lower demand for well water so the quality of groundwater would not be affected.
- No negative impacts would be generated for the quality of coastal waters or marine biota, although the impact on these components will prevail since Block 01 will need the same amount of water to regasify the gas from the Block 02 plant. Incrementally speaking there is no advantage when installing a dry cooling system.

Its main disadvantages are:

- Of the three systems evaluated, it is the one that presents the worst energy efficiency in electricity production due to the high energy consumption of the powerful fans it requires, increasing the carbon footprint of the plant over its useful life.
- It is the alternative that produces the most noise, generating the greatest impact on the community.
- Greater visual pollution in the plant area, although less on the way to the sea because pipes are not required.

Comparison of alternatives:

In Table 3-1 the aspects analyzed for the alternatives under study are summarized.

Table 3-1. Comparison of the Project alternatives

Description	Alternative 1	Alternative 2	Alternative 3
Technical feasibility.			
Social impacts.			
Environmental impacts.			
Commercial feasibility (Costs of construction, operation, and maintenance).			

Legend:

Color	Rating
	Advantage
	Intermediate situation
	Disadvantage

Source: Elaborated by EMPACA.

Alternative 1 is selected, considering that it has greater technical, social, and commercial advantages and an intermediate situation for environmental impacts that can be prevented and mitigated.

3.2 Analysis of alternatives related to the layout of the electrical transmission line.

Alternative 1: The layout of the electrical transmission line in this alternative is shown in Table 3-2 and Figure 3-1.

Table 3-2. Coordinates of the electric transmission line, Alternative 1.

Station	X	Y
PI-01	216769.00	2178286.00
PI-02	216304.00	2178435.00
PI-04	216004.00	2178639.00
PI-4B	215333.00	2178614.00
PI-5	214916.00	2178482.00
P-6	214705.87	2178335.79
P-7	214022.87	2178341.71
P-8	212814.00	2179778.00
P-8 A	212837.00	2179928.00
P-9	213082.86	2180429.59

Source: Manzanillo Energy Consortium, Inc.



Figure 3-1. Electrical transmission line layout, Alternative 1.
Source: Manzanillo Energy Consortium, Inc.

Line length: 5.56 km.

Advantages and Disadvantages:

This alternative has the following advantages:

- The route of the line is outside the nearby protected areas, avoiding environmental impacts in these sensitive areas.

Its main disadvantages are:

- The length of the line is longer than in alternative 2, therefore, the construction cost is higher.
- The transmission line crosses the Manzanillo-Copey highway twice, which increases the risk to the safety of the population during its useful life and additionally in the construction period.
- Risks of bird and bat collisions.

Alternative 2: The layout of the electrical transmission line in this alternative is shown in Table 3-3 and Figure 3-2.

Table 3-3. Coordinates of the electric transmission line, Alternative 2.

Station	X	Y
PI-1	216850.99	2178266.25
PI-2	216769.37	2178286.95
PI-3	216304.85	2178437.14
PI-4	216004.29	2178639.66
PI-5	215333.57	2178615.03
PI-6	214916.94	2178484.11
PI-7	214293.08	2178684.53

Station	X	Y
PI-8	213419.31	2179060.90
PI-9	212814.11	2179779.46
PI-10	212836.79	2179929.72
PI-11	213055.19	2180430.96

Source: Manzanillo Energy Consortium, Inc.



Figure 3-2. Layout of the electrical transmission line, Alternative 2.

Source: Manzanillo Energy Consortium, Inc.

Line length: 5.28 km.

Advantages and disadvantages:

This alternative has the following advantages:

- The route of the line is outside nearby protected areas, avoiding environmental impacts on these sensitive areas.
- The length of the transmission line is shorter, with fewer angles, therefore, the cost is reduced, making this alternative more commercially feasible.
- This alternative does not cross the Manzanillo-Copey highway, so the safety risk to the population is reduced by keeping it out of the public roadway.

Its main disadvantages are:

- The route of the line could run the risk of conflicting with the already installed natural gas pipeline in the area, so it is necessary to ensure that it is kept at a prudent and technically validated distance.
- Risk of bird and bat collisions.

Comparison of alternatives:

In Table 3-4 the aspects analyzed for the alternatives under study are summarized.

Table 3-4. Comparison of Project alternatives.

Description	Alternative 1	Alternative 2
Technical feasibility.		
Social impacts.		
Environmental impacts.		
Commercial feasibility (Costs of construction, operation, and maintenance).		

Legend:

Color	Rating
	Advantage
	Intermediate situation
	Disadvantage

Source: Elaborated by EMPACA, 2023.

Selected Alternative:

Alternative 2 is selected, considering that it has technical, social, and commercial advantages and an intermediate situation for environmental impacts that can be mitigated.

4. DESCRIPTION OF THE ALTERNATIVE SELECTED FOR THE PROJECT

This chapter describes the different components and activities of the Manzanillo Energy Consortium Power Plant Project in its pre-construction, construction, operation, and closure phases.

The Manzanillo Energy Power Plant Project consists of a high efficiency thermoelectric power plant of approximately 420 MW of net capacity using mainly Liquefied Natural Gas (LNG) as fuel and a 345 kV electric transmission line of approximately 5 km for connection to the National Interconnected Electric System. This project is also called Block 02 because of the bidding process that justifies it.

It should be clarified that as part of the International Public Bidding for New Generation No. EDES-LPI-NG-01-2021, in addition to Block 02, a second power plant (Block 01) was awarded with approximately 420 MW of additional capacity and an import terminal with regasification and LNG storage to be installed on the land adjacent to the project on the north side; however, this work is outside the scope of this Environmental Impact Study (Figure 4-1). The LNG import terminal with regasification and storage will supply LNG to both thermoelectric power plants.



Figure 4-1. Indicative artistic image where you can see the thermal power plants of the two Blocks (1 and 2) and the LNG Regasification and Storage Terminal.

Source: Manzanillo Energy Consortium, Inc. (2023).

This chapter is the result of joint work between the project designers and mainly technicians from the environmental consulting firm EMPACA who received the collaboration of the international environmental consulting firm AECOM.

The project description was based on the visits made to the project area and the documents provided by the designer, which include:

- Descriptive report of the project.
- General plan of the project.

4.1 Introducing the Developer

The project developer is Manzanillo Energy Consortium, Inc., an existing commercial company, organized under the laws of the Dominican Republic, National Taxpayers Registry (RNC) No.1-32-80572-2 and Commercial Registry No. 1019MC, with its registered office located at Kilometer 2 of the El Copey highway, Super 8 by Wyndham Manzanillo hotel, 1st level, Pepillo Salcedo municipality, Montecristi province, Dominican Republic. Telephone (809) 735-0000 and (829) 331-6604 (Annex 4).

The company is represented by Mrs. Elianne García Peña, Identity and Electoral Card No. 402-2489125-5.

It is clarified that the owner of this company was the winning consortium of Block 02 resulting from the international public bidding for the purchase and sale of power and associated electric energy through long-term contracts of the Electricity Distribution Companies (Annex 3: International public bidding for new generation No. EDES-LPI-NG-01-2021).

4.2 Project location

4.2.1 Geographic location

The Manzanillo Energy Consortium Power Plant will be located in the Pepillo Salcedo municipality, Montecristi province, Dominican Republic. See project location map in Google Earth image.

The thermoelectric plant is specifically located on the plot presented in Table 4-1. See Annex 1: Certificate of property titles and lease contract and Annex 2: Cadastral plan of the plot 211830311246.

Table 4-1. Plot where the Manzanillo Energy Consortium Power Plant will be located.

Cadastral designation	Inscription	Location	Portion (m ²)
211830311246	3000767108	Pepillo Salcedo Ward, Montecristi province.	564,295.89

Source: Manzanillo Energy Consortium, Inc. (2023).

Of the plot described above, the thermoelectric plant (Block 02) will occupy an area of 111,134.19 m². The UTM coordinates that describe said polygon are presented in Table 4-2 and the project location map on a topographic sheet. See Annex 2: Cadastral map of Block 02.

Table 4-2. Location coordinates of the Manzanillo Energy Consortium Power Plant.

Station	X	Y
E1	212807.68	2179930.49
E2	212945.87	2180254.90
E3	212952.86	2180271.31
E4	213224.16	2180142.72
E5	213078.99	2179801.90

Source: Manzanillo Energy Consortium, Inc. (2023).

The electrical transmission line, on the other hand, will have a length of approximately 5 km (5000 m), while the easement strip will have a width of 60 m (30 m on each side of the line), for a total area of approximately 300,000 m². The coordinates of the electric transmission line towers are included in Table 4-3.

Table 4-3. Coordinates of the electrical transmission line of the Project.

Station	X	Y
PI-1	216850.99	2178266.25
PI-2	216769.37	2178286.95
PI-3	216304.85	2178437.14
PI-4	216004.29	2178639.66
PI-5	215333.57	2178615.03
PI-6	214916.94	2178484.11
PI-7	214293.08	2178684.53
PI-8	213419.31	2179060.90
PI-9	212814.11	2179779.46
PI-10	212836.79	2179929.72
PI-11	213055.19	2180430.96

Source: Manzanillo Energy Consortium, Inc. (2023).

4.2.2 Borders

The boundaries of the plot where the Manzanillo Energy Consortium Power Plant project will be developed are shown in Table 4-4 and those of the transmission line in Table 4-5 and in the Boundary Map.

Table 4-4. Current use of land in the vicinity of the Manzanillo Energy Power Plant.

Borders	Land use
North	Land where block 01 of the thermoelectric plant will be built.
South	Unused land.
East	Unused land.
West	Street or public road.

Source: Elaborated by EMPACA (2023).

Table 4-5. Current use of land in the vicinity of the transmission line of the Manzanillo Energy Consortium Power Plant Project.

Borders	Land use
North	Manzanillo Power Plant (Blocks I and II) and Estero Balsa Mangrove National Park.
South	El Copey-Manzanillo Highway.
East	Vacant land and Copey community.
West	Community of Pepillo Salcedo (Manzanillo).

Source: Elaborated by EMPACA (2023).

4.2.3 Areas of influence

The area of influence corresponds, according to the International Finance Corporation (IFC), to "the area likely to be affected by both on-site and off-site impacts from project activities, assets and facilities, including related facilities. It is in this territory where potential impacts derived from the development of the project on any of its physical, biological, socioeconomic, or historical-cultural components could manifest themselves.

The following criteria were considered to determine the area of influence:

- **Project footprint:** refers to the physical space that will be occupied temporarily or permanently during the construction and operation of the project. It is the territory in which the direct impacts are manifested, occurring in the same place where the action generating the environmental impact took place, and at the same time, or at a time close to the time of the action that caused the impact.

To define the limits of the project's footprint, all the works required by the project on a temporary or permanent basis were considered, from the execution stage (construction) to the operation and maintenance stage. This area, therefore, includes:

- Area for the execution of works and installation of the power plant.
- Area required for the installation of the power transmission line and its easement strip.
- Area where the temporary facilities camp will be located.
- **Environmental boundary:** this is determined by the temporal and spatial scales of impact on the biotic and abiotic components, not limited to the project execution area itself, but extending beyond it in terms of the potential impacts that the evaluated project may generate.
- **Socioeconomic dynamics:** the area of influence in socioeconomic terms is not limited to the exact site of project implementation, but is instead related to various criteria, such as

the impact on the health and safety of the surrounding population, accessibility (roads and paths), economy, potential impacts due to physical or economic displacement of population, among other factors.

Considering that the environmental limit criteria and socioeconomic dynamics are not limited by the direct impact of the project works, an incidence analysis was carried out to delimit the spatial scope of said impact on the physical, biological, and social components. and cultural. See Table 4-6.

Table 4-6. Incidence analysis to delimit the spatial scope of the project on the physical, biological, social, and cultural components in the area of direct and indirect influence.

Criteria	Component	Analysis
Physical and biological limit	Air and noise	<ul style="list-style-type: none"> In terms of noise, the project under construction will generate an impact that will be caused mainly by the use of trucks and heavy machinery and their circulation along the access roads; this will possibly also be reflected in the external roads where the different inputs/materials and waste generated by the project activities will be transported. In turn, the combustion engines of the vehicles and machinery could increase the concentration of combustion gases in the air along the routes they will travel. The operation of the thermal power plant could affect air quality through gas and noise emissions, with negative consequences that are likely to affect the area outside the project footprint.
	Terrestrial biota (flora and fauna)	<ul style="list-style-type: none"> During the construction phase, vegetation cover will disappear, and flora will be lost due to the clearing of vegetation, especially along the route of the power transmission line, taking into account that the plot where the power plant will be built has already been cleared. Terrestrial fauna will also be affected due to the loss of habitat caused by the clearing, as well as by construction activities that generate noise and dust and the human presence itself.
	Marine biota and marine-coastal water quality	<ul style="list-style-type: none"> During the operation phase, there is a possibility that the components of the biological environment (marine biota) may be affected by the discharge of cooling water from the thermoelectric power plant into the sea.
Socioeconomic dynamics	Health and safety	<ul style="list-style-type: none"> From a social point of view, the project's works will have both a positive and negative influence on the residents located near the footprint and on the workers. In terms of health and safety, there are risks of accidents to workers and residents as a result of both the construction and operational actions of the project.
	Economy	<ul style="list-style-type: none"> The project produces tangible economic benefits from the goods and services that could be acquired from local suppliers (at the municipal and provincial levels) and from the hiring of labor, especially during the construction phase. It is also estimated that project operations will result in the demand for fuel and other inputs, as well as services and the payment of taxes to the Pepillo Salcedo Municipality, which will boost the economy.

Source: Elaborated by EMPACA (2023).

Based on the above, the areas of influence of the project have been defined (see Map of areas of influence) as indicated below:

- The area of influence of the project on the physical-biotic elements comprises the land space where the thermoelectric power plant will be built plus a perimeter strip of 1000 meters measured from the limits of this, as well as the space that will be occupied by the transmission line to the National Interconnected Electric System and its easement strip, plus a strip of 300 m measured on both sides of this.
- The area of influence on the socioeconomic elements includes the province of Monte Cristi as the indirect recipient of the identified impacts, while the municipalities of Pepillo Salcedo and Monte Cristi are identified as the territorial units where these impacts could be materialized more directly.

4.2.4 Project Accessibility

Access to the Manzanillo Energy Consortium Power Plant project is via a secondary road that connects with the El Copey-Manzanillo highway (see Map of access roads).

4.3 Components of the project

For the Manzanillo Energy Consortium Power Plant project, the following activities will be carried out.

Pre-construction phase:

1. Prequalification for the bidding process.
2. Preparation of non-invasive preliminary studies for bidding offer.
3. Preparation of the economic feasibility study.
4. Preparation and presentation of the bid offer.
5. Acceptance of the proposal and award of the project by the competent authorities.
6. Conceptual design of the project based on the studies carried out.
7. Coordination with the Ministry of the Presidency, stakeholders, and the Manzanillo Master Plan management team.
8. Proceedings for obtaining permits and certifications of no objection from the competent institutions.
9. Preparation of studies required for the detailed engineering of the project.
10. Preparation of the Environmental Impact Study.
11. Obtaining the Environmental License.

Construction phase:

1. Mobilization of materials, equipment, and machinery to the project area.
2. Installation of temporary construction facilities.
 - ✓ Construction of roads and temporary perimeter fences.
 - ✓ Temporary facilities camp site.
 - ✓ Storage of construction materials.
 - ✓ Provision of parking spaces.
 - ✓ Water supply and consumption.

- ✓ Liquid waste generation and management.
- ✓ Energy supply and consumption.
- ✓ Fuel supply and consumption.
- ✓ Solid and oily waste generation and management.
- ✓ Transportation of construction materials and other supplies.

3. Land conditioning.

- Clearing and cleaning of vegetation and topsoil from the construction area.
- Stripping or cutting of unusable material.
- Staking out.
- Earth moving and excavations.

4. Construction of the thermoelectric plant.

- Construction of buildings.
 - Administration building.
 - Storage.
 - Maintenance/Control.
- Installation of thermoelectric plant equipment:
 - Installation of gas turbine with generator.
 - Installation of steam turbine with generator.
 - Installation of a steam generating boiler from the recovery of heat from the exhaust gases (HRSG).
 - Steam condenser.
 - Desalination water plant.
 - Saltwater cooling tower.
 - Electricity transformer and booster substation.

5. Construction of service infrastructure.

- Drinking water supply system.
- Wastewater treatment system.
- Surface drainage system.
- DC backup electrical system with battery bank and inverters.
- AC backup electrical system with emergency electrical generator.
- LNG supply system inside the thermoelectric power plant.
- Liquid fuel storage and distribution system.
- Compressed air system.
- Compressed gas system.
- Security system.
- Firefighting systems.
- Natural gas and other gas leak detection system.
- Telecommunications system.
- Road system and parking lots.

6. Construction of transmission line to the National Interconnected Electric System.
7. Connection to the National Electric Grid.
8. Hiring of temporary labor force.
9. Withdrawal of temporary facilities.
10. Transportation of leftover construction materials and waste.

Operation phase:

1. Start-up and operations of the thermoelectric plant and the electrical interconnection line.
2. Maintenance of facilities and equipment.
 - Thermoelectric plant machinery.
 - Thermoelectric plant facilities.
 - Electrical transmission line.
3. Handling and consumption of Natural Gas.
4. Handling and consumption of liquid fuel.
5. Generation and management of hazardous and non-hazardous solid waste.
6. Generation and management of oily waste.
7. Water consumption and treatment.
8. Generation and treatment of industrial and domestic liquid waste. 20.
9. Vector and rodent control.
10. Handling of chemical products.
11. Hiring of permanent labor force.

Closure phase:

1. Dismantling of installations and equipment.
2. Collection of solid (hazardous and non-hazardous), liquid and oily wastes.
3. Transportation and final disposal of solid (mainly debris and scrap), liquid and oily wastes collected, as well as of dismantled equipment.

4.3.1.1 Prequalification for the bidding process

The credentials of the Manzanillo Energy, Inc. Consortium were presented to the Tender Committee to comply with the bases and be able to present a proposal. The prequalification phase was aimed at selecting registered participants who met the respective prequalification requirements.

4.3.1.2 Preparation of non-invasive preliminary studies for tender offer

These studies include environmental risk analysis, initial topographic survey, among others, with the objective of providing information for the proposal preparation process and the economic feasibility study to prepare an offer in the tender.

4.3.1.3 Preparation of economic feasibility studies

At this stage, an economic model and feasibility study were carried out to determine the prices to be presented in the offer in the bidding process.

4.3.1.4 Preparation and presentation of the tender offer

A package was prepared to present the tender offer prepared in accordance with the bidding rules which included: administrative offer, technical offer, and economic offer.

As part of the administrative offer, the following documents were attached:

- Table of Contents.
- Affidavit confirming acceptance of the bidding conditions and validity of the bid.
- Confirmation of the validity of the power of attorney granted to the authorized representative.
- Affidavit of acceptance of the remuneration system and acceptance of legal obligations, penalties, and fines.
- Confirmation of certifications contained in the affidavit and no restrictions to prequalify.
- Bid guarantee.
- Non-binding letter of intent for financing.

The technical offer contains the following documents:

- Table of Contents.
- Description and characteristics of the project.
- Land use commitment in the bidding conditions.
- Preliminary project execution schedule.
- Project construction commitment.
- Letter(s) of intent from potential Liquefied Natural Gas suppliers.

4.3.1.5 Acceptance of proposal and award of the project by the competent authorities

The Bidding Committee evaluated that the non-economic offers complied, opened the economic offers where they were subsequently evaluated.

With this result, the result of the bid evaluation process was notified, which indicated that Manzanillo Energy, Inc. Consortium was the winner and therefore the successful bidder of Block 02. A certificate of acceptance of the award was prepared in which the obligations assumed in the awarded offer and in the bidding, conditions were confirmed.

4.3.1.6 Project design based on the studies carried out.

Based on the results of the preliminary studies carried out, the conceptual design of the project, descriptive and calculation reports, as well as the conceptual design plans are made.

4.3.1.7 Coordination with the Ministry of the Presidency, stakeholders and the Master Plan management team.

Coordination and meetings were made with the stakeholders of the Manzanillo Master Plan, including the Ministry of the Presidency, promoters of the other electricity generation blocks and other planned industrial works, residents of the community, among others, with the objective to agree on coexistence and limits of the project.

4.3.1.8 Procedures for obtaining permits and no-objection certifications from the competent institutions.

The process of the necessary permits that are presented in Annex 5 began. These are:

- Pepillo Salcedo Municipal Council.
- Dominican Electricity Transmission Company ETED.
- Authorization for access to the lands of the Corporación Dominicana de Empresas Eléctricas Estatales (CDEEE).
- Permit for tree cutting and pruning with minimum impacts.
- Fire Department of Pepillo Salcedo.
- Dominican Republic Civil Defense.
- Naval Command of Port Captaincy and Maritime Authority of the Dominican Republic Navy.

4.3.1.9 Preparation of the study of studies necessary for the detailed engineering of the Project

These studies include high-resolution topographic survey using LIDAR, soil mechanics studies on the land where the works will be built, among others.

4.3.1.10 Preparation of the environmental and social impact study

This study presents the description of the project with the actions for the pre-construction, construction, operation and closure phases; the characterization of the physical, biological, economic, social and cultural baseline; The environmental and social impacts that the project activities could generate on natural resources and the environment (physical, biological, economic, social, cultural and economic) in its life cycle are identified and evaluated and prevention measures are proposed. mitigation or compensation aimed at preventing, minimizing, or compensating for them.

4.3.1.11 Obtaining the environmental license

Document granted by the Ministry of the Environment of the Dominican Republic, which states that the corresponding Environmental Impact Study has been delivered and that the activity, work or project can be carried out under the condition of abiding to the Environmental Management and Adaptation Program.

4.3.2 Activities for the construction phase

4.3.2.1 Mobilization of materials, equipment, and machinery to the project lands.

At the beginning of the construction phase, the machinery, equipment, and trucks that will be used for site preparation and construction of the works, as well as the vans that will be used for offices and storage of materials, among others, will be mobilized.

However, most of the trucks and equipment will have to travel along the Manzanillo-El Copey highway and the street that provides access to the project area, which will cause a temporary increase in heavy vehicle traffic along these roads.

4.3.2.2 Installation of temporary construction facilities

Temporary Perimeter Roads and Fences: Temporary internal roads will be created as required within the construction facilities from designated entry points to the project site.

All required temporary fencing will also be installed to isolate and control access to the construction facilities.

Offices: The prime contractors will install vans (Photo 4-1) as offices from which all coordination, supervision, inspection, control, and monitoring functions will be carried out.



Photo 4-1. Type of van used for an office on a construction site (<https://carroceriasyfurgones.co/service/contenedor-oficina/>).

Temporary facilities for the workers: There will be several huts (which can be used for changing clothes), portable restrooms, a dining room, and a medical clinic for the workers on the site. Most of the workers will commute daily to their places of residence; however, it is possible that on-site sleeping capacities could be provided that would include dormitories, restrooms, showers, and recreation facilities.

Warehouses for construction materials: For construction materials that must be stored indoors, due to their possible dispersion or deterioration, temporary warehouses will be located. These materials will include all types of cement, additives, instruments and tools, steel plates, rebar, special parts, steel screws, as well as equipment and accessories. The temporary warehouses will be made of fiber cement sheets, wood, plywood, zinc or aluzinc sheets, among others. Vans may also be used for the storage of materials at the construction site (Photo 4-2).



Photo 4-2. Vans used to store construction materials.
(<https://www.zarca.es/productos/contenedor-almacen-ligero/>).

Open spaces will also be provided for the storage of materials that may be outdoors.

Area for storing plant machinery: The area where the containers with the machinery to be installed in the project will be placed will be delimited.

Parking spaces: The temporary facilities will include open spaces for parking the equipment and vehicles that will be used during the construction phase.

Water supply and consumption: Drinking water will be supplied for workers' consumption through the purchase of 5-gallon bottles that will be installed in the offices and workers' cafeteria, while water for construction work will be supplied by tanker trucks. A water tank will be installed for water storage.

The distribution of water consumption during the construction phase is described below.

Personal water consumption: It is the consumption that derives from the physiological needs of the construction staff, as well as cleaning during and at the end of the workday.

➤ **Calculation of the volume to consume:**

- 1,400¹ (total personnel on site).
- 1,080 (duration of work in days).
- 55 liters (consumption per person per day).

Total staff water consumption = 1,400 persons x 1,080 days x 55 liters = 83,160,000 liters = 83,160.00 m³.

Civil works water consumption: It is the consumption that is generated in construction activities, such as: preparation of concrete and mortar, wetting of surfaces before pouring, cleaning of work, cleaning of tools, etc.

➤ **Calculation of volume to be consumed per m² of construction:**

- 111,134.19 (m² of construction).
- 56.78 (liters to consume per m² of construction).

Total consumption per m² of construction = 111,134.19 m² x 56.78 liters = 6,310,199.31 liters = 6,310.20 m³.

➤ **Calculation of volume to be consumed for cleaning work:**

- 111,134.19 (m² of construction).
- 2 (liters to be consumed per m² of construction for 1 cleaning).

Water consumption cleaning work = 111,134.19 m² x 2 liters x 2 cleanings = 444,536.76 liters = 444.54 m³.

Total consumption for civil works: 6,310.20 m³ + 444.54 m³ = 6,754.74 m³

Overall total consumption during the construction phase =

Staff water consumption + water consumption for civil works = 83,160.00 m³ + 6,754.74 m³ = 89,914.74 m³, for an average of 83.25 m³/day.

Generation and management of liquid waste from temporary facilities: During the construction process, portable toilets will be placed and will receive periodic service, which will be managed by the contracted company. The volume of liquid waste to be generated will be 36.3 m³/day.

Calculation of the volume to be generated:

- 1,400² (total personnel on site).
- 1,080 (duration of work in days).
- 24 liters (residue per person per day).

Liquid waste = 1,400 x 1,080 x 24 liters = 36,288,000 liters = 36,288.00 m³, for an average of 33.6 m³/day.

¹ Approximate value

² Approximate value

Power supply and consumption: Power will be supplied by connecting to the networks of Empresa Distribuidora de Electricidad del Norte (EDENORTE), which are located on the access road. During the construction phase, mobile emergency generators on wheelbarrows will also be used for very specific construction activities that require them.

Fuel supply and consumption: During the construction phase, one or more diesel fuel storage tanks will be installed to supply the site's emergency power generators and equipment. These tanks will have a spill containment berm and will be filled by tanker trucks from local suppliers.

Estimated diesel fuel consumption during the construction phase will be approximately 45,000 liters/month during the peak month. Total approximate consumption for the entire construction phase will be 1,620,000 liters.

Generation and Management of Solid Domestic Waste: During the construction phase, 55-gallon metal tanks will be placed in the temporary facilities and on the construction site as the various construction sites are built to collect the solid domestic waste generated by the workers.

The tanks will be identified with the name of the type of waste for which they are intended, which will allow separation at source of recyclable materials, such as paper, cardboard, plastics, among others.

The estimated volume of solid domestic waste will be 454 kg/day at peak activity.

The collection of solid domestic waste will be carried out using the site's own trucks, for transport to the municipal landfill.

Recyclable waste will be removed by a manager authorized by the Ministry of the Environment and Natural Resources to handle and dispose of this type of waste.

Generation and management of solid construction waste: In the case of waste resulting from the removal of topsoil or topsoil, construction debris and materials (the latter classified), the construction site managers will coordinate their removal and final disposal by a manager authorized by the Ministry of the Environment and Natural Resources for the management of this type of waste.

Generation and handling of hazardous solid waste: In the case of hazardous solid waste (paint containers, solvents, welding butts, oil-soaked rags, etc.), these will be stored in separate, duly identified containers and placed in roofed, waterproofed sites at the construction site. Each contractor must collect and dispose of these wastes in accordance with the Environmental Management and Adjustment Plan. For their removal, a manager authorized by the Ministry of the Environment and Natural Resources will be hired.

Transportation of construction materials and other supplies: During the construction phase of the project, it will be necessary to transport construction materials and aggregates in trucks or similar vehicles from quarries, hardware stores, and other suppliers to the project area.

The material suppliers will be mainly from the northern region of the country.

However, most of the vehicles will have to travel along the Manzanillo-El Copey highway and the access road to the project area, which will cause a temporary increase in heavy vehicle traffic along the same roads.

4.3.2.3 Land conditioning.

4.3.2.3.1 Dismantling and cleaning of the vegetation and topsoil in the construction area of the thermoelectric plant and the pipe network for the supply of natural gas and water for the cooling system

The area where the Manzanillo Energy Consortium Power Plant will be located was cleared and delimited with a barbed wire fence. It is clarified that the CDEEE granted a provisional authorization for access to the land for the purposes of carrying out the preliminary work and that the Ministry of Environment and Natural Resources granted on February 13, 2023, a Permit for Tree Cutting and Pruning with Minimal Impacts. See Annex 5.

In relation to the layout of the electrical transmission line, the rescue of protected and threatened species will be carried out after the redesign of the layout. See section 8.1.1.9. Plan for protection measures for terrestrial biota.

4.3.2.3.2 Stripping or cutting of unusable material.

Stripping will consist of removing the surface layer of natural soil or topsoil (including weeds and grasses), in a sufficient thickness (± 0.20 meters) to eliminate organic matter and other undesirable materials deposited on the soil.

It shall also include the removal of rocks and roots that are inconvenient for the work and that were not removed in the clearing and cleaning operation. Roots and protrusions of more than 0.05 meters in diameter will be removed from the areas where the foundations of the structures will be built and of more than 0.10 m in diameter in the areas where the roads will be constructed.

A manager authorized by the Ministry of the Environment and Natural Resources will be contracted to remove them.

4.3.2.3.3 Staking

The engineer shall be obliged to request the inspection and written approval of the stakeout by the site surveyor before proceeding with excavations. The location and stakeout of the work objects will be executed by the procedure that guarantees the greatest possible accuracy (transits, stakes, etc.).

Quality materials will be used in the staking, to guarantee its rigidity and to maintain the appropriate topographic levels. The traced axes will be marked by means of precise and permanent preferences outside the area of excavation of the materials produced by them and of the work zone.

Prior to commencing work, location reference points for all structures must be determined and approved in writing by site supervision for subsequent work to proceed. The necessary earthworks will be carried out, and the location of the work objects and other structures required in the plans will proceed. Failure to obtain such approval shall be at the risk and expense of the Contractor, who shall be obliged to correct any fault in the location determined.

4.3.2.3.4 Earthworks and excavations

In accordance with the work organization criteria, after the topographic stakeout and the verifications derived from these activities, the technicians in charge of the project will continue with the construction phase.

The project has been designed considering the technical requirements demanded by the suppliers for the assembly of the plant equipment.

As a first criterion for planning the earthworks, compensation by volume has been considered, so that the quantities of material extracted will be used in backfilling and leveling for the internal spaces, which will reduce the hauling of materials along the area's roads.

In this regard, the report Evaluation of Laboratory Results of Possible Mines Evaluated for the Manzanillo Port Expansion and Rehabilitation Project prepared by the Executing Unit of Projects Financed by External Resources of the Ministry of Public Works and Communications was consulted, for which visits were made to the mines in the area in order to learn about the type and characteristics of the existing and available materials in Monte Cristi and Dajabón, as well as their possible suitability for the different uses in the project. During the visits, material was collected from the mines and delivered to the **Soil Mechanics Laboratory of the Ministry of Public Works and Communications (MOPC)**, where its basic properties were determined and compared with the established technical requirements.

The location of the mines visited and distance in a range of approximately 20 to 30 km from those found in relation to the project is presented in Figure 4-2 and Annex 7 presents the results of the study.

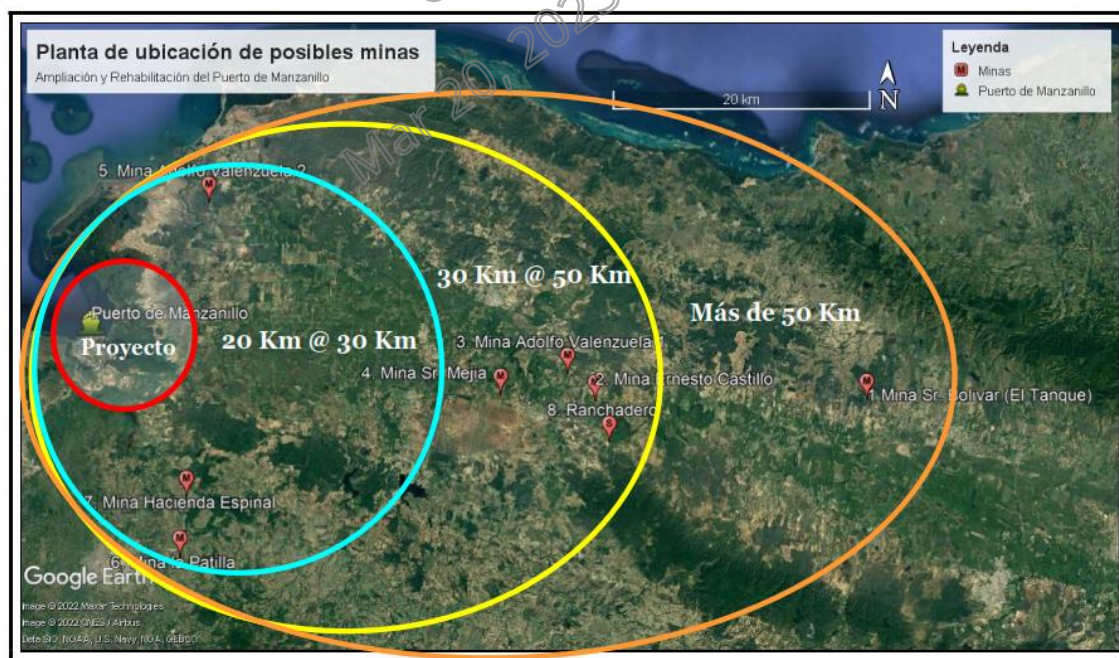


Figure 4-2. Location of mines and approximate distances in relation to the project.

Source: Laboratory results of possible mines evaluated for the Expansion and Rehabilitation of the Port of Manzanillo project.

Earthworks and excavations will be carried out within the limits marked by the stakeout, avoiding excesses outside these limits. Likewise, all of these activities involving excavations will be coordinated and respond strictly to the work organization and schedules, to avoid the need to expand access areas or equipment circulation due to obstruction of space.

4.3.2.4 Thermoelectric Power Plant Construction

The description of the different buildings and equipment that make up the thermoelectric power plant are shown in the Equipment Layout Plan Block 02 Manzanillo Generation Plant. Following is a description of the components (see Plant Assembly Plan).

4.3.2.4.1 Construction of Buildings

The thermoelectric plant will house the administration office buildings, storage, maintenance workshops and control room.

Other smaller miscellaneous buildings include the following: guard house, fire pump enclosure, chemical feed equipment enclosure, emergency generator enclosure, among others.

The various buildings at the power plant facilities will provide a weatherproof enclosure to protect equipment, personnel and allow for a controlled environment.

En In terms of both exterior and interior architecture, the following are the general architectural features that will be implemented in the various buildings of the facility.

Exterior Walls: All buildings containing structural steel framing will be equipped with wall systems consisting of exterior metal wall panels and insulation as necessary to meet the space conditioning (thermal) and acoustical requirements identified for the project.

Interior Walls: In general, interior wall partitions for finished areas will be galvanized metal studs with gypsum board sheathing and finish paint. High moisture areas will incorporate moisture resistant gypsum board material. Glazed wall tiles will be used in bathrooms and shower rooms for sanitary and maintenance purposes. Interior walls around mechanical and electrical equipment rooms will be masonry.

Ceilings: The roof of all structural steel framed buildings shall consist of a single ply membrane over insulation and a metal roof deck. The contractor will also be allowed to consider placement of a standing seam metal roof with insulation. Insulation shall be provided as necessary to meet the space conditioning (thermal) and acoustical requirements identified for the project. The roof system will be sloped to designated drainage locations to prevent water accumulation. Integrated curb systems that nest with the roof panel shall be provided in particular for equipment located on roofs.

Windows: Exterior windows, frames and glazing will be chosen to ensure compliance with environmental requirements. Double pane windows will be provided for all areas with mechanical refrigeration (air conditioning). Interior fixed windows will be provided as required by occupancy and glazing will be installed in accordance with fire resistance criteria as appropriate. Windows will be placed in the exterior walls of the administration and office areas of the various buildings.

All building windows will be equipped with hurricane shutters adequate to protect the buildings from hurricane winds, water, and flying debris.

Floor Coverings: Floor coverings in the main control room and electrical equipment rooms will be static dissipative vinyl tile. Restrooms and locker rooms will have ceramic tile floors. High humidity areas will incorporate unglazed ceramic tile. First floor service areas and elevated concrete slabs within the buildings will have a smooth, polished finish. Floor areas used for chemical storage will be covered with special protective coatings.

Doors: Personnel doors will be of hollow metal design with removable transoms as required for projecting equipment installation and replacement. Insulation and fire rating criteria for all doors will be dictated by environmental and interior requirements. Exterior doors for vehicular access will be of the rolling metal type with weather seals and wind breaks.

Miscellaneous: Buildings will be provided with space air conditioning and/or ventilation, building lighting, communications, and fire protection in accordance with applicable building code requirements, international standards, and applicable industry best practices. Floor and equipment drains that could potentially contain oily or chemical wastes will be routed to the collection system that will allow for the control and segregation of these wastes for proper management as mandated by the standard.

Safety showers and eyewash stations shall be placed in all areas that store and handle chemicals. Locations will be determined by compliance with applicable codes and regulations.

The overall size of the various buildings will be determined by the layout, operation, maintenance, and access requirements of the enclosed equipment. The overall building arrangements will include provisions for maintenance of equipment and components requiring periodic removal from their installed location. Where removal requires moving equipment or components to access pathways, the overhead clearance for the lift and aisles shall be kept reasonably free of obstructions and shall be designed to allow equipment to be transported through the aisle in a safe manner.

The exterior architectural systems provided for the various buildings and structures will be collectively consistent in color and overall appearance.

The buildings will be designed and constructed in accordance with all applicable laws and regulations of the government of the Dominican Republic, international criteria including those established by the NFPA.

Seismic design will be in accordance with the most stringent requirement of the current building code and international criteria for this type of industry. The structural system of the buildings will provide a continuous load path or paths, with adequate strength and stiffness to transfer all seismic forces from the point of application to the ultimate point of resistance.

4.3.2.4.2 Equipment Installation

The thermoelectric power plant will primarily use natural gas as fuel. However, since the plant will have state-of-the-art equipment, it could also operate with diesel and in gas mode, incorporating 30% hydrogen.

The power plant will be built in a combined cycle arrangement (CCGT) where it will be composed of a gas turbine, together with its heat recovery system (HRSG) to produce steam to feed an adjacent steam turbine, which allows it to operate with high efficiency.

The main equipment to be installed is as follows:

- Siemens SGT-PAC 8000H gas turbine with generator (see Figure 4-3) or similar.
- Siemens SST300 steam turbine with generator (see Figure 4-4) or similar.
- Heat recovery steam generator ("HRSG").
- Steam condenser.
- Desalination water plant.
- Demineralized water treatment plant.
- Saltwater cooling tower.
- Electrical substation equipment (transformers, disconnectors, busbars, blades, breakers).

The manufacturers of all plant equipment will be reputable with world-class quality.

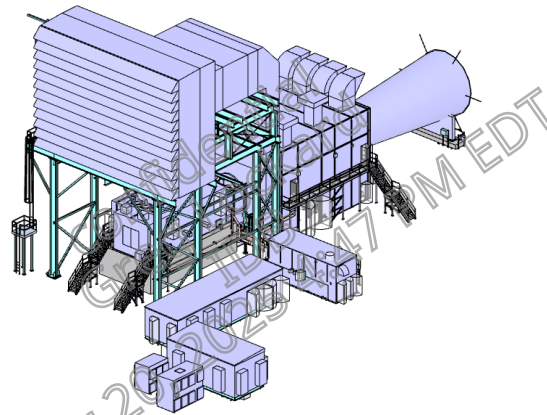


Figure 4-3. Siemens SGT6-PAC 8000H Gas Turbine – Typical Arrangement of Main Components and Systems.

Source: Manzanillo Energy Consortium, Inc.

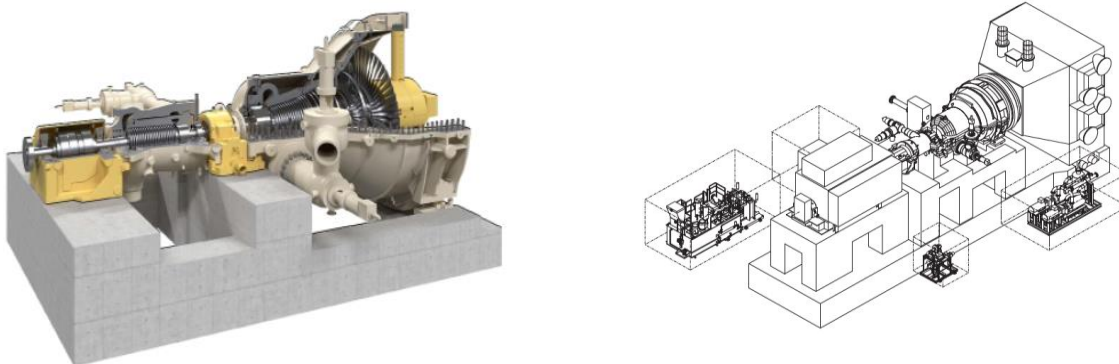


Figure 4-4. Siemens SST300 Steam Turbine (left) – Typical arrangement with Generator and Main Components (right).

Source: Manzanillo Energy Consortium, Inc.

Regarding cooling water, heat integration using the shared seawater supply between the cooling towers and the open rack vaporizer has been selected as a design case since the heat integration source (seawater supply for the cooling tower) for the power plant would allow in case the power plant is not available (e.g., during terminal start-up) that the seawater can still supply the necessary heat for the vaporizers.

The power plant will include a substation that will raise the generated voltage to the 345 kV required by the bidding conditions.

The interconnection substation will have four transformer fields and two 345 kV outgoing line fields. The main substation equipment in the switchyard is as follows:

- 345 kV dead tank circuit breakers with square hardened insulators (CT).
- 345 kV disconnectors with maintenance grounding switch.
- 345 kV surge arresters.
- 345 kV capacitive voltage transformers.
- 345 kV busbars and connectors.

The overhead line or bus will be used for the connection of 345 kV transmission lines and main and auxiliary transformers.

All control panels, protective relays, commercial metering system, alternating current (AC) and direct current (DCCC) distribution will be installed in the control building located in the substation switchyard. The DC system battery banks, battery charger, Distributed Control System (DCS), fault recording system will be displayed in the plant control building.

4.3.2.5 Construction of service infrastructure

4.3.2.5.1 Water supply system

Water for the different uses of the project will be supplied by Block 01, which will come from the sea and will be pumped through a pumping system and a network of pipes.

Block 01 will have a water treatment system that will include seawater treatment and a make-up water treatment cycle.

The seawater treatment system will supply the service water supply, potable water, fire water and make-up cycle treatment systems for both Block 01 and Block 02.

This treatment system includes: desalination membranes, softeners, filters with pumps, redundant strainers and ultrafiltration system with ultrafilters designed to provide filtered water at the required flow rate for service water.

The minimum quality of the service water will be that shown in the Table 4-7

Table 4-7. Service water quality standards.

Parameter	Units	Value
Total suspended solids	mg/l	≤ 1.0
Turbidity	NTU	≤ 0.1
pH	--	7 - 8.5
SDI	--	≤ 3

Source: Manzanillo Energy Consortium, Inc. (2023).

The demineralized water production system for the steam cycle installed in Block 01 will provide demineralized water for the following users of both Block 01 and Block 02: cycle replacement, auxiliary boiler, laboratory, cycle cooling water replacement closed and chemical feeding cycle.

The cycle replacement water treatment system installed in Block 01 will consist of the following main components: reverse osmosis systems, storage tank for the water product of the osmosis system, mixed bed demineralizers, online instrumentation to measure chemical characteristics such as conductivity, silica and sodium and chemical dosing systems as needed.

The minimum quality of the demineralized water coming from Block 01 will be the one presented in Table 4-8.

Table 4-8. Quality standards of demineralized water from Block 01.

Parameter	Units	Value
Electric conductivity	μS/cm at 25°C	<0.1
Total Silica	μg/l as SiO ₂	< 10
Sodium	μg/l as Na	< 2
Sulfate	μg/l as SO ₄	< 2
Chloride	μg/l as Cl	< 2
Total Organic Carbon (TOC)	μg/l	< 100
pH	--	6 - 8

Source: Manzanillo Energy Consortium, Inc. (2023).

Service water distribution system: The service water supply system of the thermoelectric power plant will consist of the following main components:

- Two (2) service/fire water storage tanks.
- Two (2) service water supply pumps.
- Interconnection of piping, valves, instrumentation, and accessories.

Water from Block 01 will be stored in the service and fire water storage tanks. Each tank will have the capacity to satisfy all service and fire water consumption for 2 hours to comply with NFPA 22 and NFPA 850.

Water pumps will draw water from the service/fire water storage tanks and supply it through the distribution piping system. The pumps will be provided with a minimum flow recirculation line that discharges the water back to the storage tank.

The service water supply system will provide water to: combustion turbine inlet steam cooler, cycle make-up treatment system, fire protection system, boiler feed pumps, wastewater sump flushing, pretreatment filter backwashing, general facility use.

Potable Water Supply System: The potable water supply system (except for drinking water) will be supplied from the utility water distribution system. The entire potable water piping system shall be subway and placed at a minimum distance of 10 feet (3.05 m) or more horizontally from a sewage collection system pipe or other pipe carrying substances that may contaminate the potable water.

This supply system will provide drinking water to offices, storage rooms and restrooms located in the various buildings, emergency eyewashes and safety showers.

Drinking water for human consumption is expected to be supplied by local suppliers (Pepillo Salcedo) in 5-gallon bottles with dispensing stations throughout the plant.

Fire water supply system: The fire protection water supply system will be equipped and installed to ensure action in the event of an outbreak of fire. This system will provide sufficient water pressure and flow at hydrant hydrants and fixed extinguishing stations (fire cabinets) throughout the facility.

Water for the fire system will be stored in two fire service/water tanks designed to meet NFPA 22 and NFPA 850 requirements for fire water storage using an internal standpipe.

The fire water pumping and discharge systems will be independent of all other facility water systems and will be designed to comply with NFPA standards, particularly NFPA 13, 20 and 24.

Water supply pump system:

- One horizontal diesel-driven main fire water pump.
- One main electric fire water pump.
- One main pressure maintaining jockey pump.
- Fire pump controller with associated mechanical and electrical components.
- Fire water recirculation line with flow meter for fire water pump testing.
- Full flow relief valve and support components.
- Interconnection of piping, valves, instrumentation, and fittings.

Each fire pump shall be capable of delivering fire water in support of the fire demand for the worst-case scenario plus additional flow required for the hydrant/hose simultaneously. The main and booster fire pumps will be configured to have 100% pumping, ensuring that the system can support the worst-case fire water demands even in the event that one fire pump is out of service.

Each pump shall have its own dedicated supply line to a water source, as well as a dedicated line to the fire main circuit. Fire pump systems shall be UL listed and FM approved. Fire pumps shall be separated from each other, plant equipment and buildings by a fire barrier.

All shutoff valves shall be electrically supervised by tamper switches.

4.3.2.5.2 Wastewater treatment system

The wastewater treatment system will consist of the following systems:

- Chemical wastewater collection and treatment.
- Collection and treatment of oily wastewater.
- Collection and treatment of domestic wastewater.
- Wastewater collection and treatment.

Chemical waste collection and treatment system: The chemical waste collection and treatment system will include the following components:

- Chemical waste collectors, as required.
- Wastewater transfer pumps with 100% capacity at each collector.
- Neutralization tank with ejectors.
- Wastewater neutralization circulation and discharge pumps.
- pH measuring equipment.
- Acid and caustic feed supplies (may be shared with the cycle chemical feed equipment regeneration system).

The chemical wastewater collection and treatment system should neutralize the chemical wastewater and then route it to the industrial wastewater treatment system. This system will treat chemical waste, water treatment system waste and/or chemical cleaning waste, and containment area waste drains.

The neutralization tank will be located in a containment basin.

The spill containment dikes for the chemical storage tanks and treatment system will be constructed of reinforced concrete with a suitable protective coating.

Oily wastewater collection and treatment system: Oily wastewater collection systems will be constructed where there is a possibility of oil contamination, such as in the transformer area, thermal power plant, buildings, and others.

The treatment of this type of water will be done in grease and oil separators and/or by means of devices that reduce the flow velocity and offer a calm surface, acting as a grease and oil separator.

The waste retained in the separators will be removed for final disposal by a manager authorized by the Ministry of the Environment and Natural Resources of the Dominican Republic.

Domestic wastewater collection and treatment system: Domestic wastewater will be treated in septic tanks and subsequently conveyed to the subsoil through a filter. The septic tank will be designed so that the treated effluent meets the standards established by the Environmental Standard on Groundwater Quality and Subsoil Discharge.

Sewer and Wastewater Treatment System: The sewer system will collect previously treated wastewater and cooling tower blowdown water originating at the power plant and transfer it to the authorized discharge site in coastal waters.

The sewage system shall include:

- An additional wastewater treatment system required to comply with the allowable discharge limits in Table 4 and Table A.1 of Annex I of the Environmental Standard on Control of Discharges to Surface Water, Sanitary Sewage and Coastal Waters (MIMARENA, 2012). Due to the location of the project in the vicinity of the port of Manzanillo, Class G has been considered: Coastal waters destined for industrial, port and shipping activities as defined in Art. 7 of the Surface and Coastal Water Quality Standard (NA-CASC) MIMARENA (2012), which classifies water bodies receiving surface and coastal waters.

4.3.2.5.3 Stormwater (surface) Drainage System

The project site will be graded to control surface stormwater runoff.

Stormwater will be collected from roofs and conveyed to the stormwater collection system for final disposal. This system will be calculated for storm rainfall that may occur in 100 years and 24 hours.

Water will infiltrate naturally into the subsoil and filters will be constructed where necessary.

4.3.2.5.4 Electrical and Emergency Power Supply System

DC electrical system with battery bank and inverters: The electrical system will consist of power and control wiring, conductors, miscellaneous wiring, protection relays, lightning protection and grounding, luminaires for normal and emergency conditions, conduits and conduits, cathodic protection systems, battery bank, among others.

AC backup electrical system with emergency electrical generator: Approximately 1,000 KW emergency electrical generator to supply power to the buildings in Block 02 facilities and equipment in the control center and firefighting system.

4.3.2.5.5 LNG supply system inside the thermoelectric power plant.

The Block 02 thermoelectric power plant gas pipeline is the means through which Consortium Manzanillo Energy's thermoelectric power plant will be supplied with fuel. The pipeline will consist of:

- a) one (1) pipeline of approximately 8" diameter that will have an approximate length of 200 meters;
- b) a filtering station; and
- c) a fiber optic cable for the exchange of operational signals between the Natural Gas Terminal owned by Block 01 (Manzanillo Gas & Power) and the Thermoelectric Power Plant of Block 02.

This pipeline will interconnect the gas measurement and analysis system owned by the Block 01 Natural Gas Terminal (Manzanillo Gas & Power) with the gas turbine of the Block 02 Thermoelectric Power Plant (Manzanillo Energy Consortium).

4.3.2.5.6 Liquid Fuel Storage and Distribution System

The thermoelectric power plant facilities will use diesel as an alternative fuel and to operate the emergency power generator and the fire-fighting system pump.

Tanks with spill containment berms will be installed for storage.

4.3.2.5.7 Compressed Air System

The combined air service and instrumentation system will indicatively consist of the following:

- Two (2) full capacity oil-free air compressors.
- Two (2) full capacity twin tower air dryers reactivated with heat or without heat.
- Two (2) full capacity instrument air tanks (minimum).
- Distribution piping, valves, instrumentation, and accessories.
- PLC based control system.

The compressed air system will provide dry air for instruments and controls, hose stations, air motor drives, and miscellaneous plant uses.

4.3.2.5.8 Compressed Gas System

The Compressed Gas system will consist of the following systems:

- Hydrogen storage and supply.
- Carbon dioxide storage and supply.
- Nitrogen storage and supply.

Hydrogen storage and supply: A hydrogen gas supply system will be provided to cool the steam turbine generator and/or the gas/combustion turbine generator.

The hydrogen supply system will consist of the following.

- Hydrogen storage cylinders and support racks.
- Interconnecting manifolds and pressure control stations.
- Distribution piping, valves, instrumentation, and fittings.
- Open structure roof over storage cylinders and pressure control station.
- A concrete pad and bollards.

Hydrogen gas will be stored in storage cylinders grouped in two multiple cylinder modules, one active and one reserve. Each bank of cylinders will be equipped with safety valves, pressure regulators, pressure indicating and alarm devices, and flow control valves. The total storage volume of the cylinders shall be capable of continuously replenishing the hydrogen loss from the generator for 10 days, plus a sufficient supply to purge and charge each generator housing with hydrogen. Hydrogen components shall comply with NFPA requirements.

The hydrogen cylinders and pressure control station shall be located indoors. Otherwise, a sunshade open-sided roof structure will be provided over the hydrogen cylinders and pressure control station to protect the equipment from the direct effects of sunlight and weather.

Hydrogen will be supplied in cylinders by local companies.

Carbon Dioxide Storage: A carbon dioxide supply system will be provided to supply carbon dioxide gas for generator purging.

The carbon dioxide supply system will consist of the following:

- Carbon dioxide storage cylinders and support racks.
- Interconnecting manifolds and pressure control stations.
- Distribution piping, valves, instrumentation, and fittings.
- A concrete pad for storage of the cylinder assemblies.

Carbon dioxide will be stored in storage cylinders connected in two multiple cylinder modules, one active and one standby. Each cylinder bank will be equipped with safety valves, pressure regulators, pressure indication and alarm devices, and flow control valves. The storage cylinders will be sized to provide at least two complete purges of the generator casing during a shutdown.

Carbon dioxide will be supplied in cylinders by local companies.

Nitrogen Storage and Supply: Nitrogen will provide low pressure nitrogen gas for corrosion protection of the HRSG, all steam piping, and the auxiliary boiler.

The nitrogen storage and supply system will consist of the following.

- Nitrogen storage cylinders and support racks.
- Interconnecting manifolds and pressure control stations.
- Distribution piping, valves, instrumentation, and fittings.
- A concrete pad for storage of cylinder assemblies.

The nitrogen supply system shall be designed to distribute nitrogen gas to protect the facility's equipment during unit shutdowns and maintenance.

The nitrogen supply system shall be capable of purging and inerting the heat recovery steam generator and all steam piping to the steam turbine simultaneously at 20.7 kPa (3 psig). The space allotted for storage cylinders shall be sufficient to allow for a storage volume capable of continuously covering the equipment during a shutdown of not less than 7 days.

Nitrogen shall be supplied in cylinders by local companies.

4.3.2.5.9 Security System

The fencing and security system will provide a physical enclosure of secure areas and allow for monitoring of arrivals/departures to and from the plant facilities.

The fencing and security system will indicatively consist of the following major components:

- Chain link security fence.
- Pedestrian swing gates with lock.
- Motorized gate.
- Remote security - two-way loudspeakers.
- Remote security - closed circuit television.
- Multiple motion and intrusion sensors in all facilities.

Permanent fencing will be provided around the site property boundary or plant work site. Permanent fencing will also be installed around the switchyard and gas metering station areas within the plant facility boundary.

The permanent security fencing will consist of a top rail, bottom tension wire, woven wire for the bottom 2.13 m (7 ft) of fence and another 0.3 m (12 in) high consisting of three strands of barbed wire mounted on 45-degree extension arms extending from the secured side of the fence (i.e., total fence height should be 2.44 m (8 ft). The woven wire shall be placed on the opposite side of the secured side of the fence.

The perimeter fence shall include an appropriate number of personnel gates for convenience and emergency evacuation purposes. The personnel gates will be equipped with locking devices operated by access code keypads.

The security fence will include an electric gate at the main plant entrance adjacent to the Security Building. The gate will be equipped with local and remote open, stop and close controls. Local operation of the gate will be controlled by an access code keypad. The gate will be able to be remotely operated from the Security Building, the Plant Services Building reception desk and the Main Control Room. The gate will be equipped with closed circuit television coverage and two-way speakers. Television monitors, two-way speakers and gate open/closed status will be provided at the Plant Services Building reception desk and the Main Plant Control Room.

Manual swing gates will be installed at all secondary and construction entrances to the plant to control vehicular access at these locations.

4.3.2.5.10 Fire Protection System

Thermal power plant fire protection system: The fire protection system will consist of the following:

- Water supply system.
- Fire pumps.
- Fire network.
- Area/equipment protection system.
- Clean agent fire extinguishing system.

The fire protection system will provide plant-wide fire detection and suppression systems to support personnel safety and minimize equipment damage and duration of outage for repairs. The systems will be a combination of automatic and manual systems that provide alarm, detection, and suppression in accordance with local building code requirements, NFPA codes and standards, NFPA 850, and typical industrial engineering practices, as applicable.

A fire protection system shall be provided that includes automatic and manual functions to provide alarm, detection, and suppression capability. The design shall be consistent with local building code requirements, NFPA guidance and typical industrial engineering practices, as deemed applicable.

Automatic fire suppression systems shall provide for all buildings, structures and specific hazards requiring such protection in accordance with NFPA requirements and local code requirements. Protection of equipment and areas will include NFPA 850 recommendations. In addition, specific hazards will be protected with automatic fire suppression systems as indicated below. Fire suppression systems will be designed in accordance with NFPA requirements.

A fire protection signaling system will be provided to monitor the various fixed fire protection systems throughout the power plant and announce to the main fire alarm panel located in the main control room. The system includes local supervisory panels at strategic local locations to monitor, control and annunciate all protection systems. The local panels will be networked to carry that information to the main fire alarm panel in the control room. Local and remote audible fire and trouble alarms will be provided as required by NFPA and local codes and standards.

4.3.2.5.11 Natural gas and other gas leakage detection system.

LNG leaks will be detected through rigorously designed and regularly maintained gas detection systems being permanently present at vulnerable plant locations located at the power plant.

Other detection systems will also be installed throughout the facility:

- Detection of other gases (CO₂, nitrogen).
- Heat/fire detection.
- Smoke detection.
- Detection by people.
- Temperature detection (cold).
- Systems to alert personnel, e.g., horns and beacons.

4.3.2.5.12 Telecommunication System

The function of the communication system will be to provide station personnel with a reliable and convenient means of plant public address, shared line communications, and end-to-end communication including telephone/LAN equipment.

The communications system will include the following major components:

- Outdoor and indoor wall stations with handsets, amplifiers, and cabinets.
- Wall mount audio messenger unit with telephone interface capability.
- Loudspeakers and drivers.
- Central exchange and master control unit with accessories.

4.3.2.5.13 Roadway and parking system

The roadway and parking system will provide vehicular access to various buildings and yard structures on the plant premises.

The roadway and parking system will consist of the following major components:

- Asphalt/concrete paved roads.
- Aggregate paved roads.
- Permanent parking lots.
- Pipe bollard.

4.3.2.6 Construction of transmission line to the National Interconnected Power System

An electrical transmission line will be built to interconnect the project's electrical substation with the substation of the Energía 2000, S.A. power plant, by means of an interconnection tower at the entrance to the substation.

The substation of Energía 2000, S.A. will be connected to the National Interconnected Electric System through a 345 KV transmission line that goes from Pepillo Salcedo to the Guayubín substation (under construction) and El Naranjo in Santiago.

The transmission line will be approximately 5 km (5000 m) long, while the easement strip will be 60 m wide (30 m on each side of the line), for a total area of approximately 300,000 m².

The construction of the transmission line begins with the construction of the foundations for the metallic structures (towers) that will support the line, which will be made of galvanized steel profiles bolted together. Approximately 11 tower structures for 345 kV will be installed.

The tower foundations will have four insulated industrial concrete legs, on which four pedestals will be erected. These will support each of the main angles of the towers for optimum stability (Photo 4-3 and Figure 4-5).



Photo 4-3. Typology of pedestals on the foundation where the metal structures of the towers will be anchored.

Source: EMPACA Archives.

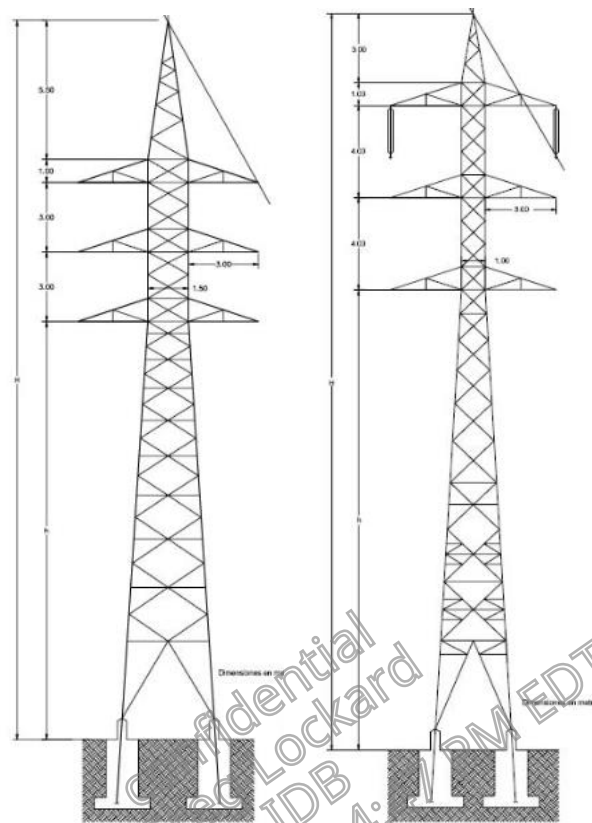


Figure 4-5. Indicative elevation view of a cross section of different types of steel towers for the suspension of transmission lines and their foundations.

Source: EMPACA Archives.

Once the concrete foundations have set and all backfill material has been compacted to the approved level, the tower supports will be erected on the foundation.

All materials will be installed in accordance with the plans corresponding to the 345 kV line structures, considering that the assembly will be done in a firm and complete manner, and that it will not overload and/or deform the structural members or damage the foundations. All tower members shall be assembled by bolting.

For the assembly of all the angles that make up the lattice structure of the electrical tower, the most convenient lifting system among those commonly used for this practice shall be used. The most commonly used systems are the following:

- **Lifting with boom:** to lift the supports with this method, the towers will be previously assembled in panels, whose assembly will always be done on chocks to prevent them from being in contact with the ground. They will be assembled on a surface as flat as possible to avoid deformations and the tightening of the bolts will not be the maximum, just enough to hold the bars together.

- Lifting with crane: the complete or partial support will be assembled on the ground, which must be horizontal and flat, on wooden wedges so as not to deform the bars and to guarantee their stability (Photo 4-4).
- Lifting bar by bar: in certain types of structures, this method may be used, which implies, as its name indicates, the lifting piece by piece with the help of a small auxiliary boom attached to one of the four uprights.



Photo 4-4. Steel tower hoisted with crane.

Source: EMPACA Archives

All towers will be adjusted as soon as they are assembled and ready in working condition, complete and safe in all respects (Photo 4-5). Frames will be tightened using the correct sizes of bolts, nuts, and washers.



Photo 4-5. Views of steel towers for transmission lines installed in the country.

Source: EMPACA Archives

The structures will be fitted with fittings, braces, insulators, etc., in the corresponding place in each structure and in accordance with the drawings.

Subsequently, the insulators and conductors and cables for 345 kV will be installed. The line will have two electrical circuits with a capacity to carry up to 1,500 MW per circuit with a power factor of 0.85. The line will have two (2) OPGW type guard cables with 96 optical fibers each, which fulfills dual functions (lightning protection and telecommunications).

The conductors and guard cables will be installed by tension laying methods; under no circumstances will they come into contact with the ground. Dynamometers will be used to maintain the correct tension.

For the attachment of conductors to suspension structure insulator assemblies, suspension clamps with preformed armatures or universal trunnion-type suspension clamps shall be used.

The connection of conductors to insulator assemblies in tension, angle and terminal structures will be made by means of a mechanical terminal assembly compatible with the conductor material.

Each structure will be provided with a basic grounding system and an additional grounding system in structures located in high resistivity soils.

Hazard warning plates will be placed on each structure (Photo 4-6).



Photo 4-6. Safety signage similar to the one which will be placed on the towers.

Source: EMPACA Archives.

The line was designed to withstand hurricane winds of up to 230 km/h in accordance with the requirements of the Dominican Electric Transmission Company (ETED).

4.3.2.7 Connection to the National Electrical Grid

The project will be connected to the substation of the power plant of the Energía 2000 company, through an interconnection tower located in front of its entrance for connection with the National Interconnected Electric System (SENI).

4.3.2.8 Withdrawal of temporary facilities

Once the construction work is completed, the temporary facilities will be dismantled.

The closure of the construction phase involves the cleaning of the exterior and interior areas, collection of materials and the leveling of sectors of the cover soil layer, as well as the reestablishment of the vegetation layer and beautification of the area.

4.3.2.9 Transport of remains of construction materials and waste

The remains of construction materials and the waste left after the removal of the temporary facilities will be transferred to their destination (warehouses or landfills), using the same material transportation routes that were followed during the construction activities.

4.3.2.10 Hiring of temporary workforce

The temporary workforce for the construction phase of the project will be in the order of 1,400 workers in the peak period, according to the different construction and equipment assembly stages (Figure 4-6).

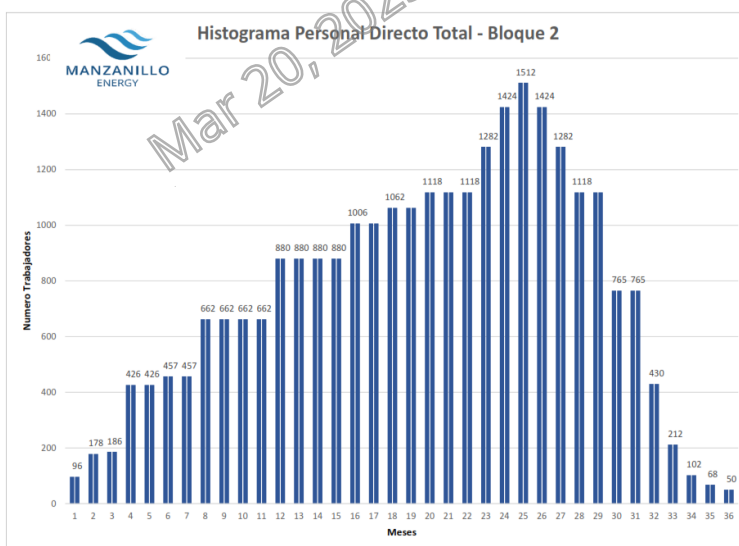


Figure 4-6. Number of jobs generated per month in the construction phase of the project.

Source: Manzanillo Energy Consortium, Inc. (2023).

According to the estimates of the potential contractors consulted, 75% of the labor used throughout the construction and installation process will be on site, i.e., in the municipality of Pepillo Salcedo. The remaining 25% will be off-site.

This high concentration of employment at the job site will boost the border area, in this case the northwestern tip of the country, Pepillo Salcedo.

The jobs will be distributed among direct expert jobs, direct non-expert jobs, indirect jobs linked to the work via the contractor, as well as jobs linked to safety, health, and environment (HSE). The hiring of personnel will be in line with the development of the infrastructure and construction of the facilities.

Management personnel required include:

Project Manager (on site): Responsible for completing all on-site project construction and commissioning work.

Construction Management Manager: Provides Project Management with a realistic plan to complete the project within a set time and budget to meet contract requirements. Also responsible for construction schedule, cost estimating and cost control for site construction and proper document control.

Safety, Health, and Environmental Coordinator: Responsible for establishing and implementing the Environmental and Social Management Plan (ESMP). Maintains a direct relationship with the owner and defines how the owner will interact with the contractor in related activities. Perform follow-up and closure of all non-conformities.

Construction Engineers (from the different contractors): They are responsible for the installation of each part of the site works (mechanical, electrical equipment, piping, instrumentation, and others) and the construction of all civil/construction works.

Among the jobs related to the construction of civil works, as well as those of security are:

- Masons.
- Carpenters.
- Reinforcing bar (rebar) workers.
- Concrete workers.
- Racking workers.
- Installers.
- Electrical welders.
- Excavator operators.
- Loader drivers.
- Roller drivers.
- Hoist workers.
- Hoisting cable workers.
- Common workers.
- Boiler body workers.
- Workers for insulation, anticorrosion.
- Gas turbine generator workers.

- Steam turbine generator workers.
- Electrical workers.
- Control workers.
- Plumber.
- Hoisting workers.
- Operators.
- Racking workers.
- Electricians.
- Purification workers.
- Safety personnel.
- Site administration personnel.
- Medical personnel.

4.3.2.11 Schedule and costs

The project will be constructed in approximately 36 months, equivalent to 3 years (Table 4-10). The project will have a total investment of USD\$ 550,000,000.00 (Table 4-9).

Table 4-9. Detailed project budget.

Detailed Budget Manzanillo Energy Power Plant Project	
Concept	Import (USD)
Engineering Procurement and Construction Contract (EPC) - Generation Plant	\$ 457,675,000
Financial and Operating Costs during construction	\$ 70,125,000
Permissions and licenses	\$ 1,500,000
Supervision of Plant Construction Engineers	\$ 10,000,000
Plant Engineering Studies and Development	\$ 3,200,000
Advisors and consultants	\$ 7,000,000
Mobile office, security, travel expenses and other costs	\$ 500,000
Total	\$ 550,000,000

Source: Manzanillo Energy Consortium.

Table 4-10. Indicative project schedule.

Description of activities	Quarter											
	1	2	3	4	5	6	7	8	9	10	11	12
Location of temporary facilities.												
• Construction of roads and temporary perimeter fences.												
• Location of the temporary facilities camp.												
• Storage of construction materials.												
• Enabling parking spaces.												
• Supply and consumption of water.												
• Generation and management of liquid waste.												
• Energy supply and consumption.												
• Supply and consumption of fuels.												

Description of activities	Quarter											
	1	2	3	4	5	6	7	8	9	10	11	12
• Generation and management of solid and oily waste.												
• Transportation of construction materials and other supplies.												
Earthworks.												
• Clearing and cleaning of vegetation and topsoil in the construction area.												
• Stripping or cutting of unusable material.												
• Stakeout.												
• Earth movement.												
Construction of the thermoelectric plant.												
Construction of service infrastructure.												
• Drinking water supply system.												
• Wastewater treatment system.												
• Surface drainage system.												
• Electrical and emergency power supply system.												
• LNG supply system inside the thermoelectric plant.												
• Liquid fuel storage and distribution system.												
• Compressed air system.												
• Compressed gas system.												
• Security system.												
• Fire system.												
• Natural gas and other gases leak detection system.												
• Telecommunications system.												
• Road system and parking lots.												
Construction of electrical transmission line.												
Connection to the National Electrical Grid.												
Hiring of temporary workforce.												
Withdrawal of temporary facilities.												
Transportation of remains of construction materials and waste.												

Source: Elaborated by Manzanillo Energy Consortium, Inc./EMPACA (2023).

4.3.2.12 Equipment and Machinery

Traditional equipment and vehicles that meet the requirements of the different construction processes will be used for the construction of the project.

Equipment and vehicles will be acquired as needed in the process, either by purchase or by rental from specialized companies, as long as they guarantee optimum performance of the programmed activities.

The equipment foreseen are:

- Bulldozer.
- Graders.
- Trucks.
- Rollers.
- Front loaders on tires.
- Backhoe on mats, with removable pneumatic hammer.
- Motor graders.
- Cranes.
- Motor welders.
- X-ray units.
- Masonry instruments and accessories.
- Plumbing instruments and accessories.
- Electricians' instruments and accessories.
- Mechanical assembly instruments and accessories.
- Leveling instruments and accessories.
- Scaffolding and ladders.
- Personal safety equipment.
- Mobile electrical plants.
- Auxiliary lighting on tripods.
- Light 4x4 vehicles.

4.3.3 Operation phase activities

4.3.3.1 Start-up and operation of the thermoelectric power plant and electric transmission line.

Once the assemblies have been completed and all the mechanical installations have been completed, tests will be carried out on each of the thermoelectric power plant systems in order to verify the correct operation of each one, simulating all types of situations and operational failures. This seeks to ensure that the designed protections operate properly to protect the integrity of people and equipment according to their design. Once the tests are completed, the equipment and the plant will undergo reception and certification of the guaranteed parameters of the equipment and the plant. These tests include, among others, the following tests of major relevance:

- Hydraulic tests of the mechanical circuits and tanks.
- Phase and insulation tests of electrical equipment.
- Tests of lubrication systems.
- Tests of backup power supply systems.
- Substation energization.
- Energization of individual equipment and individual operating equipment.
- Cooling system testing.
- Fuel transfer system testing.
- First start-up of generation units.
- Maximum load tests.
- Load rejection tests.

- Acceptance tests (Efficiency tests).
- Commercial operation of the thermoelectric power plant.

With the operations of the Manzanillo Energy Consortium Power Plant, approximately 420 MW net will be generated and delivered to the National Interconnected Electric System.

The power transmission line will be put into operation in accordance with safety standards and meeting quality criteria with respect to frequency, voltage regulation, energy losses, and distortion caused by harmonics.

4.3.3.2 Maintenance of facilities, equipment, and power transmission line

Thermoelectric power plant:

The manufacturers of the main equipment in Block 02 recommend maintenance protocols and the scope of preventive maintenance according to the operating intervals.

In general, these maintenances are divided into two categories:

- Annual maintenances with a duration of approximately 10 days.
- Major repairs (five-yearly). The time intervals between each of them depend mainly on the number of hours of operation, the power level, the number of items and the way of operation.

Major maintenance is considered to be approximately every 5 years, although these may be brought forward due to the nature of the operations to which the thermoelectric power plant has been subjected. Smaller equipment generally has redundancy in the design so that maintenance can be performed without affecting the continuity of operations and it is highly probable that they will remain operative even beyond the useful life of the project.

Other maintenance includes the cooling system, natural gas, and liquid fuel supply systems, among others.

Other equipment maintenance is included in the power plant's procedures, such as grease separators, chemical neutralization, domestic wastewater, and liquid waste treatment, among others.

Electric transmission line:

Electric transmission line maintenance may include:

Preventive maintenance

- a) Maintenance of support sites (if applicable): consists of the review of the sites of each tower, and in case of destabilization problems, the construction of corrective works such as trenches, gabions, retaining walls and drainage works will be required.
- b) Review of the condition of the elements: consists of carrying out inspections with the purpose of reviewing the condition of the component elements of the transmission line,

such as towers, conductors, insulators, hardware and associated equipment, among others.

Corrective maintenance

- a) Repair or replacement of elements: if the review of the condition of the component elements of a distribution network determines the need to implement corrective measures, the elements affected by damage to the network or by the termination of a life cycle (remodeling) will be repaired or replaced.

In some cases, services will be temporarily suspended when it is necessary to change important parts such as insulators or conductors.

Maintenance of the vegetation in the power transmission line easement strip:

Any tree that comes within 10 m of the conductor wires will be removed, either by movement due to wind action on the wires and tree, or by the eventual fall of any plant reaching the line conductors.

Weed control (herbaceous vegetation) will preferably be done by manual mowing or mechanical means (mowers or pruners) without the use of chemical products or herbicides that could have negative effects on the fauna in the area. In the event that the use of herbicides is strictly necessary, products that are environmentally friendly or of low toxicity will be chosen as much as possible.

4.3.3.3 Liquefied Natural Gas Management and Consumption

The Manzanillo Energy Power Plant Project will have a natural gas supply of approximately 40 TBTU per year, distributed in 20 TBTU per year, which will be supplied by the aforementioned storage and regasification terminal (Block 01 or Manzanillo Gas & Power) that will supply the two thermoelectric power plant blocks.

This consumption was estimated based on operation at maximum capacity, that is, 24 hours, 30 days per month.

This fuel will be piped to the gas turbines and will be handled according to the safety instructions established by international standards and the supply company.

4.3.3.4 Liquid Fuel Handling and Consumption

The Manzanillo Energy Power Plant Project will require liquid fuel (diesel) for the sporadic operation of the emergency power generator, vehicles, and forklifts.

4.3.3.5 Generation and Management of Hazardous and Non-Hazardous Solid Waste

Non-hazardous solid waste: This type of waste includes household waste generated by workers (paper, plastic, glass, and metal containers, food scraps, etc.), which is estimated at 30 kg/day.

This type of waste will be collected in sacks with plastic bags that will be placed in the areas where it will be generated. The sacks will be identified with the type of waste for which they will be used,

which will allow separation at source of recyclable materials such as paper, cardboard, plastics, metals, among others.

The collection of the sacks will be done daily, and they will be transferred to the temporary storage area at the thermoelectric plant.

Once a week the waste will be removed by the Pepillo Salcedo municipality for transfer to the municipal landfill.

Recyclable materials will be removed by a manager authorized by the Ministry of Environment and Natural Resources to provide this type of service.

Hazardous Waste: Hazardous waste to be generated at the thermoelectric plant facilities may include: oil filters, oil-soaked rags, batteries, batteries, fluorescent lamps, light bulbs, paint containers, and solvents, among others.

These wastes will be stored in separate, identified containers inside the buildings until they are removed by a manager authorized by the Ministry of the Environment and Natural Resources.

4.3.3.6 Generation and Management of Oily Waste

Considering that the power plant will operate mainly with liquefied natural gas (LNG), the generation of oily waste (sludge) will be low. However, this type of waste may be generated since diesel will be used as an alternative fuel and because of the lubrication of rotating parts such as turbines and generators.

Likewise, used lubricating oils will be generated because of the maintenance of electricity generation units and other equipment.

The oily waste will be removed periodically by a manager authorized by the Ministry of Environment and Natural Resources, for final disposal.

4.3.3.7 Water Consumption and Treatment

The plant facilities will use seawater for power plant operations, which will be treated in a desalination plant. The volume of water to be used for operations has been estimated at 2,000 m³/day.

Drinking water (for human consumption) will be purchased from local bottling companies in 5-gallon containers.

4.3.3.8 Electric Power Consumption

The thermoelectric plant facilities will consume electricity for lighting, air conditioning in some of the buildings, and operation of electrical equipment, among others.

4.3.3.9 Treatment of Liquid Waste Generated

Liquid waste will be generated at the project facilities.

Cooling/heating water: This water will be returned to the sea after use. It will be ensured that the discharge temperature of the cooling/heating water complies with the standards established in the Environmental Standard on Control of Discharges to Surface Water, Sanitary Sewage, and Coastal Waters (NA-CDAS-12).

Oily water: This type of water will be treated in grease and oil separators and/or by means of devices that reduce the flow velocity and provide a calm surface, acting as a grease and oil separator.

The oily waste resulting from this process will be managed as oily waste.

Reject water from the desalination plant, water from the laboratory: This type of water will be treated by neutralization processes using chemical reagents. They will be discharged into the sea if they meet the standards established in the Environmental Standard on Control of Discharges to Surface Water, Sanitary Sewage, and Coastal Waters (NA-CDAS-12).

Discharges from hydrostatic testing: These waters must be tested for contamination. If applicable, they will be stored in temporary tanks and removed by a manager authorized by the Ministry of the Environment and Natural Resources.

Wastewater from sanitary sewers: This water will be treated in septic tanks and the treated effluent will be discharged to the subsoil through a filter. The effluent will comply with the standards established by the Environmental Standard for Groundwater Quality and Subsoil Discharge. It is estimated that 2.4 m³/day will be generated.

4.3.3.10 Vector and Rodent Control

Vector and rodent control will be established at the thermoelectric plant. This activity will be carried out by a company with the required expertise.

4.3.3.11 Handling of Chemical Products

Chemical products will be handled at the thermoelectric power plant facilities for water treatment activities (service, domestic and wastewater), cleaning of the facilities and for vector and rodent control (see section 4.3.3.11).

A record will be kept of all chemicals on the project including quantity, concentrations, locations and SDS (Safety Data Sheet) information.

Typical major chemicals, storage provisions and containers will be as listed in Table 4-11.

Table 4-11. Major chemicals to be handled at the plant and purpose and form of storage.

Purpose	Chemical product	Bulk storage
Chemical cycle feed	Ammonium hydroxide	Portable totes less than or equal to 1.89 m3 (500 gallons) or chemical solution tank.
	Trisodium phosphate	
Auxiliary boiler chemical feed	Ammonium hydroxide	Portable totes less than or equal to 1.89 m3 (500 gallons) or chemical solution tank.
Chemical feed of circulating water	Sodium hypochlorite	Bulk storage tanks, (1-1/2 times the delivery volume, or 15 days storage, whichever is greater), or portable tote less than or equal to 1.89 m3 (500 gallons) or chemical solution tank.
	Sulfuric acid	
	Scale inhibitor/ Dispersant	
	Sodium bisulfite	
Service water treatment	Sodium hypochlorite	Bulk storage tanks (1-1/2 times the delivery volume or 15 days storage, whichever is greater), or portable totes less than or equal to 1.89 m3 (500 gallons).
	Coagulating solution	
	Coagulation adjuvant solution	
	Dehydrating polymer solution	
Cycle make-up water treatment	Sulfuric acid	Bulk storage tanks (1-1/2 times the delivery volume or 15 days storage, whichever is greater), or portable totes less than or equal to 500 gallons (1.89 m3).
	Sodium hydroxide	
	Sodium bisulfite	
	Reverse osmosis antifouling agent	
Wastewater treatment system	Sodium hypochlorite solution	Bulk storage tanks (1-1/2 times the delivery volume or 15 days storage, whichever is greater), or portable totes less than or equal to 500 gallons (1.89 m3)
	Coagulant solution	
	Coagulation adjuvant solution	
	Sulfuric acid	
	Sodium hydroxide	

Source: Manzanillo Energy Consortium, Inc. (2023).

Tanks and storage containers for chemical products will be surrounded by retaining walls.

4.3.3.12 Hiring of permanent workforce

It is estimated that approximately 145 permanent jobs will be generated during the operation phase of the thermoelectric plant.

Figure 4-7 presents the organization chart of the project in the operation phase.

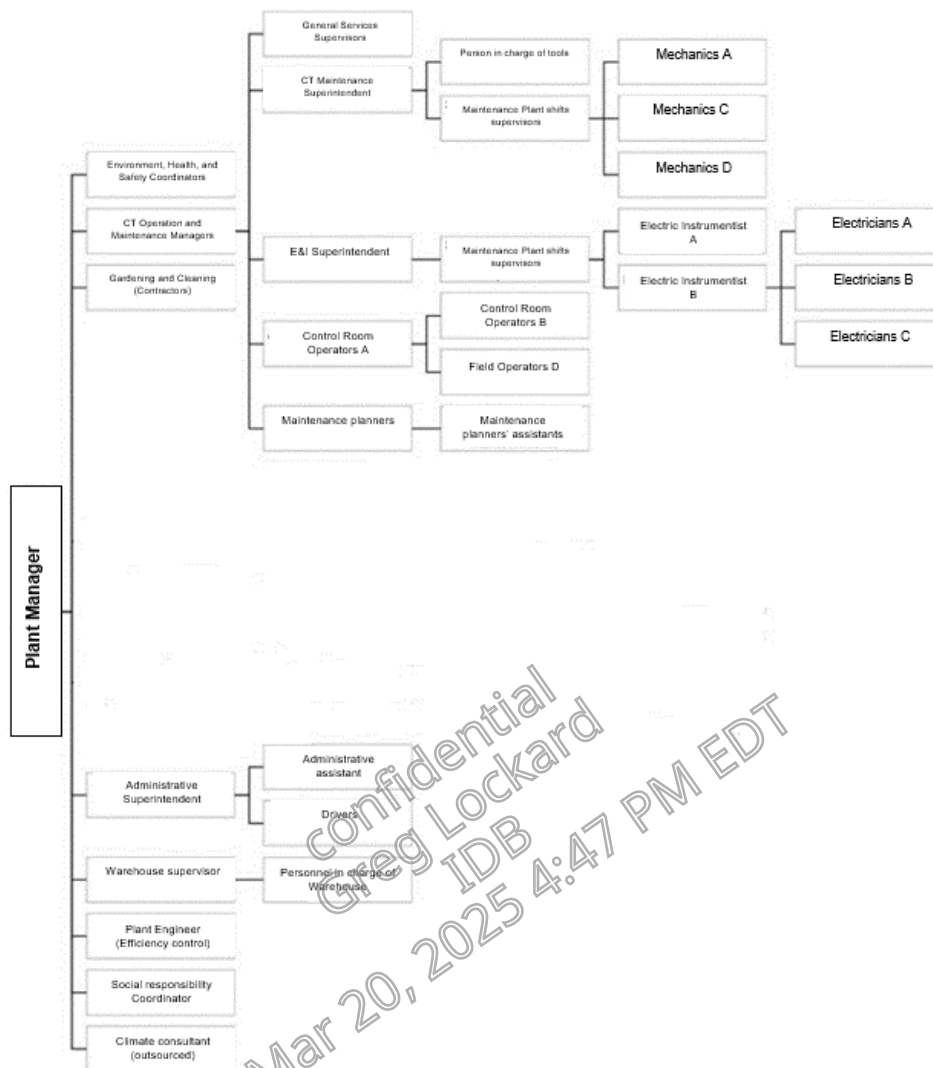


Figure 4-7. Project organization chart in the operation phase.

Source: Manzanillo Energy Consortium, Inc. (2023).

The on-site operational personnel will require different specializations, among which the following stand out:

- Plant Manager.
- Operations and Maintenance Manager.
- Operations Superintendent.
- Maintenance Superintendent.
- Maintenance Shift Supervisors.
- General Services Supervisors.
- Operations and Maintenance Analyst.
- Maintenance Planners.
- Assistant Maintenance Planners.
- Plant Engineer (Efficiency Control).

- Safety, Health, and Environment Coordinator.
- Social Responsibility Coordinator.
- Administrative Superintendent.
- Administrative Assistant.
- Drivers.
- Control Room Operators.
- Warehouse Supervisor.
- Warehouse Manager.
- Tool Room Manager.
- Field Operators.
- Electricians.
- Instrumentalists.
- Mechanics.
- Climate consultant (subcontracted).
- Cleaning and gardening personnel (subcontracted)

4.3.4 Useful Life of the Facilities and Decommissioning Phase

The thermal power plant facilities will be designed for a useful life of more than 25 years. After this period, the condition of the facilities and equipment will be evaluated to determine the feasibility of continuing operation and the necessary adjustments for these purposes (remodeling, replacement, or repair of equipment, among others).

If the need for definitive closure is determined, the main activities would be:

1. Dismantling of facilities and equipment.
2. Collection of solid (hazardous and non-hazardous), liquid and oily waste.
3. Transportation and final disposal of solid (mainly debris and scrap), liquid and oily wastes collected, as well as of the dismantled equipment.

4.3.4.1 Decommissioning of facilities and equipment

In the event of definitive closure of the facilities, the equipment installed at the thermoelectric plant would be dismantled, including the following:

- Gas turbines.
- Steam turbines.
- Steam condenser.
- Desalination plant equipment.
- Cooling tower.
- Substation equipment.
- Other.

In the case of buildings, they would be demolished or dismantled.

4.3.4.2 Collection of solid (hazardous and non-hazardous), liquid and oily waste

The solid waste generated in this phase will be classified into non-hazardous waste (municipal solid waste, special waste) and hazardous waste, identifying materials that could be reused, recycled, or those that have some commercial value, such as scrap metal. Solid waste management in this phase would be similar to that of the construction phase.

Similarly, liquid and oily waste generated in this phase would be handled in a similar manner to the construction phase.

The waste will be handled by a manager authorized by the Ministry of the Environment and Natural Resources to provide this type of service.

4.3.4.3 Transportation and final disposal of solid waste (mainly debris and scrap metal), liquids and oily waste collected, as well as dismantled equipment.

The equipment and solid, liquid, and oily waste will be transported to its destination using the same routes used for transport during the construction phase.

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5. PARTICIPATION OF STAKEHOLDERS

5.1 Introduction

This section describes the institutional actors and community organizations in the study area, as well as the information and consultation activities that have been carried out for the Manzanillo Energy Power Plant Project, to be executed in the municipality of Pepillo Salcedo, better known as "Manzanillo" because it is located in the bay that bears this name.

5.2 Area of influence

The municipalities of Pepillo Salcedo and Monte Cristi are the defined territorial demarcations that make up the area of influence of the project. The area where the socioeconomic impacts will be most directly felt includes the urban zone of the municipality of Pepillo Salcedo and the Copey, Carbonera and Los Conucos sections (Figure 5-1).

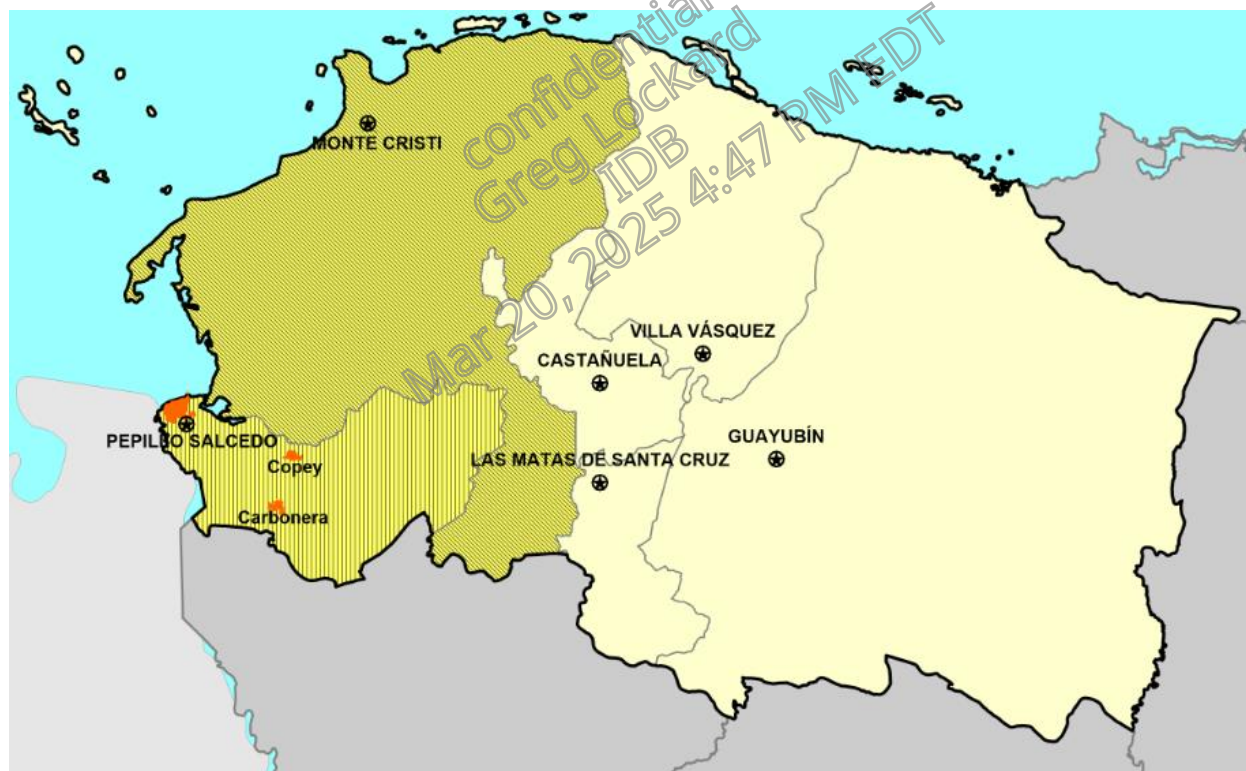


Figure 5-1. Socioeconomic influence area of the project.

Source: Elaborated by EMPACA, 2023.

5.3 Objectives

- a) Identify initial mechanisms for the characterization of stakeholders with an interest in the project's area of influence.
- b) Establish clear and effective mechanisms to ensure that information on project activities, impacts and plans is accessible to all relevant stakeholders. This includes the creation of two-way communication channels that allow for a constant flow of information between the company and the community.
- c) Design and implement consultation processes that involve a wide range of stakeholders, including groups potentially affected by the company's activities, with special attention to vulnerable and marginalized communities. This ensures that all voices are heard and considered in decision-making.
- d) Proactively identify social and environmental risks associated with the project and develop effective strategies to mitigate them. This includes the implementation of preventive and corrective measures that minimize negative impacts on stakeholders and the environment.

5.4 National and international requirements

5.4.1 National requirements

In the Dominican Republic, the participation of the populations affected by the execution of projects is regulated by the Regulation and Procedure for Public Consultation in the Environmental Evaluation Process, prepared by the Ministry of the Environment and Natural Resources, in order to implement the mandate of Law 64-00, which has as one of its principles community participation in the protection of the environment (See Chapter 2 on Legal Framework).

The instruments of the public consultation, according to the mentioned regulation, are (Art. 36):

1. Information and/or disclosure of the project. This is done through various means: the placement of the sign announcing the environmental impact study of the project, interviews for the analysis of stakeholders, public hearings and the observations of the participants in said hearings, and the placement of the study for 15 days after its publication, at the social participation office, for consultation purposes and reception of suggestions from stakeholders.
2. Stakeholder analysis. This is carried out through interviews with various stakeholders of the project and allows to have a balance of the existing opinions about the project.
3. Public hearings. Through which the project and its environmental and socioeconomic impacts are presented, and the comments and suggestions of the participants are gathered.
4. Observations on the environmental studies. These are collected in the interviews for the analysis of stakeholders, the participation of those who are present at the public hearings and the publication of the environmental impact study in the direction of social participation.

5. Public hearings. These are convened by the Ministry of Environment and Natural Resources in cases of special projects in which the Ministry is interested in meeting directly with stakeholders and hearing their views on the project.

5.4.2 International requirements

International requirements for community participation are governed by the IFC Performance Standards, and the guidance notes to those standards, as well as the Equator Principles and the Organization for Economic Cooperation and Development's Common Approaches, which promote the information and participation of the affected population in decision-making processes that affect them (see Chapter 2 on Legal Framework).

Financial institutions recognize the importance of citizen participation in the development and execution of projects, understanding that building solid and positive relationships with communities and other social actors is a process that requires time, dedication, and a proactive strategy.

Trust, mutual respect, and understanding are fundamental elements that are cultivated throughout the interactions and shared experiences. For this reason, international best practices prioritize the establishment of relationships from the early stages of projects, especially in large or controversial projects, to ensure that the opinions and well-being of communities are meaningfully considered.

From international best practices, citizen participation involves being transparent about project uncertainties and using early contacts to identify and mitigate potential problems and risks, offering alternative solutions that benefit both the project and the community.

From international experience, it has been established that ignoring the importance of these relationships until a conflict arises can result in a significant disadvantage, as communities tend to be less receptive to unfamiliar companies or those with whom regular contact has not been maintained. Therefore, integrating stakeholder relationship management as a fundamental part of business strategy not only helps to build trusting relationships for difficult times, but also promotes a long-term vision, prioritizing lasting relationships over immediate benefits and tailoring the engagement process to the specific characteristics of each project and context.

5.5 Methodology

The methodology for the stakeholder analysis was based on the identification of institutional, community and individual stakeholders relevant to the project. Individual or group interviews were conducted with each of them, emphasizing their knowledge of the context and their observations and suggestions for the project.

Information from the results of participation instruments applied in 2022 and 2023 was used. A total of 31 stakeholders belonging to more than 31 entities in the project's area of influence were interviewed, since each stakeholder participates in several institutions or organizations.

It is important to note that, although they are stakeholders, no interviews were conducted with the official sector, authorities of the governing entities, such as the Ministry of Energy and Mines and

the Ministry of Environment, whose opinions on the project are expressed only through documents that authorize or not its operation. Consultations such as those carried out for the present stakeholder analysis are not consistent with their steering role.

An exception was made only in the interview with the person in charge of the Urban Planning Office of the Manzanillo City Hall, due to the importance of the existence of the Land Use Plan, which was designed under the auspices of the Inter-American Development Bank (IDB), which establishes the proposal to move Villa Ray to another location, to make way for an industrial zone.

As will be observed during this analysis, the residents of Villa Ray erroneously attribute this proposed relocation to the project for the installation of the thermoelectric plants and the LNG tank, which is the result of fear, distrust, and actions on their part to prevent their relocation to another place. But the Project has no interest in the residents of Villa Ray being moved to another location.

In addition, information from 392 surveys conducted in Manzanillo, Copey, Carbonera and Los Conucos, between late October and early November 2022, was considered to serve as input for both the stakeholder analysis and the socioeconomic baseline of the Project. Emphasis was placed on Villa Ray, the Manzanillo neighborhood closest to the project, where most households were interviewed, to capture their level of knowledge and opinion about this initiative.

Finally, five focus groups were conducted in 2023: one with fishermen, as they are sensitive to the possible impacts of the project; another with residents of Villa Ray, as it is the closest neighborhood to the project; two with women, because of the gender issue and the project; and one with different economic actors (beekeepers, fishermen, goat and sheep breeders, ecotourism entrepreneurs).

The results of the application of these social research techniques are presented after the following point, which details the information and consultation process previously carried out with the stakeholders.

5.6 Stakeholder Outreach, Information and Consultation

5.6.1 Introduction

The following is a description of the stakeholder outreach, information and consultation process for the Manzanillo Energy Power Plant Consortium Manzanillo Energy Project carried out prior to the development of the studies in the community. This social work strategy was developed under the responsibility of EMPACA's social research team, which is responsible for its execution.

5.6.2 First visit to Pepillo Salcedo

In September 2022, as part of the activities of the environmental and social impact study of Block 01, a previously arranged visit was made to the Municipal Council of Pepillo Salcedo, where members of the EMPACA social research team met with the mayor of this municipality (Photo 1 in Annex 8). This meeting was held on September 15, 2022, and it was agreed that EMPACA's

social team would be able to get in contact with all the social actors of the municipality registered by the municipality. At the same time, during this visit, information was collected that made it possible to identify and locate other potentially relevant stakeholders. This information was used as input for the verification of key stakeholders of the Block 02 project.

In addition to the meeting with the mayor of the municipality of Pepillo Salcedo, meetings were held with other important local leaders who later introduced us to contact other social actors (Photos 2 to 5 in Annex 8). In this way, a list of all these actors and their telephone numbers was compiled, which could be used as a reference for the study of Block 02.

In addition, the members of EMPACA's social research team maintained permanent contact with the representatives of the organizations identified and participated as observers in different social events:

1. SWOT (Strengths-Opportunities-Weaknesses-Threats) workshop on the vision of development aspired by the stakeholders of the municipality of Pepillo Salcedo, organized by the Border Development Council of the Dominican Republic in collaboration with the University of Pennsylvania (Photo 6 in Annex 8).
2. Meeting with the community to inform about the start of the baseline survey of the physical, biological, social, economic, and cultural environment for the Environmental Impact Study of the Manzanillo Port Expansion and Remodeling Project (Photo 7 in Annex 8).

The participation of the EMPACA team in these activities was useful to expand the number of relevant contacts for the project, establish trusting relationships with existing contacts and deepen the understanding of the development vision of the different stakeholders in the municipality.

During October 3, 4 and 5, 2023, members of EMPACA's social team visited Pepillo Salcedo to distribute invitations to the first community participation space of the Block 02 project. This visit also served to gather essential data to identify and locate key stakeholders involved in the project, especially landowners and residents near the future locations of the towers and transmission lines. These individuals were specially invited to participate in this first meeting (Photos 8 to 11 in Annex 8) (See Annex 9.1: Invitation letters for the first meeting).

This first meeting was held on Thursday, October 12, 2023, with the participation of a total of 45 people representing different organizations and institutions of the municipality, as well as some of the landowners or their representatives (Photos 12 to 14 in Annex 8) (see Annex 9.2: Report of the first meeting).

In addition to the first meeting, during the following two days (October 13 and 14) two representatives of EMPACA's social team and a representative of AECOM's social team met with social actors, in order to conduct interviews and focus groups, particularly with representatives of fishermen, cattle ranchers, beekeepers, ecotourism entrepreneurs and women, mainly from the Villa Ray neighborhood (Photos 15 to 17 in Annex 8).

5.7 Synthesis of results of the interviews conducted.

The following is a synthesis of the results of the interviews conducted with stakeholders, showing the most relevant observations outlined about the power plant project to be carried out in Pepillo Salcedo.

Among these stakeholders the most common comments are:

- That the project does not affect or affects the environment as little as possible.
- Not to affect the mangroves of Estero Balsa.
- Avoid relocation of Villa Ray residents.
- Provide sources of work for women and youth.
- Support job training for the project.
- Prioritize social investment in projects that benefit the development of the community.
- Support the development of the local economy.
- Invest in proper environmental impact management, especially in Villa Ray.

5.7.1 Social Organizations and Institutions

a) Pastor Chauris Cadet

New Jerusalem Church. Haitian nationals.

- Established for 6 years.
- 30 to 35 people attend regularly.
- Evangelical Pentecostal church.
- They also have the Future Full of Hope Foundation.
- People come here looking for work.
- There is a lot of unity between Haitian and Dominican nationals.
- Their children go to the official school. There they receive education, food, uniform, among others.
- He believes that the installation of the plant is important for the country and for the Haitian nationals, who can have a job opportunity there.

b) Digna Chávez

Treasurer of the Santa Ana Neighborhood Council, Carbonera (Photo 18 in Annex 8).

- There is only one man on the neighborhood council; almost all the members are women.
- The community's problems are the need for support for the elderly, the lack of sidewalks and curbs, and the scarcity of jobs, among others.
- The project seems to him to be beneficial for the country.
- However, he understands that if there are going to be evictions, the families must first be relocated to adequate housing.

c) Remigio Báez Cuevas

Pastor of the Assembly of God Church and lawyer, Manzanillo.

- The church has about 70 members and a children's center with about 200 children.
- Among the problems affecting the municipality are the material they bring to build cement, which leaves a lot of dust in the community, the lack of septic and filtering systems, unemployment.
- The percentage of single mothers is high.
- Cases of violence do occur, but they are isolated. Including violence involving alcohol or drug use.
- The investment being made is important because it will create sources of work. But it will be unskilled labor. Because the young people who study and become qualified, do not stay in Manzanillo.
- The negative thing is that we have been told that some neighborhoods will be affected and will have to be relocated for security or environmental reasons. That creates a lot of instability for the people, and it must be resolved. And it is important that the housing is built beforehand.
- If this relocation is not real, he suggests creating an environmental protection belt, so that the impact of its operation does not affect the neighborhood.
- But it is necessary to know first the recommendation of the technicians in that sense.

d) Milagros Mieses

President of the Council for the Development of Manzanillo (COPADEMA) (Photo 19 in Annex 8)

- COPADEMA was created in 2010 with the purpose of cooperating with the development of Manzanillo.
- Manzanillo has isolated cases of teenage pregnancy and family violence.
- Haitian migration is strong here. I think there are more Haitians than Dominicans.
- Haitian women mostly come, sell their products and leave.
- In the case of the men, most of them stay here and start families.
- It is said that the project will need the land of Villa Ray to operate. And the residents of this neighborhood are opposed to this.
- There is a lot of distrust about this issue.
- There is fear that the project will also affect the mangroves of Estero Balsa.

e) Helvio Bejarán

Coordinator of the Economic and Social Council of the Municipality Pepillo Salcedo

- All of Manzanillo's organizations are represented on the Council.
- The Municipal Development Plan that has been designed has allowed us to work well on all the axes of development, social, economic, and environmental.
- The Plan has been articulated with the productive sector, the central government and has been articulated with sectoral organizations to follow up on the issues.
- The Plan is based on a development vision, considering that we are a port city, connected, strategically located and with great potential.

- In the economic axis, the development of the energy sector is key. That is why Manzanillo is developing electric companies that can offer services to the national and local markets, and even to the Haitian market.
- They do not want to be like Veron or Punta Cana. They are betting on the development of the whole society, not just one sector.
- The demand for hotel services, rooms, restaurants, is already impacting Manzanillo.
- In order to take advantage of this investment, more education for work is needed.
- When the consultation for the Strategic Plan was made, the population supported the electric projects.
- The healthiest thing is that the population of Villa Ray does not move.
- And that the population is impacted as little as possible.

f) Paula Mitzi Disla

World Vision Facilitator in Manzanillo and part of the Planning Team of the Carbonera Border Development Council (Photo 20 in Annex 8).

- Among the existing problems, violence against women is low.
- But there are few job opportunities for youth. As a result, young people are unmotivated to study, because they go to university for five years and when they return, they do not find work.
- A serious problem is irresponsible parenthood. In fact, 65% of the children that World Vision serves in Manzanillo live with their grandparents or aunts and uncles. In many cases with little support from the parents.
- There is a need to train youth in technical trades.
- Manzanillo is a difficult community. There is a lot of potential, but there is competition for prominence and little unity.
- I think it is important that the plants are put in place, because there will be sources of work.
- There are many people trained by INFOTEP, but they stay there. They do not take initiatives. They do not take advantage of what they have learned.
- In Manzanillo and in Carbonera, more and more young people are taking refuge in the use of drugs. This is an issue that needs attention.
- However, these are still quiet communities.
- Coexistence with Haitians is good. However, sometimes there are problems among them. There are those who come to commit crimes, but they are just passing through.
- Impact of the projects: there are no rental houses in Carbonera. At least five of the engineers working on projects in Manzanillo live here.
- And some residents who had gone to Santiago to study have returned.
- Hopefully the company can invest in a park in Manzanillo, which does not exist. In Copey neither. And the children do not have healthy spaces where to have fun.

g) Rosario Cabrera

President of the Neighborhood Council El Progreso del Buen Vivir and the Mothers' Center of the Bay

- The Neighborhood Council brings together the residents of Manhattan, they meet weekly in their office.

- They are working on organizing a bakery. They lack the space for the project.
- They understand that the project is important, especially because of the jobs and services it could demand from the community.
- But they are concerned that Villa Ray will be affected.
- They believe that, in order not to affect this community, the project should invest in improving the existing community center in Villa Ray, where even INFOTEP offers courses.

h) Raquel Brito

Vice President of the Neighborhood Council El Progreso del Buen Vivir, Sector Manhattan (Photo 21 in Annex 8)

- They are 56 women and 12 men.
- She understands that there are many teenage pregnancies, but family violence is low. It is significant among Haitian families, and in several cases, they have had to intervene.
- Regarding the project, they do not see any expectations. They say that the jobs are for men. And what about for women?
- They propose that the government should train women to be able to work in these initiatives.
- To the project, they propose to approach the community, to see what alternatives can be worked together.

i) Yesenia Perdomo

Rayo de Luz Copey Mothers Center (Photo 22 in Annex 8).

- There are 21 women in the Center.
- From the Center they work in favor of the community and the training of women.
- There are currently no cases of violence against women in the community.
- Work is scarce. Especially for women. The jobs offered are political and temporary.
- After the pandemic, many women have developed economic enterprises.
- The project is important because it will generate jobs. But it must mitigate the impacts it may cause.

j) Antonia Perdomo

President of the Neighborhood Council Unión y Esperanza, Villa Ray

- They have been told that the plant project will imply evictions.
- They are in a state of struggle.
- They are going to send a letter to the president stating their position.
- There are people talking about taking them out of Manzanillo.
- They propose that they meet with the neighborhood to explain the plans they have.

k) Padre Orlando Barajas Amaya

Sacred Heart of Jesus Parish, Manzanillo.

- Many people emigrated to the U.S. at the time of the Grenada Company, which maintains part of the town now.
- Manzanillo is a very poor community.
- There are few job opportunities.
- The women in our community create the opportunities, they look for ways to get ahead. By creating small businesses. Although this is true for adult women, most of the young people migrate.
- Family violence is not a common denominator. Perhaps because in the church environment they are adult, peaceful, good families. With many expectations that now it is going to be the moment of development.
- They hope that it will be like that and not the moment of more wealth for the companies and impoverishment of the people.
- The town is still calm, but with the migration many people have arrived, also delinquency. Robberies have increased. They can no longer do the "mañanitas" because people are afraid to go out.

l) Ramón Ureña

Member of the Neighborhood Council of El Buen Vivir, Manzanillo (Photo 23 in Annex 8)

- Among the community's problems is teenage pregnancy, which he understands is high.
- This community is invaded by Haitians; in her neighborhood, Alto de Manhattan, 90 or 95% of the neighbors are Haitian.
- The Haitian pays more for housing and usually the Dominican does not provide sanitary service or electricity. For this reason, they group together to pay for a house or room, in order to be able to pay for it.
- They welcome the project, if it is true that it is a clean energy, because it is assumed that the cost of electricity will go down in price and new jobs will be created.
- They have been told that Villa Ray is going to disappear from there, with the construction of this project. They wonder if the company is prepared to build these houses as they are in another place.
- Villa Ray has problems with water, it comes twice a week, because it is located in a high area. It is an issue that needs to be addressed.
- If Villa Ray is not going to be affected, it would be important that the company helps to maintain the Villa Ray Club, which is used for many things, among others, to give INFOTEP courses.

m) Luisanna Ferris

Coordinator of the Pepillo Salcedo University Students Association.

- The association is made up of university students who attend mainly university campuses in Dajabón and Monte Cristi, which offer careers unrelated to the employment opportunities that will be generated by the power plant projects in the municipality.

- There is a project to install a permanent National Institute of Professional Technical Training center and to convert the municipality's high school into a polytechnic. These projects need to become a reality. Currently INFOTEP has vans where they teach electricity courses.
- They are interested in learning about the employment opportunities offered by these projects, so that they can be trained and take advantage of them.
- They need to be given job opportunities, even if they do not have experience.
- As a sector, young people have had little participation in the consultation processes of the development initiatives being promoted in the province. They have been marginalized; they are not invited. They attribute as a possible cause the fact that they are not formalized.

5.7.2 Public institutions

a) Dr. Domingo Guzmán

Director of the Padre Fantino Provincial Hospital, Monte Cristi.

- In addition to the Padre Fantino hospital, the municipality of San Fernando de Monte Cristi has 7 primary care centers or first level centers (CPN).
- Each NPC has two physicians, a head physician and an intern, a nurse and two health promoters.
- The primary care centers are for consultation only, as they do not have beds for inpatient care.
- The hospital has 42 doctors and 17 nurses.
- The most frequent consultations are for arterial hypertension, diabetes, respiratory diseases, and pregnancy.
- The most frequent causes of hospitalization are childbirth and accidents.
- Sixty percent of the hospitalizations for childbirth are for Haitian women.
- Since Haitian nationals do not have medical insurance, they go for emergency medical care.
- The hospital looks like a modern, well-maintained, hygienic hospital.
- Among the hospital's staffing needs, one or two translators from Creole to Spanish should be considered.
- Since it is a provincial hospital, they attend cases coming from all the municipalities of the province and some even from other provinces, such as Dajabón.

b) Wilson Abreu

Director of the Lourdes Morel de Abreu Secondary School, Manzanillo

- The educational center has 338 students.
- This secondary education center has two cycles. The first cycle from first to third grade and the second from fourth to sixth grade.
- Teaching staff: 17 teachers, a guidance counselor, a coordinator, an interim director.
- Both the students from Carbonera and Copey attend this school in the second level, that is, from fourth to sixth grade.

- The school addresses the issue of teenage pregnancy; students who become pregnant do not discontinue their studies. Currently, two students are pregnant.
- Regarding the project, if they are going to work with natural gas, which does not affect, she agrees.
- But he is opposed to the possible resettlement of the inhabitants of Villa Ray.
- The young people are being prepared at Infotep.
- And in this center, there are plans to convert it into a polytechnic, because of the interest that the employment opportunities generated by these projects can be taken advantage of by the young people of the municipality.
- He recommends creating a dialogue table to avoid the relocation of families.

c) Dr. Leudy Tineo

Director of the Pepillo Salcedo Municipal Hospital and Councilor of the City Council (Photo 24 in Annex 8)

- He believes that the project has a very beneficial impact for the community. Especially because of the sources of employment.
- As a social work, the project could build a playground in Villa Ray, improve the clubhouse and build a court. And in other places, it could build sidewalks and curbs or help to build the premises of the two primary care units that they have rented.
- For the hospital, the project is important, because this way this center will have a greater demand of users and they will be able to request more personnel to provide medical services.
- It is expected that a large number of people will move to Manzanillo to work, as is already happening.
- Failure to increase the number of hospital staff would create a crisis in the service. With a demand that we would not be able to cover.

d) Zenaida Núñez Escoto

President of the Association of Parents and Friends of the School (APMAE) Liceo Lourdes Morel de Abreu, Pepillo Salcedo

- The APMAE is becoming increasingly important in the educational process. It supports the maintenance of the school and cases of children in vulnerability.
- Most of its members are women. There is only one man on the board.
- In Manzanillo there is a lot of unemployment.
- And there are cases of family violence.
- It was a pleasure to walk through the project site before it was dismantled. Because of the nature that existed there.
- Every project has impacts, but it is hoped that they do not damage the environment more than we are.
- The high rate of local cancer due to the handling of clinker is an example of this.
- Therefore, he suggests that the project be installed in the correct way, respecting international environmental protection measures.
- And it should be supervised, considering the participation of the community.

e) Leydi Almonte

Director of Urban Planning, Municipality of Montecristi

- As a result of the ongoing projects in Pepillo Salcedo, more local labor is expected to be hired.
- So far there are no impacts for Montecristi, except that: the price of land has risen. And there are no more rental houses, they have all been rented and skilled or unskilled labor is scarcer.
- There are no housing projects underway in Montecristi. There are three tourist residences under construction for sale. And some projects of few apartments. In addition to a hotel.
- The expected impact is mainly economic and touristic.

f) César Faña

Accounting Manager, La Cruz de Manzanillo Project

- This is a project to grow bananas for export and local sale.
- It is state-owned.
- The project is located in Palo Verde, where the productive area is located.
- It grows bananas, plantains, corn, yucca, and pumpkin. Various small fruits.
- The project started with the Grenada Company. Bananas were exported through the port of Manzanillo. And they were exported to Miami.
- Nowadays they are exported more to Holland, Spain, the Netherlands, Europe.
- The bananas that are not exported are sold and another quantity is given to the most vulnerable sectors.
- This is a quiet community. There is delinquency, but as isolated events. And scarce.
- But the youth has not been prepared, there is a lot of unemployment. And that is why skilled labor will have to come from another part of the country.
- There are many expectations with the projects that are arriving, and the impact is already being seen in new food businesses, rooms for rent.
- That is why I think it is important that projects like these come to the community, because among other things there will be new job opportunities.

g) Fernando Díaz Marte

Mayor of Carbonera (Photo 25 in Annex 8)

- In Carbonera the municipality of Manzanillo collects the garbage every eight days.
- In this community, muggings, family violence and alcoholism occur infrequently.
- There are isolated conflicts between residents, in which the mayor serves as mediator.
- The construction of the dock will affect them; it will prevent them from fishing in some specific areas. The fishermen will be the most affected by this project.
- His proposal is that they sit down with them to see how they can agree to mitigate the impact it will cause.

h) Wisnel Vargas Pimentel

Representative of the beekeeping sector in Manzanillo (Photo 26 in Annex 8).
Resident in Villa Ray

- There are about 10 beekeepers in Manzanillo, this is their main source of income.
- Each one has employees, depending on the number of hives.
- On the project site, there was one of the apiaries for honey production. It was there that they managed the genetic improvement of the queen bees. It was located there because of the biological richness of the area.
- The project has affected them enormously. For example, if the mangrove produces nectar, the trees that produce the nutritional level, which is pollen, no longer exist in that area. That is why they had to remove the hives.
- So far there are no alternatives to this problem. Only the hives in the mangroves are left.
- The hives are also used as bioindicators of contamination, because when there is contamination, the bees die.
- They are not opposed to the project, as long as it does not affect the environment and their activity.
- They propose reforesting some areas and some kind of support to the sector.

i) Ramón Moreta

Association of Motoconchos Copey - Manzanillo

- They had information about the project.
- They expect it to work well.
- The project can contribute to avoid blackouts, generate jobs, and contribute to the dynamization of transportation.
- They do not identify anything negative about the project.

j) Kenia Zayas

Owner of Comedor la Esquina con Sabor a Bahia, Manzanillo

- Kenia is from Santo Domingo. She had a similar business there for three years. When the pandemic hit, she decided to return to Manzanillo, where she grew up. She is a single mother.
- Her mother lives here and that is where she arrived.
- After 2020 she agreed with the owner of the lot to put the business here.
- The distance is a problem for many things, unlike Santo Domingo.
- However, she gets a lot of fresh things, rice, meat.
- The coexistence with the Haitians is good. Most of them come to work and leave on weekends to their country. They don't come every day like in other places along the border.
- Here there are few cattle. We have 9 months without rain. The cows were dying.
- With the projects that are coming to the area, which she believes are important, there is an increase in the labor supply that is needed.

k) María Liberato

Commercial office manager of INAPA, Manzanillo.

- She believes that the development of the project is important because it will offer new sources of employment.
- Especially because currently, there are few jobs available.
- She is concerned about the type of people who will come to work, because she believes it is important to preserve the existing tranquility in Manzanillo.
- In his opinion, there are sources in the community to provide the water needed by the population and it is well supplied.
- Family violence exists, but with a low frequency.
- He understands that the social projects in which the project should invest are to improve the Villa Ray club, build a court, help fight the plague of rats in the community, support some places in the placement of water pipes and contribute to finish the water tank of El Alto de la Paloma, which is not finished yet.

l) Katiurka Báez

Inspector of the Peace Court, Municipality of Pepillo Salcedo (Photo 27 in Annex 8)

- Making the marina in Estero Balsa will help to go to the mangroves.
- Many people go fishing in that area.
- In Manzanillo there is a low level of violence.
- But there are only two police officers for the security of the municipality. The development that is coming requires that this endowment is developed with more members.
- The most frequent cases that are presented are alimony to fathers or mothers, for the children they have and traffic accidents.
- He believes the project is important. And he suggests that the fauna and flora be preserved. The mangroves located in the impact zone of the project are one of the most beautiful areas of Manzanillo.
- He understands that the project could support the development of Villa Ray, with the improvement of the community center, the construction of a park, a court or a funeral home, service that does not exist in the community.

m) Francisco Valenzuela

Director of Urban Planning of the Municipality of Pepillo Salcedo

- The municipality has three trucks and four motorcycles for garbage collection.
- The municipalities do not pay for the services.
- The current budget is 57.6 million pesos, of which 1.5 million is destined to the participatory budget.
- The municipal landfill is located at the entrance to the urban area of the municipality. There are plans to eliminate it in coordination with the Ministry of the Environment.
- A land use plan is currently being developed, financed by the IDB, which is actually an investment management plan rather than a land use plan.
- He cites, as models, international experiences such as those of Colón in Panama and Valparaíso in Chile.

- As negative examples in the D.R., he cites experiences of municipal development such as those of Haina and Veron, which is not what they want for Pepillo Salcedo.
- At the center of the proposed investment development is Villa Ray, which would be displaced, according to the plan, to convert those lands into an industrial corridor.
- For this reason, some suggest that this corridor be located along the land between the urban area of Manzanillo and Copey.
- The mangrove park should not be affected, and social responsibility actions should not be reduced to simple operations and donations but should be committed to the real development of the municipality.

n) Alta Beira Bernard

Principal of Carbonera Elementary School

- They are an extended day school, and they cook at school.
- They have no cases of teenage pregnancies; they have an educational work in that sense.
- They have 271 students. Very few are of Haitian nationality.
- There is little demand for work for the population, especially the youth. That is why they think it is important to set up projects like this one.
- And to help train young people in the jobs required by the project.

5.7.3 Economic Sector

a) Nelson Blanco

Executive Director of Manzanillo Ecoaventura, Manzanillo

- The company is made up of fishermen's children.
- The young people use their parents' boats to offer tours to tourists in the Manzanillo Bay area.
- They propose that the government gives value to the tourism sector.
- They value that several investment projects are installed in the area.
- They fear that the development of other types of companies will affect their business.

b) Rafael Luis (Vianchy) Torres

Tourism businessman, member of the Civil Defense

- Manzanillo has a great variety of natural resources.
- It is hoped that the institutions will contribute to preserve them.
- There are things that worry, like the rocash, the handling of bulk material, which here is serious with the inputs for the cement, when this load arrives to the port the town is seriously affected by the dust in the environment.
- There are many expectations with the projects that are coming.
- And of other initiatives that are expected, for example, the construction of the sewage system.
- A real effort is needed about training for the jobs.

- There is concern about the temperature of the seawater after the project operations begin, due to the richness of the mangroves in this area.

c) Guarionex Luperón, sociologist

President of Tecnolux. He works on border development (Photo 28 in Annex 8)

- Energy projects are important for service decentralization plans.
- These projects require a lot of labor in their construction phase. There is little labor, and it is very technical, in their operation phase.
- There is concern about the fact that, due to the world situation, the operating matrix of the plants will change from natural gas to coal. This would have a serious impact on the population, especially due to the direction of the winds.
- There are also fears about the mangroves.
- The issue of occupying the land of Villa Ray worries the residents of this neighborhood, who are opposed to it. However, this intention is old, there are project documents that reflect this interest, since many years ago.

d) Roque Antonio Tavera Cabrera

President of the Association of Fishermen Marine Guardians of Manzanillo Bay, and Administrator of the Mangroves of Estero Balsa Protected Park.

- The Fishermen's Association has almost ninety members.
- There are women among them. The vice president is a woman.
- Fishing is not good. The local fishmongers are buying from Haitian fishermen and that has put the price down.
- The same is happening with the eel fishery. They cross into Dominican territorial waters to fish it, to the detriment of Dominican fishermen. This has meant that we have had to seek the help of the Navy.
- They are not opposed to the project. But they want it to be as environmentally friendly as possible.
- Regarding the project, he suggests carrying out the environmental impact studies and to save the important species affected.
- Reforestation campaigns should be carried out.

e) Wisnel Vargas Pimentel

Representative of the beekeeping sector in Manzanillo (Photo 26 in Annex 8).
Resident of Villa Ray

- There are about 10 beekeepers in Manzanillo, and this is their main source of income.
- Each one has employees, depending on the number of hives.
- On the project site, there was one of the apiaries for honey production. It was there that they managed the genetic improvement of the queen bees. It was located there because of the biological richness.
- The project has affected them enormously. For example, if the mangrove produces nectar, the trees that produce the nutritional level, which is pollen, no longer exist in that area. That is why they had to remove the hives.
- So far there are no alternatives to this problem. Only the hives in the mangroves are left.

- The hives are also used as bioindicators of pollution, because when there is pollution, the bees die.
- We are not opposed to the project, as long as it does not affect the environment and their activity.
- They propose reforesting some areas and some kind of support to the sector.

f) Ramón Moreta

Association of Motoconchos Copey - Manzanillo

- They had information about the project.
- They hope it works well.
- The project can contribute to avoid blackouts, generate jobs and contribute to the dynamization of transportation.
- They do not know anything negative about the project.

g) Kenia Zayas

Owner of the Comedor La Esquina con Sabor a Bahía, in Manzanillo

- She has a staff of Haitian and Dominican women. Of the seven, 5 are single mothers and one has a mutilated husband due to violence in Haiti.
- The coexistence with the Haitians, for her, has been very good.
- All these projects that are being developed have been a great blessing for many people in the community.
- However, there is a local culture where the women are at home and the men go out to work.
- That's why you get more Haitian women than Dominican women to work. But that is changing.
- The community is very peaceful. Even though we are next to the police, there is only one policeman in the detachment. That's why they can't go out to provide services.
- Violence against women is still low.
- But violence due to alcohol consumption, which is high, is growing.

h) Ramón Arístides López

President of the Copey - Manzanillo Cattlemen's Association and lawyer.

- This association groups cattle, goat, and sheep ranchers.
- Before it was for cows only. Now goats and sheep have been integrated, which are easier to raise.
- There are many positive expectations with this project, especially because of the supply of new jobs.
- There is already a high demand for housing, which is coming to his law office.
- There are also many people building in Manzanillo, for the coming demand.
- And families are already renting rooms in their homes.
- On the other hand, land is getting more value, after the projects the price of each task has almost tripled.

5.8 Synthesis of focus group results

5.8.1 Focus group 1: Fishermen

Participants (Photo 29 in Annex 8):

- Ramón Almonte (Johnny), secretary of the Marine Guardians Fishermen's Association In addition, he is a gasoline and diesel mechanic, welder, and merchant marine.
- Ramón Emilio Tejada, fisherman
- Evangelista Guzmán de la Cruz, fisherwoman.
- Pedro José Cabrera, fisherman and Environmental Park Ranger
- Joaquín Gabriel Cabrera, fisherman and environmental park ranger
- Kelvin Manuel Taveras, fisherman and park ranger for the Environment

Summary of results:

- a) They are in fishing out of necessity. And it is part of the inheritance given to us by our parents.
- b) Fishing gives them more income than doing other work.
- c) Environment gave work to several of them, as park rangers, in recognition of the fact that the association was doing environmental protection work on a voluntary basis.
- d) There has been a lack of information about the development of the projects in Manzanillo. They have not spoken with them.
- e) For example, with the port that is going to be built, they have not been told where their boats are going to be located.
- f) The pipeline that is going to be laid to carry natural gas from the boats to the tank could affect them, because it is in a fishing area.
- g) They state that they are not in disagreement with the development.
- h) They disagree with the impact that the fishermen will have, as they understand that they will be the most affected sector in the execution of this project.
- i) In this sense, they are concerned that certain areas will be closed, which will prevent them from carrying out their work.
- j) Therefore, they propose that the project go to the Association to explain what is going to be done and how.
- k) And if they are going to prevent them from fishing, they must compensate them in order to be able to make a living from something, a grocery store that they can put up, for example.
- l) Some have been thinking about working in fish farming if this situation arises.

5.8.2 Focus group 2: Residents of Villa Ray

Participants (Photo 30 in Annex 8):

- Altagracia Cabreja (Xiomara). Works for an NGO in Haiti. Travels daily.

- Narciso Castro (Bacho). 61 years residing in Villa Ray. Vice-president of the Neighborhood Council of Villa Ray.
- Onésima Martínez. 65 years residing in Villa Ray. Housewife.
- Roberto Espinal. 50 years residing in Villa Ray. Councilman.
- Antonia Perdomo. More than 43 years residing in Villa Ray. President of the Neighborhood Council Unión y Esperanza, of Villa Ray. Retired teacher.
- Mariana de los Santos. 48 years residing in Villa Ray. Housewife.

Synthesis of the results:

- a) The Grenada Company divided the sectors by the jobs held by the workers. The company distributed the houses in this way.
- b) When they arrived in the neighborhood, the houses were already built. Two families lived in each house.
- c) They value their houses and the land they have, which could allow them to build another house next door.
- d) They do not understand why they want to evict them now; this is their main concern, which they disagree with.
- e) They are not opposed to development, as long as it respects the environment and their neighborhood.
- f) They are concerned about how the power plants will operate and the damage they may cause.

5.8.3 Focus group 3: Women

Participants (Photo 31 in Annex 8):

- Toribia Bautista. From the Catholic Church and the Neighborhood Council.
- Milagros Ulloa. President of the Mothers' Center Nuestro Esfuerzo, Altos de la Paloma.
- Luz Divina Taveras. President of the Neighborhood Council Marcelina Batista.
- Bienvenida Acosta. From the Mothers' Center, Civil Defense and other organizations.
- Raquel Brito. Vice-president of the Neighborhood Council "El Progreso del Buen Vivir", secretary of the Civil Defense and other organizations.
- Carolina Almonte. Secretary of the Neighborhood Council Unidos Podemos.
- Rosario Cabrera. President of the Federation of Neighborhood Councils and Mothers' Centers.

Synthesis of the results:

- a) The town needs a polytechnic, so that together with the baccalaureate, young people can have a technical career.
- b) Technical training is only offered locally by INFOTEP.
- c) Violence against women, there are isolated cases.
- d) Among the community's problems are the lack of job opportunities, clinker contamination, sewage from the homes and the lack of ambulance services.
- e) The population lacks information about the projects that are underway in Manzanillo. Although public hearings are already being held for some of them.

- f) They are concerned about the existing information about the possible eviction of Villa Ray because of the power plant project.
- g) They do not agree with this, although they do agree with the realization of investments that contribute to the development of Manzanillo.

5.8.4 Focus group 4: Women in Villa Ray

Participants (Photo 31 in Annex 8)

- Victoria Páez (Neighborhood Council of Pueblo Nuevo)
- Moraima Marcelino (Alto La Paloma Mothers' Center)
- Mercedes Cabrera (Neighborhood Council Los Barracones)
- Milagros Castro (Neighborhood Council of Villa Ray)
- Antonia Perdomo (President of Neighborhood Council Villa Ray)
- Rosa Muñoz (Association of Merchant Mariners and Civil Defense)
- Isabela Abreu (Neighborhood Council Las Casitas)

Synthesis:

- a) Although the focus group was conducted in Villa Ray, women from different neighborhoods of Manzanillo participated.
- b) There is a persistent fear that there are plans to displace the population of this neighborhood. The displacement of part of the population of the Pueblo Nuevo neighborhood for the construction of the border fence contributes to this fear.
- c) Concern about the environmental impacts (noise, dust) of the project.
- d) Expectation that actions will be developed for the benefit of the Villa Ray community, such as the construction of sidewalks, help with the cost of electricity.
- e) Concern that the development of Manzanillo may cause crime in the municipality.
- f) INFOTEP has given different courses in the municipality, including electricity and accounting. The women of Manzanillo have also received training in various areas (decoration, baking, beauty, etc.).
- g) Concern that the access to employment opportunities is limited by influence peddling, particularly political influence.
- h) There is a perception that, despite training, this is of little use in obtaining employment. There is also disillusionment in starting businesses, as they receive little or no support.
- i) Among the women's needs are: *in Villa Ray, remodel and refurbish the clubhouse where women can develop training activities; an assistance center for needy children; a home for the elderly; a funeral home; support for women to start businesses that can provide services (for example, food) to companies that set up in the municipality; that the project establish permanent communication with the neighborhood councils and mothers' centers).*

5.8.5 Focus Group 5: Affected Economic Actors

Participants.

- Wisnel Vargas (President of the Pepillo Salcedo Beekeepers Association).
- Luis Manuel Núñez (Pepillo Salcedo Association of Beekeepers)
- Francisco Vargas Rodríguez (Pepillo Salcedo Beekeepers Association)

- Luis Manuel Rodríguez (goat breeder)
- Julio Paéz (goat breeder)
- José Gilberto Peña Batista (goat breeder, fisherman and owner of fish market)
- Hiciar Blanco (President of Ecoaventura, an organization of ecotourism entrepreneurs)
- Roque Antonio Tavera (President of the Fishermen's Association).

Synthesis:

- a) The fishing sector has been negatively impacted, since their work area has been adapted for the projects that are being installed, destroying the amenities that the fishing sector had to work.
- b) The intervention of the representative of the fishing sector actually refers to actions and commitments assumed by the Energy 2000 project, since the Block II project has not yet begun, nor has it had prior contact to establish commitments.
- c) Fishing, cattle raising, beekeeping, all of these have been part of the history and culture of Manzanillo. Our parents, our ancestors, have left a legacy.
- d) Similar to bananas, Manzanillo's honey has international prestige.
- e) The clearing of trees for power plant projects has caused a significant reduction in the production of beekeepers.
- f) For the ecotourism sector, the Estero Balsa protected area is the main destination, but access to it is obstructed by the energy projects. This affects them significantly.
- g) Goat and sheep raising has been greatly affected by land clearing. They used to release their goats and sheep early in the morning and they would return at dusk; now they must wait until eight o'clock at night, risking theft. The goats now travel up to ten kilometers looking for something to eat, and when they arrive, they must be fed and that costs money.
- h) All the economic actors participating in the focus group expect to receive compensation for the impact, so they hope to get in contact with the project promoters.

See Annex 9.3: Transcription of the focus groups of economic stakeholders and women.

5.9 Survey Results

The survey asked the villagers about their use of the project land. As can be seen (Table 5-1) most of the residents of Manzanillo and Villa Ray used the land, followed by residents of Copey and a few from Carbonera. The vast majority used the land for grazing, followed in descending order by crabbing, fishing, extraction of medicinal plants, wild birds, beekeeping, and agriculture (Photo 32 in Annex 8).

Table 5-1. Activities carried out by residents in the land where the project will be installed (you can select several options)

Categories	Quantity (C)					
	Carbonera	Copey	Manzanillo	Villa Ray	The Conucos	Total
Capture of wild birds.	0	2	4	9	0	15
Crab catch.	1	2	17	14	0	34
Extraction of medicinal plants.	0	2	7	10	0	19
Agriculture for self-consumption or local sale.	1	2	1	2	0	6
Beekeeping.	0	3	3	3	1	10
Goat or cattle grazing.	3	14	41	27	0	85
Fishing.	1	0	17	11	0	29

Source: Survey applied by EMPACA, Oct - Nov 2022.

Just over a third of all respondents understand that the project will impact the environment and the community (Table 5-2). In Villa Ray, due to the issue of possible eviction, this percentage is the highest of all, increasing to 44%. It is noteworthy that more than 25% of the total number of respondents did not answer or did not know the answer to this question.

Table 5-2. Project impacts on the environment and community

Responses	Carbonera		Copey		Manzanillo		Villa Ray		The Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Yes	23	28.05	31	34.83	52	36.62	24	44.44	4	16.00	134	34.18
No	27	32.93	35	39.33	59	41.55	17	31.48	11	44.00	149	38.01
N/S	27	32.93	20	22.47	24	16.90	13	24.07	10	40.00	94	23.98
N/A	5	6.10	3	3.37	7	4.93	0	0.00		0.00	15	3.83
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied by EMPACA, Oct - Nov 2022.

Of the total population surveyed whose opinion was that the project will impact the environment and the community (134 respondents), half believe that the project has positive impacts; for slightly more than a third, the impacts are both positive and negative, while for slightly more than a seventh, the impacts are negative.

However, when looking at the data disaggregated by locality, it can be seen that in Carbonera the vast majority and in Copey the majority believe that the impacts will be positive. Meanwhile, in Manzanillo and Villa Ray, slightly more than a third of the surveyed population is of the same opinion.

In Carbonera, slightly more than a tenth believe that the impacts will be positive and negative. In Copey, Manzanillo and Villa Ray this percentage is around 40%.

Finally, in Carbonera about a tenth of the respondents characterized the impacts as negative; in Copey this percentage is only 3.23, while in Manzanillo and Villa Ray it is slightly more than a fifth of the total surveyed, which expresses the existing fears in this area with respect to the project (Table 5-3).

Table 5-3. Characterization of project impact

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Positives.	18	78.26	18	58.06	20	38.46	9	37.50	4	100.00	69	51.49
Positive and negative.	3	13.04	12	38.71	21	40.38	10	41.67		0.00	46	34.33
Negatives.	2	8.70	1	3.23	11	21.15	5	20.83		0.00	19	14.18
Total	23	100.00	31	100.00	52	100.00	24	100.00	4	100.00	134	100.00

Source: Survey applied by EMPACA, Oct - Nov 2022.

When asked the reasons for the characterization of impacts, the reasons offered by the respondents were grouped in the following table (Table 5-4). The positive impact is mainly due to the creation of jobs, although for some the project may contribute beyond jobs to the development of the community.

Concerns about the negative impact are pollution, associated with more dust in the area (in addition to the clinker that arrives weekly at the port), noise, smoke, contamination of the beach water, generation of diseases and evictions. Other reasons for the negative impacts are the loss of an area with flora and fauna, which was also used for economic production and the support of several families.

Table 5-4. Reasons for impact rating

Categories	Quantity					
	Carbonera	Copey	Manzanillo	Villa Ray	The Conucos	Total
I. Positive:						
a) Labor	18	18	13	8	3	60
b) Labor and development	0	0	5	1	0	6
b) N/C	0	0	2	1	0	3
II. Positive and negative:						
a) Work/ contamination	3	12	7	3	0	25
b) Labor, development/pollution	0	0	6	1	0	7
c) Work, development/crime	0	0	3	1	0	4
d) Work/ eviction	0	0	1	2	0	3
e) Work/loss of forestry, fauna, and productive activities	0	0	0	3	0	3
f) N/C	0	0	4	0	0	4
III. Negative:						

Categories	Quantity					
	Carbonera	Copey	Manzanillo	Villa Ray	The Conucos	Total
a) Contamination	2	1	11	4	0	18
b) Pollution, eviction	0	0	0	1	0	1
Total	23	31	52	25	0	131

Source: Survey applied by EMPACA, Oct - Nov 2022.

5.10 Identification and classification of stakeholders

5.10.1 Stakeholders and degrees of impact and influence

This section presents a list of stakeholders classified by the type of entity they represent (social, public or economic) and their interest, influence and impact. In this sense, we have:

01 Affected parties: those directly or indirectly affected by the project (or by the company's operations);

02 Stakeholders: those who have "interests" in the project or the parent company that define them as stakeholders;

03 Influence on the development of the project: have the potential to influence the results of the project or the company's operations.

To determine the direction of the impact, we asked a series of questions related to the identified stakeholders:

- Who can benefit from the project?
- Who might be adversely affected?
- Who has legal rights with regulatory power to influence the project?
- Who as an organization or institution in the community, although as individuals are not directly affected, has an interest in the project being carried out?

The answers to these questions make it possible to determine whether the stakeholder influences or is affected by the project, in its construction or operation phase, or in both phases. They also make it possible to determine whether the impact or influence on the results of the project is positive or negative. It also makes it possible to distinguish between stakeholders who are directly affected by the project and actively involved stakeholders who are not directly affected or influenced by the project.

To consider the degree of influence and impact of the project, which can be high, medium or low, we ask ourselves to what extent a given stakeholder has an impact on the implementation of the project and how much it affects them.

The stakeholders presented in this section are 23 stakeholders from social entities, 13 stakeholders from public entities, and 14 stakeholders from the economic sector, for a total of 50 stakeholders (Table 5-5).

Table 5-5. Stakeholder group by type of entity and stakeholder classification

Type of entity	Identified stakeholder	Classification of social actor	Medium of contact (Voice to voice and WhatsApp)
Social Entity	New Jerusalem Church. From Haitian nationals	02 - stakeholder	809 514-1989
	Neighborhood Council Santa Ana, de Carbonera	03 influence on project results	849 209-2887
	Assembly of God Church, Manzanillo	02 - stakeholder	829 890-4776
	Missionary Church	02 - stakeholder	809 978-4464
	Council for the Development of the Municipality of Manzanillo (COPADEMA)	02 - stakeholder	849 433-7863
	World Vision (WV) and Carbonera Mothers' Center	02 - stakeholder	809 779-0833
	Nuestro Esfuerzo Mothers' Center	03 influence on project results	809 912-0657
	El Progreso del Buen Vivir Neighborhood Council Manhattan Sector	03 influence on project results	829 601-5286
	Rayo de Luz Mothers' Center, Copey	02 - stakeholder	809 383-3296
	Bay Mothers' Center	03 influence on project results	829 934-2221
	Neighborhood Council Unión y Esperanza, Villa Ray	03 influence on project results	829 641-6502
	Sacred Heart of Jesus Parish, Manzanillo	02 - stakeholder	849 878-7838
	Economic and Social Council of the Municipality Pepillo Salcedo	03 influence on project results	829 356-4765
	Council for the Development of Manzanillo (COPADEMA)	03-Influence on project results	849 433-7863
	Copey Development Union	03 influence on project results	809 383-2028
	Neighborhood Council Unidos Podemos	03 influence on project results	809 972-3277
	Neighborhood Council Unidos Marcelina Batista (Marcelina Batista United Neighborhood Board)	03 influence on project results	809 620-0898

Type of entity	Identified stakeholder	Classification of social actor	Medium of contact (Voice to voice and WhatsApp)
	Federation of Neighborhood Councils	03 - influence on project results	829 934-2221
	Monte Cristi Park Ecological Society	02 - stakeholder	809 606 9931
	Manzanillo Golf Club	02 - stakeholder	809 817-1719
	Pepillo Salcedo University Students Association	02 - stakeholder	829 914-8104
	Juan Pablo Duarte Sports and Cultural Club	02 - stakeholder	809-467-6447
	Copey Softball and Basketball League	02 - stakeholder	849 629-5525
Public Entity	Padre Fantino Provincial Hospital, Montecristi	02 - stakeholder	809 579-3073
	Lourdes Morel de Abreu Secondary Education Center, Manzanillo	02 - stakeholder	829 286-1396
	Pepillo Salcedo Municipal Hospital (HMPS)	02 - stakeholder	849 457-2422
	Asociación de Padres, Madres y Amigos de la Escuela (APMAE) Lourdes Morel de Abreu High School, Pepillo Salcedo	02 - stakeholder	809 860-6881
	Office of Urban Planning, Montecristi City Hall	02 - stakeholder	809 579-3951
	La Cruz de Manzanillo Project	02 - stakeholder	829 860-8471
	Pepillo Salcedo City Hall. Carbonera Section	02 - stakeholder	809 467-6444
	Commercial Office of the National Institute of Drinking Water (INAPA) Manzanillo	02 - stakeholder	829 801-4823
	Peace Court of the Municipality of Pepillo Salcedo	02 - stakeholder	829 356-4765
	Planning Office, Pepillo Salcedo Municipal Council	03 influence on project results	809 504-1982
	Office of Civil Status	02 - stakeholder	829 319-1555
	Fire Department	02 - stakeholder	829 601-7696
	Carbonera Elementary School	02 - stakeholder	809 249-0429
	Manzanillo Ecoadventure	01 part affected	849 244-7396

Type of entity	Identified stakeholder	Classification of social actor	Medium of contact (Voice to voice and WhatsApp)
Economic entities.			809 973-1880
	Tropical Seas (Tourism sector)	01 part affected	849 925-6167
	Tecnolux Company (social and economic consultant)	02 - stakeholder	829 602-4214
	Chamber of Commerce and Production Manzanillo	02 - stakeholder	849 629-5525
	Atlantic Cooperative	02 - stakeholder	829 760-4959
	Asociación de Pescadores Guardianes Marinos Bahía de Manzanillo (APGMBM), and Parque Protegido Manglares de Estero Balsa (PPMEB).	01 part affected	829 572-6338
	Beekeeping sector in Manzanillo, Resident in Villa Ray	01 part affected	849 272-5198
	Copey Cattleman's Association - Manzanillo	01 part affected	809 858-8444
	Pepillo Salcedo Truckers Association (affiliated to Fenatrado)	02 - stakeholder	829 639-4929
	Shipping agent	02 - stakeholder	809 914-8559
	Association of Motoconchos Copey - Manzanillo	02 - stakeholder	--
	La Esquina con Sabor a Bahía Dining Room, Manzanillo	02 - stakeholder	829 702-0680
	Demimín Pastries	02 - stakeholder	809 912-8604
	Landowners and beekeepers adjacent to the transmission line: Hugo Carías, Carlos Espinoza, Kildre Taveras, Roberto González, Joaquín Curiel	01 part affected	809 722-4881 809 722-4881 809545-0330 809 543-7980 809 481-7895

Source: Prepared by EMPACA, October - November 2022.

In the following table, the degree of impact of the project on 45 of these stakeholders is analyzed; this impact can be high, medium, or low and the same column identifies the type of this impact, which can be positive (+), negative (-) or include impacts of both signs, i.e. positive and negative (+-).

In the last column of this table, the degree of influence that each of these stakeholders have on the execution of the project is rated, which can be high, medium, or low.

Table 5-6. Stakeholders by type of social entity, including degree and sense (+ -) of involvement and influence on the project of each one.

Representative	Interest group	Degree of involvement and type	Degree of influence
1. Chauris Cadet. Pastor	New Jerusalem Church. From Haitian nationals	Low (+)	Low
2. Digna Chavez. Treasurer	Neighborhood Council Santa Ana, de Carbonera	Low (+)	Low
3. Remigio Baez Cuevas. Pastor	Assembly of God Church, Manzanillo	Low (+)	Low
4. Pastor José Guillermo Sosa	Missionary Church	Low (+)	Low
5. Milagros Miseses. President	Council for the Development of the Municipality of Manzanillo (COPAEMA)	Medium (+)	Medium
6. Helvio Bejarán	Economic and Social Council of the Municipality Pepillo Salcedo	Medium (+)	Medium
7. Paula Mitzi Disla. Facilitator (VM) and member of the Planning Team (CDF).	World Vision (WV) in Manzanillo and Consejo de Desarrollo Fronterizo (CDF), Carbonera	Low (+)	Low
8. Rosario Cabrera. President	Neighborhood Council El Progreso del Buen Vivir and the Centro de Madres de la Bahía (Bay Mothers' Center)	Low (+)	Low
9. Raquel Brito. Vice President	El Progreso del Buen Vivir Neighborhood Council Manhattan Sector	Low (+)	Low
10. Yesenia Perdomo. President	Rayo de Luz Mothers' Center, Copey	Low (+)	Low
11. María Marcelino Ogando	Nuestro Esfuerzo Mothers' Center	Low (+)	Low
12. Antonia Perdomo. President	Neighborhood Council Unión y Esperanza, Villa Ray	High (+-)	High
13. Father Orlando Barajas Amaya. Pastor	Sacred Heart of Jesus Parish, Manzanillo	Low (+)	Medium
14. Ramón Ureña. Member	El Buen Vivir Neighborhood Council, Manzanillo	Low (+)	Low
15. Giovanni Felipe. President	Copey Development Union	Low (+)	Low
16. Rosario Cabrera	Federation of Neighborhood Councils	Low (+)	Low

Representative	Interest group	Degree of involvement and type	Degree of influence
17. Luisanna Ferris	Pepillo Salcedo University Students Association	Low (+)	Low
18. Juan Pablo Terrero	Monte Cristi Park Ecological Society	Low (+)	Low
19. Victor Mora	Juan Pablo Duarte Sports and Cultural Club	Low (+)	Low
20. Manny Almonte	Copey Softball and Basketball League	Low (+)	Low
21. Radhames Tatis	Manzanillo Golf Club	Low (+)	Low
Representative	Public entity	Degree of involvement and sense	Degree of influence
1. Dr. Domingo Guzmán. Director	Padre Fantino Provincial Hospital, Monte Cristi	Low (+)	Low
2. Wilson Abreu. Director	Lourdes Morel de Abreu Secondary Education Center, Manzanillo	Low (+)	Low
3. Dr. Raysa López Ulloa	Pepillo Salcedo Municipal Hospital (HMPS) and Pepillo Salcedo Municipal Council (AMPS)	Medium (+)	Medium
4. Rafael Guzman	Asociación de Padres, Madres y Amigos de la Escuela (APMAE) Lourdes Morel de Abreu High School, Pepillo Salcedo	Low (+)	Low
5. Leydi Almonte. Director	Office of Urban Planning, Montecristi City Hall	Medium (+)	Low
6. César Faña. In charge	Accounting for the Manzanillo Cross Project	Low (+)	Low
7. Fernando Díaz Marte. Pedestrian Mayor	Pepillo Salcedo City Hall. Carbonera Section	Low (+)	Low
8. Maria Liberato. In charge	Commercial Office of the National Institute of Drinking Water (INAPA) Manzanillo	Low (+)	Low
9. Katiurka Baez. Controller	Peace Court of the Municipality of Pepillo Salcedo	Low (+)	Low
10. Francisco Valenzuela. Director	Office of Urban Planning, Pepillo Salcedo City Council	High (+)	High
11. Alta Beira Bernard. Director	Carbonera Elementary School	Low (+)	Low
12. Zenaida Núñez Escoto	Office of Civil Status	Low (+)	Low
13. Luis Rodolfo Fabian	Manzanillo Fire Department	Low (+)	Medium (+)

Representative	Interest group	Degree of involvement and type	Degree of influence
Representative	Economic sector	Degree of involvement and sense	Degree of influence
1. Nelson Blanco. Executive Director	Manzanillo Eoadventure, Manzanillo	High (-)	Low
2. Rafael Luis (Vianchy) Torres. Tourism entrepreneur and DC member	Tourism sector and Civil Defense (DC)	High (-) Low (+)	Low
3. Guarionex Luperón. President	Tecnolux Company	Low (+)	Low
4. Roque Antonio Cabrera Cabrera. President (APGMBM) and Administrator (PPMEB). And focus group of fishermen.	Asociación de Pescadores Guardianes Marinos Bahía de Manzanillo (APGMBM), and Parque Protegido Manglares de Estero Balsa (PPMEB).	Low (+) Medium (-)	Medium
5. Wisnel Vargas Pimentel. Representative	Beekeeping sector in Manzanillo, Resident in Villa Ray	High (-)	Low
6. Ramon Moreta. President	Association of Motoconchos Copey - Manzanillo	Low (+)	Low
7. Kenia Zayas. Owner	La Esquina con Sabor a Bahía Dining Room, Manzanillo	Medium (+)	Low
8. Ramón Arístides López. President	Copey Cattleman's Association - Manzanillo	High (-)	Low
9. Ramón Arístides López (attorney representative)	Owners of land adjacent to transmission lines	High (+)	Medium
10. German Tavárez	Pepillo Salcedo Truckers association (affiliated to Fenatrado)	Medium (+)	Low
11. Guillermina Perez	Demimín Pastries	Low (+)	Low

Source: Interviews conducted by EMPACA, October - November 2022

5.10.2 Stakeholder analysis

The following is a classification and analysis of the stakeholders according to their degree and type (+ -) of affectation and influence in the execution of the project.

When analyzing the data in the table above (Table 5-6), we can see that there are subgroups depending on the degree of involvement and the degree of influence, which are relevant for the present analysis, as we see below.

Seven (7) of the stakeholders are highly affected, these are:

1. Pepillo Salcedo City Hall, which is positively affected by the entry of new resources from municipal taxes. While its level of influence is high.
2. The Neighborhood Council de Villa Ray, in which we found, through interviews and focus groups, a positive impact due to the creation of new jobs, business opportunities and the social work that the company can develop in this community. At the same time, it is also negative because of the environmental impacts that the project will have on the community. Its level of influence is high.
3. The beekeeping sector in Manzanillo, which is negatively affected according to the results obtained in the application of the participation instruments. Its level of influence is low.
4. The owners of land adjacent to where the project's transmission line will be installed, whose land will be subject to the easement regime, as expressed in unstructured interviews with some of the landowners.
5. The goat and sheep farmers, represented in the association of ranchers, are affected by the displacement of land where goats and sheep used to graze, as expressed in interviews and focus groups.
6. Ecotourism entrepreneurs, since the traditional access routes to the tourist attractions will be altered, as expressed in interviews and focus groups.
7. The fishermen sector, which could be highly affected in a negative sense, due to the impact that the project could have on their fishing zone, with restrictions to the fishing zone or other measures that affect their work. Their level of influence is medium.

Five of the stakeholders present medium levels of impact, these are:

1. The Council for the Development of the Municipality of Manzanillo (COPADEMA), which will be positively affected by the creation of new sources of employment and social initiatives that can be developed with the project through its participation in an eventual roundtable discussion. Their level of influence in the execution of the project is medium.
2. The Pepillo Salcedo Municipal Hospital, which will be positively impacted by the increase in demand for medical services, which will allow this center to request more personnel. While its level of influence is medium.
3. The Urban Planning Office of the Montecristi City Council, which will be positively affected by the increase in income from municipal taxes. And its level of influence is low.
4. The dining room La Esquina con Sabor a Bahía, which will be positively affected by the increase in the number of diners coming to the dining room. While its level of influence is low.
5. The truckers' association of the municipality, which will benefit from contracts for the transportation of materials during the construction process.

Two stakeholders have high project impacts and high levels of advocacy, they are:

1. Neighborhood Council Unión y Esperanza de Villa Ray (whose impacts are both negative and positive), and
2. Pepillo Salcedo City Council, whose impacts are positive.

Three stakeholders, with medium impacts of the project, have medium levels of incidence. They are:

1. The Council for the Development of the Municipality of Manzanillo (COPADEMA), whose impacts are positive.
2. Economic and Social Council of the Municipality of Pepillo Salcedo.

3. Pepillo Salcedo Municipal Hospital, whose impacts are positive.

Two stakeholders have medium impacts on the project and low levels of incidence, they are:

1. The Urban Planning Office of the Municipality of Montecristi, the head municipality of the province, whose impacts are positive.
2. The Comedor La Esquina con Sabor a Bahía, in Manzanillo, whose impacts are positive.

Table 5-7. Stakeholders with a low degree of impact and medium degree of incidence

Representative	Entity	Degree of involvement and type	Degree of influence
Father Orlando Barajas Amaya. Pastor.	Sacred Heart of Jesus Parish, Manzanillo	Low (+)	Medium

Source: Interviews conducted by EMPACA, October - November 2022.

As can be seen in Table 5-7 above, there is only one stakeholder with a low positive impact, who nevertheless has a medium degree of influence, being the parish priest of the local Catholic Church.

Table 5-8. Stakeholders with low degree of impact and low degree of incidence

Representative	Entity	Degree of involvement and type	Degree of influence
Digna Chávez. Treasurer	Neighborhood Council Santa Ana, de Carbonera	Low (+)	Low
Remigio Báez Cuevas. Pastor	Manzanillo Assembly of God Church	Low (+)	Low
3. Paula Mitzi Disla. Facilitator (VM) and member of the Planning Team (CDF).	World Vision (WV) in Manzanillo and the Border Development Council (BDC) in Carbonera.	Low (+)	Low
4. Rosario Cabrera. President.	Neighborhood Council el Progreso del Buen Vivir and La Bahía Mothers' Center	Low (+)	Low
5. Raquel Brito. Vice-president.	El Progreso del Buen Vivir Neighborhood Council, Manhattan Sector	Low (+)	Low
6. Yesenia Perdomo. President	Rayo de Luz Mothers' Center, Copey.	Low (+)	Low

Representative	Entity	Degree of involvement and type	Degree of influence
7. Ramón Ureña. Member	El Buen Vivir Neighborhood Council, Manzanillo	Low (+)	Low
8. Giovanni Felipe. President	Copey Development Council	Low (+)	Low
9. Dr. Domingo Guzmán, Director	Padre Fantino Provincial Hospital, Montecristi	Low (+)	Low
10. Wilson Abreu. Director	Lourdes Morel de Abreu Secondary Education Center, Manzanillo	Low (+)	Low
11. Zenaida Núñez Escoto. President	Asociación de Padres, Madres y Amigos de la Escuela (APMAE) Lourdes Morel de Abreu High School, Pepillo Salcedo	Low (+)	Low
12. César Faña. In charge	Accounting La Cruz de Manzanillo Project	Low (+)	Low
13. Fernando Díaz Marte, Pedestrian Mayor	Pepillo Salcedo Town Hall, Carbonera Section	Low (+)	Low
14. Maria Liberato. In charge	Commercial Office of the National Institute of Drinking Water (INAPA), Manzanillo	Low (+)	Low
15. Katiurka Báez. Controller	Justice of the Peace, Municipality of Pepillo Salcedo	Low (+)	Low
16. Alta Beira Bernard. Director	Carbonera Elementary School	Low (+)	Low
17. Nelson Blanco. Executive Director	Manzanillo Ecoaventura Company, Manzanillo	Low (+)	Low
18. Rafael Luis (Viachy) Torres. Tourism entrepreneur and member of the DC.	Tourism sector and Civil Defense	Low (+)	Low
19. Guarionex Luperón. President	Tecnolux Company	Low (+)	Low
Ramón Moreta. President	Association of Motoconchos Copey - Manzanillo	Low (+)	Low

Source: Interviews conducted by EMPACA, October - November 2022.

As shown in Table 5-8 (above), 31 stakeholders have a low level of impact from the project, although with a positive sign, mainly due to the supply of jobs that the project will generate. And their level of incidence is equally low.

5.10.3 Vulnerable and culturally differentiated groups

Groups or stakeholders in Manzanillo that have some level of vulnerability, which may be relevant to consider in the actions to be developed by the project (confront Socioeconomic Baseline, vulnerable groups) are:

a) Women, whose vulnerability is due to the existing gender inequality in Dominican society. In the interviews conducted, they observed that this type of project has few employment options for them.

b) Fishermen, whose vulnerability stems from their livelihood in a marine area that may be environmentally impacted by the operation of the project and affect their income.

c) Residents in Villa Ray, several combined conditions make this population vulnerable: their proximity to the project, the high age of most of the residents, which limits their retirement or pension income, and the threat of a possible eviction or relocation, which they oppose, to which the present project, as mentioned above, has no relation.

d) Beekeepers, who used to use the project land for apiaries that no longer exist and therefore have reduced their income. Currently in the mangrove area they have an apiary for the genetic improvement of queen bees, which they hope to be able to maintain. The use of State or third-party land for productive purposes is a customary practice in the country.

e) Seniors, who, due to their high age, have fixed incomes depending on retirement and pensions, which will be affected by the increase in the cost of living that the investments being made in the Manzanillo area, including this project, will imply. An important part of the residents of Villa Ray will also be impacted.

f) Haitian migrants, whose vulnerability is due to several factors that combine in them: irregular migration that constitutes a risk to their labor stability, their high level of poverty and their condition of being culturally differentiated, including having a different language

5.11 Stakeholder positioning with respect to the Project

Based on the results of the focus groups, survey and interviews, we have divided the stakeholders into four groups:

- a. Stakeholders who understand that the impacts of the project will only be negative for the community and the environment.
- b. Actors in agreement with the Project, with the expectation that there will be more sources of work and few or no suggestions for its execution.
- c. Actors in agreement with the Project, with observations and suggestions for its execution.
- d. Actors in agreement with the project, but affected by its execution.

5.11.1 Stakeholders whose opinion of the project is that it will only have negative impacts

Of the total number of residents surveyed, 14% stated that the impacts of the project will only be negative, citing the following: environmental impact, deforestation, loss of mangroves, elimination of flora and fauna, loss of beach areas, noise, diseases, evictions, and risks from the operation of the plants.

Disaggregating this percentage, it can be seen that in Copey this negative opinion is low, at 3% of the total number of respondents in that community. However, in Carbonera, the percentage of those with the same opinion is already beginning to be significant, reaching 87% of those surveyed there.

In Villa Ray this percentage rises to 20% of those surveyed in the neighborhood. While in Manzanillo it increases to 21% of those surveyed in this municipality. In Villa Ray the percentage is impacted by the belief that the project promotes the eviction of the neighborhood, because it needs this land for its operation.

In Villa Ray as well as in Manzanillo, there is distrust with the impacts of the investments that are being made, since what has happened with the opening of the dock and the weekly arrival of a clinker ship for the manufacture of cement. The transportation of this material through the town to its final destination leaves dust in the environment, which the residents believe is the cause of the high frequency of respiratory diseases and cancer.

Like everyone else, this group of interviewees was asked what benefits the project could bring to the community. Only three residents said jobs, the rest said none, did not know or did not answer.

5.11.2 Stakeholders in agreement with the Project, with the expectation that there will be more sources of jobs and few or no suggestions for its execution

A total of 13 stakeholders belong to this group, among which only three have suggestions on project implementation (Table 5-9).

Table 5-9. Stakeholders according to the project with expectations

Actor	Suggestions (if applicable)
a) Pastor Chauris Cadet, New Jerusalem Church	
b) Digna Chávez, Neighborhood Council Santa Ana	b) If there are evictions, first relocate
c) Pastor Remigio Báez, Assembly of God Church	c) If there are evictions, first relocate
d) Milagros Miseses, COPADEMA	
e) Yesenia Perdomo, Rayo de Luz Mothers' Center	e) Mitigate impacts that may be caused by the project.
f) Dr. Domingo Guzman, Hospital de Montecristi	
g) Leydi Almonte, Urban Planning Montecristi	
h) César Faña, La Cruz de Manzanillo Project	
i) Fernando Díaz Marte, Pedestrian Mayor of Carbonera	
j) Upper Beira Bernard, Carbonera Elementary School	
k) Ramón Moreta, Association of Motoconchos	
l) Kenia Zayas, La Esquina con Sabor a Bahía (The	

Actor	Suggestions (if applicable)
Corner with a Taste of the Bay)	
m) Ramón Aristides López, Cattlemen's Assoc.	

Source: Prepared by EMPACA based on the interviews conducted.

5.11.3 Stakeholders in agreement with the Project, with comments and suggestions for its implementation

This group includes 15 stakeholders with observations and suggestions for the implementation of the project (Table 5-10).

Table 5-10. Stakeholders in agreement with the project, with suggestions and observations.

Actor	Suggestions (if applicable)
a) Rosario Cabrera, Neighborhood Council. El Progreso del Buen Vivir	a) Improve the Villa Ray community center.
b) Raquel Brito, Neighborhood Council. El Progreso del Buen Vivir	b) Approach project to community to work together.
c) Helvio Bejarán, COPADEMA	c) Work on education for work, so that the community can make better use of the investment.
d) Paula Mitzi Disla, World Vision	d) Train youth in technical trades,
e) Wilson Abreu, Highschool education center Lourdes Morel	e) Create a dialogue table to avoid relocation of families. Invest in a park in Manzanillo, Copey; children have no space for healthy recreation.
f) Dr. Leudy Tineo, Pepillo Salcedo's Hospital	f) In Villa Ray improve the clubhouse, build a playground and a court. Sidewalks and curbs. Build UNAP premises.
g) Zenaida Núñez Escoto, Civil Registry Officer	g) That the project has a supervision with community participation.
h) Father Orlando Barajas, Sacred Heart of Jesus Parish	h) Project helps the development of the community
i) Ramón Ureña, Neighborhood Council of El Progreso del Buen Vivir	i) Improve the Villa Ray clubhouse, support INFOTEP courses.
j) Maria Liberato, INAPA	j) Improve the Villa Ray club, build a field for them, help fight rat infestation, support the laying of water pipes, contribute to finish the water tank.
k) Katiurka Báez, Peace Court Prosecutor	k) Suggests preserving the mangroves in the project's impact zone; it is one of the most beautiful areas in Manzanillo. In addition, many people go fishing in that area.
l) Francisco Valenzuela, Urban Planning Manzanillo	l) They do not aspire to have the development model of Haina or Veron. But rather that of Colon in Panama or Valparaiso in

Actor	Suggestions (if applicable)
	Chile. It is important that the project avoids affecting the mangroves. And that the social responsibility actions to be developed are committed to the real development of Manzanillo.
m) Rafael Luis (Vianchy) Torres, Tourism Businessman	m) Support training for the work. Take care of the temperature of the seawater when the project operations begin, due to the richness of the mangroves in the area.
n) Guarionex Luperón, Sociologist, Tecnolux	n) There is a fear that the world situation could change the operating matrix of the plants from natural gas to coal. This would seriously impact the community. There are also fears about the mangroves in the project's impact zone.
o) Focus group of women from various organizations: Toribia Bautista, Milagros Ulloa, Luz Taveras, Bienvenida Acosta, Raquel Brito, Carolina Almonte and Rosario Cabrera.	o) They do not agree with the eviction of Villa Ray. They express that the population lacks information on the projects underway in Manzanillo.

Source: Prepared by EMPACA based on interviews conducted.

5.11.4 Actors who agree with the project, but affected by its execution.

6 interested actors belong to this group, each of whom has suggestions and observations for the execution of the project (Table 5-11).

Table 5-11. Actors who agree with the project, but affected by its execution.

Actor	Suggestions (if apply)
a) Nelson Blanco, Manzanillo Ecoaventura	They fear that the development of new companies will affect their business, for example, by limiting access to certain places or destroying tourist attractions such as the mangrove area.
b) Roque Antonio Cabrera Cabrera, Fishermen's Association (president)	The construction of these projects may prevent them from fishing in some areas. For example, the pipeline to be laid for gas is in a fishing area. They propose a meeting with them to see how they agree to mitigate the impact that the project will cause
c) Fishermen's Association focus group: Ramón Almonte, Ramón Tejada, Evangelista Guzmán, Pedro Cabrera, Joaquín Cabrera, Kelvin Taveras.	
d) Antonia Perdomo, Unión y Esperanza Neighborhood Council, Villa Ray (president)	They express their opposition to the eviction that, according to what they are informed, the project will carry out. They are also concerned about the contamination they may have as a result of the operation of the project. They propose that they meet with the neighborhood about the plans for the project.
e) Focus group residents of Villa Ray: Altagracia Cabreja, Narciso Castro, Onésima Martínez, Roberto Espinal, Antonia Perdomo, Mariana de los Santos.	

Actor	Suggestions (if apply)
f) Wisnel Vargas, representative of the beekeeping sector.	One of the honey production apiaries was located on the project land. That was where they managed the genetic improvement of the queen bees, due to the biological richness of the place. The project has harmed them enormously. They have no alternatives to that problem. They only have the hives found in the mangroves left. They propose reforesting some areas and some type of support for the sector.

Source: Table prepared by EMPACA based on the interviews carried out.

5.12 Consultation with key stakeholders

The following is the public participation and information process for the Manzanillo Energy Consortium Thermoelectric Power Plant project (Code No. 22571), carried out as part of the Environmental Impact Assessment and at the request of the Ministry of the Environment and Natural Resources, defined for the area of direct influence of the project in the municipality of Pepillo Salcedo, Monte Cristi province. This process includes:

- Placement of sign.
- Holding of two public hearings.
- Stakeholder analysis.

5.12.1 Process for publicizing the project

5.12.1.1 Methodology

In accordance with the requirements set forth in the Terms of Reference (ToR), Code No. 22571, a sign with a dimension of not less than 1 x 1.25 square meters shall be installed at the entrance of the project or at a visible point. The sign shall contain the following information:

- Name of the project.
- Name of the project promoter and/or project manager.
- Brief description of the project.
- It should be noted that the environmental assessment process is underway for the purpose of obtaining environmental authorization.
- Telephone numbers of the project manager and the Ministry of Environment and Natural Resources.
- Submit a photo of the sign in place.

The Regulation and Procedure for Public Consultation in the Environmental Impact Assessment Process (2016), prepared by the Vice Ministry of Environmental Management, was consulted.

5.12.1.1.1 Installation of the sign

A sign was placed in the area where the project will be developed (Photos 33 and 34 in Annex 8), with a brief description of the project. See also Figure 5-2 with the design of the sign.

Proyecto en el proceso de Evaluación de Impacto Ambiental para obtener la Autorización Ambiental.

Proyecto Central Eléctrica Consorcio Manzanillo Energy (Código No. 22571)

Promotor: Consorcio Manzanillo Energy, S.A.
Teléfono: (809) 735-0000.

El proyecto consiste en el diseño, construcción y operación de una planta de generación eléctrica con una potencia aproximada de 420 MW (Bloque 2). Este proyecto forma parte de una propuesta integral para llevar o convertir gas a energía en la Bahía de Manzanillo, y una línea de transmisión eléctrica a 345 kV con una longitud preliminar de 5.5 kilómetros desde la subestación de la Central Eléctrica de Manzanillo Energy hasta la subestación de la central térmica Energía 2000 para la conexión con el Sistema Eléctrico Nacional Interconectado (SENI). A este proyecto se le llama Bloque 2 por la licitación que lo justifica. El proyecto estará ubicado próximo al puerto de Manzanillo, municipio Pepillo Salcedo, provincia Monte Cristi, República Dominicana.

Viceministerio de Gestión Ambiental o Dirección de Participación Social
del Ministerio de Medio Ambiente y Recursos Naturales Tel: 809-567-4300
Ext: 6220 y 6160.

Consultora Ambiental:



Calle Jonas Salk, No. 101, esq. Benigno Filomeno
Rojas Cuidad Universitaria, Santo Domingo, D. N.
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Figure 5-2. Information of the sign placed in the project.

Source: EMPACA, 2023.

5.12.1.1.2 Public hearings

Methodology of public hearings

The methodology and processes described in the Regulation and Procedure for Public Consultation in the Environmental Impact Assessment Process (2016), prepared by the Vice Ministry of Environmental Management, were used to conduct the public hearings.

The activities were organized by the promoter and EMPACA, an environmental consulting firm, for which invitations were sent to the Social Participation Office of the Ministry of the Environment and the Provincial Office of Monte Cristi. A publication was also made in the newspaper El Nuevo Diario, on November 8, to invite neighboring communities and the public interested in the project (See Annex 9.4: Invitation letters for the public hearings).

5.12.1.1.2.1 First public hearing

5.12.1.1.2.1.1 Memories of the first public hearing

- Location: Manzanillo Golf Club, Pepillo Salcedo.
- Completion date: November 9, 2023.
- Meeting start time: 3:00 p.m.

5.12.1.1.2.1.2 Place where the first public hearing was held

The first public hearing of the Manzanillo Energy Consortium Thermoelectric Power Plant project was held at the Manzanillo Golf Club facilities (Photos 35 and 36 in Annex 8), located in the El Cerro sector, Pepillo Salcedo municipality, Monte Cristi province.

5.12.1.1.2.1.3 Summary of the first public hearing

- Location: Manzanillo Golf Club, Pepillo Salcedo.
- Completion date: November 9, 2023.
- Meeting start time: 3:00 p.m.
- Number of participants: 55
- Number of organizations and institutions of Pepillo Salcedo: 33
- Gender distribution of participants: 22 women, 33 men

Introduction:

Mario Méndez, vice-president of the environmental consulting firm EMPACA, introduced the first public consultation, explaining that the project must comply with the national standards of the Ministry of the Environment, that is, *with Law 64-00, by which any project to be executed in an environment must be presented to the nearby communities*, and must also comply with international standards of the International Finance Corporation of the World Bank.

As part of this introduction, the characteristics of the study that has been carried out were also explained, as well as its requirements and the criteria that regulate them. A brief reference was also made to the rationality of the linkage between the companies that are promoters of the different energy projects in the area.

Likewise, Mario Méndez referred to EMPACA's experience in environmental impact studies, as well as that of the international consulting firm AECOM, introducing engineer Gustavo Penzo, who would explain the technical aspects of the Manzanillo Energy project,

Presentation by the representative of the developer of the Manzanillo Energy project (Block II):

Gustavo Penzo, representing the promoters of the Manzanillo Energy Power Plant project (Block II), spoke on the technical aspects of the project, beginning his speech by explaining the interrelationship between the three (3) energy projects in the municipality of Pepillo Salcedo, pointing out among the elements that link them the storage and regasification terminal of Block I, which is expected to supply gas in the future to the three power plants.

He explained that the Manzanillo Energy project consists of a 420- megawatt power generation plant, using this gas, and a network of electric transmission towers, which will also serve Block I.

He justified the construction of this plant, as well as the other power generation plants in the area, based on the growth of energy demand in the country.

He specified that it is a transmission line with around ten (10) or twelve (12) towers, with an extension of five (5) kilometers, with a voltage of 345,000 volts from the substation of Block I and

Block II to an interconnection tower at the height of the Super 8 Hotel, close to where the Energía 2000 power generation plant is being built.

The project developer also explained that this Block II project is a 400- megawatt, 400,000 kilowatt capacity plant with CCGT technology, which stands for Combined Cycle Gas Turbine, a technology that was explained in detail to the participants.

The EMPACA and AECOM consultants introduced their intervention by pointing out that the first public hearing would deal with the baseline aspects, since it would be in the second consultation that the impacts and the management plan would be addressed in depth. For this purpose, a guide was handed out for the public to think about these components, so that their perception is considered, that is, so that they can write briefly what they think of the project in relation to the baseline. That is, the physical, biotic, social and economic aspects.

It was explained that the purpose of this baseline is to determine the current state of the area where Block II is to be built and the route of the transmission line.

The baseline elements include noise levels, dust emissions, vibrations, and gas emissions. These four elements are very important due to the characteristics of the project. The biota, both plants and animals, were also surveyed.

Likewise, an archaeological survey was conducted to verify that the site survey did not find any important objects that merited conservation.

In the case of the transmission line, as it is a 345 KV line, it was established that a thirty-meter strip must be left on both sides and, in addition, 300 meters were added to evaluate the entire space where each one of the towers will be placed.

For the social and economic survey of the area, as part of the baseline, interviews and focus groups were conducted, including a focus group with women and one in which fishermen, ranchers, beekeepers, and ecotourism entrepreneurs participated.

Reference was made to the fact that, as part of the social and economic baseline survey, representatives of youth groups were interviewed. It was found that there is an expectation of employment among them, and that there is also a concern that training is required to access these jobs.

It was also explained that it is not only a matter of identifying impacts, but it is also necessary to develop what we call management measures, which means that if an impact is identified, it must be mitigated, repaired, compensated, or avoided in any way. If the impact is too significant, a way must be found to avoid it.

Questions, concerns, and worries raised by participants in the first consultation:

- Concern about the availability of natural gas, considering the geopolitical issue.
- Concern about the impact on the blue crab route and flamingos that seasonally fly along the route where the transmission line will be installed.
- Interest in learning about community support actions by project promoters.

Concern that the impact on beekeepers has not been considered.

Concern that the time frame for social investments is too long and there are many needs here, so he understands that apart from the part that corresponds to the government, the private sector must emphasize that progress can be made in this area.

- What's in it for this town in return for the impact we're going to have?

Answers given by the promoters and members of the technical teams of EMPACA and AECOM to the concerns and questions raised:

In general, the project promoters and the EMPACA and AECOM consultants present at the first public hearing responded to questions and concerns, many of which referred to the project in the first block. Among the answers to concerns expressed by the public, the following stand out:

Block II, through its relationship with Block I, has secured a fifteen-year supply contract for natural gas in liquid form with a multinational company called Shell, which is implicit in the bidding process. In other words, the natural gas for Block I and Block II will come from a contract already signed with Shell, which is a multinational corporation that has countless sources to deliver the natural gas necessary for the operation of the plants.

The project promoter responded to the concern raised about actions to support the communities by referring to the company's social responsibility program. What we want to do is prioritize and identify things so we can say 'Let's tackle these things first.'

It was clarified that the project belongs to the private sector, which cannot take over the management or the work of a government or a municipality. That the project will develop actions to support the community, being the experience and the social responsibility policy of EGE Haina the one that will guide these actions.

- It was pointed out that the project will not only generate negative impacts, but also has positive impacts.

- Both Block I and Block II are designing the facilities considering that Villa Ray is there today and that Villa Ray is not going anywhere.

Conclusion

The first public hearing was held with the active participation of the different community stakeholders and the local leadership of the municipality. It was attended by 55 people, with 33 men (60%) and 22 women (40%).

The public hearing was attended by representatives of the board of aldermen and the provincial directorate of Montecristi; from the communities of Pepillo Salcedo, there was a significant attendance of community leaders, presidents, and active members of the most relevant associations in the community, and members of the neighborhood councils of the area.

The development of this activity was based on the presentation of what a public hearing is, together with the explanation of the main technical characteristics of the project, in addition to an

extensive review of the process that has been carried out, preliminary studies and justification and importance of the project for the area and the country in general; some specific examples of the social and economic benefits for the surrounding communities were also presented.

The main concerns and worries of the community stakeholders expressed refer to the interest that the municipality may benefit from the generation of jobs and social responsibility actions of the project promoters, as well as the interest that the negative impacts of the project on the environment may be mitigated and the economic effects on certain economic stakeholders may be compensated.

Apart from the above, there is consensus among all stakeholders (community, economic, authorities) in the municipality to support this project, obviously hoping that their concerns will be addressed.

5.12.1.1.2.1.4 Transcript of first public hearing

Annex 9.5: Transcripts of public hearings.

5.12.1.1.2.1.5 Photographs of those attending the first public hearing

Annex 9.5: Transcripts of public hearings.

5.12.1.1.2.1.6 General photographs of the first public hearing

Annex 9.5: Transcripts of public hearings.

5.12.1.1.2.1.7 Invitation to the first public hearing

The invitation process for the first public hearing was carried out through:

Invitations	Annexes
Letter of invitation to the first and second public hearing to the Directorate of Social Participation	Annex 9.4: Letters of invitation to public hearings
Letter of invitation to the first and second public hearing to the Provincial Directorate of Montecristi	
Letter of invitation to the first and second public hearing at the municipal council of Pepillo Salcedo	
Publication in the national newspaper Listín Diario of the first and second public hearing.	Annex 9.6: Publication of public hearings in the newspaper

5.12.1.1.2.1.8 List of attendees at the first public hearing

Annex 9.7: List of attendees of the public hearings.

5.12.1.1.2.2 Second public hearing

5.12.1.1.2.2.1 Memoirs of the second public hearing

- Location: Manzanillo Golf Club, El Cerro sector.
- Completion date: November 16, 2023.
- Meeting start time: 3:00 p.m.

5.12.1.1.2.2.2 Location where the second public hearing took place

For the second public hearing of the Manzanillo Energy Consortium Thermoelectric Power Plant project, the Manzanillo Golf Club was again chosen.

5.12.1.1.2.2.3 Summary of the Second Public Hearing

- Location: Manzanillo Golf Club, Pepillo Salcedo.
- Completion date: November 16, 2023.
- Meeting start time: 3:00 p.m.
- Number of participants: 46
- Gender distribution of participants: 14 females, 32 males

Introduction:

The introduction was given by Mario Méndez, vice president of the environmental consulting firm EMPACA and director of the social research team of this consulting firm, who briefly explained that this second public hearing will address the impacts of the project and its management program. He gave way to a representative of the project's promoters.

Representative of the project promoters:

It was explained that there is a symbiosis, an important relationship between Block I and Block II, since Block I brings the gas that Block II will consume and Block II transports the electricity that Block I will generate.

The transmission line will connect the project to the National Interconnected Electric System. There are five kilometers of lines that will take the electricity from the project to a substation, where it will be connected to the entire country.

The technology of the plant was explained: gas and combined cycle, which will have a cooling tower and will have the flexibility that these turbines can burn diesel in case there is no gas.

Questions, concerns, and worries raised by participants in the second consultation:

Among the questions, concerns and worries raised by the public were:

- *The cooling system, as it is with water, is it internal, the cooling or does the water have to go to the sea or elsewhere for cooling?*
- Relationship of the Energy 2000 pipeline with the Block I and II projects.
- Concern that *the project in the future could cause situations that could significantly affect the environment.*

- Concern that when the project starts operating, the population of Villa Ray itself will voluntarily leave the area due to the environmental impacts that the project will produce.
- What is the percentage of certainty that neither human life nor aquatic or marine life will be affected?
- Concern that the project will only hire unskilled or low-skilled labor.
- Interest in knowing what benefits the project will bring to the municipality.

Responses from developers and consultants:

- It was clarified that there are two water consumptions. One is used to enter the steam turbine and the other is used to cool the gas turbine. The gas turbine cooling water passes through and exits, but when it exits it does so with certain requirements, so that it does not affect the marine waters.
 - *Energía 2000* has a more accelerated timeline than the project. This project will not start up until the end of 2025, so they need to have the gas provisionally, but when the Block I pipeline is operating, the plan is that it will also supply natural gas to *Energía 2000*.
 - Natural gas-fired power generation is the least impactful thermal technology to the environment and human health in the world right now. In addition to that, we are taking steps to make sure that impact is far away from human life and wildlife at the project site.
- In fact, the design of the plant complies with the limits imposed by the Ministry of the Environment and the banks that are going to finance the project. None of them will allow us to have a negative impact on Villa Ray, nor on Villa Ray or anyone else in this area.
- During the construction phase the impact has to be minimal. All construction raises dust or generates noise; but, at the same time that it does that, it generates employment, it generates economic movement and there is a way to contain all those impacts within the construction zone so that it does not bother me as a person, as a community.
- The company promoting the project, in the plants where it has locations, hires local personnel. This is a combined cycle gas-fired power generation plant, if there is someone here, in this community who is an industrial engineer, electrical engineer, electromechanical engineer, certified welder, electrician, they don't necessarily have to be professional, but we like them to be professional because we have had better experience with professionals.
 - The benefits of the project are direct and indirect; the community will also benefit, during the construction phase, by providing lodging and food services. In other words, direct and indirect jobs will be generated. In addition, the land and properties will acquire greater value in the municipality, and there will be greater economic dynamism that will have an impact on commerce.

- *The company has requirements that will ensure that the majority of the jobs are for local people. For example, they have to be people who are able to work in the Dominican Republic, it cannot be anyone illegal, it cannot be someone who does not have a permit or a cédula to work in the Dominican Republic, they have to be registered with the Social Security Treasury of the Dominican Republic.*
- *A communication channel will be established with the community that will allow people interested in employment to submit their applications.*

Impacts identified and proposals contained in the environmental management plan

Construction phase:

Impacts identified:

- *Noise and dust pollution, especially from the transportation of heavy equipment and materials that will be needed during the construction stage.*
- *Increased truck and vehicle traffic on access roads. There will be possibilities of deterioration of the access roads due to the passage of trucks and heavy equipment. And there may also be an increase in the concentration of particulate matter, noise, as we have already seen above, and vibrations.*
- *Soil contamination from solid, liquid and oily waste management.*
- *Disappearance of vegetation cover and loss of flora and vegetation clearing due to construction works.*
- *Possibility of deterioration of the landscape due to construction activities. There will be an installation that was not there, there could also be waste generation by the workers if they do not act correctly and they can also deteriorate the landscape with garbage.*
- *Affecting fauna.*
- *Possible exposure to diseases due to the influence of temporary or permanent labor. Risk or occurrence of accidents that cause physical injury or loss of life as a consequence of the project's construction activities.*
- *Economic impact on beekeepers in the area due to land clearing.*
- *Loss of area for goat grazing due to clearing in the project area.*
- *Increased demand and use of construction materials and other inputs for the construction activity*

Measures proposed for the management plan:

- *Wetting of access roads.*

- *Speed limit to avoid noise and particle lifting; trucks must be covered.*
- *Speed limit signs must also be posted in the areas where the equipment will be passing.*
- *Equipment maintenance.*
- *To provide an access road in the southern part of Block II to prevent trucks from reaching as far as possible the area where Villa Ray is located.*
- *To place traffic controllers at specific points, which are these flaggers, we call them; these are the people who stop, "Stop", so that there is order, right, when the trucks pass by. Respect the speed limits by the drivers of these trucks.*
- *Use of spill containment trays.*
- *Zafacones for waste classification.*
- *The final disposal of the waste must be carried out by a company that has been endorsed by the company.*
- *The transmission line must have a right-of-way easement that will be cleared to avoid any type of inconvenience with the power line. This easement area will be sixty meters wide. Once this area has been established, signaling is important.*
- *Live fences will also be established around the facilities or native species to add a vegetative and environmentally friendly touch to the project area.*
- *In the transmission line we will avoid affecting the fauna as much as possible. If a previous rescue can be done, it will be done; if not, then, whatever is left, these measures must be taken as campaigns to prevent the capture and illegal traffic of any species seen in the area. In particular, it is a priority to establish action plans for the protection of the **blue crab**.*
- *Have a health and safety plan for the protection of workers. Know that personal protective equipment must be available, that it must be properly used, and that training must be provided to ensure that they have adequate safety when carrying out their activities.*
- *Stakeholder engagement actions to ensure that expected mitigation is being met.*
- *A person will be appointed in the municipality of Pepillo Salcedo to serve as a permanent interlocutor between the company and the community representatives, so that any inconvenience they may have, any doubt that may arise, that person can approach the project promoter with complete confidence to find a solution to the doubt or complaints they may have.*
- *The action plan must be disclosed. Any intended action should be previously disclosed to stakeholders. Disclose this information in a timely manner.*
- *Creation of temporary jobs, involving the community in the job openings they may have, but for this there must also be training, perhaps for some aspects that are a little more technical,*

- Take advantage of the material from excavations to use it as fill in other areas of the project and avoid creating new quarries and borrow banks as much as possible.

Operating phase

Impacts:

- There may also be air, noise, and vibration impacts, to a lesser extent, caused by the equipment of the same plant in operation.*
- Possibility of groundwater contamination due to poor liquid waste management.*
- Possibility of affecting fauna, due to the use of chemical products, pest control products.*
- Decrease in fauna caused by collisions of birds and bats with power transmission line towers.*
- Accidents resulting in physical injury or loss of life for workers.*
- Permanent jobs for the duration of the plant's operation.*
- Increase in working capital.*
- A community development plan that will focus on education, sports, and culture, strengthening of organizations, environment, health, community infrastructure, and training and income generation are the areas that the project aims to address in order to develop or support the development of the community.*

Management plan measures:

- Placing acoustic barriers, monitoring of gases, chimney emissions, monitoring of emissions. All this is at a technical level, equipment is used to measure these emissions, gas direction sensors.

Implement measures, such as placing the septic tank for the treatment of domestic wastewater, i.e., wastewater from the bathrooms, wastewater from the kitchen area.

- That the use of pest control products shall preferably be organic and of low toxicity.*
- Maintain the management, health, and safety plan in the workplace.*
- Prioritize skilled local labor. Also include hiring policies that do not involve gender discrimination, men and women equally, age and vulnerable population.*
- Maintain communication mechanisms with the community and within the company.*

Intervention by community organizations in response to impacts and measures:

COPADEMA and Municipal Council of Pepillo Salcedo (Helvio Bejarán)

He expresses his concern about the possibility for the population to have access to jobs that require technical qualifications, running the risk of repeating the history of Energía 2000, where all jobs requiring certain qualifications are filled by people from other municipalities and provinces.

*He proposes the creation of a **dialogue table**, a local institution that can manage the aspects of social commitment that will come in the future in the short or medium term. He suggests that in this table the community be represented by the entities, in this case, COPADEMA, which is an NGO that is present and has also managed other projects at the community level and that brings together 23 local organizations.*

- He insists that the creation of an INFOTEP center in the municipality should be accelerated.

- Proposal that the company contribute water to the community that would be generated by the desalination plant.

Monte Cristi Ecological Society:

- Participate in the elaboration and implementation of a co-management plan, it can be a co-management plan, where the community and its organizations participate together with the project.

Conclusion

The second public hearing held for the environmental impact study for the Manzanillo Energy project was attended by 46 people, with 32 men (70%) and 14 women (30%).

At this public hearing, the concerns, worries, and questions raised were answered. Likewise, the impacts that the project would generate in its construction and operation phases were identified, as well as the proposed measures for the mitigation and compensation of the identified impacts.

Table 5-12. Results of the gender distribution of the application of the project evaluation form

Gender	Quantity	%
Feminine	16	42
Masculine	22	58

Source: Elaborated by EMPACA, 2023.

See Annex 9.8: Project evaluation form.

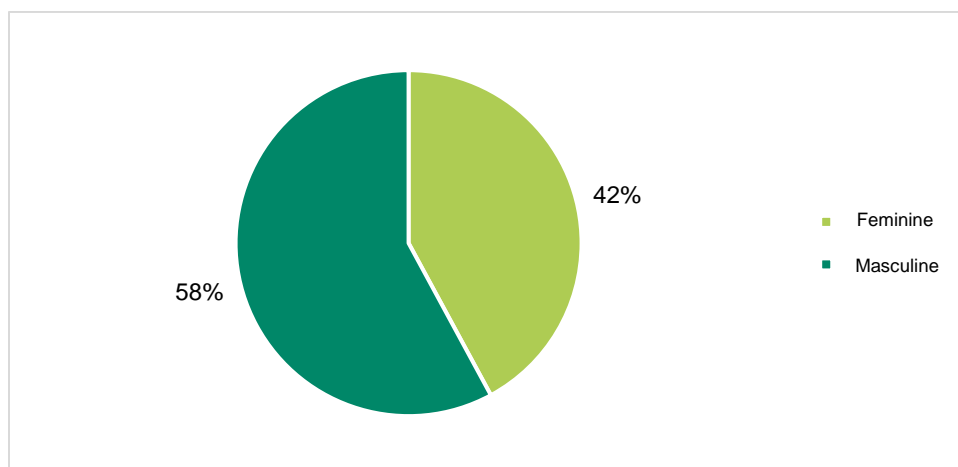


Figure 5-3. Graph of the results of the gender distribution of the application of the project evaluation form

Source: Elaborated by EMPACA, 2023.

What is your impression of the project?

1. The project aims to increase energy production and reduce blackouts in the country.
2. The energy production is expected to have a positive impact on the country.
3. The project also seeks to create opportunities in the province, especially in the northeast line of the country.
4. In addition, the project is expected to have positive impacts on the community.
5. The project will contribute to the development of the community and the economic development of the municipality and the country, while reducing environmental pollution.
6. With this project, the country will be able to meet the current demand for electricity.
7. This investment is part of Manzanillo's Development Plan and will contribute to the country's development.

What do you like about the project?

1. The fact that the project is aimed at the production of clean energy, which is fundamental for the development of the region and the country.
2. The project generates jobs and promotes the dynamism of commerce.
3. The implementation of citizen and municipal proposals guarantees greater development and community involvement in the project.
4. The clear exposition of the benefits of high technology in the power plant motivates young people to learn about energy and its importance. In addition, the use of these technologies is environmentally friendly, which translates into a lower cost of energy consumed and greater efficiency at both the municipal and national levels.

What do you dislike about the project?

1. Its short-term social impact, so the promoters must act.
2. That no consideration has been given to training people from the community, so that they are qualified for the jobs in the operation phase.
3. That no clear information has been issued to solve the existing problems.
4. The possibility that the project may have a negative impact on the environment.

5. That the limits and location of the boilers, as well as the vapors they emit, are not clear.
6. The loss of green and wooded areas necessary for beekeeping has not been properly assessed.
7. The possibility that residents near the project could be affected by noise pollution.
8. The fact that the project occupies a large amount of land.
9. The community receives few benefits from the project.

5.12.1.1.2.2.4 Transcript of second public hearing

Annex 9.5: Transcripts of public hearings.

5.12.1.1.2.2.5 Photographs of those attending the second public hearing

Annex 9.5: Transcripts of public hearings.

5.12.1.1.2.2.6 General photographs of the second public hearing

Annex 9.5: Transcripts of public hearings.

5.12.1.1.2.2.7 Invitation to the second public hearing

Invitations	Annexes
Letter of invitation to the first public hearing to the Directorate of Social Participation	Annex 9.4: Letters of invitation to public hearings
Letter of invitation to the first public hearing to the Provincial Directorate of Montecristi	
Letters of invitation to the first public hearing at the municipal council of Pepillo Salcedo	
Publication in the national newspaper Listín Diario	Annex 9.6: Publication of public hearings in the newspaper

5.12.1.1.2.2.8 List of attendees at the second public hearing

Annex 9.7: List of attendees of public hearings.

6. DESCRIPTION OF THE ENVIRONMENTAL AND SOCIAL BASELINE

6.1 Physical Baseline

6.1.1 Methodology for the description of the physical baseline

Considering the natural and anthropic conditions in the project area and the modifications that this condition causes on the environmental factors, a diversity of interpretation and measurement methodologies were established, adjusted to these conditions of the physical environment.

For the characterization of climate and meteorology, we reviewed the information available from reliable data with at least 20 years of observation, using Las Estadísticas del Agua (2004) published by the National Institute of Hydraulic Resources of the Dominican Republic, the information published by the National Meteorological Office (ONAMET) and the web pages weather.org, stormcarib.com and nhc.noaa.gov, as the main sources of information for wind speed and direction, cloudiness, humidity, evaporation, hours of sunshine, and hurricane statistics.

For the information on normal and maximum rainfall, as well as minimum, maximum and average temperatures, and wind direction and speed, we used the data available from ONAMET for the only station in the region (Table 6-1), in addition to the annual mean isohyets map for the region (Atlas MIMARENA 2012).

Table 6-1. ONAMET weather station as a source of precipitation, temperature and wind data.

Station	UTM coordinates		Observation
	X	Y	
Montecristi	223278	2196840	18 km northeast of the study area. Altitude 20-25 m. Dates years 1981-2022.

Source: ONAMET 2022.

All rainfall analyses were based on models applicable to the Caribbean islands, following the pattern of the distribution of annual averages and based on morphometric criteria. The rainfall data obtained were organized, extracting the maximum monthly and annual rainfall values for each station (Pmax), and analyzing their quality using the outlier method.

For the characterization of air quality in the study area, 9 points were established for the measurement of noise levels, concentrations of particulate matter and combustion gases in immission; and in 8 of these points ambient vibrations were measured (Table 6-2). In parallel, meteorological variables were measured at the time of the measurements. In the respective headings of noise levels, air quality and vibration levels, each of the measurement points is described with their UTM coordinates.

Table 6-2. Measurements at the nine air quality characterization points.

Sampling point	Measured parameters	day/month/year	Site Description	UTM coordinates	
				X	Y
RVA-1	Noise levels, concentration of gases in immission and particulate matter, environmental vibrations.	3/10/2023 daytime measurements and 5/10/2023 nighttime measurements	Villa Barnack, west-southwest of the project area.	212432	2180065
RVA-2			Villa Ray, west of the project area.	212872	2180346
AVR-3			Northern boundary of the projected plant area.	213359	2180482
RVA-8			Southern boundary of Block 02 area.	213001	2179829
AVR-9			In front of the Manzanillo Photo Parador.	212716	2179544
RVA-10			Farm to the southeast of the project.	213432	2178833
RVA-11			In front of the Manzanillo Plant, Plantaciones del Norte.	215287	2178379
RVA-12			In front of the entrance to the MPL Project Site.	216687	2178155
RA-6	Noise levels, concentration of gases in immission and particulate matter.		At the Pepillo Salcedo Golf Club, southwest of the port facilities.	212118	2180184

Source: EMPACA field work and measurements, 2023.

A REED 8080 *datalogger* sound level meter was used for noise measurements, which complies with IEC 61672-1 Class 2 (International Electrotechnical Commission) and ANSI S1.4. Type 2 (American National Standards Institute) standards, with digital storage of up to 32,000 values (Photo 1 in Annex 11).

The equipment measures the maximum and minimum noise, both in dB(A) and dB(C), using for the current measurements the response in dB(A) which is the most similar to the logarithmic perception of the human ear to a low intensity sound. On the other hand, it responds in slow mode (*Slow*, which is the average effective value for approximately one second) and in *fast* mode (*Fast*, which is the average effective value for 125 milliseconds), using for the measurement the response in *Fast*, since it is more effective against fluctuations.

The general data of the equipment are shown in Table 6-3.

Table 6-3. Technical characteristics of the digital datalogger sound level meter.

Parameter	Value
Accuracy	±1.4 dB
Frequency range	31.5 HZ ~ 8 KHZ
Dynamic range	50 dB
Measuring ranges	Low 30 dB~80 dB Medium: 50 dB~100 dB, High: 80 dB~130 dB and Auto: 30 dB~130 dB
Response time	Fast: 125 mS and Slow: 1 s
Resolution	0.1 dB

Source: REED 8080 sound level meter user's manual.

At each of the 9 measurement points, point readings were taken at a height of 1.5 m from the ground, taking the record in the direction of the source of noise generation, during daytime and nighttime hours, continuously for no less than five minutes as established in the IFC General Guidelines: Environment (Noise, Table 1.7.1) and the Environmental Standard for protection against noise in the Dominican Republic (NA-RU-001-03) and the Standard that establishes the reference method for the measurement of noise from fixed sources (NA-RU-002-03).

Annex 10.1 shows the reference sheets of the field noise level measurements and Annex 10.2 shows all the data recorded at each point.

For field calibration of the sound level meter used, prior to the measurements, an acoustic calibrator (pistophone) REED 12777-830 (12030026 series), class 2 IEC 60942 with levels at 94 and 114 dB(A), at 1000 Hz normal frequency, with an accuracy of ± 0.2 dB, according to the requirements of the Environmental Standard for noise protection of the Dominican Republic (NA-RU-001-03), was used (Photo 2 in Annex 11).

Annex 10.3 shows the calibration certificate of the sound level meter and the acoustic calibrator (pistophone) that fits the sound level meter in use.

For the characterization of the air quality criteria indicators under immission conditions, the concentrations of particulate matter (PM 2.5, PM 10 and total suspended particulate matter PST) were measured at the nine points distributed in the study area. A description of each of the measurement points with their UTM coordinates is given in the air quality section of the Climate and Meteorology chapter. Annex 10.4 shows the reference sheets of the particulate matter measurement in the field and Annex 10.5 shows the data recorded at each point.

Airmetric Minivol TAS equipment was used for particulate matter concentration measurements, with a constant flow rate of 5 lpm, during 24 hours of continuous measurement. Three parallel measuring devices were installed at each point, two of them with PM 2.5 and PM 10 impactors, and the third for total particulate matter. The measurement procedures were in accordance with the specifications of the Environmental Technical Regulations for Air Quality of the Dominican Republic.

The sampling technique used by the Minivol TAS is a modification of the reference method described in the U.S. Code of Federal Regulations (40 CFR Part 50, Appendix J). In accordance with these established procedures, the equipment is fitted with the inlet impactor capable of separating the particle sizes to be established, a flow control device to keep the flow rate constant (5 lpm), a flow meter to measure the flow rate during the sampling period, an elapsed time counter and a timer to start and stop sampling (Photo 3 in Appendix 11).

To determine the concentrations of particulate matter in the air (air quality), a previously dried and weighed filter is placed on a precision balance in each unit, and once the test is completed, it is dried and weighed again as a final condition. By relating the amount of particles retained and weighed to the volume of air circulated, the measurement time and the air temperature, the particle concentration is obtained in units of $\mu\text{g}/\text{m}^3$. The calibration certificates of the equipment used are shown in Annex 10.6.

An Aerocet 531S was used to characterize the heterogeneity of the particulate matter concentrations and as a complement to the measurements. Annex 10.4 shows the reference sheets of the field measurements and Annex 10.5 shows the data recorded at each point. This equipment, manufactured by the North American firm Met One, establishes a constant flow rate of 3.0 lpm by counting the individual particles using the scattered laser light and then calculates the equivalent total concentration using a proprietary algorithm (Photo 4 in Annex 11).

The measurements were programmed in eight cycles with readings at 15-minute intervals, summarizing anthropogenic activities and measuring the PM 2.5, PM 10 and total particulate fractions. The Aerocet 531 calibration certificate is presented in Annex 10.7.

For gas concentration measurements under immission conditions, as criteria indicators of air quality, and considering the open space conditions at the sites, a multiparameter station was used, consisting of several pieces of equipment with gas specifications and capable of recording values with ranges adjusted to the requirements of the Environmental Technical Regulations on Air Quality of the Dominican Republic (Photo 5 in Annex 11).

In the case of concentrations of volatile organic compounds TVOC BTEX and formaldehyde HCHO, a FORENSICS professional air pollution detector was used. This equipment for formaldehyde measurements uses an electrochemical HCHO sensor, with a double platinum catalytic electrode, while the TVOC sensor is semiconductor, which groups volatile organic compounds of chemical pollution: benzene, toluene, xylene, aromatic hydrocarbons, aldehydes and hydrogen sulfide, among others.

For NO_2 , SO_2 and non-methane hydrocarbons (NMCH) measurements, an Aeroqual 500 series environmental meter with electrochemical sensors was used with measurement ranges of 0-1 ppm for NO_2 , 0-10 ppm for SO_2 and 0-25 ppm for NMCH.

For carbon monoxide (CO) concentration measurements, considering the open space conditions at the site, Smart Sensor equipment with a stabilized electrochemical sensor was used, with a range approved by the U.S. Department of Labor, Occupational Safety & Health Administration (OSHA) of up to 1000 ppm.

For the ozone gas measurements (O_3), a professional Forensics FD-90A detector was used, with electrochemical sensors and calibrated by NIST of the USA, with a measurement range of 0 to 20 ppm, and a resolution of 0.092 ppm ($200 \mu g/Nm^3$).

For carbon dioxide (CO_2) measurements, a Temtop M2000 with a professional-grade SenseAir NDIR sensor with a measurement range of 0-5000 ppm was used.

This equipment has a high measurement autonomy, with continuous recordings throughout the measurement period, which lasted for one hour, at each of the 9 points in the study area. A description of each of the measurement points with their UTM coordinates can be found in the air quality section of the Climate chapter.

The field measurement reference sheets are presented in Annex 10.8 and the data recorded at each point in Annex 10.9.

Environmental vibration measurements, under baseline conditions, considered the typology of normal anthropogenic activities in the project area and along the transmission line route, and which may reflect the existing Environmental Baseline vibrations.

A VM-6380 meter was used with a triaxial geophone that measures particle velocity, acceleration and displacement with a reading frequency ranging from 4 to 1000 Hz, in addition to the possibility of recording in the three axes X, Y and Z in parallel (Photo 6 in Annex 11). At each point, measurements were taken for 15 minutes, with continuous recordings, and describing the type of events that could cause vibration peaks.

As a complement to the air quality measurements, parallel measurements of meteorological variables, including ambient air temperature, relative humidity, and wind speed, were performed using an Extech model 45170 portable station (Table 6-4 and Photo 7 in Annex 11). Indirect methods were used to determine wind direction.

Table 6-4. Technical characteristics of the Extech 45170 portable station.

Parameter	Features techniques
Temperature measurement range	0 - 50 °C
Resolution of temperature measurements	± 0.1 °C
Relative humidity measurement range	10 - 95 %
Resolution of temperature measurements	± 4 %
Wind speed measurement range	0 - 30 m/s
Resolution of wind speed measurements	0.1 m/s

Source: Extech 45170 portable station user's manual.

The described meteorological variables, measured at each of the 9 environmental quality measurement points, are presented with the results for each air quality parameter.

The specialists who participated in the field surveys were equipped with GARMIN personal GPS, model GPSMAP 64, which is a high-sensitivity GPS and GLONASS receiver with a Quadrifilar Helix antenna (Photo 8 in Annex 11). All measurement and survey points were georeferenced with UTM coordinates of the WGS84 system in zone 19 of the northern hemisphere.

Prior to the start of the field survey work, the technical information available in the EMPACA Technical Archive was consulted, with emphasis on those aspects that make up the parameters and criteria for describing the components of the Physical Environment, and which must be completed for their characterization at a scale of sufficient detail for the Environmental Impact Study.

The studies of regional morphostructural interpretation, the regional geology of the project and along the route of the transmission line were evaluated, as well as the rest of the available works, from which the detailed work programs and strategies for the completion of the necessary information were drawn up.

The geomorphological characterization was based on regional interpretation based on the location of the project within the distribution of physiographic domains of the Dominican Republic, with delimitation in the geomorphological zoning as a regional context and following the current designation of regions and geomorphic zones of the Atlas of Biodiversity and Natural Resources (MIMARENA 2012).

Within this regional context, the zones were described based on the sediments and rocks that make up the surface, and giving characteristics according to their irregularities and discontinuities, relief forms, structural escarpments and sediment accumulations.

As a fieldwork methodology, geo-referenced markers were used, with observations at sites where there are indicators of erosion, sedimentation and dragging processes, as well as escarpments and steps in the rock massif. In addition, flights were made at low altitude with advanced *Phantom 4* drones, with 4K high-definition cameras installed at angles of 30, 45 and 90°, to visually cover a wide territory as a perspective landscape and vertical photos. The flights are adjusted to allowable heights and distances, complying with all the recommendations of Resolution No. 008-2015 of the IDAC on the use and operations of drones in the national territory.

As a graphic output of this chapter, the geomorphological map of the study area and a morphological profile with SSE to NNW direction, representing the relief forms and levels of structural floors and marine terraces, were presented (see map 8 in Annex 6).

In the regional geological characterization, general technical information was analyzed, available from the published memories of the Geothematic Mapping Program of the Dominican Republic, carried out through the SYSMIN program of geological-mining development (2004) by the *Bureau de Recherches Géologiques et Minières* (BRGM), which was part of the IGME-BRGM-INYPSA Consortium, and the supervision of the General Directorate of Mining of the Dominican Republic, and the Geological Map of the Dominican Republic 1:250000, with the objective of expanding the knowledge of the structural context of the main blocks that make up the regional massifs, describing the lithologies at the scale of geological formations.

Subsequently, at a more detailed scale of the study area, the geological analysis was based on the Geological Map 1:50000 of the National Geological Service, sheet Pepillo Salcedo 5875-II,

edition 3-ICM (DMA), and its descriptive memory, differentiating the elements of the geology that can characterize this area, which includes the project areas and its area of influence.

The lithological characteristics were recorded which, at a local scale, is the primary information for the interpretation of geomorphological processes and physical-geological phenomena occurring within the project area.

The photointerpretation used the available satellite images of the region (Google Earth service), in addition to the "historical images" tools of the same service. The 1:50000 map of the Dominican Republic, sheet 5875-II Pepillo Salcedo, 3-ICM edition (DMA) was used as a complement to the image base.

In the characterization of soils and sediment cover, the agricultural productivity classification, at regional scale, of the Atlas of Biodiversity and Natural Resources (MIMARENA 2012) was consulted as a primary grouping of this environmental factor.

Subsequently, during the field surveys, the in-situ analysis of physical characterization and visual description was carried out according to Cuban Standard NC 61:2000 for the Identification and Description of Soils (visual examination and simple manual tests). The values established by the United States Environmental Protection Agency (EPA) for industrial soils in the Summary Table - Regional Detection Level³, November 2023, were also taken as a reference. Four surface soil samples (secondary information) and one new sample were collected in Block 02 (SO-5) for analysis of their physical and chemical properties (Photo 9 in Annex 11). Section 6.1.5 Soil characterization describes each of the sampling points with their UTM coordinates.

The optimized measurement and sampling program was carried out in accordance with the schedule (Table 6-5).

Table 6-5. Sampling and measurements at terrestrial soil characterization points.

Block	Sampling point	day/month/year	Site Description
01	SO-1	25/10/2022	West boundary of the projected plant area.
	SO-2		Central sector of the projected plant area.
	SO-3		Sector to the west of the plant area, in the pipeline route from the coastal strip.
	SO-4		Coastal strip, in the route of the pipelines from the sea.
02	SO-5	6/10/2023	Center of Block 02.

Source: EMPACA field work and measurements, 2022 and 2023.

The sample was collected in zip lock bags with more than 2 kg to conserve humidity. In addition to the "in situ" observations, pH and granulometric composition (ASTM D4972-89 and D422-63), concentrations of organic matter, total petroleum hydrocarbons, oils and greases, and metals were determined.

For the preparation of plans, profiles and working scale maps, as supports for detailed information and drawing and mapping tools, commercial computer programs were used, in updated versions, among which SURFER v.13 and AUTOCAD v.2013 stand out.

³ [Summary RSL November 2023 HQ10 PDF \(epa.gov\)](#)

All the basic cartographic material produced as a result of the field work was georeferenced in the Universal Transverse Mercator (UTM) system and WGS 84 *datum* in zone 19 of the northern hemisphere, with coordinates in meters. This georeferencing method was applied to the cartographic sheets that were originally made with NAD 27 *datum*, achieving a single reference.

For the characterization of the hydrogeology, a regional scale was considered, taking as a reference the classification of the hydrographic basins of the Dominican Republic, prepared by the specialists of the National Institute of Hydraulic Resources.

Using the nomenclature of the hydrogeological map of the Dominican Republic at a scale of 1:250000, the main aquifers in the region were determined, with lithological characteristics and their hydrogeological importance. From a subterranean hydrodynamic point of view, a larger scale zoning approach was made, delimiting the coastal strip and highlighting the flow dynamics towards the coastline. Reference was made to the groundwater deposits through an observation well located in the town of Pepillo Salcedo.

For the characterization of the surface hydrology, we used the 1:50000 scale cartographic sheets as a primary base, tracing the limits of the hydrological basins of the Masacre and Chaquey rivers.

After the watershed basins were mapped, the main morphometric parameters of total area, perimeter, channel length, overall slope and general runoff patterns spatially related to the study area were calculated.

Calculation closures were established at each mouth of the rivers described, and the rational and modeling method was used in the HEC HMS software to calculate the hydrometric parameters of maximum flows for hydrological probabilities of 1, 2 and 10% (return period 10, 50 and 100 years). In the Figure 6-1 shows the hydrometric calculation grid for the Masacre river basin.

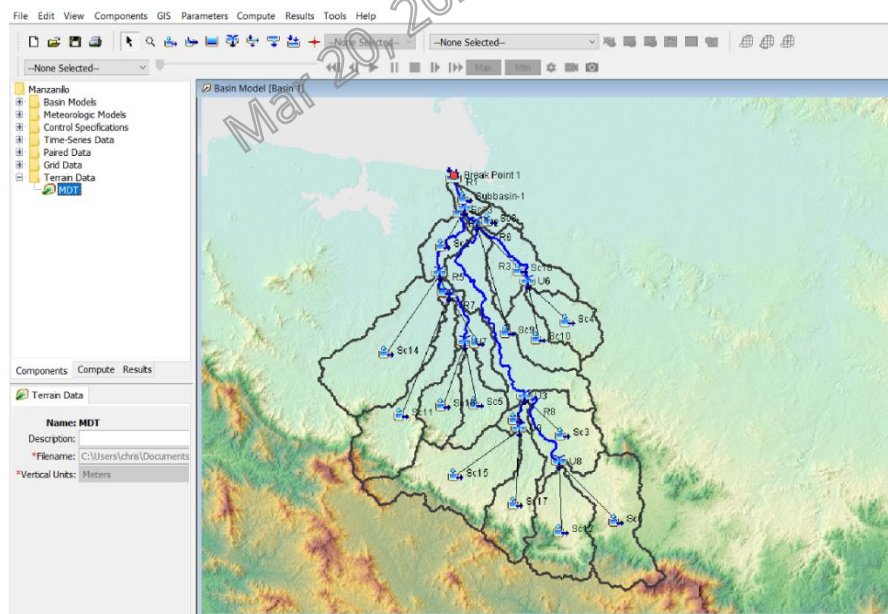


Figure 6-1. Example of computational grid for the calculation of hydrometry in the hydrological basin of the Masacre river.

Source: HEC HMS software modeling

With the knowledge acquired about the physical scenario and the primary cartographic base and the results of the 7 measurement and sampling points of marine water quality and 2 of the surface water accumulated in the low floodplain, to determine their physicochemical and bacteriological parameters established for Block 01 (secondary information), another sampling point was added in Estero Balsa (W-12).

The design of the sampling program was based on the principle of representativeness for the entire study area, following the general criteria of the Environmental Quality Standard for Surface and Coastal Waters of the Dominican Republic (NA-CASC-2012), the *Standard Methods for the Examination of Water and Wastewater* (APHA) and the U.S. *Environmental Protection Agency* (EPA).

For reference, each sampling and measurement site was georeferenced in UTM coordinates, DATUM WGS84 system, northern hemisphere, using the personal GPS described above. The UTM coordinates of the sampling and measurement site are presented with the test results.

The optimized measurement and sampling program was carried out according to schedule. Table 6-6 shows the sampling points to be monitored (including those of Block I, secondary information) and the new point that would complete the information for Block 02, in particular, the route of the 345 kV transmission line. Samples from the marine coastal scenario were identified as W, and those from surface waters in the plain were WE.

Table 6-6. Sampling and measurements at the 9 marine and surface water characterization points (Block 01, secondary information).

Block	Sampling point	day/month/year	Site Description
01	W-1	27/10/2022	Coastal sector northeast of the projected plant area, in the Estero Balsa marine area.
	W-2		Coastal sector to the north of the projected plant area, in the Estero Balsa marine area.
	WE-3		Aquariums in the low, flooded coastal plain in the project area.
	W-4		Coastal sector northeast of the low floodplain, at the marine entrance to the Estero Balsa area.
	W-5		At the location of the jetty in Manzanillo Bay.
	W-6		Coastal sector to the east of the Port facilities.
	W-7		Coastal sector to the west of the Port facilities.
	W-8		Coastal sector to the south of the projected plant area.
	WE-9		Pass culvert to inland wetland in low, flooded plain.
02	W-12	6/10/2023	Estero Balsa near the route of the transmission line.

Source: EMPACA field work and measurements, 2022 and 2023.

Section 6.1.14, as secondary information, presents the results of the oceanographic studies and in each of its sections the methodology used for their development. This section also describes each of the seven marine water sampling points, their parameters and UTM coordinates, while section 6.1.8 Hydrology and hydrogeology presents the two surface water samples and the groundwater sample as secondary information. Map 11 in Annex 6 shows the sampling and field measurement references for the 9 marine and surface water points.

All sampling followed established protocols to ensure that the conditions and validity of the samples were met until they were delivered to the EqLab laboratory, which was assumed by EMPACA's technical team under the technical direction of hydrogeological engineer Ernesto Rocamora, member of the International Association of Hydrogeologists (IAH) and accredited by the Ministry of Environment and Natural Resources of the Dominican Republic (registration 19-756).

In the Table 6-7 (Photos 10, 11 and 12 in Annex 11) details the general scope and structure of marine and surface water sampling in the area.

Table 6-7. Scope of the marine and surface water measurement and sampling program.

Block	Samples	Physicochemical and bacteriological quality parameters of marine and surface waters.
01	W-1, W-2, WE-3, W-4, W-5, W-6, W-7, W-8	<u>In situ tests</u> : pH, water temperature, electrical conductivity, total dissolved solids, dissolved oxygen, oxygen saturation and turbidity. <u>Laboratory tests</u> : Total and fecal coliforms, BOD ₅ , COD, organic material, total suspended solids, total solids, total phosphorus, total nitrogen, chloride, residual chlorine, total petroleum hydrocarbons, metals.
	WE-9	<u>In situ tests</u> : pH, water temperature, electrical conductivity, total dissolved solids, dissolved oxygen, oxygen saturation and turbidity. <u>Laboratory tests</u> : total suspended solids, chloride and residual chlorine.
02	W-10	<u>In situ tests</u> : pH, water temperature, electrical conductivity, total dissolved solids, dissolved oxygen, oxygen saturation and turbidity. <u>Laboratory tests</u> : Total and fecal coliforms, BOD ₅ , COD, organic material, total suspended solids, total solids, total phosphorus, total nitrogen, chloride, residual chlorine, total petroleum hydrocarbons, metals.

Source: EMPACA field work and measurements, 2022 and 2023.

All sampling and primary parameter measurements "*in situ*" were performed by EMPACA Environmental Quality Laboratory Division, and the Environmental Consulting Group S.R.L. (ECGroup) laboratory was used as an accredited entity for processing the samples collected.

Sampling procedures followed the protocols established by EMPACA Environmental Quality Laboratory Division, in accordance with the recommendations of the U.S. *Environmental Protection Agency* (EPA), the ISO/IEC 17025 Quality Management System, the *Standard Methods for the Examination of Water and Wastewater* (APHA) and other international institutions of worldwide reference.

Laboratory analyses of physicochemical and bacteriological parameters were performed by Environmental Consulting Group S.R.L. (ECGroup), following the methods established by the U.S. *Environmental Protection Agency* (EPA), the ISO/IEC 17025 Quality Management System and the *Standard Methods for the Examination of Water and Wastewater* (APHA).

Sampling of marine and surface waters for *in situ* analysis was carried out in order to avoid alterations in the physicochemical parameters due to sampling and transfer to the laboratory, and samples were collected with a smooth, high-density polyethylene sampler with a capacity of 4000 ml.

For each collection, a 300-ml glass bottle was filled, previously prepared in the laboratory, to measure the parameters *in situ* and using containers previously washed with deionized water and subsequently rinsed (sweetened) with the collected water. Additionally, 400 ml were taken in a polyethylene plastic bottle for the determination of turbidity and subsequent filtration of suspended solids.

A portable HQ40d was used for the measurements, with intelligent probes for electrical conductivity (ranges 0.01μ S/cm to 200 mS/cm), water temperature (ranges 0 to 80°C), pH (ranges 0 to 14), total dissolved solids (range 0-50000 mg/l) and dissolved oxygen (ranges 0.1 to 20 mg/l).

In addition, a portable Hatch 2100 q turbidity meter was used for real-time turbidity measurements. This equipment has a measurement range between 0 and 1000 NTU, with temperature range from 0 to 50° C, and bases its analysis on EPA method 180.1.

The resolution is 0.01 NTU and the response time is 6 seconds, which allows determination of turbidity down to settleable solids. The calibration of the equipment is parallel to the measurements with primary standards in sealed vials of 10, 20, 100 and 800 NTU.

For chloride determinations an ISEC18101 probe was used and for nitrates an ISENO318101 probe was used, using the same HQ40d portable equipment and the volumes of water collected for the other physicochemical parameters measured. The measurement range is from 0.1 mg/l to 35500 mg/l, using a Hach Chloride ISA reagent (1 bag of powder/25 ml of sample). Nitrate measurement ranges from 0.1 mg/l up to 14000 mg/l using a Hach Nitrate ISA reagent (1 powder bag/25 ml sample).

For residual chlorine measurements, Hach colorimeter II equipment was used with 10 ml glass and plastic vials, http://www.pce-instruments.com/espanol/instrumento-de-medida/medidor/medidor-de-cloro-kat_70100_1.htm in high-range (0.1 to 8.00 mg/l) and low-range (0.02 to 2.0 mg/l) solutions, following the SM 4500CIB, G method.

In general terms, the established procedures were followed for this sampling:

1. The technicians always wore latex gloves.
2. The sample containers were sealed and dry and were labeled prior to sampling with the name of the sample, date, time and laboratory record.
3. In general, 1-liter wide-mouth plastic bottles, 1-liter amber-colored glass bottles, and 100-ml sealed and sterilized bottles were used.
4. When filling the containers, a free space was considered to avoid thermal expansion or acidification effects.
5. The chain of custody was completed for each sample.
6. Immediately after sampling, and independent of acidification from the laboratory, the samples were placed in a cooler with crushed ice, guaranteeing the temperature between 4°C. The cooler was kept protected from the sun during the sampling day.

After the sampling days were completed, we verified that all the fields of the chain of custody of the samples were filled out, and communication was established with the EqLab laboratory to establish the transport times and coordinate the time of delivery.

Table 6-8 presents a summary of all the procedures carried out for the collection of the samples and the preservation data. The dates of transfer, delivery to the laboratory and execution of the analytical tests are presented in the tables for each sample in Annex 10.10 corresponding to the laboratory reports of the test results for each of the samples.

Table 6-8. Summary table of sampling, preservation, transfer and processing of samples.

Testing	Type of container and volume	Preservation	Laboratory
pH and water temperature	Plastic 300 ml	On-site analysis	EMPACA
Electrical conductivity and total dissolved solids	Plastic 300 ml	On-site analysis	
Dissolved oxygen and oxygen saturation	Plastic 300 ml	On-site analysis	
Turbidity	Glass vial 25 ml	On-site analysis	
Total Suspended Solids	Glass 400 ml	Cooling	
Chlorine residual		On-site analysis	
Chloride			
Organic matter	Plastic 250 ml	Cooling	ECGroup
Total nitrogen	Plastic 250 ml		
Total phosphorus	Plastic 250 ml		
Metals	Plastic 250 ml	Filtration, HNO ₃ and refrigeration	
Total petroleum hydrocarbons	1000 ml amber glass container	Cooling	
Total coliforms	Sterile container 100 ml	Cooling	
Fecal coliforms			
Biochemical oxygen demand (BOD) ₅	Plastic 500 ml	H ₂ SO ₄ and refrigeration	
Chemical oxygen demand (COD)			

Source: EMPACA Environmental Quality Laboratory measurements, 2022 and 2023.

Total and fecal coliform determinations were carried out within 24 hours after sampling, at EqLab's headquarters in Santo Domingo, following method SM9221B with a "most probable number" (MPN) result; while for BOD₅ and COD, methods SM 5210B and EPA 410A were used, also before 24 hours had elapsed.

For the characterization of the sediments for Block 01, parallel to the sampling of marine and surface waters, three samples of seafloor sediments were collected for analysis of their physical and chemical properties. In section 6.1.14 as secondary information, oceanographic studies describe each of the sampling points with their UTM coordinates.

The optimized measurement and sampling program was carried out in compliance with the schedule at all three points (Table 6-9).

Table 6-9. Sampling and measurements at the three seafloor sediment characterization points (Block 01, secondary information).

Sampling point	day/month/year	Site Description
SE-1	25/10/2022	Coastal edge (shore) where the projected pipeline route is located.
SE-2		Marine coastal sector where the projected pipeline route is located.
SE-3		Location of the unloading platform (jetty) in Manzanillo Bay.

Source: EMPACA Environmental Quality Laboratory field work and measurements, 2022.

Each sample was collected in zip lock bags weighing more than 2 kg and, in addition to the in-situ observations, granulometric composition (ASTM D422-63 standards), concentrations of oils and fats, total hydrocarbons, total organic carbon, total phosphorus, tributyltin and metals were determined.

Sampling was performed by EMPACA Environmental Quality Laboratory Division, and the Environmental Consulting Group S.R.L. (ECGroup) laboratory was used as an accredited entity for processing the samples collected.

6.1.2 Geology

In the region there is a great diversity of rocks and sediments, from continental conglomerates to turbiditic fans and micritic limestones, with a very heterogeneous spatial distribution, being able to differentiate a series of tectonic-sedimentary domains with different characteristics. The nature of these domains is unequal, since while some represent allochthonous terrains located in favor of large rift faults, others correspond to minor differentiations within the same terrain and others correspond to cover materials after the main stages of deformation.

The study area in this regional context is located between the domain of the Northern Cordillera and the Cibao Valley, whose tectonics are conditioned by two fundamental factors at the plate scale: the displacement between the North American and Caribbean plates, and the oblique subduction of the island platform.

The Cibao Valley domain corresponds to a basin of mainly Neogene age with a complex history within which at least four evolutionary stages can be differentiated. Corresponding to this evolution, in a second stage (Upper Miocene-Middle Pliocene) the basin has a predominant west to east direction, with the deepest facies located on the coastline, very close to its current position in the Pepillo Salcedo region. In the third stage (Middle Pliocene-Upper Pliocene) the basin, in its western sector, is compartmentalized into sub-basins where large amounts of sediments accumulate, although maintaining an approximately south-north direction. In a fourth stage, which would begin in the Pleistocene, or perhaps already in the upper Pliocene, the basin acquires its current configuration of a fluvial valley with an outlet to the west.

Following the details shown in the geological map of the study area (see map 7 in Annex 6), the following is a description of the Quaternary geological formations and sediments.

Gurabo Fm. represented by marls with intercalations of sands and coralline limestones, and silty limestones with corals from the Lower Pliocene of the Neogene (identified as **3** and **4** in the geologic map).

The Gurabo Formation outcrops in the region around the town of Pepillo Salcedo, in the south, southwest and west sectors, with no spatial relationship with the project area.

Most of the series is made up of an alternation of marls with intercalations of sands and coralline limestones (representation **3** in the Geological Map). In the outcrops of the area, the predominant lithology are levels of up to one meter of calcareous marls and shales, sometimes passing to calcareous siltstones, among which occasional fine-grained sandstones are intercalated, and presenting some lenticular intercalations of coral limestones up to 2.0 m in thickness. The marly levels present abundant shallow marine fauna, while the fine-grained sandstones occur as the roof of the marls in sequences that sometimes culminate with a level of mangrove roots.

The coralline limestones form bodies of reduced lateral extension composed mainly of coral fragments that give a medium and large-scale cross stratification. In the cores and edges of the corals and small bioherms in life position are sometimes identified (Photo 13 in Annex 11). In the outcrops of the southern sector these same facies are present, among which are interspersed, in addition, detrital levels up to 2.0 m thick and medium-grained micro conglomerates and sands.

In the outcrops in the southern and southwestern sector of the project area there are predominantly carbonate facies consisting mainly of whitish silty limestones with corals (representation **4** on the geological map), interspersed with levels of *grainstone* limestones and marls or limestones in nodules. The silty limestones are biomicrites with terrigenous contamination of fines with a *wackestone-packestone* texture. They include frequent corals and small bioherms of corals in life position up to 1.0 m in height among which globose forms clearly predominate, but with occasional presence of branching colonies.

La Isabela Fm. represented by reef limestones of the Middle-Upper Pleistocene of the Quaternary (identified **6** in the geological map).

This geological formation outcrops in the surroundings of the city of Pepillo Salcedo with some manifestations in the urban sector and in the coastal area near the border with Haiti, in addition to constituting the massif where the project's industrial plant will be located.

They are reef limestones with abundant corals, frequently in life position, which in the outcrops present whitish colors and outside the coastline they usually present a loamy texture. The locally abundant matrix is a bioclastic "*grainstone*" and they present micritic cement occasionally recrystallized. In addition to corals, the unit has a very abundant fauna, predominantly of mollusks, with current species, among which the presence of large shells of *Strombus gigas* stands out. The corals, at least the majority of which belong to present-day species, present a wide variety of shapes, from branching to hemispherical (Photo 14 in Annex 11).

In general, the rocks of this geological formation form the platforms or steps between the older rocks and the coastline. They generally have a morphological expression of great continuity, which constitute extensive plains (Photo 15 in Annex 11).

The level of the plain reaches +20 m, with a whole perimeter edge in the form of a structural bluff, whose base is at sea level or very low flooded marshes.

The base of the La Isabela Fm. has not been observed, inferring thicknesses more than 20 m. Where exposure permits, a certain zonation in the composition of the main builder corals is observed, similar to that observed in other areas of the Dominican Republic.

Although the rocks described for this geological formation are reef limestones, from observations in other sites of similar geology, there may be intercalations of semi rocky, fractured marls of lower strength and hardness.

High terraces represented by conglomerates with ferruginous patina of the Quaternary Pleistocene (identified **7** in the geological map).

The materials attributed to high terraces are horizontal deposits up to 4.0 m thick, of polymict pebbles with predominant sizes between 3 and 15 cm and sandy matrix. The composition of the pebbles, with metavulcanites, amphibolites, diorites and gabbros, indicates their origin in the Central Cordillera. The cobbles have a ferruginous patina, which also affects the matrix, and gives the deposits reddish tones. The outcrops are not very representative and only in some places the cross stratifications and imbrication of the cobbles can be appreciated.

Its distribution is in terraces with heights of about 30 m to the south of the project area and related to the fluvial valley of the Masacre River.

Floodplain represented by Holocene Quaternary muds, sands and gravels (identified **8** on the Geologic Map).

The materials belonging to the flood plain of the Yaque del Norte River occupy a large superficial extension to the west of the project area and are not directly related.

They consist mainly of muds and, to a lesser extent, sands with some gravel horizons. The maximum observable power is about 4.0 m, but it is probably much higher. Numerous meanders and abandoned channels can be seen as a result of avulsion processes.

The fact that some of these abandoned watercourses follow tectonic lines raises the possibility that the abandonment of the watercourses may have had, at least in some cases certain structural control, probably in favor of small fault scarps present in the alluvial plain that could channel avulsions.

Glaciers represented by Holocene Quaternary sands and gravels (identified **11** on the geologic map).

The glacia deposits, consisting of sands and gravels with a diffuse flat stratification, occur at 5.2 km from the project area to the east-southeast, with no direct relation to the study area, on the boundary between the alluvial plain of the Yaque del Norte River and the Neogene materials of the Cibao Valley.

In general, they present alternations of power of several decimeters of fine to medium sands and poorly classified clays, whose texture was caused by laminar flows of water on a flat surface, which is slightly inclined and undulated by the succession of erosive and sedimentation events linked to these laminar flows.

The maximum strength of the deposits can be estimated at 10.0 m, with colors ranging from reddish-brown in the clays to yellowish orange in the sandy facies. A characteristic of these

glaciers is the absence of a well-defined permanent hydrographic network, although they are slightly eroded by the current fluvial network.

Low marshes represented by gray to black silty-clay silts of the Quaternary Holocene (identified **13** on the Geologic Map).

These are littoral deposits distributed forming low marshes, usually covered by mangroves, and without outcrops of the underlying rock layers. They are located in the intertidal zone of the coast, so they lie in conditions of saturation and flooding closely related to the tidal regime, although there are cays that have emerged several centimeters above the water level reached during normal high tides (Photo 16 in Annex 11). Although the literature suggests that this behavior is linked to recent slight eustatic uplift or downwelling in the region over the last few thousand years, locally it is considered to be associated with coastal dynamics and anthropogenic modifications that have limited the exchange with the sea. The projected route of the gas lines to the plant is distributed over these formations.

In general, the silts are described as fine-textured, soft, saturated, with abundant organic matter content, associated with surface waters of high salinity and temperature.

High marsh represented by Holocene Quaternary silts and fine sands (identified **14** on the geologic map).

These are deposits of fine detrital character, occasionally visible in large surfaces with saline efflorescence, and where they basically lie blackish-colored silts with a foul odor that incorporate abundant remains of bivalves and gastropods. Its manifestations in the region are to the south of the project area, with no direct relation to it (Photo 17 in Annex 11). It is not possible to establish its thickness, possibly of metric order.

Beach and coastal strand represented by medium to fine sands of the Holocene Quaternary (identified **15** on the geological map).

Their accumulation has formed the cumulative shoreline in the study area, in the form of a continuous sandy beach belt parallel to the shoreline (Photo 18 in Annex 11).

In some sectors of the beach there are very small dunes that do not reach a meter in height. The beach profile has a steep slope, and evidently its natural development limits the superficial exchange with the post-beach floodplains or mangroves.

These formations of fine to medium sands, with remains of corals, have erosion events during the hurricane and storm season, although a rapid recovery has been considered during times of normal coastal dynamics (Photo 19 in Annex 11).

In the case of these Quaternary cover sediments, their distribution is quite generalized in the area, due to the morphology of the low region of the coastal plain, where elevations below 1.0 m predominate.

Anthropic represented by Holocene Quaternary fills (identified **16** on the geologic map).

To the south of the town of Pepillo Salcedo is a landfill with debris fill that occupies an area of about 0.25 km², in addition to the entire sector where the port facilities are distributed over an area of marshland with technical fill.

Anthropic represented by Holocene Quaternary salt pans (identified **17** on the geologic map).

They are distributed more than 4.0 km northeast of the project area, with notable extensions and always in high marsh lying areas. These are salt flats where workings are done in an artisanal manner by the typical process of flooding and evaporation. Both the flooded area and the salt accumulations have intense temporary modifications depending on the dynamics of the salt marsh processes (Photo 20 in Annex 11).

Regional tectonics

The most relevant tectonic structures in the region correspond to faults with an approximate NW-SE and W-E direction (Figure 6-2).

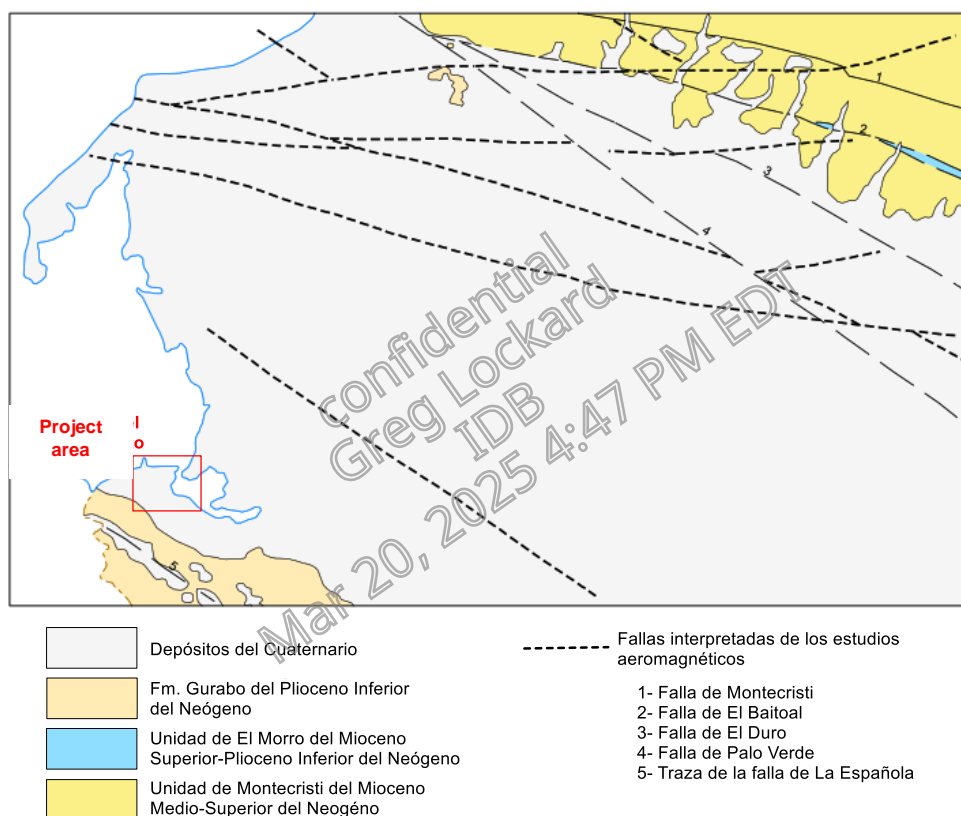


Figure 6-2. Regional tectonic scheme.

Source: Geological Map 1:50000 of the Dominican Republic.

These main tectonic structures are distributed to the north and south of the project area, without any of them cutting it. From north to south the most important faults are:

- Los Cayucos fault with an apparent vertical displacement of more than 4.0 km, which brings into contact a powerful sedimentary series of the Middle Miocene-Pliocene with Lower Cretaceous materials.
- Isabel de Torre fault with a very straight line that indicates the verticality of its fault plane and its transcurrent character, given the regional context. Its morphological expression is very strong, giving rise to an inverted scarp with respect to its apparent vertical movement.

- Montecristi fault is the most important structure in the region together with the Los Cayucos fault. It affects materials within the domain of the Cordillera Septentrional as a large, currently inactive rift. It shows a strong morphological expression by escarpment and fossilized by alluvium of Pleistocene age.
- El Duro Fault represents the southern limit of the outcrops belonging to the Northern Cordillera domain. The affected materials do not show signs of sedimentary movements associated with the fault activity, so the action has been subsequent to the deposition of the Gurabo Formation in the Lower Pliocene.

Tectonic activity continues today, with the development of several Holocene-age faults in the plain of the Yaque del Norte River and reactivation of previous faults, with block replay, in the Northern Cordillera domain.

6.1.3 Geomorphology

The relief of the region is conditioned by the westernmost foothills of the Cordillera Septentrional and mostly by the processes of sediment accumulation in the alluvial plain of the Yaque del Norte River in the western Cibao Valley and its remodeling by the morphogenetic action of the sea on the coast.

Thus, the elements of geomorphology are not complex as they are represented by morphological formations of the terraces surrounding the coastal strip. However, reference is made to the relief in the study area, considering its importance for the design of the works and as the element that conditions surface runoff.

The action of external agents on these peripheral elevated sectors has resulted in a significantly different expression. Thus, the modeling of the areas of the highest rocky massif in the south is the product of a long evolution of sedimentary and tectonic processes, generating a positive relief on which various weathering agents have acted, with greater or lesser effectiveness, highlighting those of a marine nature for the coastal area where the project will be located.

Thus, these massifs are closely related to the relief of flat surfaces, low marshes of the coastal strip, where its condition of flooded area according to the tidal regime is the predominant factor of relief modeling (Photo 21 in Annex 11).

It should be noted that in this coastal sector, anthropic transformations are intense, not because of their development but because of their influence on the modification of the natural dynamics of coastal ecosystems. Thus, a network of roads can be observed, several as simple circulation routes on the sands of the coastal strip that in addition to the compaction and immobility of the sediments, constitute a superficial and subsurface barrier to the exchange with the sea and the drainage of surface runoff from the land (Photo 22 in Annex 11). In addition, an embankment was built from the technical compaction of carbonate rocky materials, which allows access from the urbanized sector of the eastern part of the city to the lower coastal zone (Photo 23 in Annex 11).

Behind the strip of low coastal plain (marshes), with accumulation of sands, silts and muds, a first terrace or morphostructural step can be observed, which represents the geological-morphological evolution explained for the region, considered as a medium plain formed in limestones of the La Isabela Fm. with heights above 15 m (Figure 6-3).



Figure 6-3. Diagram of the middle plain behind the marshes, as a morphostructural step of the relief in the project area.

Source: Elaborated by EMPACA, 2023.

As a summary of the geomorphological characteristics, the geomorphological map of the study area is presented with details of the main morphologies described (Map 8 in Annex 6).

As a last element of the morphology of the study area, an analysis of the spatial distribution of the morphoalignments was carried out, based on their regional manifestations due to their masking in the study area by the cover sediments.

In Figure 6-4 the main axes of the morphoalignments are represented based on the interpretation analysis of the satellite images and the geological map, and whose result is expressed in the relationship of direction versus frequency, which facilitated observing the distribution of the groupings in families.

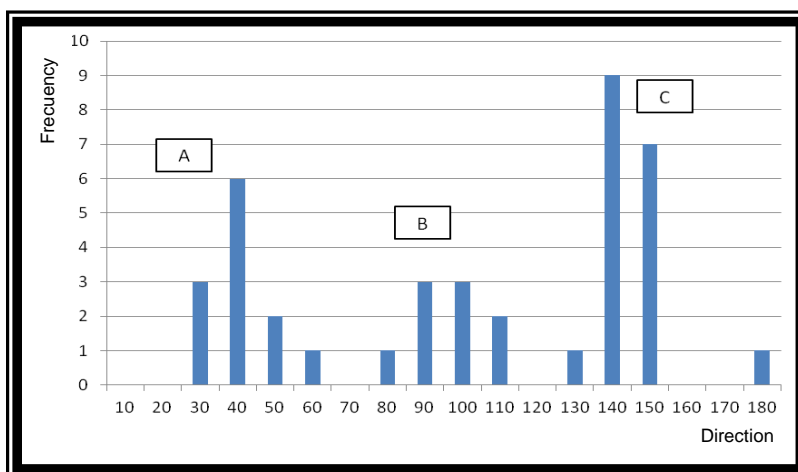


Figure 6-4. Plot of frequency vs. direction of morphoalignments.

Source: Elaborated by EMPACA

Family A and C have an orthogonal distribution, very marked throughout the region, involving major morphostructures and faults. In the case of family A, directions from 30 to 60° (SW-NE) predominate, represented by elements of medium continuity, bordering geological structures and normal fault systems. On the other hand, family C with a direction of 130-150° is more related to the axes of regional tectonics, with a very wide continuity, and which conditions the main fluvial runoff in the Yaque del Norte river basin, in its lower third.

Distributed in the region are W-E aligned structures (90-110° B family), which significantly influence the main surface drainage network and valley edges.

6.1.4 Topography

As described in the geomorphology, the current relief of the area has as its main feature a plain with different levels of relief that characterize it as low and medium, without relicts of the original morphology.

Based on topographic sheet 5875-II Pepillo Salcedo, in addition to updates of the field campaign surveys, a relief profile of the study area was drawn up, which summarizes the current topography and highlights the main discontinuities, heavily masked by intense anthropic modifications and coastal-marine dynamics.

In the topographic profile with a SSE to NNW direction in the study area, two specific levels are observed that express the regional morphological development; the first with elevations that do not exceed +3.0 m (meters above sea level, masl) that represents the low coastal plain, flooded, where marshes have formed with very little hydrodynamics. The second topographic level is represented by the relief surface with elevations between +10 and +20 masl as a structural barrier massif that is destroyed parallel to the elevation line. It is noticeable that the slopes of the escarpment formed by the topographic difference of the surfaces reach values of up to 20-25%. In Figure 6-5 is a scheme taken from the morphological profile to scale presented in Annex 6. Geomorphological map of the study area, showing the discontinuities expressed and the difference in elevations explained.

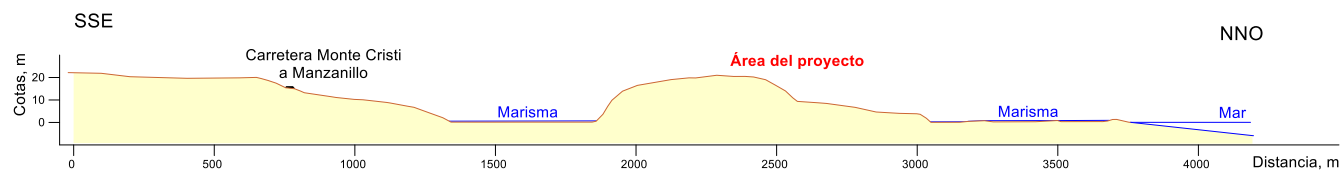


Figure 6-5. Diagram of the relief in a morphological profile from SSE to NNW in the study area (taken from the morphological profile in the Geomorphological Map of the study area).

Source: Elaborated by EMPACA, 2023.

6.1.5 Soil Characterization

From a regional point of view, according to soil information from the Dominican Republic and field verifications, the region linked to the project area is described as having poorly developed deluvial soils, accumulated from the processes of dragging from the southern mountain massifs and marine dynamics. On the other hand, some associations of clayey, brown soils have been

observed, accumulating in the medium and high plains sectors, mainly to the SW of the project, with low productive capacity, but with intense management actions to achieve agricultural vocation.

In the map of soil types in the study area with sampling points (Map 9 in Annex 6), and made from the field surveys, the three main soil types are identified, in addition to the anthropic fills.

Table 6-10 describes the reference soil sampling sites for Block 01 as secondary information and a new point to characterize Block 02, carried out during the field surveys and as a complement to the regional characterizations and to report several of their physical properties (Map 9 in Annex 6 Map of soil types in the study area with sampling points).

Table 6-10. Location of soil and sediment sampling sites.

Block	Point	Sampling sites	Physical description of soils and sediments	UTM coordinates	
				X	Y
01	SO-1	West boundary of the projected plant area.	Brown clay-loam soils.	213111	2180478
	SO-2	Central sector of the projected plant area.	Brown clay-loam soils.	213530	2180151
	SO-3	Sector to the west of the plant area, in the pipeline route from the coastal strip.	Brown clay-loam soils with gravel.	212871	2180746
	SO-4	Coastal strip, in the route of the pipelines from the sea.	Silty sands, without development of edaphic soils.	212901	2181263
02	SO-5	Center of Block 02.	Brown clay-loam soils.	212978	2179976

Source: Elaborated by EMPACA, 2022 and 2023.

Table 6-11 details the physical and chemical properties of these soils observed (Annex 10.11 Soil physicochemical parameter reports), where brown soils of silty-clay texture, of medium thickness and a granulometry where the fine fraction predominates stand out, although in sectors close to the embankments and with technical fillings, the percentages of gravel are notable as a characteristic of stoniness (Annex Photos 24, 25 and 26 in Annex 11). Regarding metals, the results remain below the values established in the EPA reference guide.

Table 6-11. Physical and chemical parameters of sampled soils in Block 01, secondary information.

Parameters	Unit of measure	SO-1: On the western boundary of the projected plant area.	SO-2: In the central sector of the projected plant area.	SO-3: In the sector to the west of the plant area, in the pipeline route from the coastal strip.	SO-4: In the coastal strip, in the pipeline route from the sea.	EPA Reference Values (mg/kg)
		Block 01				
pH	--	7.97	7.91	8.31	8.56	--
Natural moisture	%	29.0	24.5	17.5	19.7	--
Gravel (grain size)	%	6	3	6	1	--

Parameters		Unit of measure	SO-1: On the western boundary of the projected plant area.	SO-2: In the central sector of the projected plant area.	SO-3: In the sector to the west of the plant area, in the pipeline route from the coastal strip.	SO-4: In the coastal strip, in the pipeline route from the sea.	EPA Reference Values (mg/kg)
			Block 01				
Sand (granulometry)		%	32	23	35	61	--
Silt (granulometry)		%	11	28	21	15	--
Clay (granulometry)		%	51	46	38	23	--
Salinity		‰	1.57	0.89	0.23	14.16	--
Organic matter		%	16.71	20.92	7.54	4.03	--
Total petroleum hydrocarbons		mg/kg	< 19.9	< 19.9	< 19.9	< 20.0	--
Oils and fats		mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	--
Metals	Total cadmium	mg/kg	1.35	0.11	< 0.0926	< 0.0957	100
	Total cobalt	mg/kg	5.44	10.1	10.7	5.46	350
	Total Chromium	mg/kg	35.0	58.4	70.1	23.3	--
	Total copper	mg/kg	164.0	18.4	15.3	5.27	47000
	Total iron	mg/kg	12100	18300	20900	9530	820000
	Total nickel	mg/kg	29.0	30.3	27.1	10.5	--
	Total lead	mg/kg	512.0	1.53	2.39	0.804	--
	Total vanadium	mg/kg	19.6	37.7	50.3	19.3	5800
	Total zinc	mg/kg	341.0	29.1	19.3	14.0	--

Source: ECGroup and EMPACA laboratory reports, 2022. EPA Summary Table - Regional Level of Detection⁴, November 2023.

Table 6-12 details the physical and chemical properties of the soil (SO-5) sampled in the center of Block 02 (Annex Photo 27 in Annex 11) (Annex 10.11 Soil physicochemical parameter reports). Regarding metals, the results remain below the values established in the EPA reference guide.

Table 6-12. Physical and chemical parameters of the soil sampled in Block 02.

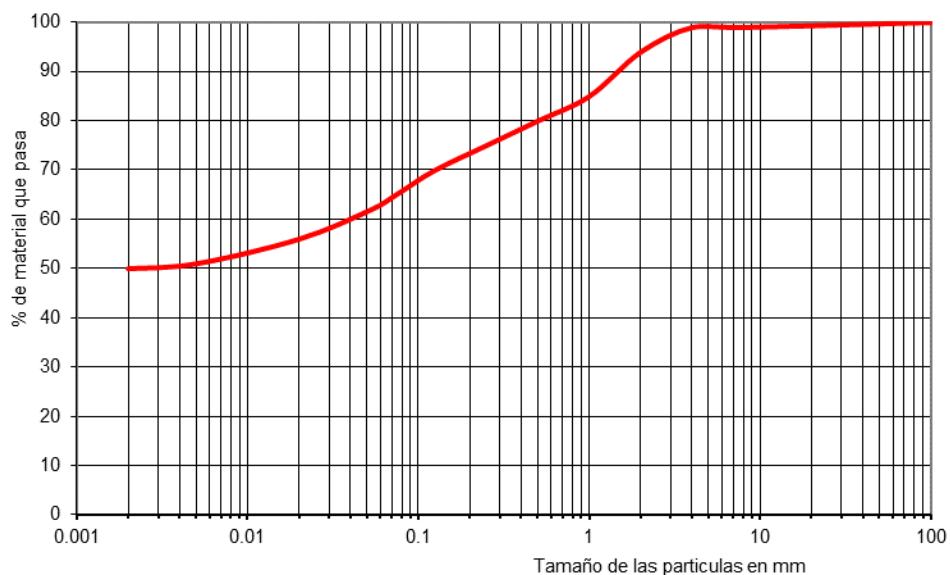
Parameters	Unit of measure	SO-5: In the center of Block 02	EPA Reference Values (mg/kg)
pH	--	7.93	--
Natural moisture	%	25.6	--
Gravel (grain size)	%	4	--
Sand (granulometry)	%	23	--

⁴ Summary RSL November 2023 HQ10 PDF (epa.gov)

Parameters		Unit of measure	SO-5: In the center of Block 02	EPA Reference Values (mg/kg)
Silt (granulometry)		%	29	--
Clay (granulometry)		%	44	--
Salinity		‰	0.85	--
Organic matter		%	3.47	--
Total petroleum hydrocarbons		mg/kg	< 15.0	--
Oils and fats		mg/kg	40	--
Metals	Total cadmium	mg/kg	< 0.195	100
	Total cobalt	mg/kg	12	350
	Total Chromium	mg/kg	79.8	--
	Total copper	mg/kg	25.6	47000
	Total iron	mg/kg	21600	820000
	Total nickel	mg/kg	39.9	--
	Total lead	mg/kg	2.27	--
	Total vanadium	mg/kg	49	5800
Total zinc		mg/kg	31	--

Source: ECGroup and EMPACA laboratory reports, 2023.

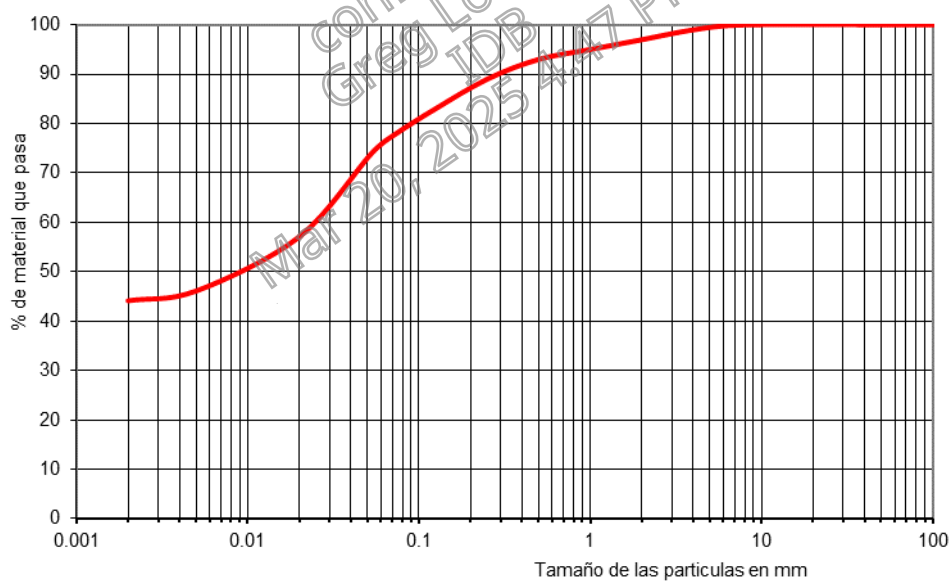
In Figure 6-6, Figure 6-7, Figure 6-8, Figure 6-9 y Figure 6-10 The granulometric curves of the soils sampled for Block 01 (secondary information) and of the new soil sample for Block 02 are presented (Annex 10.11 Soil physicochemical parameter reports).



Gravel: 6	Sand: 32	Silt: 11	Clay: 51 %.
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Figure 6-6. Typical grain-size curve of brown silty-clay soils (Sample SO-1).

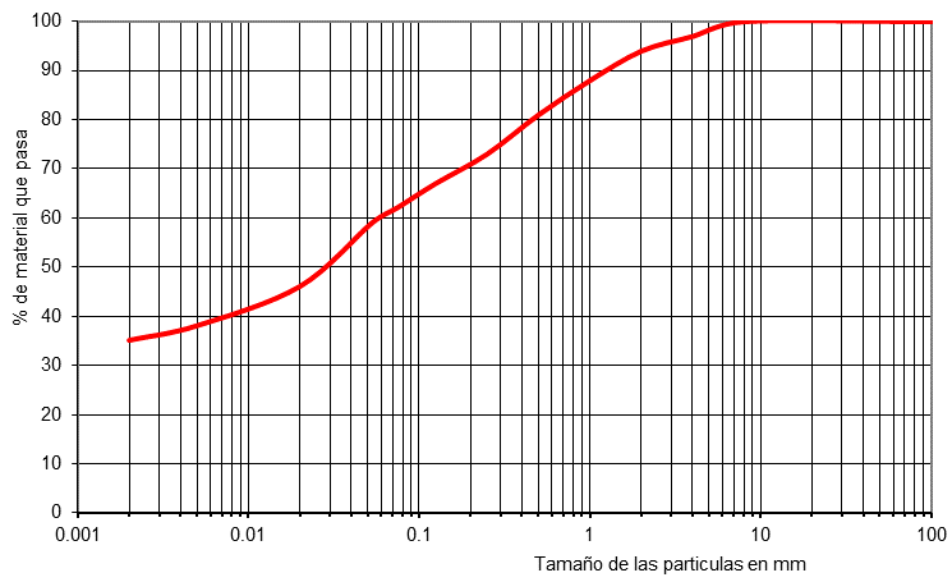
Source: Elaborated by EMPACA, 2022.



Gravel: 3	Sand: 23	Silt: 28	Clay: 46 %.
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Figure 6-7. Typical grain-size curve of brown silty-clay soils (Sample SO-2).

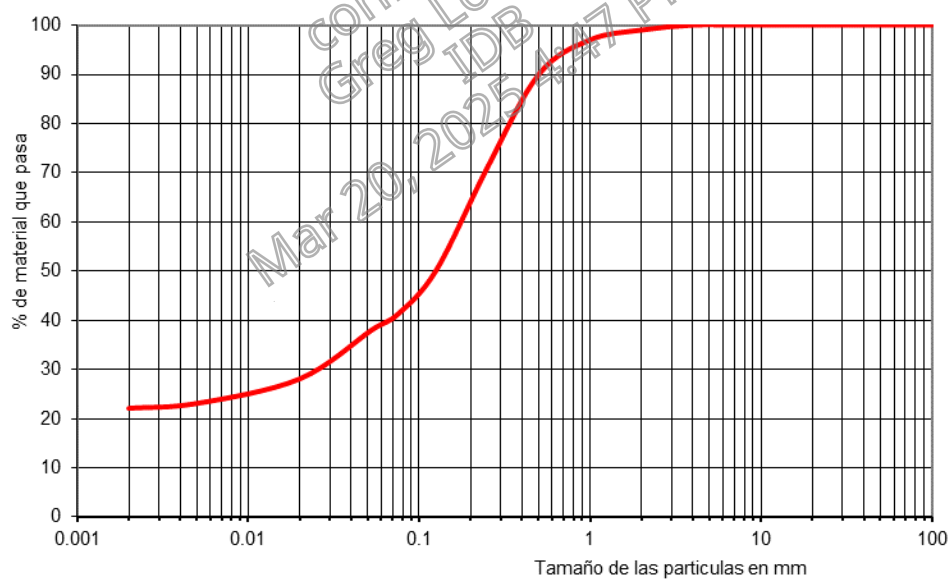
Source: Elaborated by EMPACA, 2022.



Gravel: 6	Sand: 35	Silt: 21	Clay: 38 %.
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Figure 6-8. Typical grain-size curve of brown silty-clay soils (Sample SO-3).

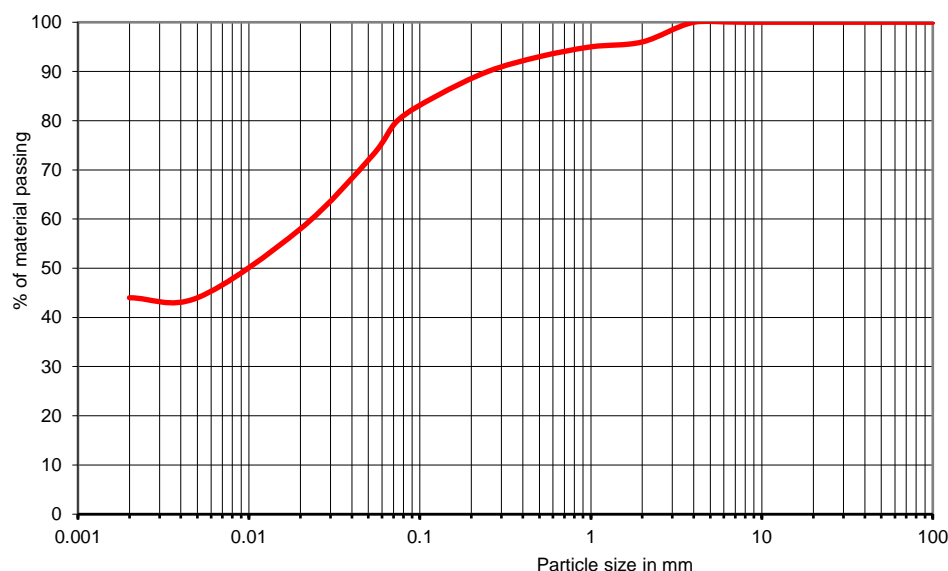
Source: Elaborated by EMPACA, 2022.



Gravel: 1%.	Sand: 61	Silt: 15	Clay: 23
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Figure 6-9. Typical grain-size curve of silty sands in the low plain (Sample SO-4).

Source: Elaborated by EMPACA, 2022.



Gravel: 4	Sand: 23	Silt: 29	Clay: 44 %.
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Figure 6-10. Typical grain-size curve of silty sands in the low plain (Sample SO-5).

Source: Elaborated by EMPACA, 2023.

From the chemical parameters determined (concentrations of metallic elements), it is evident that in the areas where the SO-1, SO-2, SO-3 and SO-5 soils are located, located in the middle and elevated plain surface, it has been affected by the influence of activities related to local industry and traffic on embankments, which has been noticeable according to the remaining structures of the platforms where fuel deposits were located, among other works.

In the case of the SO-4 sandy soils, the difference in chemical parameters is notable, although some concentrations of metals stand out, suggesting anthropogenic activity (vehicular traffic circulation routes and tillage with boats), in addition to dragging by rainfall dynamics from adjacent higher sectors. In this low zone, there are several parameters that highlight the high predominant influence of the marine coastal environment on the plain.

As explained, in the study area there are plots where the natural cover has been disturbed and there are rocky sediments of fills mixed with soils, with absent edaphic horizons. The texture is silty and sandy, also associated with the mid-plain sector and adjacent to the project area, which have been represented as "anthropic fills" in the Map of soil types in the study area with sampling points (Annex 10.11 and Photo 28 in Annex 11).

In the coastal strip of the project area, the sediments that lie are medium to fine sands, locally with low presence of organic matter (Photo 29 in Annex 11). They present a flat profile, with a slightly inclined slope front and with features of a very low dune formation.

The parameters of these fine sands from the beachfront are detailed in section 6.1.14 Oceanographic studies, as part of the group of three marine sediment samples that were collected.

6.1.6 Land use capacity

As land use in the study area, an edaphic formation was identified that, interpreted for its agro-productive capacity, can be summarized as class IV according to the OAS classification used in the Atlas of Biodiversity and Natural Resources of the Dominican Republic (MIMARENA, 2012). In addition, another formation was identified without agro-productive classification corresponding to organic sandy silts.

In this grouping, several edaphological characteristics such as depth, structure and permeability were used to determine the potential and limitations of the soils, adding some physical properties from recent field surveys as elements of general characterization.

In the Table 6-13 (Figure 6-11) describes these two edaphic formations and presents the map according to the original description for their agro-productive capacity used according to the OAS classification (MIMARENA, 2012). In addition, a description of classes II and III has been included, which, although they do not occur in the study area, are found in neighboring sectors.

Table 6-13. Edaphic formations described for the study area and its surrounding sectors.

Classes	Description by agro-productive capacity
--	Soft sandy silt with high organic matter content, high salinity and saturated. Substrate of mangroves and low, muddy coastal vegetation.
II	Arable soils, suitable for irrigation, with undulating topography and non-severe limiting factors. High productivity with good management.
III	Arable soils, suitable for irrigation, only with very profitable crops, have undulating topography with limiting factors of some severity. Medium productivity with intensive management practices.
IV	Limited soils for crops and not suitable for irrigation, except for very profitable crops. They have severe limitations and require intensive management practices.

Source: OAS classification according to agro-productive capacity in MIMARENA's Atlas of Biodiversity and Natural Resources, 2012.

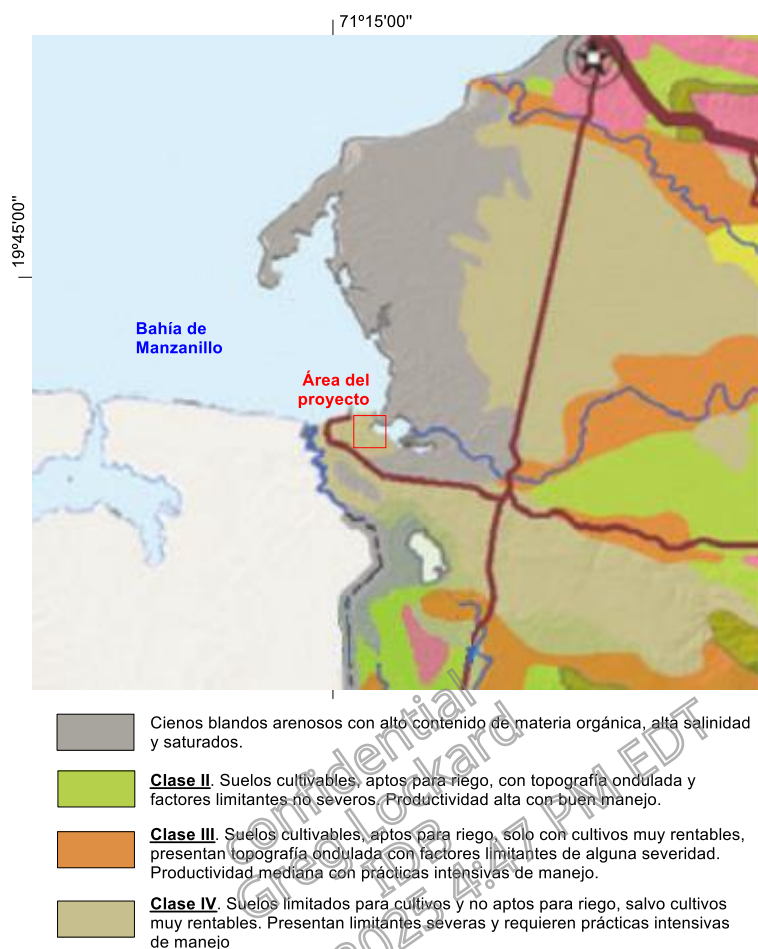


Figure 6-11. Map of soil formations according to their agricultural production capacity.

Source: OAS classification according to agro-productive capacity in MIMARENA's Atlas of Biodiversity and Natural Resources, 2012.

Class IV soils are distributed in the mid-plain, with little relation to the lower sectors, covering primary carbonate rocks and with extensive urbanized sectors. In the sector of the project area where the plant will be located, these types of soils are found without current use (Photo 30 in Annex 11).

Also to be considered is the coastal strip where the fine sands lie, without any direct use, where isolated rustic houses and fishermen's facilities are located (Photo 31 in Annex 11).

6.1.7 General Climatology of the Region

The determining factors of the climate in the region where the project will be located are the same as those that affect all the coastal regions of the northern Dominican Republic.

For the region where the project is located, climatic information from the Monte Cristi station located 18 km northeast of the project area with morphological characteristics similar to the area

of interest was used. The data on meteorological variables from the station is reliable for the years 1981 to 2022 and is managed by the National Meteorological Office (ONAMET).

6.1.7.1 Air temperature

The air temperature regime in the region of the project site is typical of coastal zones (Table 6-14).

Table 6-14. Monthly average temperature values, with maximum and minimum records in °C (years 1981-2022).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Prom	23.9	24.2	25.2	26.1	27.2	28.2	28.6	28.7	28.2	27.6	26.1	24.3	26.5
Max.	30.0	30.1	30.3	30.8	31.6	33.5	33.7	33.7	33.3	32.6	30.9	30.0	31.7
Min.	19.8	20.0	20.5	21.6	22.5	23.7	23.9	23.8	23.3	22.0	21.7	20.4	21.9

Source: ONAMET 2022.

From this data we have interpreted the behavior of the maximum and minimum values (Table 6-15 y Table 6-16).

Table 6-15. Interannual monthly maximum temperature records in °C (years 1981-2022).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Prom	30.0	30.1	30.4	30.8	31.7	33.5	33.7	33.7	33.3	32.7	31.0	30.1
Max.	31.5	31.9	31.6	32.9	33.6	34.6	34.7	34.6	34.6	34.1	32.8	32.5
Min.	28.4	28.1	28.0	22.6	23.3	31.8	25.5	25.4	25.0	24.2	23.1	22.5

Source: ONAMET 2022.

Table 6-16. Interannual monthly minimum temperature records in °C (years 1981-2022).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Prom	19.8	20.1	20.6	21.6	22.6	23.7	23.9	23.8	23.3	22.0	21.8	20.4
Max.	21.2	21.7	22.4	24.1	25.2	32.1	27.7	25.6	25.0	24.3	23.3	22.5
Min.	18.7	18.4	18.9	20.1	19.8	21.6	22.7	22.7	21.8	0.0	20.0	18.5

Source: ONAMET 2022.

6.1.7.2 Relative humidity

In the Table 6-17 shows the relative air humidity data, compiled with data from stations in the region, considering data from coastal areas, where this factor tends to be higher than in the interior.

Table 6-17. Monthly average relative humidity (%).

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
72.0	70.0	68.0	70.0	71.0	69.0	67.0	69.0	71.0	73.0	73.0	72.0

Source: Historical data processed by EMPACA.

6.1.7.3 Cloudiness

In the region, the average percentage of the sky covered with clouds has a significant variation during the year (Table 6-18). The clearest period extends from November to April, and the cloudiest month of the year is June, during which the sky is cloudy or mostly cloudy on average 73% of the time.

Table 6-18. Percentage of cloudy skies per month (%).

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
17	17	19	31	60	73	64	64	69	64	45	27

Source: Historical data processed by EMPACA.

6.1.7.4 Sunshine hours

The length of the day in the region varies throughout the year, with the shortest days in December and the longest day in June (Table 6-19).

Table 6-19. Length of days per month (hours).

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
11.1	11.5	12.1	12.6	13.1	13.3	13.2	12.8	12.2	11.7	11.2	11.0

Source: Historical data processed by EMPACA.

The earliest sunrise usually occurs in the month of June, around 6:05 a.m., while the latest occurs in the days of January, around 7:20 a.m. On the other hand, the earliest sunset usually occurs in the month of November, and the latest in the month of July.

6.1.7.5 Water temperature

The average water temperature has significant seasonal variations during the year, with the hottest time of the year being from August to November, with an average temperature above 28 °C (Table 6-20). The month of the year in which the water temperature is warmest is September with an average water temperature of 29 °C.

Table 6-20. Monthly average water temperature (°C).

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
26	26	26	26	27	28	28	29	29	29	28	27

Source: Historical data processed by EMPACA.

6.1.7.6 Wind direction and speed

The wind regime can be broken down into two parts: one due to the average or general circulation in the structure of the atmosphere (trade winds), and the other due to local disturbances in each region (breezes); seasonal variations are also important.

The average monthly wind speed prevailing in the locality is shown in Table 6-21 considering measurements at 3.00 m height. Table 6-22 details the prevailing directions measured at the same station in Montecristi.

Table 6-21. Interannual monthly wind speed records (km/h), for the years 1981-2022.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
prom.	11.1	12.3	13.1	13.2	12.5	13.0	13.8	13.7	13.7	11.8	10.8	11.0
Max.	17.1	19.6	18.3	19.2	19.8	18.6	19.1	17.1	22.7	16.6	16.2	15.2
Min.	7.9	9.3	10.1	9.7	8.6	9.5	10.9	10.5	9.8	8.8	7.6	8.2

Source: ONAMET 2022.

Table 6-22. Interannual monthly wind direction records (NSEW), for the years 2009-2022.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly fashion	E	E	E	E	JAN	E	E	E	E	E	E	E

Source: ONAMET 2022.

Interestingly, the highest wind speeds are reported from July to September, except for winds associated with extreme weather events. The direction of the winds is predominantly from the east, although some slight deviations associated with the regional climate are reported. It should be noted the very occasional influence of winds from the north, with the influence of cold fronts.

6.1.7.7 Precipitation

For the analysis of the behavior of this variable of annual precipitation, data from the Monte Cristi station operated by ONAMET were used. The reference location and data series of this weather station are shown in section 6.1.1 of Methodology.

In Table 6-23 shows the total monthly distribution of precipitation for a 42-year period, with a 12-year period of missing precipitation.

Table 6-23. Interannual monthly rainfall accumulations (mm), years 191-2022.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1981	57.8	98.1	79.1	56.5	45.8	19.6	10.7	11.6	27.0	36.2	68.6	131.7	642.7
1982	26.1	4.0	2.1	26.8	128.9	1.0	10.3	5.7	24.7	58.7	93.4	57.5	439.2
1983	32.9	8.4	29.3	12.9	88.2	106.2	4.9	30.4	42.1	44.4	6.7	40.9	447.3
1984	52.6	19.0	43.1	102.6	32.8	60.7	1.4	15.2	28.0	68.9	111.0	44.1	579.4
1985	34.1	88.7	93.7	53.8	132.4	18.0	3.3	52.2	22.8	50.1	113.0	21.6	683.7
1986	102.1	13.9	153.9	104.0	20.2	39.9	0.3	6.8	2.6	16.4	48.2	3.3	511.6
1987	231.7	35.8	20.0	101.5	107.3	69.0	8.5	4.4	93.5	41.9	44.0	112.4	870.0
1988	254.4	25.5	10.0	4.2	61.3	75.5	3.4	76.7	67.6	42.0	1.8	48.1	670.5
1989	22.8	112.4	13.2	3.1	20.8	36.4	0.1	34.8	9.1	13.5	26.9	161.4	454.5
1990	21.4	28.9	25.9	74.8	3.2	17.1	10.5	20.6	6.0	300.2	89.4	81.9	679.9
1991	1.2	42.3	52.1	-	23.3	5.1	8.2	32.7	35.4	3.9	97.9	27.5	329.6
1992	19.2	8.7	105.5	70.2	66.6	31.9	8.0	16.3	12.2	22.2	0.7	58.9	420.4

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1993	27.4	40.6	45.6	177.2	117.8	2.1	6.6	0.8	6.3	11.5	24.0	6.9	466.8
1994	269.1	4.0	75.6	7.0	67.4	0.0	0.2	1.8	88.5	19.5	-	55.9	589.0
1995	8.6	-	-	-	-	46.3	-	-	-	-	-	-	-
1996	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	-	-	-	-	-	-	-	-	-	-	-	-	-
1998	-	-	-	-	-	-	-	-	-	-	-	-	-
1999	-	-	-	-	-	-	-	-	-	-	-	-	-
2000	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	-	-	-	-	-	-	-	-	-	-	-	-	-
2002	-	-	-	-	-	-	-	-	-	-	-	-	-
2003	-	-	-	-	-	-	-	-	-	-	-	-	-
2004	-	-	-	-	-	-	-	-	-	-	-	-	-
2005	-	-	-	-	-	-	-	-	-	-	-	-	-
2006	-	-	-	-	-	-	-	-	-	-	57.5	23.8	-
2007	37.4	41.2	134.5	17.9	108.9	65.0	3.3	80.0	33.8	184.8	214.4	106.5	1027.7
2008	41.1	0.4	19.8	10.3	25.2	57.5	3.2	22.1	181.2	74.7	79.5	45.5	560.5
2009	91.0	98.5	104.1	18.8	11.5	57.9	1.7	10.9	21.0	24.8	31.3	53.6	525.1
2010	92.5	152.8	166.9	10.3	21.7	25.3	126.1	54.2	81.4	149.7	153.8	61.6	1096.3
2011	3.2	25.0	18.0	6.9	72.1	43.0	31.6	87.0	7.9	21.1	56.3	50.9	423.0
2012	24.8	27.6	62.3	354.0	27.0	3.4	0.0	19.0	7.6	41.4	612.8	171.5	1351.4
2013	6.4	29.6	45.8	46.4	66.0	51.2	28.4	24.9	35.0	88.2	18.2	4.4	444.5
2014	7.7	1.5	67.4	10.2	27.5	1.3	29.6	86.3	15.9	50.5	243.4	22.6	563.9
2015	167.1	46.1	14.9	1.0	110.2	9.7	6.1	12.5	7.4	114.0	3.8	0.8	493.6
2016	48.7	162.9	5.1	96.5	231.6	20.1	18.0	27.7	9.9	172.9	547.5	90.1	1431.0
2017	61.1	26.4	85.7	55.2	66.3	5.9	71.8	43.0	186.9	13.5	146.5	63.9	826.2
2018	83.7	28.0	26.5	0.0	37.7	0.5	2.1	32.6	18.5	45.4	113.6	8.1	396.7
2019	5.9	21.1	17.3	16.5	18.7	29.9	0.0	0.0	119.0	13.5	4.7	1.4	248.0
2020	22.6	19.7	15.2	2.5	31.0	1.5	32.8	24.9	13.7	-	-	-	163.9
2021	11.4	49.2	22.7	16.1	6.6	2.0	4.7	0.0	0.0	99.0	66.4	49.9	328.0
2022	207.9	20.8	94.9	5.8	3.0	0.0	2.1	-	-	-	-	-	

Source: ONAMET 2022.

In the Table 6-24 presents a summary of the processing of the available series.

Table 6-24. Summary of interannual monthly rainfall accumulated (mm).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Max.	269.1	162.9	166.9	354.0	231.6	106.2	126.1	87.0	186.9	300.2	612.8	171.5	-
Min.	1.2	0.4	2.1	0.0	3.0	0.0	0.0	0.0	0.0	3.9	0.7	0.8	-
Prom.	66.9	42.7	55.0	50.4	59.4	29.1	14.6	28.8	41.6	65.1	109.8	55.4	609.1

Source: Elaborated by EMPACA.

As additional data, according to the information of the mean annual rainfall isohyets map for the Dominican Republic, the average for the territory where the project is located is less than 800 mm (Figure 6-12).

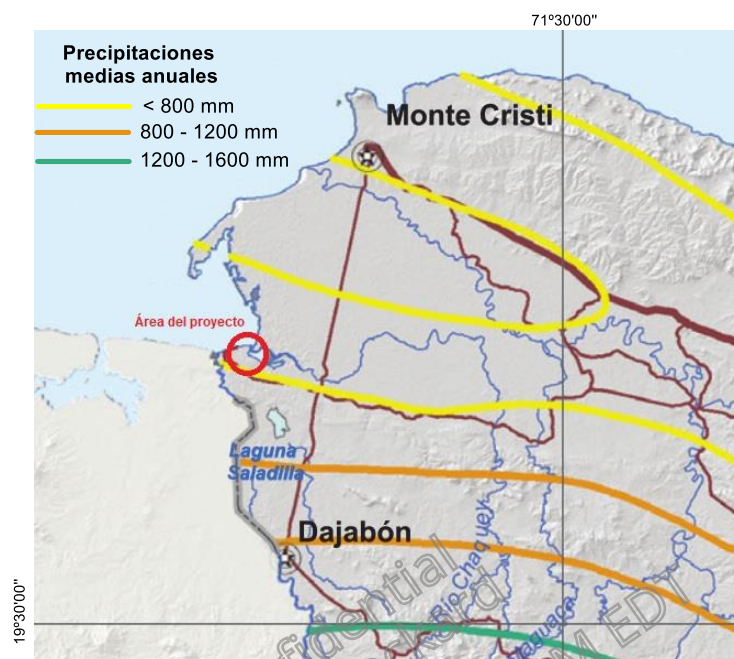


Figure 6-12. Isohyets map of mean annual precipitation (mm) in the region.

Source: Atlas MIMARENA 2012

6.1.7.8 Maximum rainfall

Using the same ONAMET station source with maximum daily rainfall data for 40 years with 10 years missing (years 1981-2020), in the Table 6-25 shows the maximum daily rainfall by month for the years of observation.

Table 6-25. Maximum 24-hour rainfall values in mm, by month, recorded at Monte Cristi Station (1981-2020).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Set	Oct	Nov	Dec	Pmax24
1981	15.2	58.7	48.8	37.6	19.8	11.7	3.8	4.6	19.4	8.3	28.2	32.7	58.7
1982	5.6	2.0	1.8	11.3	49.0	1.0	9.3	5.7	16.0	57.5	41.2	27.5	57.5
1983	16.6	3.8	7.7	5.6	60.7	48.0	2.6	20.0	26.0	19.0	4.5	33.4	60.7
1984	24.6	6.8	18.8	40.7	13.2	18.6	0.9	7.5	11.3	32.1	30.5	9.8	40.7
1985	23.5	83.5	46.5	22.5	43.3	18.0	2.8	25.2	8.0	18.2	91.3	16.0	91.3
1986	50.5	8.5	82.9	47.4	6.6	28.5	0.3	2.9	1.5	8.4	33.8	2.5	82.9
1987	107.2	27.2	14.6	33.4	39.2	31.6	7.7	2.3	81.0	32.7	23.5	41.2	107.2
1988	101.0	14.3	4.2	3.5	25.7	21.5	1.6	43.3	19.2	22.3	1.4	19.2	101.0
1989	9.2	34.9	8.4	2.3	7.2	22.3	0.1	29.6	3.2	12.9	25.9	106.2	106.2
1990	11.2	19.8	21.0	53.3	2.9	11.6	8.0	19.7	2.8	65.8	24.1	41.1	65.8
1991	0.8	8.5	32.2	-	16.8	2.6	6.0	29.7	30.7	3.1	53.3	22.0	53.3
1992	6.9	4.5	64.3	50.0	35.5	30.4	3.8	11.1	11.6	17.0	0.5	20.2	64.3

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Set	Oct	Nov	Dec	Pmax24
1993	8.9	24.3	18.7	60.0	24.4	1.8	2.7	0.8	4.0	10.0	10.2	6.7	60.0
1994	121.7	3.5	50.0	3.7	22.7	-	0.2	1.8	66.5	6.3	-	23.9	121.7
1995	4.9	-	-	-	-	38.5	-	-	-	-	-	-	38.5
2006	-	-	-	-	-	-	-	-	-	-	35.9	14.3	35.9
2007	16.6	29.6	67.0	5.7	66.4	40.5	-	39.9	-	47.5	79.9	31.1	79.9
2008	15.5	0.2	12.4	7.4	15.0	15.9	2.6	6.3	69.2	34.4	23.4	13.4	69.2
2009	18.8	38.2	51.2	18.8	9.9	25.3	1.4	8.9	10.8	12	17.9	15.4	51.2
2010	30.3	98.2	79.4	3.7	7.3	13.9	68.4	40.3	33.8	45.6	42.3	21.6	98.2
2011	2	19.4	6.8	4.5	25.9	26	23.2	40.3	3.8	8.1	43.4	11.7	43.4
2012	8.6	14	24.6	126.9	13.2	2.2	-	6.5	6.8	14.6	255.2	73.9	255.2
2013	3.3	13.9	21.8	24.6	34.8	26.3	9.7	23.9	21.6	60.7	15.7	3	60.7
2014	6.9	1.5	38.9	7.4	15.5	1.3	13.5	56.4	8.3	32.5	143.5	10.7	143.5
2015	62.2	18.3	10.5	1	105.4	3.3	4.6	10.2	3.6	72.4	3	0.8	105.4
2016	14.4	87.2	2	66	96.5	14	6.6	14.3	4.1	58.7	77.2	29.3	96.5
2017	30.2	20.3	24.1	25.9	19.6	5.1	69.5	28.2	99.6	10.7	107.2	29.4	107.2
2018	21.2	8.4	12.4	-	18.1	0.5	2.1	17.3	10	27.9	69.1	8.1	69.1
2019	5.6	8.9	10.2	16.5	14.7	25.6	-	-	69.6	10.4	47.9	40.1	69.6
2020	9.4	10.4	8.2	2.5	23.4	1.5	11.4	14.9	9.4	-	-	-	23.4

Source: ONAMET 2022.

Based on the data analyzed, in Table 6-26 the statistical values of the series are detailed, and the histogram of the hyperannual behavior of these values of maximum rainfall in 24 hours (Figure 6-13).

Table 6-26. Statistical summary of daily maximum rainfall characteristics for the observation time of the Montecristi station (ONAMET).

Statistical parameters	Montecristi	
	Pmax24hr	Log(Pmax24hr)
Number of data, N =	30	30
Sum, mm =	2418.2	55.735
Maximum value, mm =	255.2	2.407
Minimum value, mm =	23.4	1.369
Mean, mm =	80.6	1.858
Variance =	1884.2	0.042
Standard Deviation, mm =	43.4	0.205
Variation Coefficient =	0.539	0.111
Bias Coefficient =	2.330	0.141

Source: Elaborated by EMPACA based on ONAMET 2022.

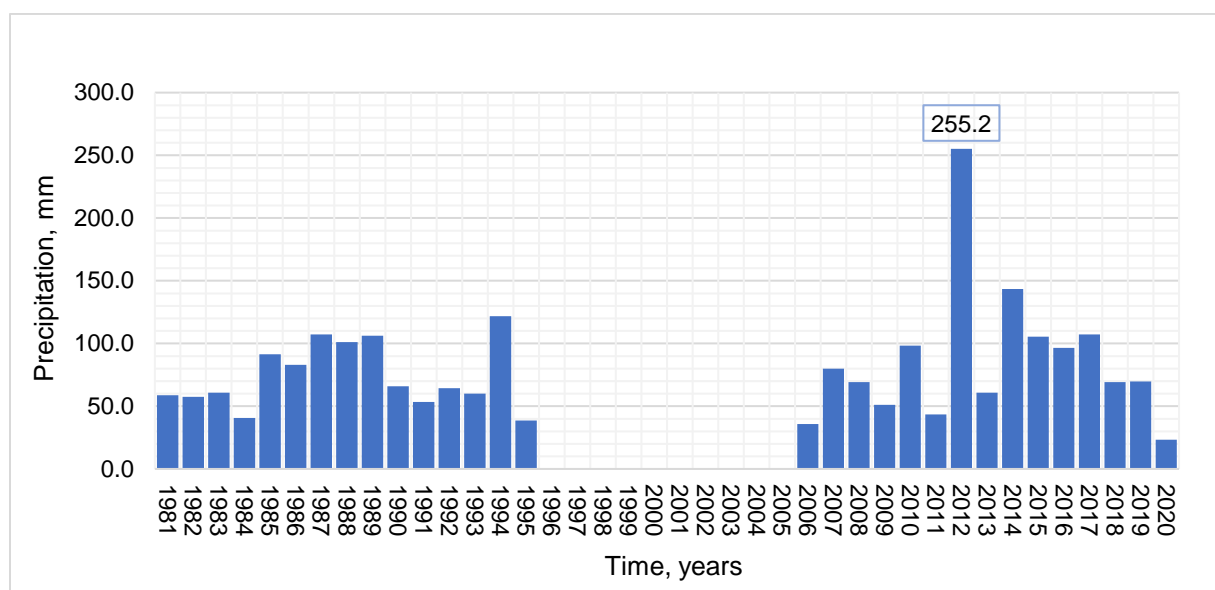


Figure 6-13. Distribution of rainfall (24-hour maximum in mm) recorded at Monte Cristi Station (1981-2020).

Source: Elaborated by EMPACA based on ONAMET 2022.

In the analysis of the distribution of maximum rainfall in 24 hours, it was verified by literature review that the maximum extreme record of 255.2 mm, occurred as a result of a stationary frontal system in November 2012, so it was considered in the processing.

With the file references corresponding to the maximum daily rainfall (24 hours) and the return periods in years, we obtained the probability curve (Table 6-27 y Figure 6-14), according to the theoretical distributions of best fit GEV-Max (Kappa specified), with an acceptance correlation of 99.49% (Smirnov-Kolgomorov test) and higher than 71% (Chi-Square test), in accordance with the goodness of fit tests applied.

Table 6-27. Summary of maximum daily rainfall (mm) for each return period analyzed (years).

Return period (T), years	Maximum daily rainfall (Pmax), mm	Excess hydrological probability (P), %
2	70.72	50.00
5	105.30	20.00
10	131.64	10.00
25	169.46	4.00
50	201.21	2.00
100	236.20	1.00

Source: Elaborated by ONAMET and EMPACA

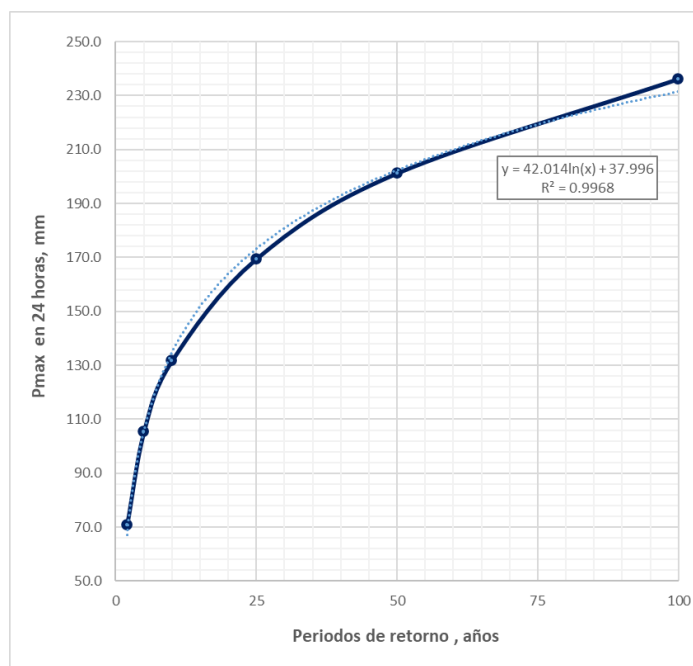


Figure 6-14. Probability plot (%) of daily maximum rainfall (Pmax) at the reference station.

Source: Elaborated by EMPACA based on ONAMET 2022.

It is important to consider that these maximum daily rainfall values in the region are associated with extreme weather events or hurricanes that hit the northern region of the country.

Thus, in the Figure 6-15 shows the IDF (intensity-duration-frequency) curves, calculated for return times of 2, 50 and 100 years.

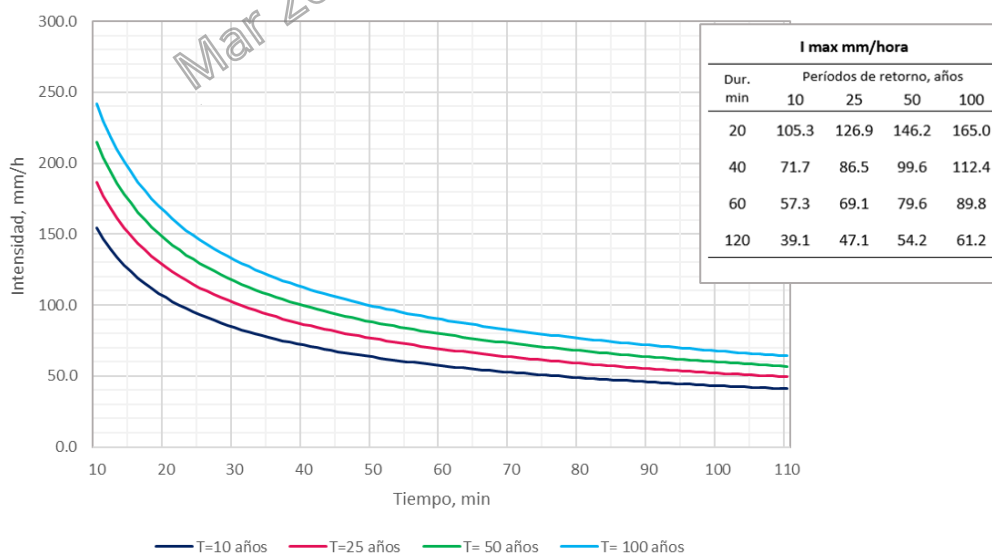


Figure 6-15. Graph of IDF curves for different return periods T

Source: Elaborated by EMPACA based on ONAMET 2022.

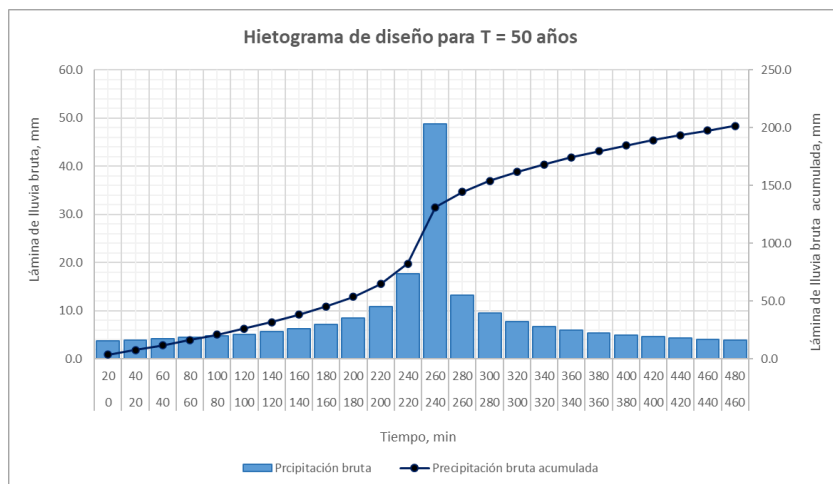
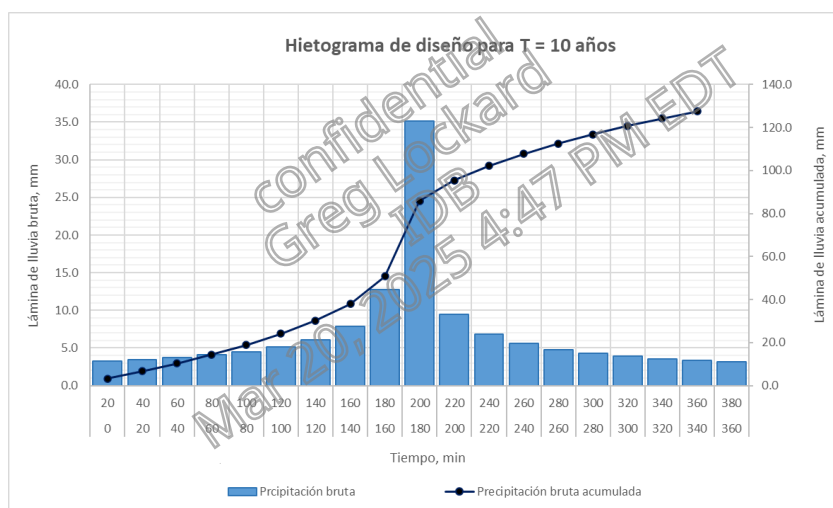
With the above processing of average rainfall and maximum 24-hour rainfall, all the calculation variables are available for the design of any drainage and/or storm drainage way.

In the Table 6-28 summarizes the results of the maximum 24-hour rainfall (Pmax), duration (D) and maximum intensity (Imax) for the return periods analyzed, and Figure 6-16 summarizes the results of the maximum 24-hour rainfall (Pmax), duration (D) and maximum intensity (Imax) for the return periods analyzed. the design hyetograms are presented in Figure 6-16.

Table 6-28. Daily maximum rainfall values, duration and intensity for each return period.

Return periods, years	Maximum rainfall (Pmax) mm	Duration, hours	Maximum intensity, (mm/h)
10	131.64	6:20	105.3
50	201.21	8:00	146.2
100	236.20	8:40	165.0

Source: Elaborated by EMPACA based on ONAMET 2022.



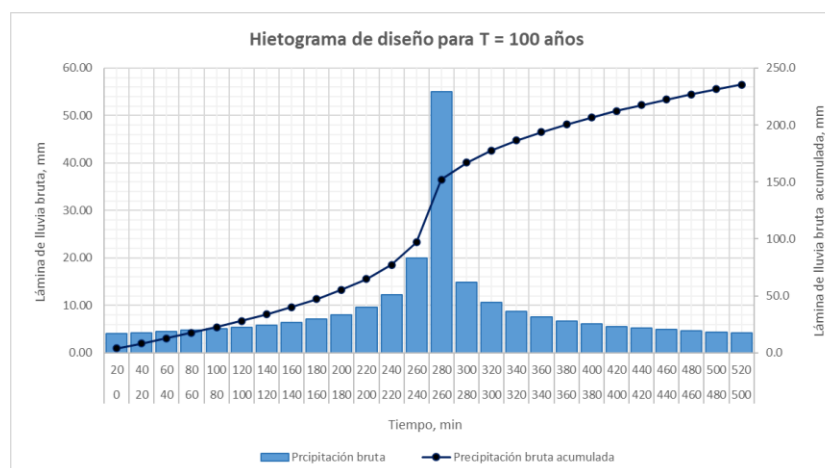


Figure 6-16. Distribution of the design hietogram for the analyzed return periods.

Source: Elaborated by EMPACA based on ONAMET 2022.

6.1.7.9 Cyclones and hurricanes

Although statistics cannot always fully express the characteristics of extreme hydrometeorological events, it is important to consider that hurricanes are precisely the main cause of very intense rainfall episodes, when the highest accumulations are recorded, with a very low return period, which can be every year.

To express this usual behavior for the region we have used information from records related to cyclones developed in the North Atlantic from 1851 to 2021, and taken from several websites, including the National Hurricane Center (NHC), *Stormpulse*, *StormCarib*, Cuba's INSTMET and the website <https://agricultura.gob.do> (Table 6-29).

Table 6-29. Cyclones that have hit the Dominican Republic during the period 1950 - 2021, after implementing the naming of names for each event.

Nº	Cyclone	Date	Nº	Cyclone	Date	Nº	Cyclone	Date
1	BAKER	Aug. /24/1950	22	FREDERIC	Set /5/1979	43	FAY	Aug /16/2008
2	CHARLIE	Aug. /17/1951	23	ALLEN	Aug. /5/1980	44	GUSTAV	Aug. /26/2008
3	CHARLIE	Set /23/1952	24	GERT	Set /9/1981	45	IKE	Set /3/2008
4	DOLLY	Set /8/1953	25	DEBBY	Set /13/1982	46	HENRI	Oct. /11/2009
5	HILDA	Set /13/1955	26	LILI	Dec. /24/1984	47	EMILY	Aug /3/2011
6	KATIE	Oct. /17/1955	27	ISABEL	Oct. /10/1985	48	IRENE	Aug /23/2011
7	BETSY	Aug. /12/1956	28	EMILY	Sept. /9/1987	49	ISAAC	Aug /24/2012
8	SHE	Aug. /31/1958	29	CHRIS	Aug. /25/1988	50	CHANTAL	Jul /10/2013
9	GERDA	Set /14/1958	30	CINDY	Aug. /16/1993	51	GABRIELLE	Set /5/2013
10	GRACIE	Oct. /21/1959	31	HORTENSE	Set /10/1996	52	BERTHA	Aug /2/2014
11	FLORENCE	Set /18/1960	32	GEORGES	Sept. /22/1998	53	ERIKA	Aug /28/2015
12	FRENCH	Oct. /3/1961	33	DEBBY	Aug /23/2000	54	MATTHEW	Oct /10/2016

Nº	Cyclone	Date	Nº	Cyclone	Date	Nº	Cyclone	Date
13	EDITH	Set. /27/1963	34	HELENE	Set /18/2000	55	HARVEY	Aug /19/2017
14	FLORA	Oct. /3/1963	35	IRIS	Oct. /6/2001	56	IRMA	Set /7/2017
15	CLEO	Aug. /24/1964	36	MINDY	Oct. /10/2003	57	MARIA	Set /21/2017
16	INEZ	Sept. /29/1966	37	ODETTE	Dec. /6/2003	58	ISAIAS	Jul. /30/2020
17	BEULAH	Set /10-11/1967	38	JEANNE	Set /16/2004	59	LAURA	Aug. /22-23/2020
18	FIFI	Set /15/1974	39	ALPHA	Oct. /22-23/2005	60	ELSA	July/3/2021
19	ELOISA	Set /16-17/1975	40	DEAN	Aug /18/2007	61	FRED	Aug /11/2021
20	CLAUDETTE	Jul. /17/1979	41	NOEL	Oct. /28/2007	62	GRACE	Aug /16/2021
21	DAVID	Aug. /31/1979	42	OLGA	Dec. /12/2007			

Source: <https://agricultura.gob.do> and EMPACA processing

The processing of the data shows the increase in the occurrence of the events, i.e., the trend towards an increase in the number of cyclones in each season, most of which cross the Caribbean and therefore Hispaniola (Figure 6-17).

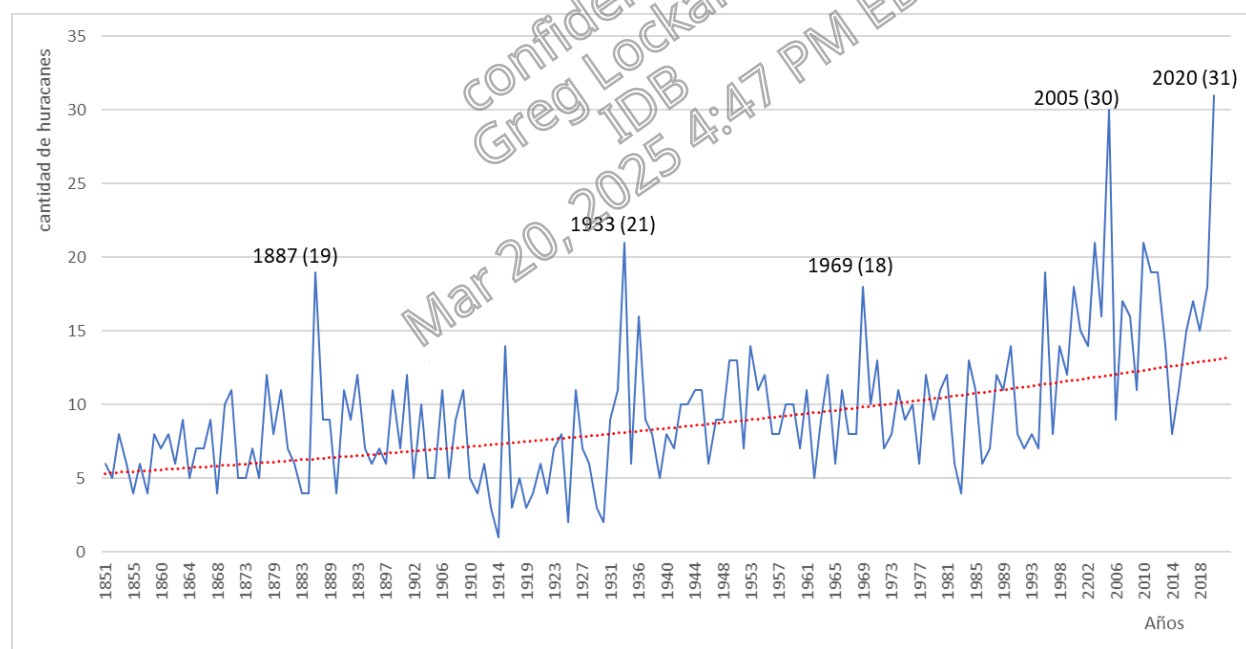


Figure 6-17. Trend of increasing cyclone numbers by decade, over the period 1851-2020, in the North Atlantic (named cyclones).

Considering that the Dominican Republic, due to its position in the Western Caribbean (according to the *Caribbean Hurricane Network* zoning), is hit by tropical storms every year, it is important to describe the regional dynamics of these meteorological events.

Based on a data of hurricanes and storms that occurred between 1851 and 2019, it can be seen that the greatest possibility of a tropical cyclone affecting the territory is in the month of September, followed by August and October. According to archival data provided by NOAA's *National Hurricane Center*, the region has been hit by more than 40 extreme weather events between the last 168 years (1851-2019), considering those that have directly affected the territory (Table 6-30).

Table 6-30. Distribution of meteorological events by category for the northern region.

Category of events	In the north of the country, registered at the Puerto Plata station
All events	43
Tropical storms	30
Hurricanes 1	6
Hurricanes 2	2
Hurricanes 3	2
Hurricanes 4	2
Hurricanes 5	1

Source: Caribbean Hurricane Network Zoning

According to statistics, the 2005 hurricane season was characterized by the formation of 30 meteorological events that hit the Caribbean, although only storm Alpha affected Dominican territory. This season was the most active since 1931, which showed a return period in the order of 80 years.

In the 2020 season, there was a record number of extreme events with 31. Likewise, 31 tropical depressions and 30 storms were recorded, also a historic record for the Caribbean. With respect to hurricanes, 13 events were reported, 6 of which reached the category of major hurricanes.

In terms of regional extreme storms, which are interpreted as events that can cause rainfall in the study area or the region, they should be considered as an affectation with high hydrological probabilities, meaning return periods of less than 5 years.

6.1.8 Hydrology and hydrogeology

6.1.8.1 Surface Hydrology

The study area has its coastal front in a stretch of 980 m on the inner coast of Manzanillo Bay, in addition to 700 m to the east towards the inland waters of Estero Balsa and is not directly related to any hydrological basin of rivers in the region. However, its local hydrodynamic condition is not only influenced by its location, but also by the anthropic modifications in the periphery, where the following stand out:

- The facilities of the Port of Manzanillo to the west, built in the 1940s,
- The artificial embankment to the east, compacted, with a single culvert for the exchange of the mangrove with the sea, built in the 70s of the twentieth century,
- Earth movements on the surface of the southern rocky massifs, which have modified their relief and therefore the dynamics of surface runoff and the quality of the rainwater that flows into the low plains.

Thus, in the sector within the project identified as low, flooded marshland, the surface hydrodynamics have been transformed, establishing very unfavorable conditions of high sedimentation and deterioration of the physicochemical properties of the surface waters. These conditions apparently affected the existing mangrove forest in an area of about 20% of the total area of the flooded sector. According to *Google Earth's* historical images service, the mangrove has been affected since 2015, with no evidence of conditions conducive to its recovery (Photos 32 and 33 in Annex 11).

Regardless of these conditions of very limited hydrodynamics in the low plain sector within the project area, and the critical exchange with the sea, other important water elements have been identified in this southwestern region of the province of Manzanillo whose contribution to the study area is very low.

Thus, from a regional point of view, the most important hydrological elements are the Yaque del Norte River, more than 16 km to the NE of the study area, the Chacuey River 4.0 km to the east, and the Masacre River 1.7 km to the west. In the case of the first two rivers, their mouths correspond to low alluvial plains with mangroves, salt marshes and flood conditions.

Considering this regional scenario, in the Figure 6-18 shows the distribution of these main river currents with respect to the study area, where mangrove cover and accumulation of marine sediments can be seen throughout the mouth of the Chacuey River.



Figure 6-18. Regional distribution scheme of the main rivers and their mouths with respect to the project area.

Source: EMPACA, 2023 based on Google Earth image.

Thus, it has been considered that due to the distance to the Yaque del Norte River and the regional marine dynamics, this river current has no relationship with the project area.

In the regional scenario, the main morphometric and hydrometric characteristics of the hydrological basins of the Chacuey and Masacre rivers are described. For the respective characterizations, two calculation closures C1 and C2 were established, at the mouths of both rivers (Table 6-31 y Table 6-32 and Map 10 in Annex 6 Regional Hydrological Map).

Table 6-31. Location of calculation closures at the mouths of the Masacre and Chacuey rivers.

Calculation closures	UTM coordinates		Description
	X	Y	
C1	210913	2180787	Mouth of the Masacre River, west of the project area and the Port facilities.
C2	214375	2180133	Mouth of the Chacuey River, east of the project area.

Table 6-32. Morphometric and hydrometric parameters of the hydrological basins of the Masacre and Chacuey rivers.

Watersheds	Area, (km) ²	Perimeter, (km)	Average slope, (%)	Average slope (m/m)	Difference in dimensions, (m)
Rio Masacre	740.9	174.0	6.32	0.063	1223.0
Chacuey River	352.2	108.1	11.21	0.112	806.0

Watersheds	Length of drainage network, (km)	Drainage network elevation difference, (km)	Average slope drainage network (%)
Rio Masacre	70.1	422.0	0.60
Chacuey River	63.8	688.0	1.07

Watersheds	Tc Kirpich, (min)	Effective intensity (mm/h)			Maximum flow rates, (m ³ /s) Hydrometry by HEC-HMS		
		T=10 years	T=50 years	T=100 years	T=10 years	T=50 years	T=100 years
Rio Masacre	771.2	14.0	19.4	22.3	504.9	1116.6	1460.5
Chacuey River	573.5	16.4	22.8	26.3	436.7	858.8	1089.0

tc- time of concentration in minutes, **Effective intensity**- Maximum effective intensity in mm/h and Maximum flow rates in m³/s.

Source: Elaborated by EMPACA 2022

The results of the above table summarize the maximum flows that will drain in the different calculation closures, which coincide with the outflows to the sea. It is evident that, due to the volume calculated, during river floods there are significant changes in the respective areas of mixing with seawater, which in many cases will have an unfavorable influence due to turbidity and floating solids.

Under these fluvial conditions, it is important to take into account the solid runoff provided by these fluvial currents, referring to the amount of materials and sediments that the current can carry during a certain time, conditioning it to the processes of mechanical erosion on the

sediments and soils by the action of surface waters, and by chemical erosion, mainly by groundwater. Thus, almost all the sediment mass comes from the surface of the river basins, although the turbulence of the current creates point forces capable of removing soil particles from the bed and banks of the channel.

Under these criteria, it has been considered that the solid contribution of the Chacuey River has no direct influence on the marine coastal environment of the project, mainly due to the large extension of mangroves and coastal vegetation that covers more than 30 km at its mouth, in addition to being a scenario with predominantly sediment deposition conditions. Likewise, the marine dynamics in the area are very slow, inland waters.

However, sediment input from the Masacre River is more significant over the project because of its discharge location to the west and open ocean conditions (C1 calculation closure at the mouth to the sea). This volume of solid input represents a highly variable expression as a result of the difficulties of quantification without direct measurements, the temporal variability of hydrologic processes, and changes in land management practices in the watershed from year to year.

Based on the morphometric and hydrometric parameters of the watershed that were discussed earlier in Table 6-32, the following table shows that the hydrological parameters of the watershed are not available. Table 6-32, highlighting the total area of the watershed, average and maximum flood flows, liquid runoff modulus, surface water turbidity, and volumetric particle weight, it is concluded that sediment production is of the order of 78036.1 m³/year.

As a reference, during the days of the field survey in the area, carried out for the Block 01 project, there was an intense rainfall event, without reaching significant accumulations, but which nevertheless caused river flooding in the Masacre and Chacuey rivers. This hydrological situation could be observed in the coastal-marine scenario of the project area, where the highest turbidity of the marine waters was recorded in the sectors west of the Port's dock, which evidently acted as a barrier to the dispersion of the suspended sediment plume discharged into the sea by the Masacre River (Photo 34 in Annex 11). Likewise, it was observed how in the eastern sector of the coastal front, in the channel of exchange of Estero Balsa with the open sea, this plume was not dispersed by the temporary discharge current of all this inland sea territory, with no appreciable turbidity indicators (Photo 35 in Annex 11).

As described above, in the physical setting of the study area there is no defined fluvial stream or rainfall concentration pathway that can form extreme flood flows at times of heavy rainfall. However, the low floodplain or marsh functions as a receiving body for the low runoff that forms from the higher massifs to the south and from the Port facilities to the west.

In general terms, the morphologies described, presented in the morphological profile of the Figure 6-5 in epigraph 6.1.3 Topography, represent this criterion on rainfall surface runoff, which is also very scarce due to the rainfall regime in the region.

Thus, in order to determine the local hydrodynamics, the low plain or marsh has been considered as a small water basin with poor drainage due to its flat surface, where critical flood flows will not be formed, but rather accumulations of rainfall volumes, which will temporarily modify the permanent flood levels. This hydrological condition will be significantly influenced by the dynamics of the tidal regime, which will be reflected by a single culvert that exchanges with the sea. In the Figure 6-19 shows a basic hydrological scheme from which the hydrometric parameters were calculated.



Figure 6-19. Local hydrological scheme of hydrometric calculation basis.

Source: Elaborated by EMPACA 2022

In the Table 6-33 describes the morphometric and hydrometric parameters of the river basin, as reference values in the design of the project works.

Table 6-33. Morphometric and hydrometric parameters of the watershed.

Basin area, (km ²)	Flooded area, (km ²)	Slope of perimeter escarpments, (%)	Maximum rainfall 24 hours (P=1%), (mm)	Maximum accumulated rainfall sheet for P=1%, (m)
0.50	0.40	< 4.0	237	0.30

Source: Elaborated by EMPACA

Considering the closed basin, under conditions of an extreme precipitation with a 1% probability (100-year return period), it has been estimated that the flood sheet that could accumulate above the permanent surface water level of the flooded sector could reach 0.3 m. It is evident that this calculation has not estimated the effects that could occur in a critical scenario of sea level rise.

It is evident in this extreme hydrodynamic scheme, when considering the existing culvert as the only way of exchange with the sea (Photo 36 in Annex 11), that there will be a delay in the discharge of the accumulated waters, very dependent on the tide levels and the marine dynamics due to the storm.

Likewise, it has been considered that the subsurface or subsurface exchange with the sea does not vary significantly for extreme conditions of water accumulation, but neither will it additionally favor the drainage of the low plain.

According to the results described in Table 6-33, these levels of accumulated surface water for extreme conditions should be considered in the design of linear works that cross flooded sites. It is important that the design of works consider the non-interruption of shallow surface hydrodynamics and the fragmentation of space.

Of the group of samples taken from the marine and surface waters in the project scenario, two of them correspond to the terrestrial scenario as they are surface waters accumulated in the low marsh of the low, flooded plain. The results of these samples were used to characterize the chemistry of these waters, which are different from the marine waters in the coastal scenario of the project (Table 6-34, Photo 37 and 38 in Annex 11; Annex 6: Location map of surface and marine water sampling stations and Annex 10.10: Laboratory report of surface and marine water parameters). *In situ* measurements of physicochemical characterization parameters were performed at each point.

Table 6-34. Physicochemical parameters of surface water at the measurement points.

Parameters	Unit of measure	WE-3, Acuatorios in the low, flooded coastal plain in the project area.		WE-9, Culvert pass to inland wetland in low, flooded plain.		Environmental Standard NA-CASC-2012*.
		UTM X: 212906	UTM Y: 2181092	UTM X: 213212	UTM Y: 2180923	
pH	--	8.90		7.82		6.5-8.5
Water temperature	°C	36.5		23.8		--
Electrical conductivity.	µS/cm	78400		61000		--
Total dissolved solids	mg/l	50000		37100		1000
Dissolved oxygen	mg/l	5.43		6.63		--
Oxygen saturation	%	63.4		83.2		> 70
Turbidity	NTU	2.83		4.98		--
Total suspended solids	mg/l	12.6		16.0		--
Total solids	mg/l	50013		37116		--

Parameters	Unit of measure	WE-3, Acuatorios in the low, flooded coastal plain in the project area.		WE-9, Culvert pass to inland wetland in low, flooded plain.		Environmental Standard NA-CASC-2012*.
		UTM X: 212906	UTM Y: 2181092	UTM X: 213212	UTM Y: 2180923	
Chloride	mg/l	8500		5680		250
Chlorine residual	mg/l	0.00		0.00		--
Biological Oxygen Demand (BOD) ₅	mg/l	8.0		--		5.0
Chemical Oxygen Demand (COD)	mg/l	69.0		--		--
Oils and fats	mg/l	< 1.4		--		1.0
Total hydrocarbons	mg/l	< 0.875		--		--
Total coliforms.	mg/l	15		--		1000
Fecal coliforms		< 1.8		--		1000
Total phosphorus.	mg/l	< 0.02		--		0.025
Total nitrogen.	mg/l	0.80		--		--
Total cadmium	mg/l	< 0.001		--		0.005
Total cobalt	mg/l	0.003		--		0.20
Total Chromium	mg/l	< 0.005		--		0.05
Total copper	mg/l	0.00907		--		0.20
Total iron	mg/l	0.349		--		0.30
Total nickel	mg/l	< 0.003		--		0.10
Total lead	mg/l	< 0.002		--		0.05
Total vanadium	mg/l	< 0.007		--		0.10
Total zinc	mg/l	< 0.008		--		0.05

* Environmental quality standard for surface and coastal waters, for class B surface waters.

Source: EqLab and EMPACA laboratory reports.

These surface waters in their current condition have been classified as class B surface waters according to the Environmental Quality Standard for surface and coastal waters of the Dominican Republic, considering their extreme condition of confinement due to anthropic modifications, with no supply or recreational uses, and without any conservation or management criteria that would favor their improvement as coastal aquariums. Likewise, these are not surface waters that have been categorized for the preservation of flora and fauna habitat, regardless of whether local management plans and improvements in hydrodynamics are established in the future, which could then argue for conditions to be classified with more restrictive quality requirements.

From these results it is evident that the surface waters accumulated in the marsh have a very high mineralization and temperature, with variable concentrations of dissolved oxygen depending on the sector where they accumulate. In general, the tendency is towards oxygen supersaturation in periods of low dynamics and little external contribution in sectors farther from the coast and

with no exchange, while low concentrations predominate in periods of greater pluvial contribution towards the intermediate sectors in relation to the sites of greater exchange with marine waters. In general, it has been considered that this sector is dominated by an oxidizing environment, aggressive to metallic and concrete structures.

The results of the physicochemical parameters of these waters sampled in the plain were compared with the parameters of the marine waters of the marine coastal scenario of Manzanillo Bay and Estero Balsa, sampled during the field campaigns and which are detailed in section 6.1.14 Oceanographic studies.

From this comparison, several criteria on local hydrodynamics and hydrochemistry were obtained, which are very important from the point of view of characterizing the existing conditions in the area:

1. The waters that flow into the aquariums of the lower lagoon due to the effect of high tide, through the only free circulation route (existing culvert), identified as sample WE-9, have physicochemical parameters very much in accordance with the conditions of the rest of the marine waters sampled.
2. Once these flowing waters are dispersed in the low marshes of the plain, they tend to modify their hydrochemistry acquiring the conditions of high mineralization, and elevated temperature.
3. These low hydrodynamic conditions in the plain aquifers cause a tendency to low dissolved oxygen values (sample WE-3), and an increase in BOD₅, COD, total nitrogen concentrations and organic matter percentages with respect to the marine waters of the coastal environment. Some of these physicochemical parameters report non-compliance with the requirements of the Environmental Standard for surface and coastal water quality (NA-CASC-2012), for class B surface waters (Table 6-34).

Thus, we can summarize a very notable difference in terms of the mineralization of the accumulated waters, which also reach temperatures up to 7 °C higher than the surrounding marine waters (Annex 10.10: Surface water laboratory reports).

In the design of the project works, the physicochemical parameters of the waters must be considered, as patterns of levels of aggressiveness of the environment. Likewise, it is important to consider the marine aerosols with a high dispersion throughout the project area, and whose physicochemical composition tends to be of high salinity.

6.1.8.1 Hydrogeology

According to the hydrogeological zoning of the Dominican Republic, at regional scale, based on INDRHI's Hydrogeological Map 1:250000 (Figure 6-20), aquifers formed in Quaternary sediments and terrigenous rocks are distributed in the areas of the river basins and their flood valleys.

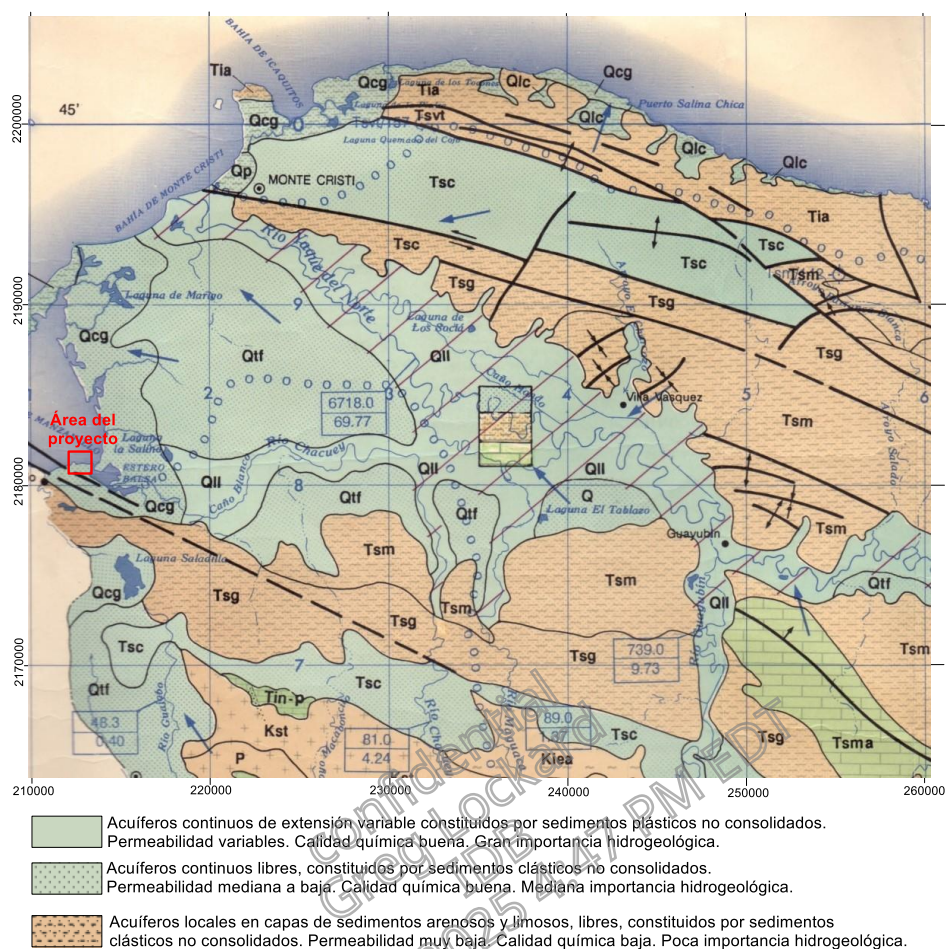


Figure 6-20. Regional hydrogeological map.

Source: Hydrogeological map of the Dominican Republic 1:250000, and EMPACA processing.

This first analysis at the regional scale suggests a very well-marked zonation between the regional aquifers present in the study area.

Thus, continuous aquifers in clayey and silty sediments that predominate in the fluvial plains of streams and rivers (QII), which may represent hydrogeological interest for local supplies of land with agricultural vocation.

However, in the scenario of the study area, aquifers are classified in accumulated sediments that form swamps and low marshes (Qcg), where higher salinity values predominate. The hydrogeological interest of these aquifers is very specific, due to sites of preferential circulation of better quality fluvial-pluvial surface waters.

Towards the sectors of the middle plain, where terrigenous and carbonate-terrigenous (Tsg) materials lie, general aquifer conditions predominate in low permeability rocks, with low productivity. It is important to note that within these zones of low permeability rocks there may be groundwater catchment works of medium productivity in very specific conditions of subway hydrodynamics related to faults and discontinuities of the massif.

From a more detailed hydrogeological point of view regarding the study area, the location of wells near the project area was not recorded, nor groundwater emergences. In the project area, the thickness of the unsaturated zone is about 15-16 m, in the southern elevated massifs of the La Isabela geological formation, with the influence of marine waters due to the altimetric relationship of the territory with the sea, the influence of marine aerosols, tidal levels and low rainfall. In the low plain it is evident that the normal flood levels coincide with the sea level and are directly related to the tide levels.

Further south, towards the rock massifs of the Gurabo geological formation (Annex 6: Regional geological map), there is a description of carbonate-terrigenous rocks that coincide with the aquifers in low permeability rocks identified on a regional scale.

In the eastern sector of the town of Pepillo Salcedo, about 1.12 km west of the project area, a well (well PP) was located, used for irrigation of private agricultural plots in the surrounding area (Photo 39 in Annex 11).

According to measurements from a well in Pepillo Salcedo, the groundwater table is of the order of 3.0-3.5 m deep, with a water column of 7.0 m and is exploited daily with a flow rate of 18 gpm for irrigation of small agricultural plots within the urbanized area. The mineralization measured *in situ* is moderate at 1.3 g/l, with acceptable hydrodynamics. Table 6-35 shows the UTM coordinates of the PP well location and the physicochemical parameters measured for the groundwater.

Table 6-35. UTM coordinates of PP well location and physicochemical parameters of groundwater.

Parameters	Unit of measure	Groundwater in well PP		Standard Environmental
		Coordinate UTM X: 211962	Coordinate UTM X: 2180638	
pH	-	7.33		--
Water temperature.	°C	29.6		--
Electrical conductivity.	µS/cm	2760		--
Total dissolved solids.	mg/l	1341		--
Dissolved oxygen.	mg/l	5.26		--
Oxygen saturation.	%	66.6		--
Turbidity.	NTU	0.63		--
Total suspended solids.	mg/l	< 8.0		--
Nitrate	mg/l	10.7		10
Chloride	mg/l	220.1		--
Chlorine residual	mg/l	0.00		--

* Environmental standard on groundwater quality and subsoil discharges, class B.

Source: EMPACA laboratory reports

The quality of this groundwater is compared to the permissible limits of the Environmental Standard on groundwater quality and subsoil discharges, class B, in a low vulnerability aquifer due to its location in an urbanized area with no liquid waste collection or treatment system.

For these waters, although the zone is far from the project area, the low concentration of dissolved oxygen is appreciable, which may be related to the bacteriological condition, and the concentration of nitrate reflects the agricultural activity that contributes nutrients to the groundwater, in addition to other possible local sources.

It is considered that, towards the project area, the influence of marine waters in the aquifer interface zone may be greater and have an impact on groundwater mineralization, and there are also urbanized sectors on the eastern and southeastern borders without liquid waste collection, where there is also a notable presence of small livestock corrals.

6.1.9 Air Quality

Nine air quality measurement points were established for the study area, distributed to cover the project area and the route of the 345 kV transmission line, especially the adjacent urbanized sectors and sectors of the town of Pepillo Salcedo. The factors analyzed were the concentrations of combustion gases under immission conditions (carbon monoxide CO, ozone O₃, nitrogen dioxide NO₂, sulfur dioxide SO₂, non-methane hydrocarbons HCNM, volatile compounds TVOC, formaldehyde HCHO and carbon dioxide CO₂) and the concentrations of particulate matter in the air (PM 2.5, PM 10.0 and total suspended particles). Meteorological variables were measured at each point at the time of the environmental factor measurements.

Concentration of air quality standards in immission conditions (combustion gases and particulate matter).

The results of measurements of particulate matter concentrations, as air quality standards, are presented in Table 6-36. Table 6-36 and in Annex 10.5 the measurement reports and primary calculations are attached (see photos 40 and 41 in Annex 11, in Annex 10.4 the field sheets of measurements of particulate matter concentrations and map 12 in Annex 6 showing the location of air quality measurement points).

Table 6-36. Summary of particulate matter concentrations (PM 2.5, PM 10 and total suspended particles).

Point	Description	Coordinates UTM		Meteorological variables			
		X	Y	T (°C)	Hr (%)	Vv (m/s)	Dv
RVA-1	Villa Barnak, west-southwest of the project area.	212432	2180065	34.0	59.5	0.3	SE
RVA-2	Villa Ray, west of the project area.	212872	2180346	31.0	71.9	0.1	SE
AVR-3	Northern boundary of the projected plant area.	213359	2180482	32.8	64.0	2.1	S
RVA-8	Southern boundary of Block 02 area	213001	2179829	33.2	61.4	3.3	S
AVR-9	In front of the Manzanillo Photo Parador.	212716	2179544	35.7	51.3	2.5	S
RVA-10	Farm southeast of the project on the road parallel to the transmission line route.	213432	2178833	30.9	72.5	0.5	SE
RVA-11	In front of the Manzanillo Plant, Plantaciones del Norte.	215287	2178379	31.8	71.1	1.1	SE

Point	Description	Coordinates UTM		Meteorological variables			
		X	Y	T (°C)	Hr (%)	Vv (m/s)	Dv
RVA-12	In front of the entrance to the MPL Project Site.	216687	2178155	33.2	57.3	1.6	SE
RA-6	At the Pepillo Salcedo Golf Club, southwest of the port facilities.	212118	2180184	38.2	52.6	1.8	S
Point	Description	Particulate matter (µg/Nm) ³					
		PM 2.5	PM 10	PST			
RVA-1	Villa Barnak, west-southwest of the project area.	27.1	67.7	121.8			
RVA-2	Villa Ray, west of the project area.	15.1	93.4	110.8			
AVR-3	Northern boundary of the projected plant area.	29.2	127.7	193.1			
RVA-8	Southern boundary of Block 02 area	18.3	118.7	192.0			
AVR-9	In front of the Manzanillo Photo Parador.	39.5	122.9	219.3			
RVA-10	Farm southeast of the project on the road parallel to the transmission line route.	26.8	53.6	93.8			
RVA-11	In front of the Manzanillo Plant, Plantaciones del Norte.	30.6	91.2	152.0			
RVA-12	In front of the entrance to the MPL Project Site.	27.2	108.8	203.9			
RA-6	At the Pepillo Salcedo Golf Club, southwest of the port facilities.	15.9	93.5	111.5			
Environmental Technical Regulation on Air Quality in the Dominican Republic (Table 1)		24 hours	65	150	230		
		Annual	15	50	80		
WHO Air Quality Guidelines, 2021. Table 01. Recommended AQG levels and interim targets (µg/m)³		24 hours	15	45	-		
		Annual	5	15	-		

T- air temperature in °C, Hr- relative humidity in %, Vv- wind speed in m/s, Dv- wind direction.

Source: Field work and measurements EMPACA

In general, particulate matter concentrations are at moderate levels, with some notable levels. These levels are characteristic of urbanized areas in rural zones, where the main emission sources are the usual socioeconomic activity and vehicular traffic. The RVA-9 point stands out, where the highest values were obtained, due to the circulation of heavy vehicles transporting material from the port.

These results for PM2.5 and PM10 fractions in Ambient Baseline conditions are above the WHO Air Quality Guidelines recommended limits for 24 hours.

In the graph in Figure 6-21 the results obtained at each point are compared with the permissible limits established by the Environmental Air Quality Technical Regulations of the Dominican Republic.

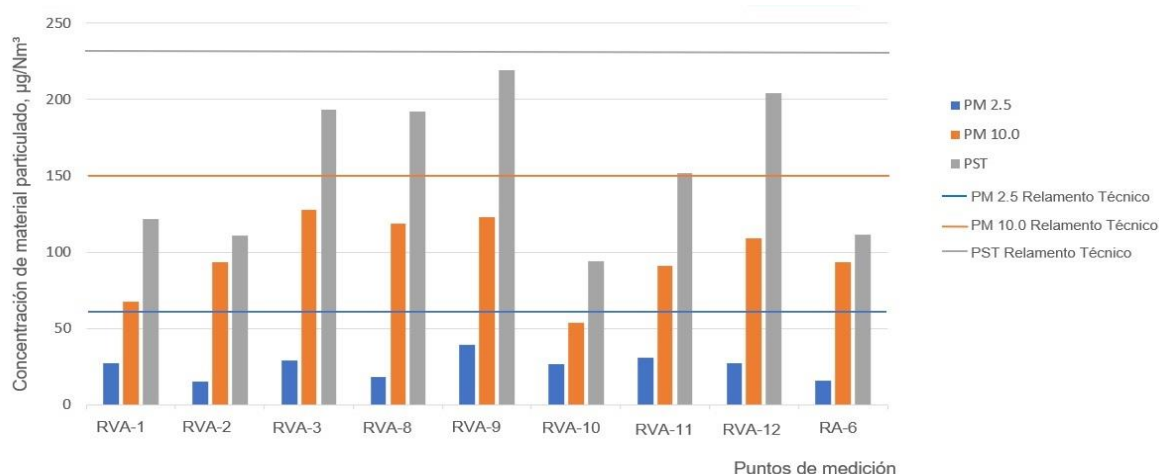


Figure 6-21. Concentration of particulate matter at the measurement points and compared with the permissible limits of the Technical Regulation.

Source: Elaborated by EMPACA, 2023.

With respect to measurements of flue gas concentrations at immission conditions (Table 6-37 and Table 6-38), these were performed at the 9 points described above. In Annex 10.9 are attached the reports of the measurements and primary calculations (see photos 42 and 43 in Annex 11), in Annex 10.8 the field sheets of measurements of the concentrations of combustion gases in immission conditions and in map 12 in Annex 6 showing the location of air quality measurement points). In this case the UTM coordinates of the location of the sampling points and the meteorological variables are the same as for the particulate matter points described above.

Table 6-37. Summary of flue gas concentrations (CO, O₃, TVOC and HCHO) at immission conditions.

Points	Description	TVOC	HCHO	CO	O ₃
		µg/Nm ³			
RVA-1	Villa Barnak, west-southwest of the project area.	61.2	41.3	2321.0	< 200.0
RVA-2	Villa ray, west of the project area.	69.8	64.6	1798.2	< 200.0
AVR-3	Northern boundary of the projected plant area.	69.7	38.2	1630.9	< 200.0
RVA-8	Southern boundary of Block 02 area	39.8	38.7	1714.6	< 200.0
AVR-9	In front of the Manzanillo Photo Parador.	69.6	38.3	2237.3	< 200.0
RVA-10	Farm southeast of the project on the road parallel to the transmission line route.	43.0	49.0	3282.8	< 200.0
RVA-11	In front of the Manzanillo Plant, Plantaciones del Norte.	38.3	55.0	2028.2	< 200.0
RVA-12	In front of the entrance to the MPL Project Site.	77.4	20.0	2927.3	< 200.0
RA-6	At the Pepillo Salcedo Golf Club, southwest of the port facilities.	40.0	48.7	2488.2	< 200.0

Points	Description	TVOC	HCHO	CO	O ₃
		µg/Nm ³			
Environmental Technical Regulations on Air Quality of the Dominican Republic (Table 1 Criteria Pollutants)	1 hour	(*)	(*)	40000	250
	8 hours	-	-	10000	160
WHO Air Quality Guidelines, 2021. Table 01. Recommended AQG levels and interim targets (µg/m)³		-	-	4000 (24 hours)	100 (8 hours)
WHO Air Quality Guidelines, 2021. Table 02. Air Quality Guidelines for NO₂, SO₂ and CO (Short averaging times), (µg/m)³		-	-	35000 (1 hour)	-
				10000 (8 hours)	

CO- carbon monoxide, O₃ - ozone, TVOC- volatile compounds, HCHO- formaldehyde.

* Limits of 1000 µg/Nm³ in 30 minutes for Toluene, and 870 µg/Nm³ annually for Xylene, according to Table 2 non-conventional pollutants of the Environmental Technical Regulation on Air Quality of the Dominican Republic.

Source: EMPACA 2022 and 2023 field work and measurements.

Table 6-38. Summary of flue gas concentrations (SO₂, NO₂, HCNM and CO₂) at immission conditions.

Points	Description	SO ₂	NO ₂	HCNM	CO ₂
		µg/Nm ³			ppm
RVA-1	Villa Barnak, west-southwest of the project area.	371.0	114.6	112.5	466.0
RVA-2	Villa Ray, west of the project area.	434.6	76.8	112.5	519.4
AVR-3	Northern boundary of the projected plant area.	59.2	36.5	326.6	528.8
RVA-8	Southern boundary of Block 02 area	235.8	133.9	128.1	485.2
AVR-9	In front of the Manzanillo Photo Parador.	127.2	93.7	317.4	487.9
RVA-10	Farm southeast of the project on the road parallel to the transmission line route.	299.1	166.4	514.1	495.3
RVA-11	In front of the Manzanillo Plant, Plantaciones del Norte.	437.6	76.8	112.4	519.8
RVA-12	In front of the entrance to the MPL Project Site.	262.1	29.8	371.9	470.4
RA-6	At the Pepillo Salcedo Golf Club, southwest of the port facilities.	253.3	83.5	243.1	483.4
Environmental Technical Regulations on Air Quality in the Dominican Republic (Table 1 Criteria Pollutants)		450 (1 hour)	400 (1 hour)	160 (3 hours)	(*)
		150 (24 hours)	300 (24 hours)		
		100 (Annual)	100 (Annual)		
WHO Air Quality Guidelines, 2021. Table 01. Recommended AQG levels and interim targets (µg/m)³		40 (24 hours)	25 (24 hours)	-	-
			10		

Points	Description	SO ₂	NO ₂	HCNM	CO ₂
		µg/Nm ³			ppm
			(Annual)		
	WHO Air Quality Guidelines, 2021. Table 02. Air Quality Guidelines for NO₂, SO₂ and CO (Short averaging times), (µg/m³)	500 (10 min.)	200 (1 hour)	-	-

SO₂ - Sulfur dioxide, NO₂ - Nitrogen dioxide, HCNM- Non-methane hydrocarbons, CO₂ - Carbon dioxide.

* CO₂ is not considered regulated; limits of 700 ppm are recommended as air quality in urban sectors.

Source: EMPACA 2022 and 2023 field work and measurements.

In general terms, the concentrations of combustion gases in immission in ambient baseline conditions, considered as criteria pollutants, remain below the limits established by the national regulation and by the WHO Air Quality Guidelines for short measurement times, and tend to be above the limits recommended by the WHO Air Quality Guidelines when compared to the values for longer measurement times.

In the case of non-methane hydrocarbons (NMHC), in most points the average value is higher than the limit established in the national Environmental Technical Regulation; however, these gases are not considered criteria pollutants by this regulation. Carbon dioxide concentrations (CO₂) are reported at acceptable levels for sectors with anthropic activity.

It is relevant to highlight that, in the areas related to the project and its surroundings, the air quality is benefited by the wind flow conditions in the territory, which is mainly characterized by having a flat surface and no significant obstacles. In addition, the location near the coast also contributes to this favorable situation.

6.1.10 Odors

According to the WHO, a bad effect on health is any experience that causes physical, emotional or mental discomfort, so odor pollution is a quality factor.

Thus, people who are close to the development of activities that generate bad odors suffer from insomnia, bad mood, headache, mucosal irritation, especially the tendency to develop stressful situations, and apparently neurotoxic reactions. These effects occur because when odoriferous substances are captured from the environment through the nose or mouth, they are transported to the olfactory mucosa, where they are received and subsequently translated into electrical signals.

Odors can be generated by several types of sources, whether they are of natural origin, generated by man and his activities, generated by industrial, fixed or area activities, etc. In this sense, international studies report that the odors that bother the population in densely populated areas are bad handling and accumulation of garbage, sewage, odors emanating from factories, feces, contaminated or stagnant water and aromatic odors from the handling of fuel, among others. The information related to the study area is presented below.

During the field surveys for this study, a general characterization of the odors perceived in the area was carried out by means of reconnaissance inspections to identify the odor sources. The results obtained are presented by sectors of the study area (Table 6-39).

Table 6-39. Odors perceived in the sectors of gullies to be intervened by the project and vehicular traffic routes.

Sectors of the study area	Typology of perceived odors
Sector of the coastal strip with accumulative beach and sparse vegetation	Moderate odors predominate from the coastal edge to the open sea. Sporadic odors of decomposing plant matter from inland mangrove sites are perceived. Very locally, in the sites of rustic houses and agglomeration of fishing boats, there are slight odors of handling fishing gear or fish remains.
Low floodplain sector with mangroves	Moderate odors predominate from the coastal edge to the open sea. Towards the center of this sector, moderate odors of decomposing plant matter can be perceived.
Medium plains sector with little vegetation.	Low odors predominate at rural sites, without anthropic activities, but with the perception of dust in the air. Sporadically, moderate odors are perceived from the coastal edge to the open sea, but they are of low intensity and short duration. Very locally, on the unpaved embankment routes, low odors of exhaust combustion from some passing vehicles predominate, and there is a moderate perception of dust in the air.
Sectors adjacent to the project area in the middle plain, urbanized (Villa Ray).	Moderate odors due to the diversity of anthropic domestic activities. Sporadically there are smells of corrals and small livestock breeding, which are mixed with those generated in the houses.
Sectors of the Port of Manzanillo and surrounding area	Low odors due to a variety of anthropic industrial activities, mainly due to moderate traffic on unpaved embankments. Very sporadically, low odors are perceived from the combustion of truck exhaust during hauling activities to or from the Port.

Source: EMPACA elaboration, 2023, 2022.

6.1.11 Noise levels

For the study area, 9 measurement points were established for noise levels, coinciding with the location of the measurement points for particulate matter and combustion gas concentrations. Meteorological variables were measured at each point during the entire time of the environmental factor measurements (Table 6-39).

This distribution of measurement points covered the entire territory, especially the sectors where the main works of the project and the 345 kV transmission line route will be located, in addition to the urbanized borders.

The results of the daytime noise level measurements are presented Table 6-40 and the nighttime measurements are presented in Table 6-42. Noise measurement sheets are attached in Annex 10.1 and in Annex 10.2 the complete data of the measurements recorded in the field (Photos 44

and 45 in Annex 11 and map 12 in Annex 6 showing the location of air quality measurement points). The meteorological variables are the same as for the particulate matter and flue gas concentration measurement points described above.

Table 6-40. Location coordinates of the sampling points for noise levels and prevailing meteorological conditions during daytime hours.

Point	Description	Coordinates UTM		Variables weather			
		X	Y	T (°C)	Hr (%)	Vv (Dv
RVA-1	Villa Barnak, west-southwest of the project area.	212432	2180065	34.0	59.5	0.3	SE
RVA-2	Villa Ray, west of the project area.	212872	2180346	31.0	71.9	0.1	SE
AVR-3	Northern boundary of the projected plant area.	213359	2180482	32.8	64.0	2.1	S
RVA-8	Southern boundary of Block 02 area	213001	2179829	33.2	61.4	3.3	S
AVR-9	In front of the Manzanillo Photo Parador.	212716	2179544	35.7	51.3	2.5	S
RVA-10	Farm southeast of the project on the road parallel to the transmission line route.	213432	2178833	30.9	72.5	0.5	SE
RVA-11	In front of the Manzanillo Plant, Plantaciones del Norte.	215287	2178379	31.8	71.1	1.1	SE
RVA-12	In front of the entrance to the MPL Project Site.	216687	2178155	33.2	57.3	1.6	SE
RA-6	At the Pepillo Salcedo Golf Club, southwest of the port facilities.	212118	2180184	38.2	52.6	1.8	S

T- air temperature in °C, Hr- relative humidity, in %, Vv- wind speed in m/s, Dv- wind direction.

Source: Field work and measurements EMPACA Environmental Quality Laboratory.

Table 6-41. Summary of noise levels measured during daytime hours.

Point	Noise level dB(A)				Standard NA-RU-001-03*, Continuous Noise	IFC General Guidelines**
	Minimum value	Maximum value	Average value	Logarithmic mean (Leq.)		
RVA-1	45.0	65.0	53.4	54.9	Area II Residential zone (residential area) 60 dB(A)	Residential 55 dB(A)
RVA-2	37.8	67.6	45.3	50.5		
AVR-3	50.6	70.0	54.9	56.5	Area I Zone of tranquility (area of quietness) 60 dB(A)	
RVA-8	44.0	70.3	48.3	50.5	Area III Commercial zone (industrial area) 70 dB(A)	

Point	Noise level dB(A)				Standard NA-RU-001-03*, Continuous Noise	IFC General Guidelines**
	Minimum value	Maximum value	Average value	Logarithmic mean (Leq.)		
AVR-9	46.3	84.9	62.6	71.5	Area IV Roads of one or more lanes and one-way through areas II 65 dB(A)	
RVA-10	38.6	88.0	56.4	67.7		
RVA-11	41.4	88.1	57.0	71.0		
RVA-12	51.6	83.0	59.2	66.2	Area IV Roads with one or more lanes and one-way through areas III 70 dB(A)	
RA-6	42.3	67.1	48.1	51.0	Area II Residential zone (residential area with surrounding stores) 65 dB(A)	

* Environmental Standard for Noise Protection (NA-RU-001-03), Table 4.2. Maximum permissible noise emission levels.

** IFC General Guidelines: Environment, 2007 (Noise, Table 1.7.1).

Source: EMPACA field work and measurements, 2023.

Table 6-42. Coordinates of the location of the sampling points for noise levels and prevailing meteorological conditions at night.

Point	Description	UTM coordinates		Meteorological variables			
		X	Y	T	Hr	Vv	Dv
RVA-1	Villa Barnak, west-southwest of the project area.	212432	2180065	30.5	74.1	0.2	S
RVA-2	Villa Ray, west of the project area.	212872	2180346	30.9	61.7	0.9	S
AVR-3	Northern boundary of the projected plant area.	213359	2180482	29.3	78.0	1.5	S
RVA-8	Southern boundary of Block 02 area	213001	2179829	29.5	76.8	1.6	S
AVR-9	In front of the Manzanillo Photo Parador.	212716	2179544	29.7	75.5	0.1	S
RVA-10	Farm southeast of the project on the road parallel to the transmission line route.	213432	2178833	29.8	76.6	0.1	S
RVA-11	In front of the Manzanillo Plant, Plantaciones del Norte.	215287	2178379	29.7	75.2	Calm	-
RVA-12	In front of the entrance to the MPL Project Site.	216687	2178155	29.7	75.3	Calm	-
RA-6	At the Pepillo Salcedo Golf Club, southwest of the port facilities.	212118	2180184	30.5	69.9	0.2	S

T- air temperature in °C, Hr- relative humidity in %, Vv- wind speed in m/s, Dv- wind direction.

Source: Field work and measurements EMPACA Environmental Quality Laboratory.

Table 6-43. Summary of noise levels measured at night.

Point	Noise level dB(A)				Standard NA-RU-001-03*, Continuous noise	Guides General IFC**
	Value minimum	Value maximum	Value average	Media Logarithmic (Leq.)		
RVA-1	44.7	80.1	52.3	64.0	Area II Residential Zone 50 dB(A)	Residential 45 dB(A)
RVA-2	47.1	70.8	50.7	54.7		
AVR-3	40.6	81.8	45.5	58.5	Area I Zone of tranquility (quiet area) 50 dB(A)	
RVA-8	33.9	56.2	39.3	40.7	Area III Commercial zone (industrial) 55 dB(A)	
AVR-9	39.2	86.6	51.1	67.8	Area IV Roads with one or more lanes and one way through areas II 55 dB(A)	
RVA-10	46.4	77.5	50.6	58.7		
RVA-11	48.1	83.7	52.2	60.2		
RVA-12	44.0	84.9	47.9	60.1	Area IV Roads with one or more lanes and one-way through areas III 60 dB(A)	
RA-6	41.3	68.6	47.5	51.1	Area II Residential Zone 50 dB(A)	

* Environmental Standard for Noise Protection (NA-RU-001-03), Table 4.2. Maximum permissible noise emission levels.

** IFC General Guidelines: Environment, 2007 (Noise, Table 1.7.1).

Source: EMPACA field work and measurements, 2023.

In general, daytime noise levels are moderate, and the logarithmic average in almost all of them remained below the permissible limit established by the Environmental Standard of the Dominican Republic. Only at points RVA-9, RVA-10 and RVA-11, the values recorded marginally exceeded the limit, caused by being a sector with a greater circulation of heavy vehicles compared to the remaining points. In the measurement summary data, maximum values above 70 dB(A) were observed at several points, which were caused by local anthropic activity.

On the other hand, during nighttime, the logarithmic mean calculated is higher than the permissible limit of the environmental standard in most of the points caused by anthropic activity and the circulation of heavy vehicles in these sites. Very similar to the daytime measurements, maximum levels above 70 dB(A) are observed, which were caused by particularities of the anthropic activity associated with these sites.

Graphs of Figure 6-22 and Figure 6-23 compare the results obtained at each point with the permissible limits established by the Environmental Air Quality Technical Regulations of the Dominican Republic, for daytime and nighttime hours, respectively.

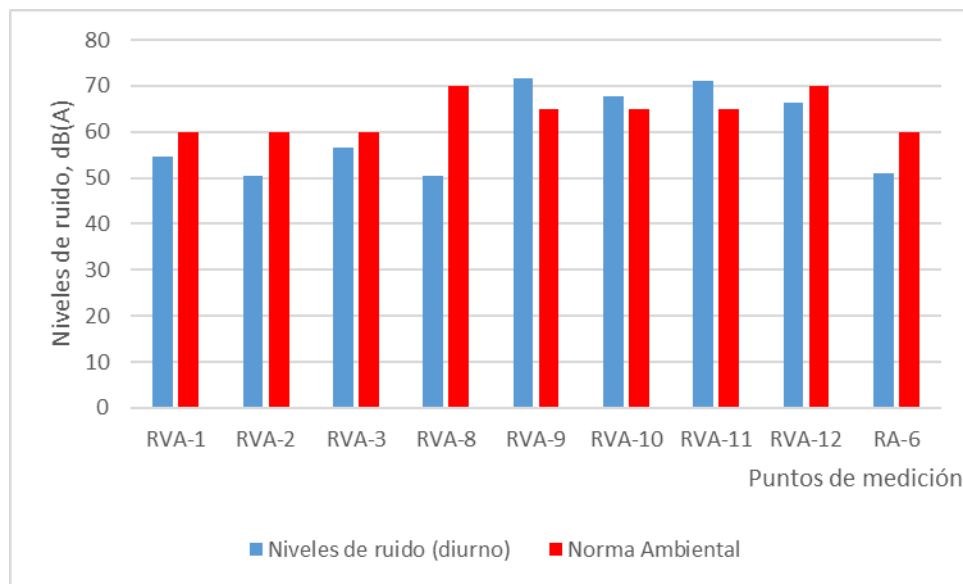


Figure 6-22. Noise levels (Leq) reported at the measurement points during daytime hours.

Source: EMPACA Processing, 2023.

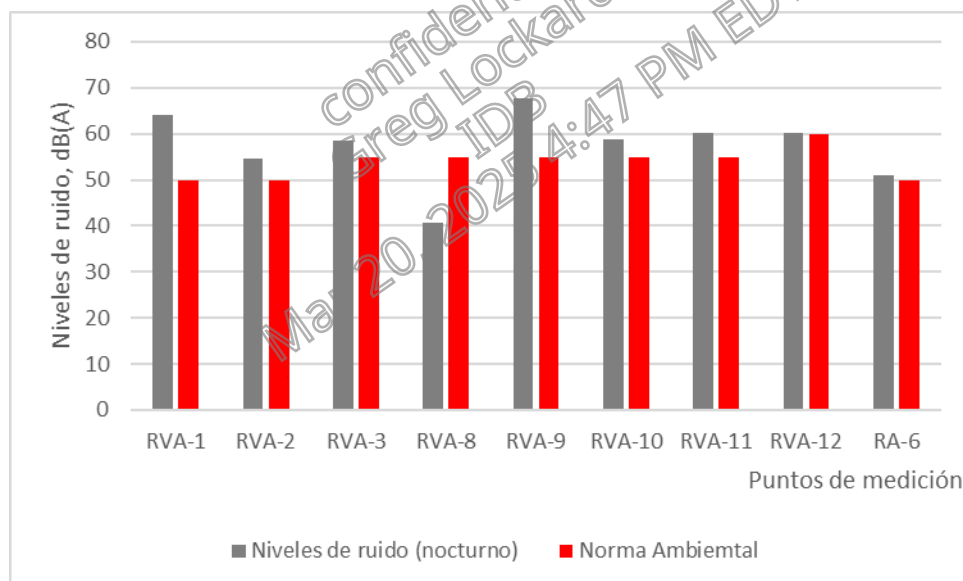


Figure 6-23. Noise levels (Leq) reported at the measurement points at night.

Source: EMPACA Processing, 2023.

6.1.12 Vibration Levels

In general, environmental vibrations in baseline conditions are an important aspect for existing structures in the vicinity of traffic roads, machinery and constructions, with the presence of heavy equipment, trucks and constructive actions as sources of vibrations that are transmitted at ground level to these structures. These vibrations can cause damage to the structures depending on the characteristics of the vibrations (speed, frequency), the structures or receivers of the vibrations (construction material, age, presence of previous damage, among other characteristics) and the medium of transmission, i.e. the soil (compaction, presence of concrete or asphalt layer, among others).

However, one of the main vibration contamination problems will be related to the construction stage of the project, especially in neighboring neighborhoods, and in the operations stage due to the operation of the industrial machinery that will be installed.

The highest levels of vibrations are generated during construction activities, depending on their typology and intensity, mainly during the working with construction materials and excavations, among other activities. These vibrations are produced by sources that cause oscillations to the material medium that encompasses both the generating source and the surrounding buildings, including the ground on which the elements involved are located. This physical phenomenon can be perceived to a lesser or greater degree by the occupants of these buildings, affecting them in various ways that can range from a simple nuisance to the deterioration of their quality of life, and can even produce material damage depending on the nature and characteristics of the vibrations.

The region where the study area is located is distributed in a territory that is not characterized by the frequent occurrence of earthquakes, which is a favorable characteristic with respect to this evaluated factor.

At the scale of the study area, 8 environmental vibration measurement points were established and their location is shown in Annex 6 Map of the location of the air quality measurement points, which coincide with the measurement points for noise levels and concentration of particulate matter and gases in immission. Annex 10.12 contains the environmental vibration field measurement sheets and Annex 10.13 contains the environmental vibration results reports.

The northern and southern sectors of the study area can be characterized as wastelands, with very little anthropic intervention, where most of the construction activities will take place (Points RVA-3 and RVA-8). This condition means that the main vibration generating activities currently existing in this territory correspond to very little vehicular traffic, of low speed, so it has been anticipated that vibrations remain at very low levels, typical of environments with no significant sources of vibrations, with very isolated events of little significance where levels of peak particle velocity (PPV) of less than 1.0 mm/s can be recorded (Table 6-44 and Annex 10.13).

Table 6-44. Summary of ambient vibration velocities in the northern and southern terrains of the study area.

Point	Description	Coordinates UTM		Maximum speeds, mm/s/ Frequency, HZ		
		X	Y	X-axis	Y-axis	Z-axis
AVR-3	Northern boundary of the projected plant area.	213359	2180482	0.01/10	0	0
RVA-8	South boundary of Block 02.	213001	2179829	0	0.01 / 10	0

Source: Field work and measurements EMPACA Environmental Quality Laboratory.

The parallel sectors along the route of the 345 kV transmission line (RVA-9, RVA-10, RVA-11 and RVA-12) are characterized by scattered houses in a rural environment, where construction activities will be carried out parallel to the existing road and between private lands dedicated to agricultural work. This condition means that the main vibration-generating activities are low-intensity, heavy vehicular traffic and activities related to port operations, which are predominantly moderate. In addition, there are construction activities in the area such as the MPL Project Site (RVA-12). In general, the existing buildings are of little structure, single-story, where light roofs predominate. In this sector, vibrations remain at low levels considering that the sources are not significant, also reporting levels of peak particle velocity (PPV) of less than 1.0 mm/s (Table 6-45, Photo 47 and Annex 10.13).

Table 6-45. Summary of ambient vibration velocities in the western territories of the project area.

Point	Description	Coordinates UTM		Maximum speeds, mm/s / Frequency, HZ		
		X	Y	X-axis	Y-axis	Z-axis
AVR-9	In front of the Manzanillo Photo Parador.	212716	2179544	0	0	0.06 / 15
RVA-10	Farm southeast of the project on the road parallel to the transmission line route.	213432	2178833	0.07 / 18	0	0.07 / 35
RVA-11	In front of the Manzanillo Plant, Plantaciones del Norte.	215287	2178379	0	0.13/33	0.05 / 13
RVA-12	In front of the entrance to the MPL Project Site.	216687	2178155	0	0.01/3	0

Source: Field work and measurements EMPACA Environmental Quality Laboratory.

The adjacent sectors to the west of the project area are characterized by being rural urbanizations, where construction activities will not be developed directly (Points RVA-1 and RVA-2) but will be related to the area of influence. This condition means that the main vibration-generating activities are low-intensity vehicular traffic and activities related to port operations, which are predominantly moderate. In general, the existing buildings are of little structure, with only one floor, where light roofs predominate. In this sector, vibrations remain at low levels considering that the sources are not significant, also reporting levels of peak particle velocity (PPV) of less than 1.0 mm/s (Table 6-46).

Table 6-46. Summary of ambient vibration velocities in the western territories of the project area.

Point	Description	Coordinates UTM		Maximum speeds, mm/s / Frequency, HZ		
		X	Y	X-axis	Y-axis	Z-axis
RVA-1	Villa Barnak, west-southwest of the project area.	212432	2180065	0.01 / 10	0	0
RVA-2	Villa Ray, west of the project area.	212872	2180346	0.02 / 20	0	0

Source: EMPACA Environmental Quality Laboratory field work and measurements, 2023.

In summary, the peak velocities obtained from the vibration events recorded during the measurements did not reach the value of 1 mm/s with frequencies between 1 - 65 Hz, which are low to cause damage in the type of structure that predominates in the western and eastern sectors of the study area, which are buildings without reinforced structures with light roofs.

According to the requirements of BS 7385-2:1993 Evaluation and measurement for vibration in buildings (Table 1), transient vibrations that cause damage in light, unreinforced buildings and residences should reach peak velocities greater than 15-20 mm/s at frequencies between 4 and 15 Hz, or 20-50 mm/s at frequencies greater than 15 Hz.

6.1.13 Vulnerability to natural hazards

6.1.13.1 Seismic Hazards

The Dominican Republic is exposed to seismic hazards according to known records and statistics, so the probability of occurrence of an event with a destructive characteristic is always present. In addition to this, the lack of urban development and land use planning, the lack of application of seismic-resistant regulations, "the lack of rules and standards for geotechnical studies" (De León, 1999), the obsolescence of extension codes and the deviation to good construction practice, (Brief diagnosis of the geographic areas most exposed to natural phenomena and their characteristics, Sectorial Executing Unit of the Disaster Prevention Subprogram, Loan Bid 1152/Oc-Dr, Ing. Valentín Cordero, MSc, 2000).

Figure 6-24 shows the occurrence of earthquakes of different magnitudes near the province of Montecristi from 1970 to date.

The "IRIS Earthquake Browser (IEB)" available as an interactive map to explore epicenters of seismic events was used as a source of information. The data come from various sources, mainly from the U.S. Geological Survey, and are stored in the main data archives at the IRIS Data Management Center in Seattle, WA, USA.

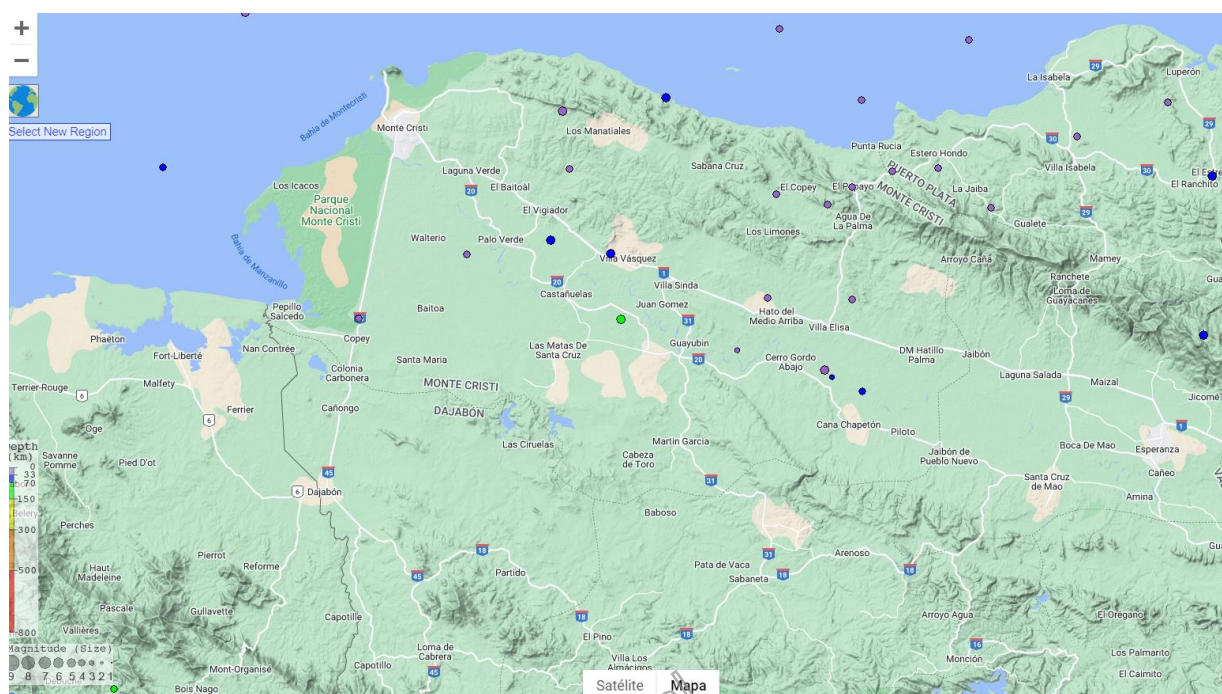


Figure 6-24. Earthquakes in the Montecristi area (Data from IRIS Earthquake Navigator, USA).

Source: www.iris.washington.edu

Table 6-47 shows the 10 earthquakes closest to the project area that occurred between 1970 and 2022, where the highest magnitude recorded was 5 on September 3, 1987.

Table 6-47. Earthquakes closest to the project area occurring between 1970 and 2022.

Magnitude	Depth (km)	Date	Time (UTC)	Latitude	Length	Distance (km)
4.2	10	2010-05-06	09:42:37.630	19.69	-71.68	0
4.2	10	2010-03-11	06:20:31.210	19.74	-71.58	11
4.5	35.85	2016-01-02	15:25:43.030	19.76	-71.51	18
4.3	47.8	2004-06-27	07:46:38.070	19.82	-71.85	22
4.3	10	2022-03-14	20:36:06.184Z	19.81	-71.5	23
5	34	1987-09-03	00:04:53.450	19.75	-71.46	23
4.6	115.4	2007-10-28	02:21:18.930	19.69	-71.45	23
4.8	33	2002-06-27	17:13:41.910	19.86	-71.5	26
4.7	10	2022-07-31	16:37:55.759Z	19.94	-71.78	29
4.8	35	2009-09-04	09:45:14.220	19.87	-71.41	34

Source: www.iris.washington.edu

It is necessary to consider that earthquake damage is not limited to buildings, but generally affects more intensely linear works such as roads, aqueduct systems, sewage systems, gas distribution networks and power lines. It is also common to observe damage to rigid elements of storage tanks for fuel, water and chemical products.

6.1.13.2 Hurricane threat

Although statistics cannot always fully express the characteristics of extreme hydrometeorological events, it is important to consider that hurricanes are precisely the main cause of very intense rainfall episodes, when the highest accumulations are recorded, with a very low return period, which can be every year.

To express this usual behavior for the Caribbean Region, we have used information from records related to cyclones developed in the North Atlantic from 1851 to 2020, and taken from several websites, including the National Hurricane Center (NHC), Stormpulse, StormCarib and the Institute of Meteorology of Cuba (INSTMET), among others.

The processing of the data shows the increase in the occurrence of the events, i.e., the trend towards an increase in the number of cyclones in each season, most of which cross the Caribbean and therefore Hispaniola (Figure 6-25).

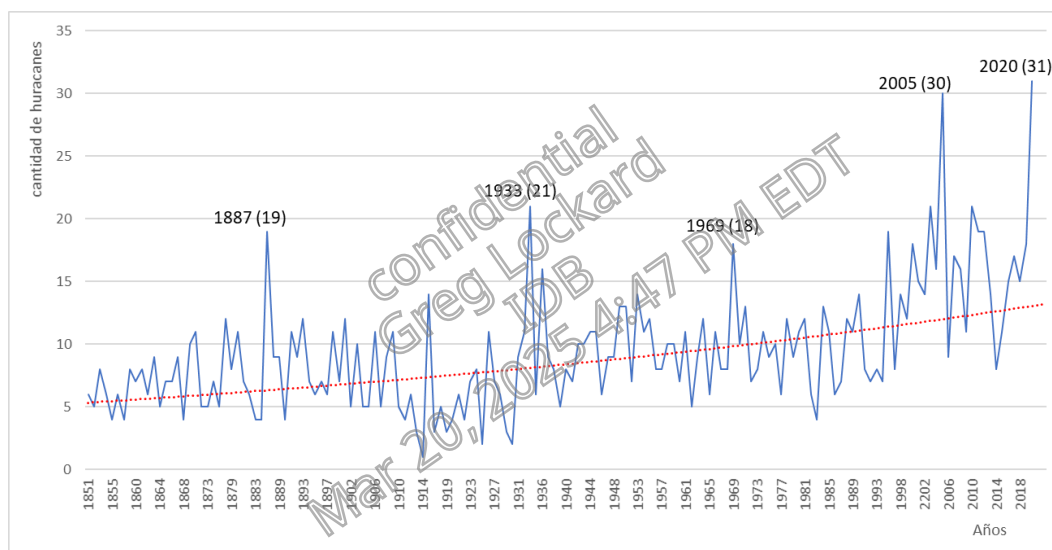


Figure 6-25. Trend of increasing cyclone numbers by decade, over the period 1851-2020, in the North Atlantic (named cyclones).

Source: Processing by EMPACA

In Figure 6-26 shows the list of cyclones that have impacted the Dominican Republic directly or indirectly by month from 1851 to 2021.

Num.	Año	Tipo	Nombre	Mes	Fecha	Dec.	Impacto	Via	Ruta
65	1932	TT	Tormenta	5	May/7/1932	1	DIRECTO	Caribe	Península Barahona/Nagua
70	1935	DT	Depresión	5	May/15/1935	2	DIRECTO	Caribe	San Pedro/Samana
137	2021	TT	ELSA	7	Julio/3/2021	1	Sur/indirecto	Caribe	Este a Sur país
40	1901	TT	Tormenta	7	Jul/4/1901	1	Sur/indirecto	Caribe	Sur península Barahona
41	1901	TT	Tormenta	7	Jul/7/1901	1	DIRECTO	Caribe	Higüey/B. Samana/Nagua
127	2013	TT	CHANTAL	7	Julio/10/2013	1	Sur/indirecto	Caribe	Península Barahona (frente)
67	1933	DT	Depresión	7	Jul/15/1933	2	Sur/indirecto	Caribe	Costa Sur (paso)
97	1979	DT	CLAUDETTE	7	Jul/17/1979	2	DIRECTO	Atlántico	Este/Centro/Haiti
58	1926	H	Huracán	7	Jul/24/1926	3	DIRECTO	Caribe	Higüey/Nagua/Atlántico
35	1899	H	Huracán	7	Jul/28/1899	3	DIRECTO	Caribe	Ocoa/frontera/Haiti
68	1933	H	Huracán	7	Jul/28/1933	3	Norte/Indirecto	Atlántico	Costa Norte (paso)
135	2020	TT	ISAIAS	7	Jul/30/2020	3	DIRECTO	Caribe	Este/Haitíes/ Pto. Pta.
129	2014	TT	BERTHA	8	Ago/2/2014	1	DIRECTO	Caribe	Higüey a Samana/Cabrera
25	1887	TT	Tormenta	8	Ago/3/1887	1	Sur/indirecto	Caribe	Sur frente pen. Barahona
124	2011	TT	EMILY	8	Ago/3/2011	1	Sur/indirecto	Caribe	Península Barahona (frente)
76	1945	TT	Tormenta	8	Ago/4/1945	1	DIRECTO	Caribe	Bahía de Ocoa
21	1880	TT	Tormenta	8	Ago/5/1880	1	Sur/indirecto	Caribe	Sur paso frente a costa
100	1980	GH	ALLEN	8	Ago/5/1980	1	Sur/indirecto	Caribe	Costa Sur/Península Barahona
72	1940	TT	Tormenta	8	Ago/6/1940	1	Norte/Indirecto	Atlántico	Costa Norte (paso)
51	1915	H	Huracán	8	Ago/8/1915	1	Sur/indirecto	Caribe	Sur península Barahona
59	1928	TT	Tormenta	8	Ago/8/1928	1	Norte/Indirecto	Atlántico	Frente Noreste
36	1899	GH	Gran Huracán	8	Ago/9/1899	1	DIRECTO	Caribe	Samana/Noreste
71	1938	TT	Tormenta	8	Ago/9/1938	1	DIRECTO	Atlántico	Samana/Cibao/Haiti
43	1903	GH	Gran Huracán	8	Ago/10/1903	1	Sur/indirecto	Caribe	Sur frente Península Barahona
60	1928	H	Huracán	8	Ago/10/1928	1	Sur/indirecto	Caribe	Península Barahona (frente)
138	2021	TT	FRED	8	Ago/11/2021	2	DIRECTO	Caribe	Nigua/Ocoa/Elias Piña
84	1956	H	BETSY	8	Ago/12/1956	2	Norte/Indirecto	Caribe	Higüey/Noreste (paso)
7	1861	TT	Tormenta	8	Ago/13/1861	2	Norte/Indirecto	Atlántico	Norte frente a costa
10	1866	H	Huracán	8	Ago/13y14/1866	2	Sur/indirecto	Caribe	Sur frente a costa paso
23	1886	H	Huracán	8	Ago/14y15/1886	2	DIRECTO	Caribe	Pen. Barahona/Lenr/Haiti
19	1879	TT	Tormenta	8	Ago/15/1879	2	Norte/Indirecto	Atlántico	Norte frente a costa
107	1993	TT	CINDY	8	Ago/16/1993	2	DIRECTO	Caribe	Península Barahona
120	2008	TT	FAY	8	Ago/16/2008	2	DIRECTO	Caribe	Este a Sur país
139	2021	DT	GRACE	8	Ago/16/2021	2	DIRECTO	Caribe	Península Barahona (frente)
30	1893	GH	Gran Huracán	8	Ago/17/1893	2	Noreste/indirecto	Caribe	Paso frente Noreste
79	1951	H	CHARLIE	8	Ago/17/1951	2	Sur/indirecto	Caribe	Costa Sur (paso)
1	1851	H	Huracán	8	Ago/18/1851	2	DIRECTO	Caribe	SE (San Cris.)LE/Haiti
117	2007	GH	DEAN	8	Ago/18/2007	2	Sur/indirecto	Caribe	Península Barahona

Num.	Año	Tipo	Nombre	Mes	Fecha	Dec.	Impacto	Via	Ruta
28	1889	TT	Tormenta	8	Ago/19/1889	2	DIRECTO	Caribe	Bani/Cibao/Montecristi
75	1944	GH	Gran Huracán	8	Ago/19/1944	2	Sur/indirecto	Caribe	Costa Sur (paso) pen. Barahona
132	2017	DT	HARVEY	8	Ago/19/2017	2	Sur/indirecto	Caribe	Costa Sur (frente)
29	1891	H	Huracán	8	Ago/21/1891	3	DIRECTO	Caribe	Higüey/B. Samana/Nagua
13	1871	H	Huracán	8	Ago/22/1871	3	Norte/Indirecto	Atlántico	Norte frente a costa
47	1909	H	Huracán	8	Ago/22y23/1909	3	DIRECTO	Caribe	Sur Palenque/Lenr/Haiti
52	1916	H	Huracán	8	Ago/22y23/1916	3	DIRECTO	Atlántico	Bahía Samana/Noreste
136	2020	TT	LAURA	8	Ago/22y23/2020	3	DIRECTO	Caribe	Sto. Dgo/Azuza/Haiti
110	2000	TT	DEBBY	8	Ago/23/2000	3	DIRECTO	Atlántico	Costa Norte (cabecera a Montc)
125	2011	H	IRENE	8	Ago/23/2011	3	Norte/Indirecto	Atlántico	Frente a Costa Norte
49	1910	TT	Tormenta	8	Ago/23y24/1910	3	DIRECTO	Caribe	Península Barahona
78	1950	DT	BAKER	8	Ago/24/1950	3	DIRECTO	Caribe	Higüey/Noreste
92	1964	GH	CLEO	8	Ago/24/1964	3	Sur/indirecto	Caribe	Costa Sur (paso)
126	2012	TT	ISAAC	8	Ago/24/2012	3	Sur/indirecto	Caribe	Península Barahona (frente)
5	1856	H	Huracán	8	Ago/25/1856	3	Norte/Indirecto	Atlántico	Norte frente a costa
106	1988	TT	CHRIS	8	Ago/25/1988	3	DIRECTO	Caribe	SP Macoris/Cibao/Montecristi
4	1855	TT	Tormenta	8	Ago/26/1855	3	DIRECTO	Caribe	SPM*Cibao-Linea-Haiti
121	2008	H	GUSTAV	8	Ago/26/2008	3	Sur/indirecto	Caribe	Península Barahona (frente)
8	1864	H	Huracán	8	Ago/28/1864	3	Sur/indirecto	Caribe	Sur frente a costa
130	2015	TT	ERIKA	8	Ago/28/2015	3	Sur/indirecto	Caribe	Isla Saona (frente)
37	1899	H	Huracán	8	Ago/29/1899	3	Haiti/indirecto	Haiti	Frontera
53	1916	H	Huracán	8	Ago/29/1916	3	Sur/indirecto	Caribe	Sur lejos (MEMPHIS)
85	1958	H	ELLA	8	Ago/31/1958	3	Sur/indirecto	Caribe	Península Barahona (frente)
98	1979	GH	DAVID	8	Ago/31/1979	3	DIRECTO	Caribe	Palenque/Centro/Haiti
38	1900	TT	Tormenta	9	Sep/1/1900	1	DIRECTO	Caribe	Bahía Ocoa/Haiti
27	1888	H	Huracán	9	Sep/2/1888	1	Norte/Indirecto	Atlántico	Norte frente a costa
44	1906	GH	Gran Huracán	9	Sep/3/1906	1	Norte/Indirecto	Atlántico	Norte frente a costa
62	1930	GH	San Zenon	9	Sep/3/1930	1	DIRECTO	Caribe	Sto. Dgo/Azuza/Haiti
63	1931	TT	Tormenta	9	Sep/3/1931	1	DIRECTO	Atlántico	Península Samana/Centro
122	2008	GH	IKE	9	Sep/3/2008	1	Norte/Indirecto	Atlántico	Frente a Costa Norte
17	1878	H	Huracán	9	Sep/4/1878	1	DIRECTO	Caribe	Península Barahona
56	1919	TT	Tormenta	9	Sep/4/1919	1	DIRECTO	Caribe	Este/Noreste/Pto.Pta
2	1852	TT	Tormenta	9	Sep/5/1852	1	DIRECTO	Caribe	SE (Hig.) Cibao-Linea
22	1883	GH	Gran Huracán	9	Sep/5/1883	1	DIRECTO	Caribe	Azuza/Lenr/Haiti
99	1979	TT	FREDERIC	9	Sep/5/1979	1	DIRECTO	Caribe	Santo Domingo a Montecristi
128	2013	DT	GABRIELLE	9	Sep/5/2013	1	DIRECTO	Caribe	Cabo Engaño
50	1910	H	Huracán	9	Sep/7/1910	1	DIRECTO	Caribe	Península Barahona
133	2017	GH	IRMA	9	Sep/7/2017	1	Norte/Indirecto	Atlántico	Costa Norte (paso)

Num.	Año	Tipo	Nombre	Mes	Fecha	Dec.	Impacto	Via	Ruta
9	1865	H	Huracan	9	Sep/7y8/1865	1	DIRECTO	Caribe	Roce Peninsula Barahona
81	1953	TT	DOLLY	9	Sep/8/1953	1	Norte/Indirecto	Atlantico	Noreste (paso) canal Mona
101	1981	TT	GERT	9	Sep/9/1981	1	Norte/Indirecto	Atlantico	Costa Norte (paso)
105	1987	GH	EMILY	9	Sep/9/1987	1	DIRECTO	Caribe	Bahia Ocoa/Centro/Haiti
45	1908	TT	Tormenta	9	Sep/10/1908	1	DIRECTO	Atlantico	Norte roce a Pto. Pta.
57	1921	GH	Gran Huracan	9	Sep/10/1921	1	DIRECTO	Caribe	Higuey/Atlantico
108	1996	H	HORTENSE	9	Sep/10/1996	1	DIRECTO	Caribe	Mona/Cabo Engaño/Samana
94	1967	GH	BEULAH	9	Sep/10y11/1967	2	DIRECTO	Caribe	Costa Sur y Pen. Barahona
55	1918	TT	Tormenta	9	Sep/11/1918	2	Sur/Indirecto	Caribe	Peninsula Barahona (frente)
64	1931	H	Huracan	9	Sep/11/1931	2	DIRECTO	Atlantico	Higuey/Costa sur
32	1896	H	Huracan	9	Sep/12/1896	2	DIRECTO	Caribe	Canal Mona/Noreste
42	1901	TT	Tormenta	9	Sep/12/1901	2	DIRECTO	Atlantico	Higuey/Centro/Haiti
15	1876	H	Huracan	9	Sep/13/1876	2	DIRECTO	Caribe	Romana/centro/Linea
82	1955	H	HILDA	9	Sep/13/1955	2	Norte/Indirecto	Atlantico	Costa Norte (paso)
102	1982	DT	DEBBY	9	Sep/13/1982	2	Norte/Indirecto	Atlantico	Formacion frente a Pto. Pta.
61	1928	GH	Gran Huracan	9	Sep/14/1928	2	DIRECTO	Caribe	Bahia Samana/Noroeste
86	1958	TT	GERDA	9	Sep/14/1958	2	DIRECTO	Caribe	Costa Sur (paso) Malecon
95	1974	TT	FIFI	9	Sep/15/1974	2	Sur/Indirecto	Caribe	Costa Sur y Pen. Barahona
115	2004	H	JEANNE	9	Sep/16/2004	2	DIRECTO	Caribe	Higuey/Samana/Norte
96	1975	H	ELOISA	9	Sep/16y17/1975	2	DIRECTO	Atlantico	Norte/Pto. Plata/Linea
73	1942	TT	Tormenta	9	Sep/17/1942	2	Sur/Indirecto	Caribe	Sur (paso) peninsula Barahona
88	1960	TT	FLORENCE	9	Sep/18/1960	2	Norte/Indirecto	Atlantico	Costa Norte (paso)
111	2000	DT	HELENE	9	Sep/18/2000	2	Sur/Indirecto	Caribe	Frente a Peninsula Barahona
134	2017	GH	MARIA	9	Sep/21/2017	3	Norte/Indirecto	Atlantico	Costa Norte (paso)
31	1894	H	Huracan	9	Sep/22/1894	3	DIRECTO	Caribe	Barahona/Lenr/Haiti
54	1917	H	Huracan	9	Sep/22/1917	3	Sur/Indirecto	Caribe	Peninsula Barahona (frente)
77	1949	H	Huracan	9	Sep/22/1949	3	DIRECTO	Caribe	San Pedro/Costa Sur
109	1998	GH	GEORGES	9	Sep/22/1998	3	DIRECTO	Caribe	Este/Centro/Haiti
80	1952	DT	CHARLIE	9	Sep/23/1952	3	Norte/Indirecto	Atlantico	Formacion frente Cabrera
16	1877	TT	Tormenta	9	Sep/24/1877	3	Norte/Indirecto	Atlantico	Norte frente a costa
33	1896	TT	Tormenta	9	Sep/24/1896	3	Sur/Indirecto	Caribe	Sur frente costa
3	1852	H	Huracan	9	Sep/25/1852	3	Norte/Indirecto	Atlantico	Norte frente a costa
6	1857	H	Huracan	9	Sep/26/1857	3	Indirecto/Sur	Caribe	Sur frente a costa
14	1873	H	Huracan	9	Sep/27/1873	3	Sur/Indirecto	Caribe	Peninsula Barahona frente
46	1908	H	Huracan	9	Sep/27/1908	3	DIRECTO	Caribe	Peninsula Barahona
66	1932	H	Huracan	9	Sep/27/1932	3	DIRECTO	Caribe	Costa Sur/Peninsula Barahona
90	1963	H	EDITH	9	Sep/27/1963	3	DIRECTO	Caribe	Romana/Samana/Nagua

Num.	Año	Tipo	Nombre	Mes	Fecha	Dec.	Impacto	Via	Ruta
93	1966	GH	INEZ	9	Sep/29/1966	3	DIRECTO	Caribe	Peninsula Barahona
89	1961	TT	FRANCES	10	Oct/3/1961	1	DIRECTO	Caribe	San Rafael Yuma a Samana
91	1963	GH	FLORA	10	Oct/9/1963	1	Sur/Indirecto	Caribe	Paso frente a Pedernales
112	2001	TT	IRIS	10	Oct/6/2001	1	Sur/Indirecto	Caribe	Frente a Peninsula Barahona
113	2003	TT	MINDY	10	Oct/10/2003	1	Norte/Indirecto	Atlantico	Formacion frente a Samana
20	1879	TT	Tormenta	10	Oct/10/1879	1	Sur/Indirecto	Caribe	Sur paso frente a costa
26	1887	TT	Tormenta	10	Oct/18/1887	1	DIRECTO	Atlantico	Noreste/Cibao/Linea/Haiti
104	1985	TT	ISABEL	10	Oct/10/1985	1	DIRECTO	Caribe	Nizao/Central/Isabela
131	2016	GH	MATTHEW	10	Oct/19/2016	1	Sur/Indirecto	Caribe	Peninsula Barahona (frente)
123	2009	DT	HENRI	10	Oct/11/2009	2	DIRECTO	Atlantico	Costa Norte (Isabela)
74	1943	H	Huracan	10	Oct/14/1943	2	DIRECTO	Caribe	Higuey (Cabo Engaño)
83	1955	H	KATIE	10	Oct/17/1955	2	DIRECTO	Caribe	Pens. Barahona a Pto. Plata
87	1959	DT	GRACIE	10	Oct/21/1959	3	DIRECTO	Atlantico	Roce costa norte
24	1886	TT	Tormenta	10	Oct/22/1886	3	Haiti/Indirecto	Haiti	Frente a Montecristi
116	2005	TT	ALPHA	10	Oct/22y23/2005	3	DIRECTO	Caribe	Peninsula Barahona
39	1900	DT	Depresion	10	Oct/25/1900	3	DIRECTO	Caribe	Bahia Ocoa/Haiti
118	2007	TT	NOEL	10	Oct/28/2007	3	Sur/Indirecto	Caribe	Costa Sur (paso)
34	1898	TT	Tormenta	10	Oct/29/1898	3	DIRECTO	Caribe	Pen. Barahona
11	1866	GH	Gran Huracan	10	Oct/30/1866	3	Norte/Indirecto	Atlantico	Norte frente a costa
12	1867	H	Huracan	10	Oct/30/1867	3	DIRECTO	Caribe	Sur SD/Lenr/Haiti
48	1909	H	San Severo	11	Nov/12/1909	2	Norte/Indirecto	Caribe	Norte Montecristi/Pto. Pta.
69	1934	DT	Depresion	11	Nov/11/1934	3	DIRECTO	Haiti	Frontera Haiti Linea Noroeste
18	1878	TT	Tormenta	11	Nov/29/1878	3	Sur/Indirecto	Caribe	Sur paso frente a costa
114	2003	TT	ODETTE	12	Dic/6/2003	1	DIRECTO	Caribe	Pens. Barahona a Nagua
119	2007	TT	OLGA	12	Dic/12/2007	2	DIRECTO	Caribe	Este/Cibao/Haiti
103	1984	DT	LILI	12	Dic/24/1984	3	DIRECTO	Atlantico	Fin en Bahia Samana

Figure 6-26. Cyclones that have impacted the Dominican Republic directly or indirectly by month from 1851 to 2021 (DT/TT/H/GH).

Source: Ministry of Agriculture/ManEGon Te. Own elaboration based on NHC/NOAA Cyclone Trajectory. Update ManEGon Te on August 31, 2021.

An interesting fact is that 80% of the cyclones arrived between the months of August and September, therefore, these are the months where there is a greater risk of being affected.

During the last hurricane season, the Dominican Republic was affected by the passage of hurricane Fiona, category 1, on September 19, 2022. This hurricane mainly affected the eastern and northeastern part of the country, mainly the provinces of La Altagracia, La Romana, El Seibo, Hato Mayor, Monte Plata, Samaná, and María Trinidad Sánchez. (Figure 6-27).



Figure 6-27. Hurricane Fiona route

Source: <https://fvdigital.do/2022/09/19/huracan-fiona-cambia-su-ruta-y-pasara-sobre-territorio-nacional/>.

Two deaths were reported, 613 homes destroyed, 1555 homes partially damaged, 23 roads and 16 bridges affected, 12 communities cut off from communication, 300 homes with affected electrical service, 1 million homes with interrupted water service, damage to telephone and data systems, damage to agriculture, damage to hotels and tourist infrastructure, including extensive damage to a tourist pier in Miches, among others.

6.1.13.3 Threat of sea penetrations

Events such as earthquakes can give rise to sea penetrations. Data extracted from the Atlas of Biodiversity and Natural Resources (Ministry of Environment and Natural Resources, 2012) are presented below, with information on sea penetrations that occurred as a consequence of earthquakes in the Dominican Republic.

"In the territorial sea and within the country's territory, several phenomena of different magnitudes and depths have occurred. The area where the greatest number of earthquakes are concentrated is the north coast, and within this region, the area of Monte Cristi and Puerto Plata.

In the Dominican Republic, in 1946, an earthquake occurred on the north coast, produced by a displacement of the Caribbean plates, with a magnitude of 8.1 on the Richter scale, which caused a tidal wave causing serious damage in the community of Matancitas, in the municipality of Nagua.

6.1.13.4 Threat of atmospheric lightning strikes

This danger is due to the occurrence of natural electrical discharges, produced in the atmosphere and that the structures of the chimneys can attract them, as conduction routes to the ground. It is important to point out that, in many Caribbean countries, death due to electric discharges is one of the first causes due to natural phenomena.

Thunderstorms are one of the events that occur due to the instability of atmospheric conditions, with significant vertical air movements. One of the most characteristic facts of storms is that they are accompanied by electrical phenomena: lightning, thunder and lightning.

Considering that the average intensity during each main discharge is up to 20,000 amperes, it is not surprising that lightning is a very powerful event, however, the actual amount of electricity transferred from the cloud to the ground is very small, since this enormous current circulates only for a fraction of a second.

The damage caused by lightning is largely due to the heat it generates. On the one hand, they can cause fires with devastating consequences and/or damage to poorly protected structures.

Increased wind speed, downpours and cloudy skies are most often the precursor signs of an approaching thunderstorm, however, with thunderstorm clouds nearby, thunderstorms can occur several kilometers away and can affect even if it is sunny and rain-free. Another factor that contributes significantly to the occurrence of thunderstorms is high surface humidity.

It is important to mention that, in the project, these atmospheric indicators have been considered as a design element. It is recommended that attention be paid to the evolution of the phenomena and that emergency plans be activated in the case of personnel working and in the area of the generators.

The project facilities will be protected by grounding systems designed in accordance with the technical specifications of the work objects and the electrical resistivity of the local soils and sediments. These installations make the facilities very unlikely to be affected by this phenomenon; however, the associated personnel and the surrounding population must take measures because they are very vulnerable to the occurrence of this type of phenomenon (Photos 48 and 49 in Annex 11).

It is important that regardless of these measures installed, the personnel linked to the plant in all phases and the surrounding population should take measures in the event of the occurrence of these hazards, as they themselves are very vulnerable and unprotected elements.

6.1.14 Oceanographic studies

6.1.14.1 Bathymetric Surveys

One of the most important elements in coastal studies is the knowledge of the relief of the seabed and the coastal zone. At the local level, the formation of currents, wave transformation, tidal

behavior and wind circulation patterns have a marked influence on the relief, both emerged and submarine.

Although the Block 02 project as such does not have elements in the marine zone, the information is considered because of the interdependence that exists between the Block 01 and Block 02 projects for the supply of LNG and the operations of the cooling system; therefore, the data placed here comes from the study carried out on Block 01 as secondary information.

In order to characterize the ocean meteorology at the project site, it is necessary to know the sea relief over an area of several kilometers. For more remote areas, regional databases were used, while for the project site, local surveys were carried out at a high level of detail.

Regional scale data were taken from GEBCO. This is a database that provides the most accurate bathymetric information in public use data worldwide. GEBCO operates under the combined auspices of the International Hydrographic Organization (IHO) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO. Areas with missing information in the GEBCO databases were supplemented with data provided by C-MAP, which is part of the Navico group and offers digital charts for fishing and navigation purposes.

For the project area, higher quality and higher resolution information was used. These data were taken from the electronic charts of the port of Manzanillo, contained in the study "Digitization of nautical charts and smooth sheets for the Dominican Republic. Island of Hispaniola, Caribbean Sea", which is a project sponsored by the SEA GRANT COLLEGE PROGRAM and conducted by Professors Aurelio Mercado Irizarri and Harry Justiniano, from the Department of Marine Sciences of the University of Puerto Rico.

In order to obtain more precise details in the project area, high resolution surveys were carried out using multibeam and single-beam techniques. The multibeam surveys were carried out by INDEMAR and covered from depths of more than 200 meters to shallow areas with depths of 2 to 4 meters.

To know the depths in the area of the beaches and inside the estuary, EMPACA integrated the surveys carried out by INDEMAR, with bathymetric soundings using a single-beam sonde, integrated with motion sensors (IMU) and GNSS positioning in RTK mode.

For this purpose, a CEEPULSE-100 probe™ from CEE Hydrosystems was used. This equipment works at high frequency, which allows it to measure small depths with high resolution. The Figure 6-28 shows the CEEPULSE-100 probe™ and summarizes its technical specifications.

GNSS techniques were used for positioning during the surveys in RTK (*Real Time Kinematic*) mode, with NTRIP correction. A Trimble Spectra Precision SP-60 GNSS equipment was used as ground base. Photo 50 (Annex 11) shows the differential correction base station used during the bathymetric surveys of the estuary and the shallow nearshore reef zone.



Mode	Auto, Shallow auto and Manual
Frequency	High band: 190 kHz – 210 kHz
Output Power	High: 200 kHz – 172 W RMS max
Resolution	1 cm
Accuracy	0.01 m +/- 0.1% of depth @ 200 kHz
Depth range	0.3 – 100 m (0.98 – 328 ft) @ 200 kHz
Sound Velocity	1350 – 1750 m/s
	Resolution 1 m/s
Transducer Draft Setting	0 – 10 m (1 cm increments)
Index Offset	0 – 10 m
Blanking	27 – 300 cm
Ping rate	10 Hz (20 Hz optional)
Pulse length	200 kHz 1-30 cycles
TVG	None, LOG 10, LOG 20
Manual gain	30 – 100%
Detection threshold	10 – 50%



Figure 6-28. CEEPULSE-100 high frequency probe™ from CEE Hydrosystems.

Source: EMPACA, 2023.

In the beach area and along 2,500 meters, profiles perpendicular to the coast were made so that the bathymetric studies were integrated with the topographic surveys to obtain a unique digital relief model (DTM). Photo 51 (Annex 11) shows the process of surveying the coastal profiles using GNSS techniques in RTK mode.

The maps used in each stage of the study are shown below, depending on the required accuracy.

The Figure 6-29 shows the regional bathymetry used by AKTIS to conduct the wave and tidal transformation studies. This bathymetry integrates data from GEBCO, ENC, C-MAP, INDEMAR detailed surveys and areas completed by EMPACA.

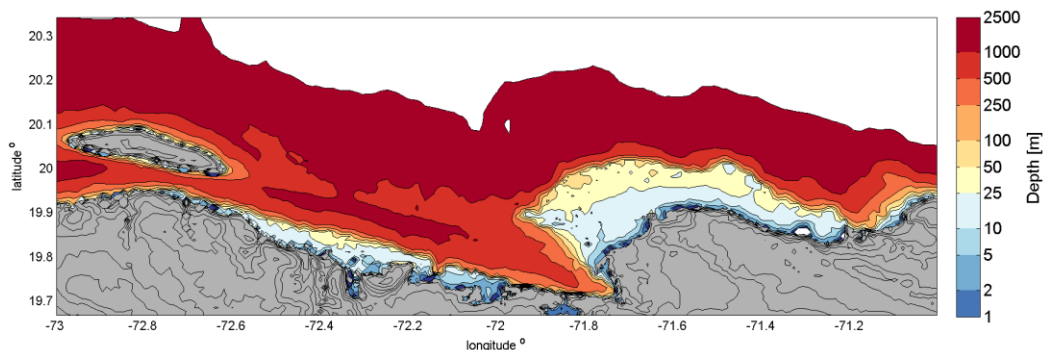


Figure 6-29. General bathymetry of the study area, used by AKTIS for the study of wave transformation and tidal behavior.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

The Figure 6-30 shows in detail the bathymetry used by AKTIS for wave, wind and tidal dynamics studies.

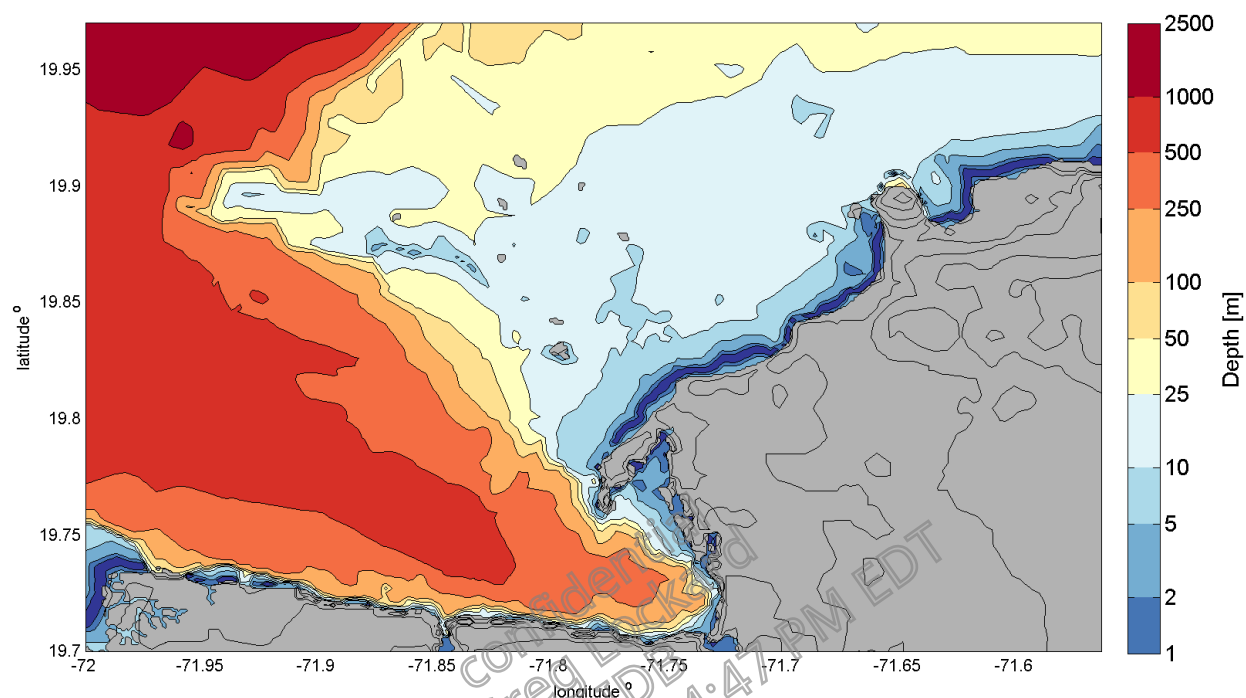


Figure 6-30. Regional bathymetry of Manzanillo Bay and the immediate oceanic zone.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

In Figure 6-31 shows the bathymetry data prepared by INDEMAR using multi-beam sounding techniques. This type of survey ensures high spatial resolution in data acquisition.

The performance of multi-beam sondes is very poor in shallower areas, since the beam aperture only covers a small area close to the vessels. Moreover, in shallow bottoms there is a danger that the transducers will be damaged by bumps against the bottom.

To obtain depth information in the shallower areas and the interior of the estuary, EMPACA completed the survey using single beam sounding techniques. The probe used has a frequency of 200 kHz, which allows it to record depths in the range of 0.3 to 100.0 meters with an accuracy of 0.01 meter.

Figure 1 in Annex 10.14 shows the bathymetry of the estuary and beaches near the project. The bathymetry is the result of integrating INDEMAR's surveys with EMPACA's soundings and topographic surveys. Figure 1 (Annex 10.14) highlights the area where most of the dynamic processes that influence the project occur and also marks the limits of the expected impacts.

In this zone, the resolution of the surveys is from 1.0 to 5.0 meters, which implies that the depths are represented by cells or triangular elements that have 1.0 to 5.0 meters on each side.

Finally, Figure 2 (Annex 10.14) shows the finite element mesh used in multiple numerical simulations of the hydrodynamic performance and the behavior of environmental variables as a function of the changes to be introduced by the project.

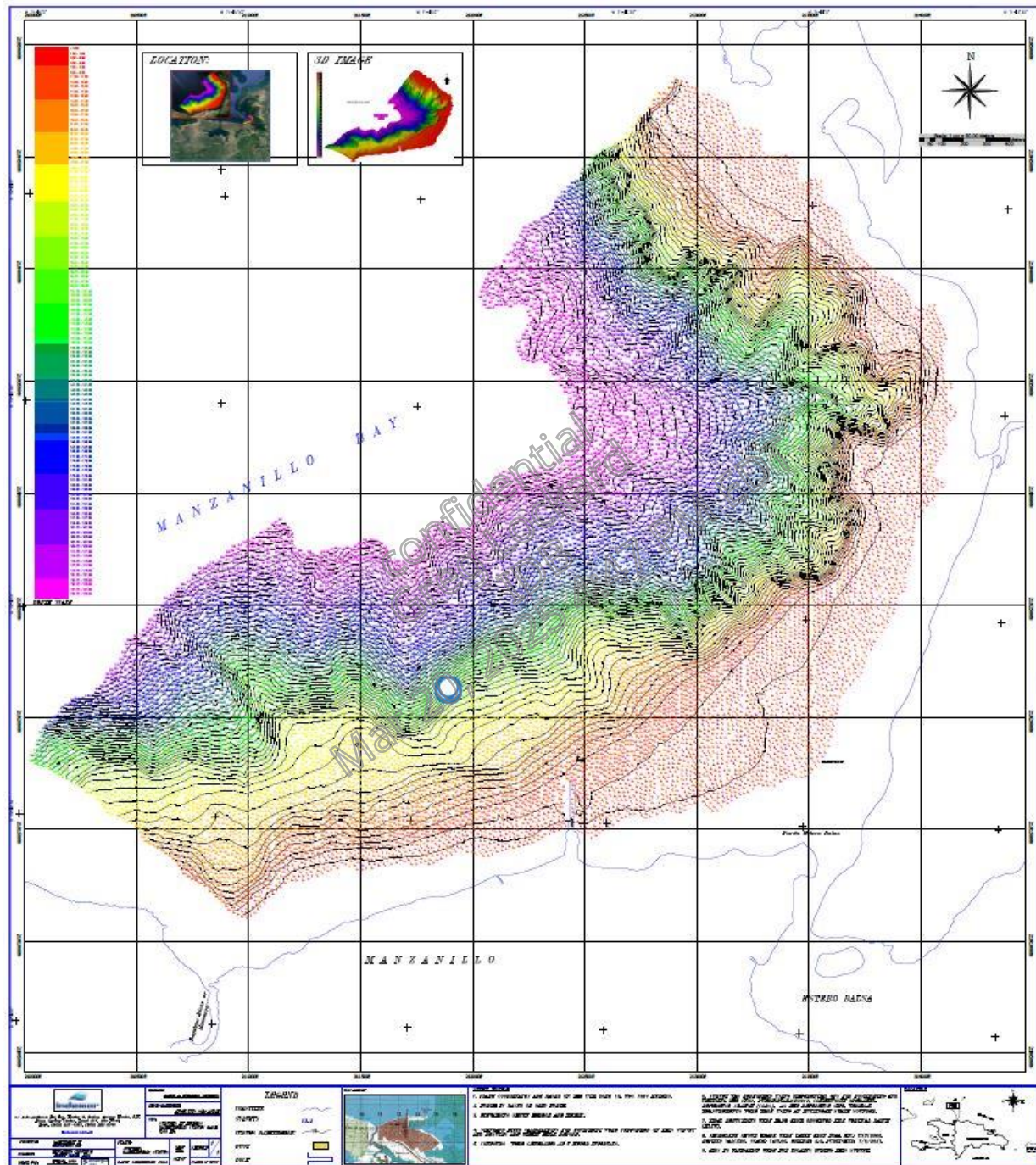


Figure 6-31. Bathymetric survey conducted by INDEMAR, using multibeam sounding and RTK positioning.

Source: INDEMAR.

6.1.14.2 Wind characterization.

For the characterization of the wind in the project area and its influence on environmental conditions, we have used the studies conducted by AKTIS as part of the project preparation and specific studies conducted by EMPACA, for the purpose of preparing the Environmental Impact Study.

In its study, ATKIS has used the ERA5 databases to evaluate planetary winds and other atmospheric parameters affecting the territory. The ERA5 database is a fifth generation ECMWF atmospheric reanalysis model, which covers the period from 1950 to the present, although in the study presented by AKTIS only the period from 1979 to 2020 is analyzed. The available data are organized in 31 km grids at 13 vertical levels, ranging from the surface to 0.01 hPa pressure (approximately 80 km altitude).

To calculate wind duration and wind profile for operational conditions and non-cyclonic storms, AKTIS uses the Frøya formulation recommended by Veritas (2010). When in-situ measurements are not available.

Frøya's formulation (Andersen and Løvseth, 2006), allows to calculate the wind speed at an elevation z , for an average duration t , as follows:

$$u(z, t) = U(z)^{40m} * \left(1 - 0.41 * I_u(z) * \ln \left(\frac{t}{t_0} \right) \right)$$

In this case, $t_0 = 40 \text{ min}$, while the wind speed for 40 min $U(z)^{40m}$ is calculated in m/s according to the following expression:

$$U(z)^{40m} = U_{10} * \left(1 + \frac{C_D^{0.5}}{0.4} * \ln \left(\frac{z}{10} \right) \right)$$

$$C_D = 5.26 * 10^{-4} * \left(1 + 1.48 * \frac{U_{10}}{10} \right)$$

Where the turbulence intensity factor $I_u(z)$ is given by the relation:

$$I_u(z) = 0.087 * \left(1 + 0.302 * \left(\frac{U_{10}}{10} - 1 \right) \right) * \left(\frac{z}{10} \right)^{-0.2}$$

In both the studies presented by AKTIS and the analyses and databases processed by EMPACA, the following conventions are used to represent the local wind:

- Units are expressed using the International System (SI) unless otherwise specified.
- Lengths and distances (wave height, surface elevation, water depth) are expressed in meters (m).

- The surface and wind speed elevation is referred to as *Mean Sea Level* (MSL).
- Depths are referenced to *Chart Datum* (CD).
- The period of the waves is expressed in seconds (s).
- Velocities are given in meters per second (m/s).
- To specify the direction of the wind and waves, the convention "from where it comes from" is used, with origin in the north. The angle is considered positive and grows clockwise.
- The direction of the currents is specified as "where it flows". The angle is considered positive and grows clockwise.

The Figure 6-32 shows the wind rose obtained by AKTIS for the whole year. In Figure 6-33 the combined frequency table of wind speed and wind direction is presented.

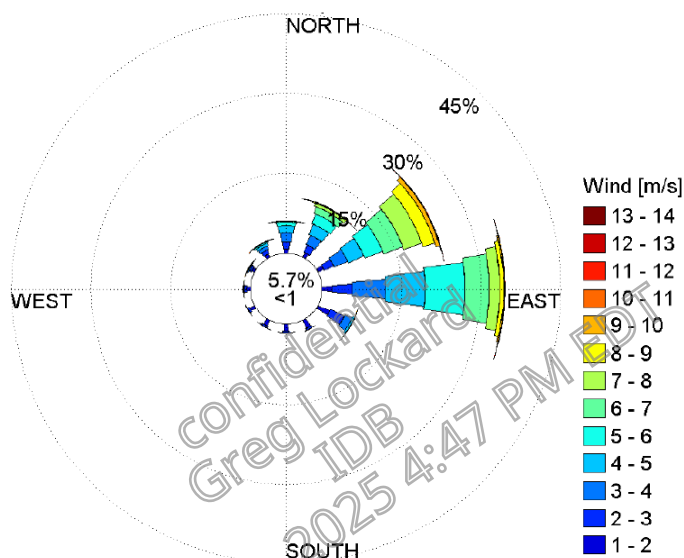


Figure 6-32. Annual wind rose obtained by AKTIS for the study area.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

		U_{lower}^{10d} [deg]	15.0	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	-
		U_{upper}^{10d} [deg]	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	345.0	-
$U_{lower}^{10,1hr}$ [m/s]	$U_{upper}^{10,1hr}$ [m/s]		-	-	-	-	-	-	-	-	-	-	-	-	Total
14.0	15.0	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
13.0	14.0	-	0.000	0.000	-	-	-	-	-	-	-	-	-	-	0.00
12.0	13.0	-	0.001	0.002	0.002	-	-	-	-	-	-	-	-	-	0.01
11.0	12.0	-	0.003	0.007	0.002	-	-	-	-	-	-	-	-	-	0.01
10.0	11.0	0.000	0.008	0.114	0.036	-	-	-	-	-	-	-	-	0.000	0.16
9.0	10.0	0.001	0.017	0.759	0.213	0.000	-	-	-	-	-	-	0.002	0.003	1.00
8.0	9.0	0.004	0.145	2.315	0.758	-	-	-	-	-	-	-	0.003	0.008	3.23
7.0	8.0	0.035	0.599	3.601	1.992	0.001	-	0.000	-	-	-	0.000	0.009	0.031	6.27
6.0	7.0	0.156	1.288	3.839	4.545	0.003	-	0.001	0.001	-	-	0.001	0.021	0.084	9.94
5.0	6.0	0.689	1.935	3.591	7.485	0.054	-	0.004	0.003	0.005	0.011	0.051	0.250	14.08	14.08
4.0	5.0	1.362	2.086	3.227	7.471	0.392	0.002	0.005	0.008	0.009	0.031	0.105	0.478	15.18	15.18
3.0	4.0	1.630	1.922	2.775	6.227	1.470	0.044	0.025	0.029	0.058	0.156	0.201	0.686	15.22	15.22
2.0	3.0	1.342	1.483	1.963	3.918	2.895	0.381	0.283	0.324	0.411	0.492	0.406	0.769	14.67	14.67
1.0	2.0	0.873	0.984	1.198	1.808	2.479	1.694	1.333	1.245	1.025	0.679	0.553	0.684	14.56	14.56
0.0	1.0	0.351	0.382	0.419	0.494	0.605	0.678	0.666	0.584	0.479	0.371	0.321	0.335	5.68	5.68
-	Total		6.444	10.853	23.810	34.951	7.901	2.799	2.317	2.195	1.986	1.742	1.671	3.330	100.000

Figure 6-33. Combined annual frequency chart of wind speed $U_{10,1hr}$ vs U_{10d} .

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

In addition to the annual characterization, AKTIS conducted a study of the seasonal wind behavior. The following figures show the monthly wind speed and direction roses and tables.

JANUARY

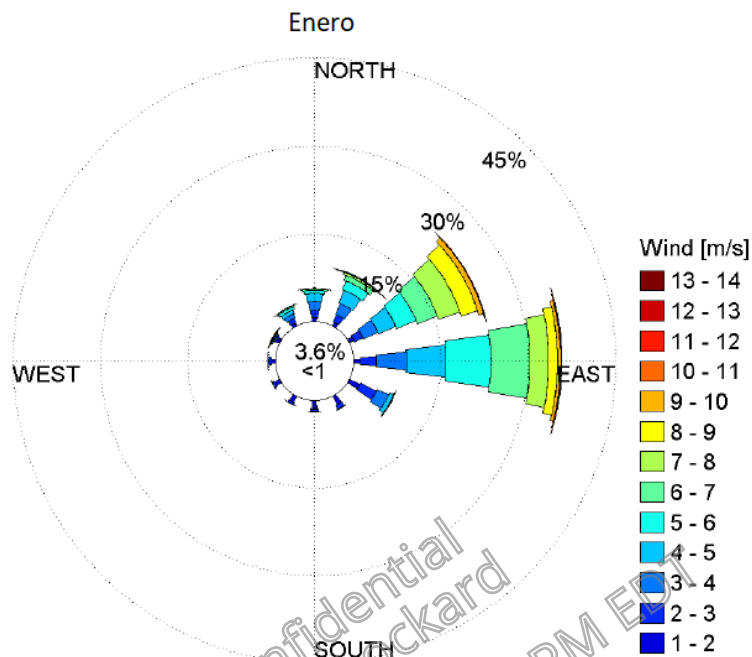


Figure 6-34. Wind rose calculated by AKTIS for the month of January in the project area.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

		U_{10d}^{lower} [deg]	15.0	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	-
		U_{10d}^{upper} [deg]	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	345.0	-
$U_{10,1hr}^{lower}$ [m/s]	$U_{10,1hr}^{upper}$ [m/s]		-	-	-	-	-	-	-	-	-	-	-	-	Total
14.0	15.0	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
13.0	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
12.0	13.0	-	0.006	-	-	-	-	-	-	-	-	-	-	-	0.01
11.0	12.0	-	0.026	0.013	0.006	-	-	-	-	-	-	-	-	-	0.04
10.0	11.0	-	0.029	0.118	0.163	-	-	-	-	-	-	-	-	-	0.31
9.0	10.0	-	0.048	0.867	0.538	-	-	-	-	-	-	-	0.006	-	1.46
8.0	9.0	0.010	0.086	2.928	1.546	-	-	-	-	-	-	-	0.022	0.016	4.61
7.0	8.0	0.090	0.358	3.907	3.219	-	-	-	-	-	-	0.003	0.042	0.045	7.66
6.0	7.0	0.218	0.886	3.683	6.669	0.013	-	-	-	-	-	0.010	0.080	0.221	11.78
5.0	6.0	0.582	1.587	3.578	7.773	0.154	-	-	-	-	-	0.029	0.118	0.435	14.26
4.0	5.0	1.376	2.336	3.226	6.724	0.749	-	0.010	0.003	-	-	0.038	0.195	0.688	15.34
3.0	4.0	1.530	2.026	2.733	5.213	2.179	0.102	0.048	-	0.048	0.173	0.224	0.730	-	15.01
2.0	3.0	1.232	1.334	1.575	2.723	3.053	0.730	0.480	0.397	0.381	0.477	0.378	0.813	-	13.57
1.0	2.0	0.666	0.704	0.883	1.146	1.984	1.655	1.437	1.194	0.989	0.611	0.467	0.563	-	12.30
0.0	1.0	0.266	0.202	0.211	0.314	0.426	0.426	0.426	0.342	0.307	0.278	0.198	0.253	-	3.65
-	Total		5.968	9.629	23.723	36.034	8.557	2.912	2.400	1.936	1.725	1.619	1.731	3.763	100.000

Figure 6-35. Combined probability of wind speed $U_{10,1hr}$ and direction U_{10d} , at station SOP1 calculated by AKTIS for the month of January.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

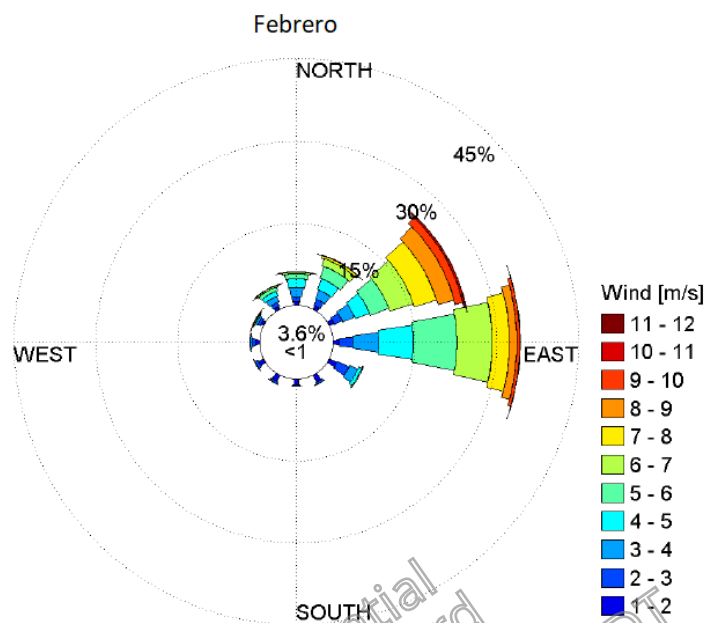
FEBRUARY

Figure 6-36. Wind rose calculated by AKTIS for the month of February in the project area.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

$U_{10,1hr}$ [m/s]	U_{10d} [deg]	-15.0	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	-
$U_{10,1hr}$ [m/s]	U_{10d} [deg]	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	345.0	-
$U_{10,1hr}$ [m/s]	U_{10d} [deg]	-	-	-	-	-	-	-	-	-	-	-	-	Total
14.0	15.0	-	-	-	-	-	-	-	-	-	-	-	-	0.00
13.0	14.0	-	-	-	-	-	-	-	-	-	-	-	-	0.00
12.0	13.0	-	-	-	-	-	-	-	-	-	-	-	-	0.00
11.0	12.0	-	-	0.017	0.003	-	-	-	-	-	-	-	-	0.02
10.0	11.0	-	-	0.381	0.065	-	-	-	-	-	-	-	-	0.45
9.0	10.0	0.003	0.003	1.440	0.573	-	-	-	-	-	-	0.007	0.021	2.05
8.0	9.0	0.027	0.086	3.093	1.427	-	-	-	-	-	-	0.003	0.024	4.66
7.0	8.0	0.120	0.477	4.300	3.107	-	-	-	-	-	-	0.021	0.048	8.07
6.0	7.0	0.274	1.331	4.503	6.471	-	-	-	-	-	-	0.003	0.069	12.91
5.0	6.0	0.933	2.236	3.611	7.960	0.154	-	-	-	-	0.051	0.117	0.665	15.73
4.0	5.0	1.605	2.085	2.805	6.344	0.628	-	-	-	0.017	0.062	0.189	0.881	14.62
3.0	4.0	1.595	1.691	2.370	4.787	1.629	0.041	0.014	0.038	0.075	0.226	0.429	1.049	13.94
2.0	3.0	1.022	1.252	1.529	2.449	2.359	0.436	0.298	0.436	0.580	0.730	0.535	0.782	12.41
1.0	2.0	0.634	0.720	0.960	1.121	1.523	1.382	1.077	1.235	1.060	0.713	0.504	0.590	11.52
0.0	1.0	0.233	0.243	0.257	0.247	0.412	0.305	0.394	0.412	0.305	0.288	0.237	0.298	3.63
-	Total	6.447	10.123	25.267	34.554	6.704	2.164	1.783	2.119	2.037	2.075	2.109	4.616	100.000

Figure 6-37. Combined probability of wind speed $U_{10,1hr}$ and direction U_{10d} , at station SOP1 calculated by AKTIS for the month of February.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

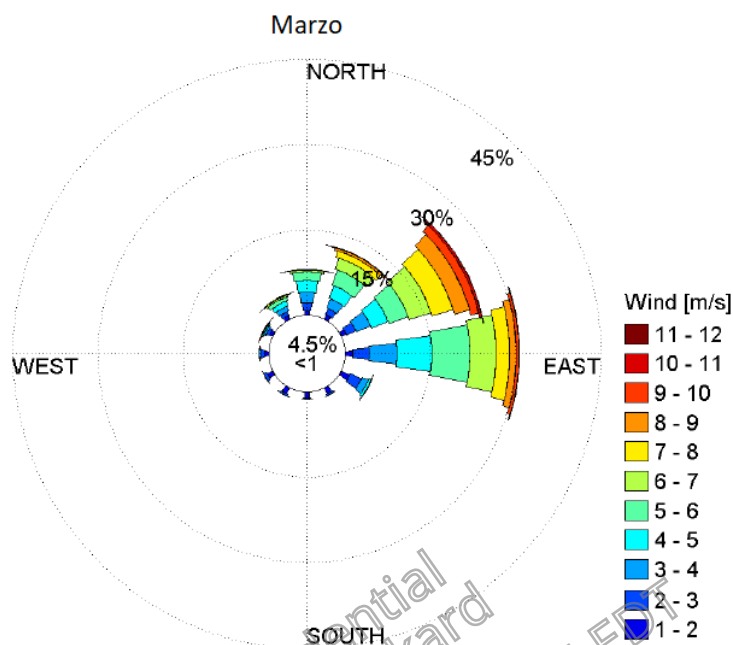
MARCH

Figure 6-38. Wind rose calculated by AKTIS for the month of March in the project area.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

$U_{10,1hr}^{lower}$ [m/s]	$U_{10,1hr}^{upper}$ [m/s]	U_{10d}^{lower} [deg]	U_{10d}^{upper} [deg]	-15.0	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	-
-	-	-	-	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	345.0	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Total
14.0	15.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
13.0	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
12.0	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
11.0	12.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
10.0	11.0	0.003	0.031	0.406	0.113	-	-	-	-	-	-	-	-	-	0.003	0.56
9.0	10.0	0.003	0.075	1.432	0.472	-	-	-	-	-	-	-	-	-	0.009	2.00
8.0	9.0	0.016	0.419	2.769	1.160	-	-	-	-	-	-	-	-	-	0.006	4.40
7.0	8.0	0.075	1.094	3.857	2.404	-	-	-	-	-	-	-	-	-	0.028	7.60
6.0	7.0	0.381	2.107	4.048	4.636	0.003	-	-	-	-	-	-	-	-	0.047	11.50
5.0	6.0	1.475	2.804	3.579	6.670	0.072	-	-	-	-	-	-	-	-	0.125	15.35
4.0	5.0	2.079	2.329	3.148	6.161	0.469	-	-	-	0.006	0.003	0.022	0.228	0.885	0.885	15.33
3.0	4.0	1.844	1.735	2.723	4.832	1.219	0.034	0.003	0.003	0.044	0.191	0.309	0.885	0.885	0.885	13.82
2.0	3.0	1.316	1.160	1.775	2.863	2.116	0.322	0.225	0.338	0.572	0.697	0.575	0.725	0.725	0.725	12.68
1.0	2.0	0.878	0.853	0.953	1.341	1.657	1.147	1.069	1.178	1.091	0.750	0.610	0.691	0.691	0.691	12.22
0.0	1.0	0.294	0.344	0.369	0.359	0.381	0.413	0.453	0.444	0.459	0.359	0.316	0.303	0.303	0.303	4.49
-	Total	8.365	12.956	25.094	31.011	5.917	1.916	1.750	1.969	2.169	2.019	2.254	4.579	100.000		

Figure 6-39. Combined probability of wind speed $U_{10,1hr}$ and direction U_{10d} , at station SOP1 calculated by AKTIS for the month of March.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

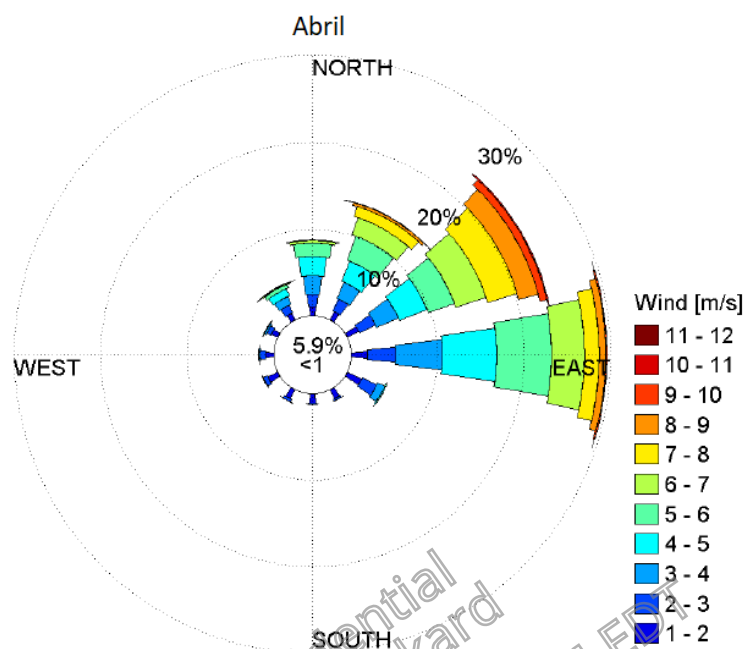
APRIL

Figure 6-40. Wind rose calculated by AKTIS for the month of April in the project area.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

-	U_{10d}^{lower} [deg]	-15.0	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	-
-	U_{10d}^{upper} [deg]	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	345.0	-
$U_{10,1hr}^{lower}$ [m/s]	$U_{10,1hr}^{upper}$ [m/s]	-	-	-	-	-	-	-	-	-	-	-	-	Total
14.0	15.0	-	-	-	-	-	-	-	-	-	-	-	-	0.00
13.0	14.0	-	-	-	-	-	-	-	-	-	-	-	-	0.00
12.0	13.0	-	-	-	-	-	-	-	-	-	-	-	-	0.00
11.0	12.0	-	-	-	-	-	-	-	-	-	-	-	-	0.00
10.0	11.0	-	0.023	0.142	0.006	-	-	-	-	-	-	-	-	0.17
9.0	10.0	-	0.026	0.820	0.139	-	-	-	-	-	-	-	0.006	0.99
8.0	9.0	-	0.307	2.319	0.766	-	-	-	-	-	-	-	0.019	3.41
7.0	8.0	0.084	1.221	3.569	1.696	-	-	-	-	-	-	-	0.048	6.62
6.0	7.0	0.333	2.096	3.682	3.805	-	-	-	-	-	-	-	0.116	10.03
5.0	6.0	1.521	2.968	3.220	6.344	0.003	-	-	-	-	0.010	0.026	0.436	14.53
4.0	5.0	2.242	2.494	3.427	6.302	0.142	-	-	0.003	-	0.023	0.052	0.888	15.57
3.0	4.0	2.077	2.019	2.762	5.397	0.895	0.013	0.003	0.026	0.071	0.171	0.229	0.953	14.62
2.0	3.0	1.473	1.537	2.061	3.272	1.883	0.239	0.174	0.346	0.526	0.581	0.514	0.963	13.57
1.0	2.0	1.076	1.082	1.489	1.848	1.815	1.166	1.059	1.169	1.263	0.953	0.827	0.891	14.64
0.0	1.0	0.381	0.417	0.388	0.549	0.568	0.623	0.507	0.585	0.533	0.481	0.397	0.423	5.85
-	Total	9.186	14.189	23.879	30.123	5.307	2.041	1.744	2.129	2.393	2.219	2.045	4.745	100.000

Figure 6-41. Combined probability of wind speed $U_{10,1hr}$ and direction U_{10d} , at station SOP1 calculated by AKTIS for the month of April.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

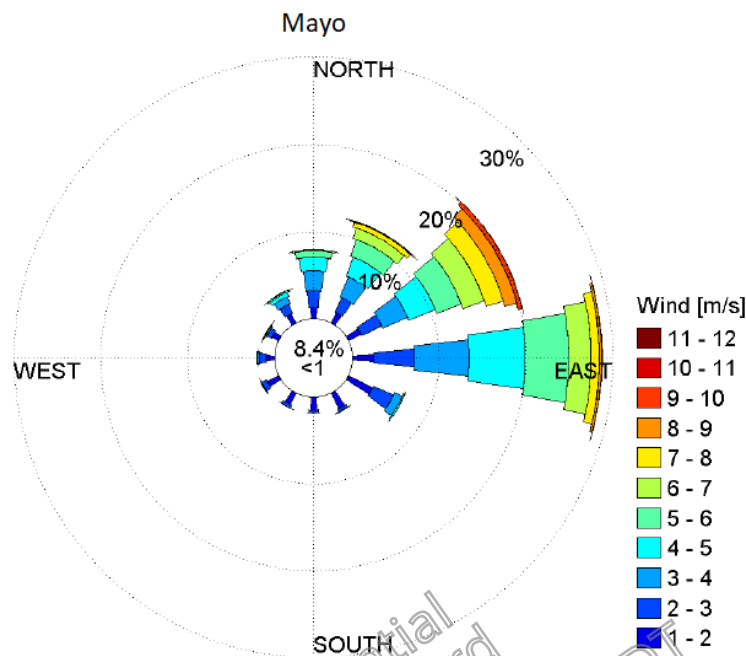
MAY

Figure 6-42. Wind rose calculated by AKTIS for the month of May in the project area.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

		U_{lower}^{10d} [deg]	U_{upper}^{10d} [deg]	-15.0	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	-
		U_{lower}^{10d} [m/s]	U_{upper}^{10d} [m/s]	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	345.0	Total
14.0	15.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
13.0	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
12.0	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
11.0	12.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
10.0	11.0	-	-	-	-	0.022	-	-	-	-	-	-	-	-	-	0.02
9.0	10.0	-	-	0.006	0.456	0.041	-	-	-	-	-	-	-	-	-	0.50
8.0	9.0	-	-	0.113	1.414	0.267	-	-	-	-	-	-	-	-	-	1.79
7.0	8.0	0.003	0.575	2.115	0.980	-	-	-	-	-	-	-	-	0.003	0.003	3.68
6.0	7.0	0.135	1.238	2.618	2.536	-	-	-	-	-	-	-	-	0.006	0.022	6.55
5.0	6.0	0.745	2.036	3.039	5.037	0.003	-	-	-	-	-	-	-	0.016	0.157	11.03
4.0	5.0	1.552	2.319	3.262	6.464	0.182	0.006	-	0.009	0.009	0.035	0.094	0.459	0.157	0.157	14.39
3.0	4.0	2.328	2.457	3.120	6.303	0.977	0.063	0.035	0.019	0.091	0.226	0.163	0.886	0.163	0.886	16.67
2.0	3.0	1.954	1.848	2.574	4.657	2.517	0.333	0.302	0.377	0.597	0.767	0.559	1.119	0.559	1.119	17.60
1.0	2.0	1.247	1.329	1.621	2.473	3.117	2.014	1.502	1.486	1.499	0.990	0.867	1.172	0.867	1.172	19.32
0.0	1.0	0.465	0.600	0.650	0.647	0.848	1.021	1.075	0.883	0.738	0.544	0.459	0.500	0.459	0.500	8.43
-	Total	8.431	12.522	20.890	29.405	7.645	3.438	2.913	2.775	2.935	2.561	2.168	4.317	100.000		

Figure 6-43. Combined probability of wind speed $U_{10,1hr}$ and direction U_{10d} , at station SOP1 calculated by AKTIS for the month of May.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

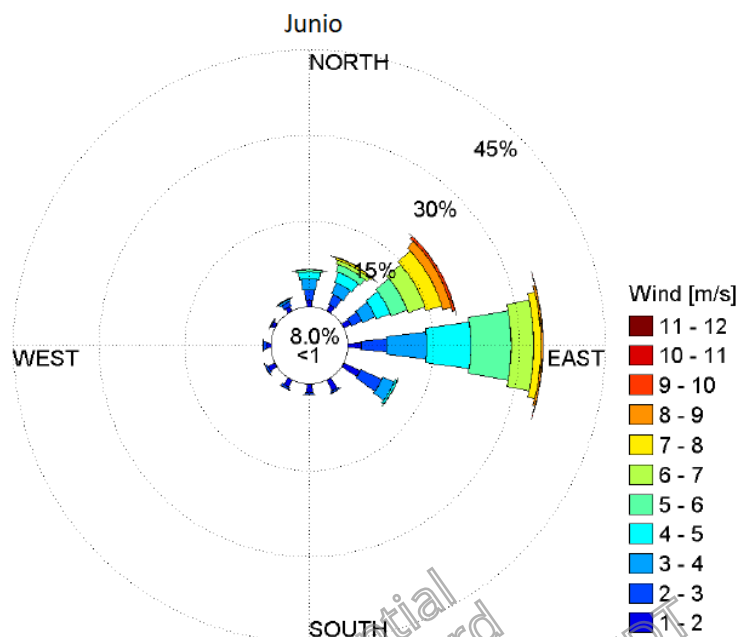
JUNE

Figure 6-44. Wind rose calculated by AKTIS for the month of June in the project area.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

$U_{10,1hr}^{lower}$ [m/s]	$U_{10,1hr}^{upper}$ [m/s]	U_{10d}^{lower} [deg]	U_{10d}^{upper} [deg]	-15.0	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	-
$U_{10,1hr}^{lower}$ [m/s]	$U_{10,1hr}^{upper}$ [m/s]	U_{10d}^{lower} [deg]	U_{10d}^{upper} [deg]	-	-	-	-	-	-	-	-	-	-	-	-	Total
14.0	15.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
13.0	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
12.0	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
11.0	12.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
10.0	11.0	-	-	0.023	0.003	-	-	-	-	-	-	-	-	-	-	0.03
9.0	10.0	-	0.003	0.436	0.032	-	-	-	-	-	-	-	-	-	-	0.47
8.0	9.0	-	0.061	1.586	0.329	-	-	-	-	-	-	-	-	-	-	1.98
7.0	8.0	0.006	0.371	2.868	1.282	-	-	-	-	-	-	-	-	-	-	4.53
6.0	7.0	0.045	0.685	3.130	3.937	-	-	-	-	-	-	-	-	-	-	7.80
5.0	6.0	0.401	1.250	2.972	7.057	0.036	-	-	-	-	-	-	-	-	0.042	11.76
4.0	5.0	1.260	1.822	2.613	7.723	0.417	-	-	-	0.003	0.013	0.003	0.120	13.97		
3.0	4.0	1.835	2.116	2.510	6.980	2.148	0.045	0.013	0.029	0.045	0.149	0.065	0.407	16.34		
2.0	3.0	1.770	1.867	1.990	4.474	4.057	0.333	0.336	0.423	0.381	0.484	0.216	0.804	17.14		
1.0	2.0	1.247	1.208	1.344	2.313	3.159	2.122	1.550	1.373	1.366	0.788	0.604	0.872	17.95		
0.0	1.0	0.494	0.507	0.694	0.669	0.778	0.946	1.072	0.875	0.640	0.481	0.446	0.446	8.05		
-	Total	7.057	9.890	20.165	34.800	10.594	3.446	2.972	2.700	2.435	1.915	1.334	2.691	100.000		

Figure 6-45. Combined probability of wind speed $U_{10,1hr}$ and direction U_{10d} , at station SOP1 calculated by AKTIS for the month of June.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

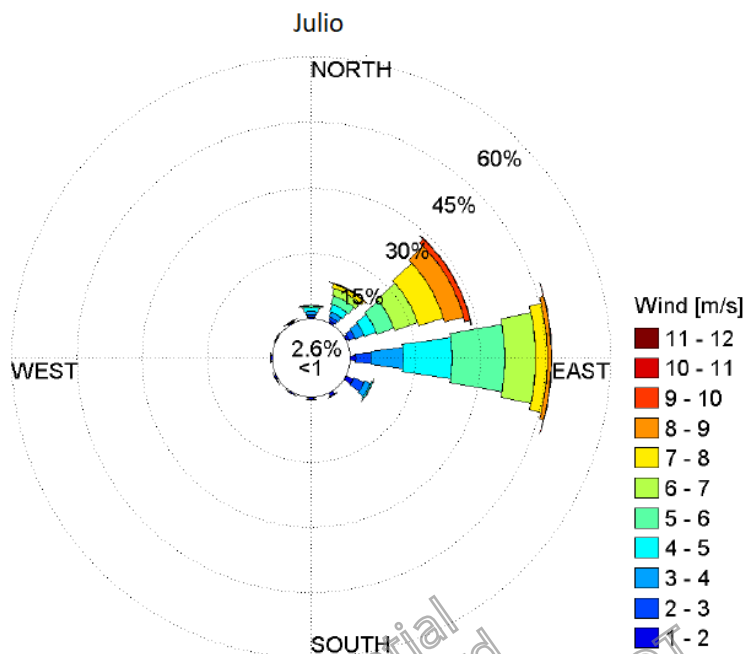
JULY

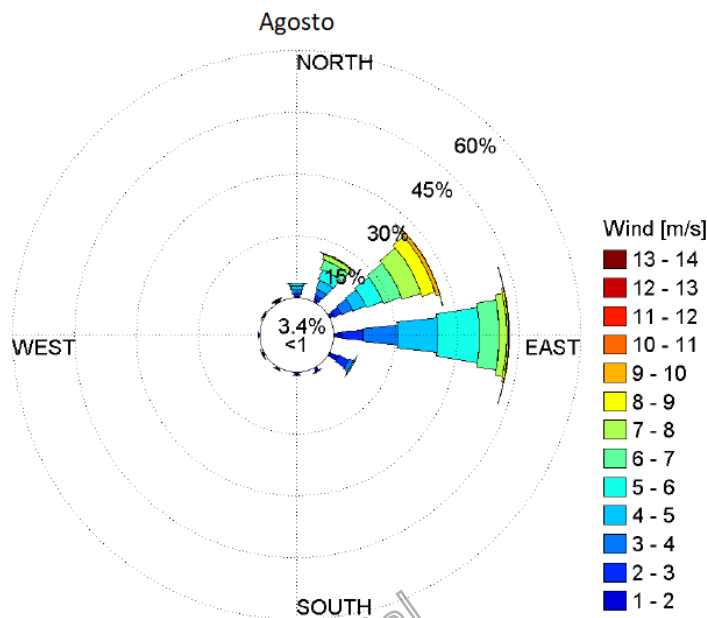
Figure 6-46. Wind rose calculated by AKTIS for the month of July in the project area.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

$U_{10,1hr}^{lower}$ [m/s]	$U_{10,1hr}^{upper}$ [m/s]	U_{10d}^{lower} [deg]	U_{10d}^{upper} [deg]	-15.0	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	-
$U_{10,1hr}^{lower}$ [m/s]	$U_{10,1hr}^{upper}$ [m/s]	U_{10d}^{lower} [deg]	U_{10d}^{upper} [deg]	-	-	-	-	-	-	-	-	-	-	-	-	Total
14.0	15.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
13.0	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
12.0	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
11.0	12.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
10.0	11.0	-	-	0.118	0.010	-	-	-	-	-	-	-	-	-	-	0.13
9.0	10.0	-	0.003	1.254	0.111	-	-	-	-	-	-	-	-	-	-	1.37
8.0	9.0	-	0.242	4.542	0.914	-	-	-	-	-	-	-	-	-	-	5.70
7.0	8.0	0.010	0.933	5.987	2.767	-	-	-	-	-	-	-	-	-	-	9.70
6.0	7.0	0.118	1.608	5.561	7.077	0.003	-	-	-	-	-	-	-	-	-	14.37
5.0	6.0	0.406	1.932	4.156	12.154	0.052	-	-	-	-	0.003	-	-	-	0.020	18.72
4.0	5.0	0.812	1.710	2.892	11.266	0.354	-	-	-	0.007	0.010	-	0.003	0.039	0.128	17.09
3.0	4.0	0.760	1.215	2.148	7.392	1.470	0.010	0.003	0.010	0.036	0.075	0.016	0.128	0.255	7.35	13.26
2.0	3.0	0.583	0.809	1.382	3.511	2.548	0.141	0.075	0.029	0.151	0.203	0.069	0.177	0.255	7.35	9.68
1.0	2.0	0.409	0.544	0.704	1.277	1.821	0.793	0.475	0.350	0.324	0.216	0.183	0.255	0.255	7.35	7.35
0.0	1.0	0.154	0.183	0.210	0.282	0.341	0.383	0.295	0.190	0.141	0.177	0.134	0.141	0.141	2.63	2.63
-	Total	3.252	9.180	28.955	46.761	6.589	1.326	0.848	0.586	0.665	0.671	0.406	0.760	100.000		

Figure 6-47. Combined probability of wind speed $U_{10,1hr}$ and direction U_{10d} , at station SOP1 calculated by AKTIS for the month of July.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

AUGUST**Figure 6-48. Wind rose calculated by AKTIS for the month of August in the project area.**

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

		-15.0	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	-
		15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	345.0	-
$U_{10,1hr}$ [m/s]	U_{10d} [deg]	-	-	-	-	-	-	-	-	-	-	-	-	Total
14.0	15.0	-	-	-	-	-	-	-	-	-	-	-	-	0.00
13.0	14.0	-	-	-	-	-	-	-	-	-	-	-	-	0.00
12.0	13.0	-	-	0.014	0.014	-	-	-	-	-	-	-	-	0.03
11.0	12.0	-	-	0.011	0.007	-	-	-	-	-	-	-	-	0.02
10.0	11.0	-	-	0.036	0.007	-	-	-	-	-	-	-	-	0.04
9.0	10.0	-	0.029	0.004	0.058	-	-	-	-	-	-	-	-	0.99
8.0	9.0	-	0.257	3.313	0.467	-	-	-	-	-	-	-	-	4.04
7.0	8.0	0.004	1.244	4.858	1.852	0.004	-	-	-	-	-	-	-	7.96
6.0	7.0	0.123	2.402	4.601	4.807	-	-	-	-	-	-	-	-	11.93
5.0	6.0	0.608	2.565	4.275	10.056	0.022	-	-	-	0.004	-	0.004	0.051	17.58
4.0	5.0	0.922	2.246	3.324	9.759	0.289	0.004	-	-	0.004	-	0.007	0.105	16.66
3.0	4.0	0.998	1.472	2.894	8.526	1.176	0.029	0.018	0.022	0.014	0.036	0.036	0.170	15.39
2.0	3.0	0.582	1.038	1.899	5.050	2.637	0.134	0.141	0.087	0.159	0.174	0.109	0.224	12.23
1.0	2.0	0.434	0.644	1.031	1.971	2.311	1.016	0.604	0.517	0.405	0.279	0.271	0.279	9.76
0.0	1.0	0.170	0.231	0.271	0.329	0.463	0.488	0.391	0.297	0.246	0.156	0.163	0.152	3.36
-	Total	3.841	12.128	27.433	42.903	6.902	1.671	1.154	0.922	0.832	0.644	0.590	0.980	100.000

Figure 6-49. Combined probability of wind speed $U_{10,1hr}$ and direction U_{10d} , at station SOP1 calculated by AKTIS for the month of August.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

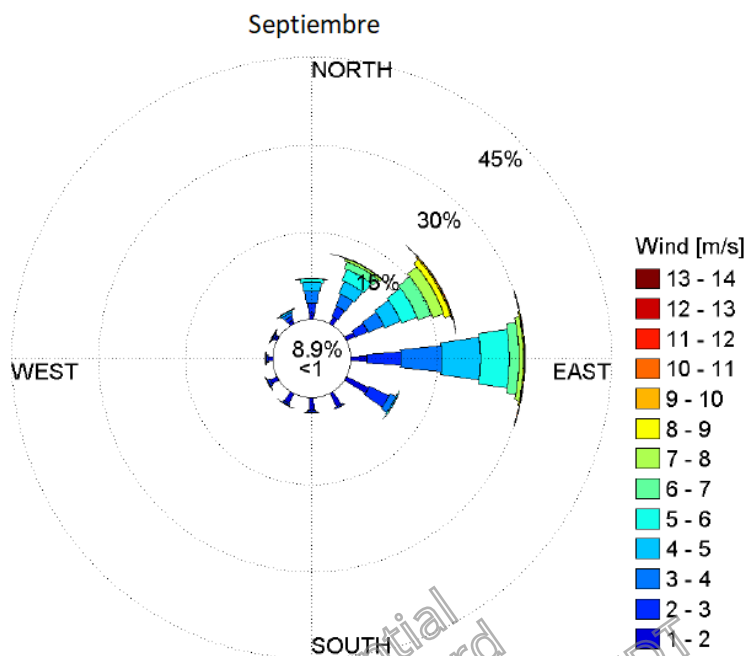
SEPTEMBER

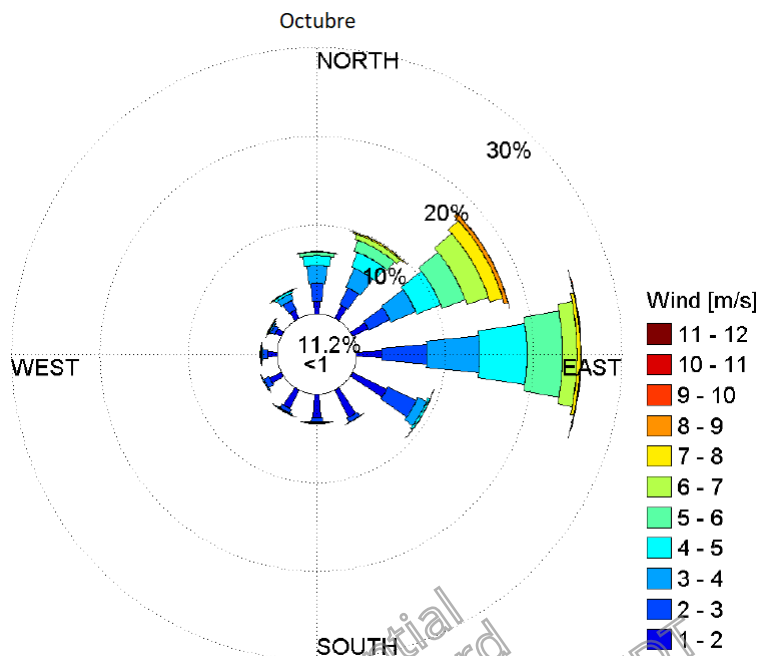
Figure 6-50. Wind rose calculated by AKTIS for the month of September in the project area.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

		-15.0	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	-
		15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	345.0	-
$U_{10,1hr}^{lower}$ [m/s]	$U_{10,1hr}^{upper}$ [m/s]	-	-	-	-	-	-	-	-	-	-	-	-	Total
14.0	15.0	-	-	-	-	-	-	-	-	-	-	-	-	0.00
13.0	14.0	-	0.004	0.004	-	-	-	-	-	-	-	-	-	0.01
12.0	13.0	-	-	0.020	0.020	-	-	-	-	-	-	-	-	0.04
11.0	12.0	-	-	0.008	0.012	-	-	-	-	-	-	-	-	0.02
10.0	11.0	-	-	0.035	0.012	-	-	-	-	-	-	-	-	0.05
9.0	10.0	-	-	0.212	0.031	-	-	-	-	-	-	-	-	0.24
8.0	9.0	-	0.082	1.032	0.216	-	-	-	-	-	-	-	-	1.33
7.0	8.0	0.004	0.443	2.024	0.753	-	-	-	-	-	-	-	0.004	3.23
6.0	7.0	0.059	1.275	2.491	1.675	0.004	-	-	0.004	-	-	0.004	0.008	5.52
5.0	6.0	0.569	2.060	2.868	4.967	0.016	-	-	0.004	0.020	0.012	0.039	0.094	10.65
4.0	5.0	1.558	2.244	2.982	6.729	0.216	-	0.008	0.016	0.031	0.051	0.102	0.341	14.28
3.0	4.0	2.040	2.217	2.927	7.019	1.130	0.027	0.067	0.094	0.126	0.122	0.090	0.585	16.44
2.0	3.0	1.734	1.895	2.370	5.815	3.763	0.302	0.302	0.381	0.428	0.388	0.333	0.738	18.45
1.0	2.0	1.122	1.318	1.632	2.821	4.257	2.558	2.221	1.852	1.310	0.694	0.483	0.604	20.87
0.0	1.0	0.522	0.530	0.624	0.773	1.048	1.373	1.075	1.028	0.687	0.467	0.369	0.381	8.87
-	Total	7.608	12.068	19.229	30.842	10.432	4.261	3.672	3.378	2.601	1.734	1.420	2.754	100.000

Figure 6-51. Combined probability of wind speed $U_{10,1hr}$ and direction U_{10d} , at station SOP1 calculated by AKTIS for the month of September.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

OCTOBER**Figure 6-52. Wind rose calculated by AKTIS for the month of October in the project area.****Source:** Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

-	U_{10d}^{lower} [deg]	-15.0	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	-
-	U_{10d}^{upper} [deg]	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	345.0	-
$U_{10,1hr}^{lower}$ [m/s]	$U_{10,1hr}^{upper}$ [m/s]	-	-	-	-	-	-	-	-	-	-	-	-	Total
14.0	15.0	-	-	-	-	-	-	-	-	-	-	-	-	0.00
13.0	14.0	-	-	-	-	-	-	-	-	-	-	-	-	0.00
12.0	13.0	-	-	-	-	-	-	-	-	-	-	-	-	0.00
11.0	12.0	-	-	-	-	-	-	-	-	-	-	-	-	0.00
10.0	11.0	-	-	-	0.003	-	-	-	-	-	-	-	-	0.00
9.0	10.0	-	-	0.043	0.013	-	-	-	-	-	-	-	-	0.06
8.0	9.0	-	0.013	0.424	0.074	-	-	-	-	-	-	-	-	0.51
7.0	8.0	-	0.137	1.514	0.371	0.003	-	0.003	-	-	-	-	0.003	2.03
6.0	7.0	0.037	0.605	2.550	1.641	0.003	-	0.010	0.010	-	0.003	0.010	0.003	4.87
5.0	6.0	0.424	1.273	2.821	4.044	0.027	-	0.053	0.030	0.017	0.027	0.053	0.060	8.83
4.0	5.0	1.133	1.782	2.878	5.341	0.257	0.020	0.047	0.047	0.027	0.084	0.094	0.277	11.99
3.0	4.0	1.969	2.310	3.065	5.956	1.103	0.053	0.060	0.107	0.114	0.197	0.194	0.742	15.87
2.0	3.0	2.046	2.102	2.637	5.094	3.553	0.495	0.475	0.478	0.632	0.572	0.485	1.160	19.73
1.0	2.0	1.424	1.634	1.959	2.848	4.318	3.473	2.671	2.326	1.487	1.006	0.755	1.009	24.91
0.0	1.0	0.709	0.739	0.752	1.043	1.237	1.380	1.427	1.227	0.989	0.578	0.582	0.535	11.20
-	Total	7.741	10.596	18.644	26.429	10.502	5.421	4.746	4.225	3.266	2.467	2.173	3.790	100.000

Figure 6-53. Combined probability of wind speed U_{10,1hr} and direction U_{10d}, at station SOP1 calculated by AKTIS for the month of October.**Source:** Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

NOVEMBER

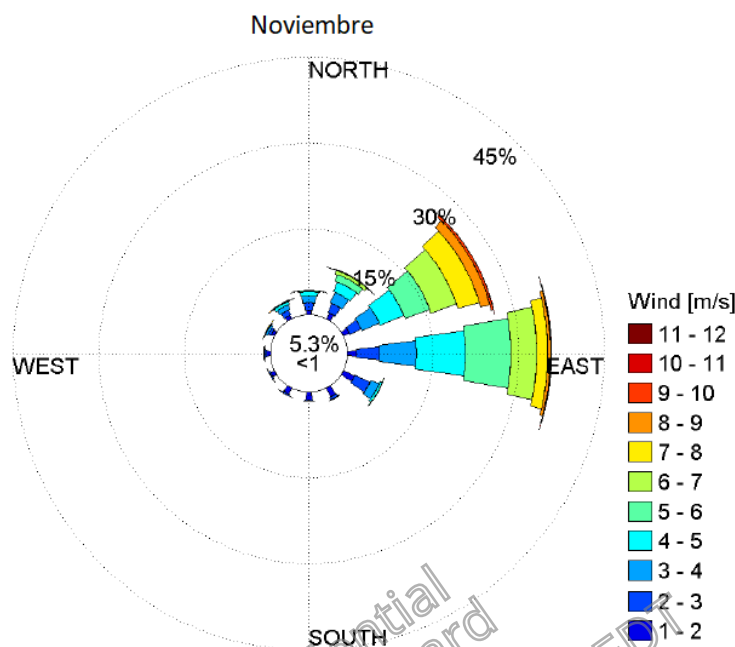


Figure 6-54. Wind rose calculated by AKTIS for the month of November in the project area.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

$U_{10,1hr}^{lower}$ [m/s]	$U_{10,1hr}^{upper}$ [m/s]	U_{10d}^{lower} [deg]	U_{10d}^{upper} [deg]	-15.0	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	-
				15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	345.0	Total
14.0	15.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
13.0	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
12.0	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
11.0	12.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
10.0	11.0	-	-	0.007	0.007	0.003	0.020	-	-	-	-	-	-	-	-	0.03
9.0	10.0	0.007	0.007	0.007	0.007	0.415	0.136	-	-	-	-	-	-	-	-	0.56
8.0	9.0	-	-	0.014	0.014	1.635	0.500	-	-	-	-	-	-	-	0.003	2.15
7.0	8.0	0.007	0.119	0.119	3.912	1.971	-	-	-	-	-	-	-	0.003	0.031	6.04
6.0	7.0	0.041	0.605	0.605	4.769	4.493	0.003	-	-	-	-	-	-	0.003	0.027	9.94
5.0	6.0	0.194	1.200	1.200	4.592	7.943	0.044	-	-	0.003	0.017	0.003	0.031	0.109	-	14.14
4.0	5.0	0.738	1.825	1.825	4.497	8.589	0.425	-	-	0.010	0.003	0.017	0.143	0.530	-	16.78
3.0	4.0	1.169	1.982	1.982	3.304	6.465	1.550	0.075	0.020	0.017	0.037	0.139	0.394	0.819	-	15.97
2.0	3.0	1.292	1.706	1.706	2.186	4.082	2.903	0.489	0.231	0.279	0.258	0.387	0.537	0.962	-	15.31
1.0	2.0	0.812	1.169	1.169	1.156	1.536	2.179	1.757	1.417	1.193	0.714	0.608	0.571	0.704	-	13.82
0.0	1.0	0.357	0.364	0.364	0.418	0.506	0.510	0.544	0.578	0.503	0.425	0.374	0.306	0.370	-	5.25
-	Total	-	-	4.616	8.997	26.886	36.243	7.614	2.865	2.247	2.005	1.455	1.530	1.988	3.555	100.000

Figure 6-55. Combined probability of wind speed $U_{10,1hr}$ and direction U_{10d} , at station SOP1 calculated by AKTIS for the month of November.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

DECEMBER

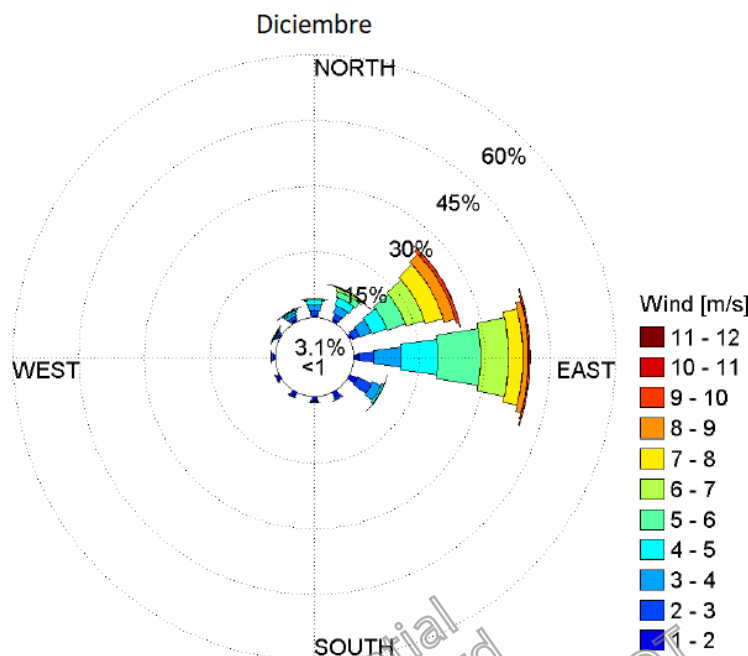


Figure 6-56. Wind rose calculated by AKTIS for the month of December in the project area.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

$U_{10,1hr}^{lower}$ [m/s]	$U_{10,1hr}^{upper}$ [m/s]	U_{10d}^{lower} [deg]	U_{10d}^{upper} [deg]	-15.0	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	-
$U_{10,1hr}^{lower}$ [m/s]	$U_{10,1hr}^{upper}$ [m/s]	-15.0	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	345.0	-	Total
14.0	15.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
13.0	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
12.0	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
11.0	12.0	-	0.006	-	-	-	-	-	-	-	-	-	-	-	-	0.01
10.0	11.0	-	0.003	0.058	0.013	-	-	-	-	-	-	-	-	-	-	0.07
9.0	10.0	-	0.003	0.733	0.361	0.003	-	-	-	-	-	-	-	-	-	1.10
8.0	9.0	-	0.035	2.588	1.307	-	-	-	-	-	-	-	-	-	0.003	3.93
7.0	8.0	0.010	0.197	4.208	3.285	-	-	-	-	-	-	-	-	0.003	0.039	7.74
6.0	7.0	0.081	0.665	4.366	6.393	0.003	-	-	-	-	-	-	-	0.029	0.055	11.59
5.0	6.0	0.332	1.330	4.373	9.733	0.065	-	-	-	-	-	-	-	0.074	0.252	16.16
4.0	5.0	0.991	1.839	3.656	8.410	0.549	-	-	-	-	-	0.032	0.142	0.461	0.461	16.08
3.0	4.0	1.375	1.814	2.782	6.225	2.091	0.032	0.023	-	0.006	0.152	0.239	0.820	0.820	0.820	15.56
2.0	3.0	1.065	1.281	1.639	3.469	3.501	0.591	0.349	0.310	0.236	0.381	0.523	0.700	0.700	0.700	14.04
1.0	2.0	0.513	0.636	0.704	1.178	1.904	1.365	1.017	1.117	0.755	0.491	0.436	0.510	0.510	0.510	10.62
0.0	1.0	0.177	0.232	0.197	0.242	0.319	0.326	0.336	0.271	0.281	0.258	0.236	0.210	0.210	0.210	3.09
-	Total	4.544	8.042	25.304	40.617	8.436	2.314	1.723	1.697	1.278	1.313	1.681	3.050	100.000		

Figure 6-57. Combined probability of wind speed $U_{10,1hr}$ and direction U_{10d} , at station SOP1 calculated by AKTIS for the month of December.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

In addition to the wind characterization developed by AKTIS, EMPACA conducted an additional study to develop three-dimensional hydrodynamic models to simulate the thermal plume and coastal evolution. The results of both characterizations were compared for confirmation purposes.

The wind characterization performed by EMPACA is based on *hindcast* data obtained by NOAA for the period from February 2005 to May 2019. The data were collected from the WAVEWATCH III model. This data comprises a 14-year time series of wind and wave characteristics at 3-hour intervals over an unstructured grid of the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico. The data correspond to the deep-water area offshore of the project, at coordinates 71.83 W - 19.83 N, of Node (170, 120) located 16 km northwest of the site of interest (Figure 6-58).



Figure 6-58. Location of Node (170,120) of the NOAA Waves Watch III hindcasting model oceanographic database.

Source: NOAA.

The Figure 6-59 y Figure 6-60 show the wind rose and the combined frequency table of wind speed and direction for the entire year. In this case, the rose indicates the direction in which the wind is blowing.

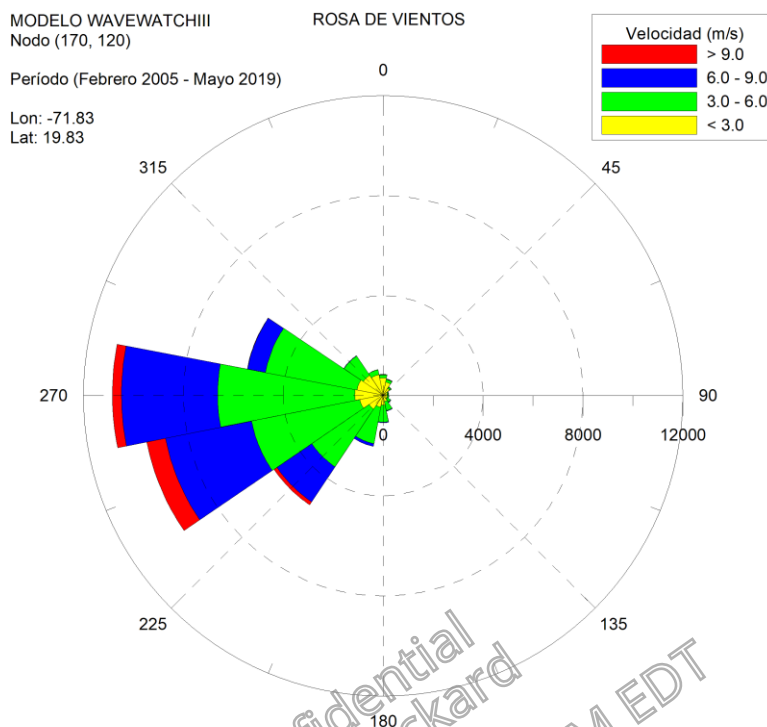


Figure 6-59. Annual wind rose, obtained from Node (170,120) of the *Waves Watch III* model. The rose indicates the direction in which the wind is blowing.

Source: NOAA.

Velocidad (m/s)	Dirección																Total
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	
> 10.0			30	312	136	8		2	6	7	4	1	2	3	3	4	518
9.0-10.0	1	1	118	467	237	5	1	2	1	2	2	1	1	1			840
8.0-9.0		2	291	784	606	47	4	1	3	2	3			1		3	1747
7.0-8.0	10	20	542	1271	1287	155	2	1	4	6	1	3	4		4	5	3315
6.0-7.0	19	92	884	1527	2027	546	9	3	5	6	1	5	5	3	14	10	5156
5.0-6.0	99	387	1054	1661	2343	1162	53	6	8	5	9	5	6	17	30	52	6897
4.0-5.0	264	607	1036	1605	1890	1434	231	22	17	15	16	11	22	14	67	127	7378
3.0-4.0	324	520	743	1240	1369	1209	667	173	100	92	48	31	27	29	77	197	6846
2.0-3.0	253	311	431	670	765	718	639	474	370	249	143	58	65	70	71	152	5439
1.0-2.0	127	147	200	229	334	304	282	314	255	217	129	79	52	68	85	91	2913
< 1.0	36	50	63	68	57	59	52	54	68	64	50	39	44	42	32	36	816
Total	1133	2137	5392	9834	11051	5647	1940	1052	837	665	406	233	228	248	383	677	41865

Figure 6-60. Table of combined annual wind speed and direction frequency obtained from Node (170,120) of the *Waves Watch III* model.

Source: NOAA.

Similar to the data obtained by AKTIS, there is a predominance of easterly winds, followed by easterly-northeasterly winds.

To input the wind data to the three-dimensional hydrodynamic model. EMPACA performed a wind speed exceedance probability analysis. The Figure 6-61 shows the wind speed exceedance probability. Similarly, Figure 6-62 shows the probability curve associated with these data.

Q	Velocidad (m/s)	Probabilidad (%)
0.01	9.56	1.00
0.02	8.54	2.00
0.05	7.19	5.00
0.10	6.17	10.00
0.20	5.15	20.00
0.30	4.56	30.00
0.40	4.13	40.00
0.50	3.81	50.00
0.60	3.54	60.00
0.70	3.31	70.00
0.80	3.11	80.00
0.90	2.94	90.00
1.00	2.79	100.00

Figure 6-61. Probability of wind speed exceedance, for the study area. Values obtained from the statistics of Node 170,120 of the WWIII model.

Source: EMPACA elaboration, 2023

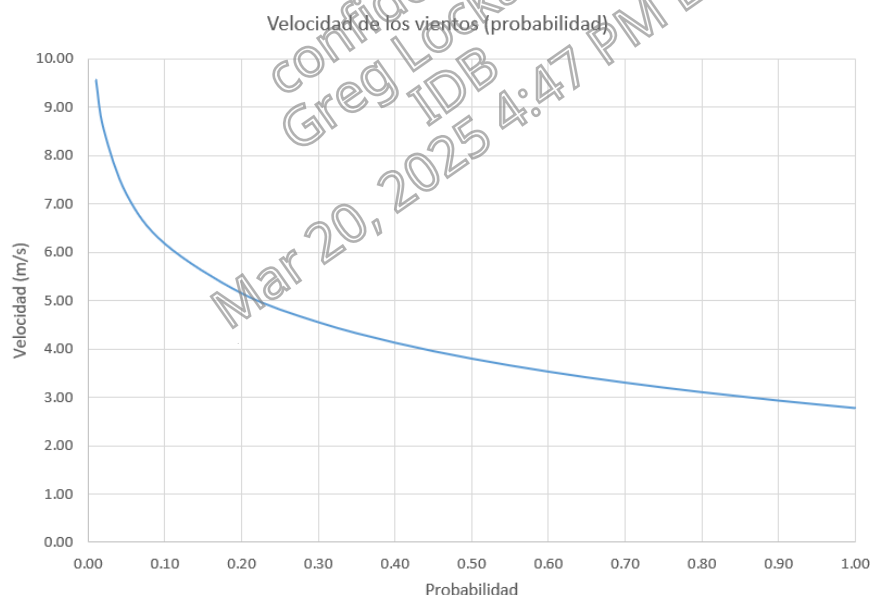


Figure 6-62. Wind speed exceedance probability plot according to the WWIII model.

Source: EMPACA elaboration, 2023

According to the fit, for a probability of 0.9, the wind speed may exceed 2.94 m/s, while for a probability of 0.5, the wind speed may exceed 3.81 m/s.

As for the monthly behavior, the NOAA WWill model confirms the results obtained by AKTIS. The figures from Figure 6-63 to Figure 6-74 show the monthly behavior of wind speed and direction for Node (170,120) of the WWill model.

Velocidad (m/s)	Dirección																Total
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	
> 10.0			4	22	24	1											51
9.0-10.0		1	9	41	48	2											101
8.0-9.0		1	13	61	77	7											159
7.0-8.0	6		32	113	156	26									1	1	336
6.0-7.0	4	6	56	148	213	58				1					4	1	491
5.0-6.0	9	32	93	154	208	93	7			1	1	1		1	1	7	608
4.0-5.0	31	57	91	113	177	105	21	1	2	2	1	1	5	2	9	17	635
3.0-4.0	15	40	72	70	103	98	50	15	13	10	7	3	2		10	18	526
2.0-3.0	23	26	29	37	51	38	36	32	25	20	11	4	4	2	5	6	349
1.0-2.0	8	10	5	12	13	20	19	18	17	17	8	6	3	2	4	4	166
< 1.0	3	4	4	6	2	6	3	2	5	3	2	1	5	3	1		50
Total	99	178	408	777	1072	454	136	68	62	54	30	16	19	10	35	54	3472

Figure 6-63. Combined wind speed-direction frequency (January).

Source: EMPACA elaboration, 2023

Velocidad (m/s)	Dirección																Total
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	
> 10.0			2	41	21	1											65
9.0-10.0	1		10	40	29												80
8.0-9.0			18	88	95	1								1			203
7.0-8.0	3	1	49	100	180	12							1		1	2	349
6.0-7.0	2	14	76	130	181	63						3	1		3	2	475
5.0-6.0	20	50	92	120	196	130	2					1		2	6	7	626
4.0-5.0	45	66	85	118	128	78	18	1	2	1	1		1	1	10	18	573
3.0-4.0	27	49	55	77	91	68	44	12	6	5	7	2	2	4	10	22	481
2.0-3.0	20	18	29	32	58	30	23	23	17	20	13	5	8	4	9	13	322
1.0-2.0	5	10	10	7	18	13	12	12	11	14	8	10	5	5	12	6	158
< 1.0	3	1	4	5	2	3	3	3	6	4	2	3	2	5	3	3	52
Total	126	209	430	758	999	399	102	51	42	44	31	24	20	22	54	73	3384

Figure 6-64. Combined wind speed-direction frequency (February).

Source: EMPACA elaboration, 2023

Velocidad (m/s)	Dirección																Total
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	
> 10.0			5	57	13												75
9.0-10.0			12	48	19												79
8.0-9.0		1	30	52	57	4											144
7.0-8.0		8	69	87	101	7									1	1	274
6.0-7.0	5	27	122	147	138	29									3	2	473
5.0-6.0	35	80	111	156	168	46	3						1		14	15	629
4.0-5.0	45	84	111	150	145	76	12			1	1	2	2	1	15	23	668
3.0-4.0	47	48	78	123	119	66	34	11	10	7	5	6	3	4	8	32	601
2.0-3.0	42	24	49	67	69	50	39	12	20	13	8	7	9	9	9	21	448
1.0-2.0	13	19	24	24	23	26	17	16	11	15	17	5	3	10	13	10	246
< 1.0	2	7	6	7	5	3	6	5	6	9	3	4	4	6	4	7	84
Total	189	298	617	918	857	307	111	44	47	45	34	24	22	30	67	111	3721

Figure 6-65. Combined wind speed-direction frequency (March).

Source: EMPACA elaboration, 2023

Velocidad (m/s)	Dirección																Total
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	
> 10.0			1	24	3												28
9.0-10.0			11	35	14												60
8.0-9.0			37	54	41	3											135
7.0-8.0		1	44	298	79	9											431
6.0-7.0	4	22	100	121	156	27									1		431
5.0-6.0	16	68	103	138	189	71	1								1	6	593
4.0-5.0	37	61	102	138	141	90	10						1	3	5	19	607
3.0-4.0	36	48	65	126	114	65	22	9	4	3	5	2	2	2	12	16	531
2.0-3.0	18	32	49	73	67	51	33	34	23	18	15	4	7	1	5	16	446
1.0-2.0	15	21	21	23	27	31	24	24	22	14	10	5	3	6	14	9	269
< 1.0	1	3	3	9	8	7	3	4	5	6	5	2	3	2	4	4	69
Total	127	256	536	1039	839	354	93	71	54	41	35	13	16	14	42	70	3600

Figure 6-66. Combined wind speed-direction frequency (April).

Source: EMPACA elaboration, 2023

Velocidad (m/s)	Dirección																Total
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	
> 10.0			1	23	5												29
9.0-10.0			9	33	15	1											58
8.0-9.0			29	62	29	6											126
7.0-8.0		2	50	78	70	9											209
6.0-7.0	2	3	67	115	139	43	1								2	1	373
5.0-6.0	8	40	111	113	172	108	1	1								4	558
4.0-5.0	32	45	83	158	166	137	19	2	2			1	1		1	3	664
3.0-4.0	32	49	75	127	135	105	59	19	3	9	2	6	3	3	9	15	651
2.0-3.0	27	22	50	94	71	91	65	43	38	32	15	11	7	9	13	18	606
1.0-2.0	12	18	28	34	33	30	26	35	35	27	12	14	8	9	8	8	337
< 1.0	5	7	9	7	5	9	8	5	9	10	7	6	7	3	8	4	109
Total	118	186	512	844	840	539	179	105	87	78	37	38	25	25	43	64	3720

Figure 6-67. Combined wind speed-direction frequency (May).

Source: EMPACA elaboration, 2023

Velocidad (m/s)	Dirección																Total
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	
> 10.0			2	11	12												25
9.0-10.0			5	47	14												66
8.0-9.0			25	67	32	3											127
7.0-8.0		1	36	71	63	15											186
6.0-7.0		1	54	106	156	58										1	376
5.0-6.0	3	25	73	144	160	112	4										521
4.0-5.0	13	49	76	109	158	152	22	2				1				3	585
3.0-4.0	23	33	52	104	105	123	100	23	8	11	7				4	5	600
2.0-3.0	14	27	33	49	63	80	80	76	48	25	9	5		2	2	6	519
1.0-2.0	11	7	20	20	22	30	31	42	30	22	16	3	7	6	5	11	283
< 1.0	2	2	8	8	6	3	4	5	6	5	7	4	6	4		2	72
Total	66	145	384	736	791	576	241	148	92	63	40	12	15	12	11	28	3360

Figure 6-68. Combined wind speed-direction frequency (June).

Source: EMPACA elaboration, 2023

Velocidad (m/s)	Dirección																Total
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	
> 10.0			5	52	13	2											72
9.0-10.0			25	62	18												105
8.0-9.0			41	117	64	6											228
7.0-8.0			68	132	151	19											370
6.0-7.0			89	181	281	82	1										634
5.0-6.0		18	86	196	282	163	9	2									756
4.0-5.0	6	24	38	134	185	191	30	2								1	611
3.0-4.0	4	15	17	66	85	115	75	10	6	1						3	397
2.0-3.0	2	4	14	33	32	27	49	24	8	5	2	1				4	205
1.0-2.0		2	8	13	14	7	7	8	8	1	1		1	3		1	74
< 1.0	3	1	2	1	1	1	2	1	2	1		2		1	2		20
Total	15	64	393	987	1126	613	173	47	24	8	3	3	1	4	2	9	3472

Figure 6-69. Combined wind speed-direction frequency (July).

Source: EMPACA elaboration, 2023

Velocidad (m/s)	Dirección																Total
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	
> 10.0			9	36	17	3				1	1	2	1		2	1	73
9.0-10.0			23	58	20	1											102
8.0-9.0			51	92	59	5										1	208
7.0-8.0			73	101	120	14											308
6.0-7.0		7	91	142	233	56	1										530
5.0-6.0	2	19	77	143	228	166	8	1	1	1	1			1		1	649
4.0-5.0	6	37	65	141	152	177	21	2	3	5	1	1					611
3.0-4.0	9	25	43	94	93	119	64	14	8	9	1	1	1		1	3	485
2.0-3.0	4	10	18	43	53	61	53	39	24	3			1	2	1	6	326
1.0-2.0	1	8	10	16	24	19	16	18	12	9	4	3		4	1	3	148
< 1.0	2	2	2	4	1	5	1	1	3	2	4	1	1		2	1	32
Total	24	108	462	870	1000	626	164	75	52	35	16	7	3	9	6	15	3472

Figure 6-70. Combined wind speed-direction frequency (August).

Source: EMPACA elaboration, 2023

Velocidad (m/s)	Dirección																Total
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	
> 10.0			1	7				1	4	6	2		2	1	2	3	29
9.0-10.0			8	23	2			2	1	2	2	1	1	1			43
8.0-9.0			24	34	11	1			2		2					1	75
7.0-8.0	1		39	56	43	4			2		1				1		149
6.0-7.0		3	76	58	79	28	1	1		2			1	1			250
5.0-6.0		18	77	94	136	68	8			1	2	1	2	2	2	4	415
4.0-5.0	16	53	108	118	169	125	31	5	1	2	6	4	2		2	9	651
3.0-4.0	35	53	77	124	130	160	69	20	8	8	4	3	2	1	4	18	716
2.0-3.0	17	34	35	68	85	95	96	47	52	28	17	6	7	10	2	4	603
1.0-2.0	8	10	25	24	43	40	45	48	32	30	14	8	1	8	4	6	346
< 1.0	4		6	5	9	8	7	11	3	9	7	1	5	5	2	1	83
Total	81	171	476	611	707	529	257	135	105	88	57	24	25	29	19	46	3360

Figure 6-71. Combined wind speed-direction frequency (September).

Source: EMPACA elaboration, 2023

Velocidad (m/s)	Dirección																Total
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	
> 10.0				5	1												6
9.0-10.0			1	10	6		1										18
8.0-9.0			2	20	16	4	4	1	1	2							50
7.0-8.0			25	35	41	7	1			2	6		2	1			120
6.0-7.0		3	47	78	51	25	2	1	5	3	1	2	2	1			221
5.0-6.0	2	15	70	91	137	40	2	2	6	2	5	2	2	7	2	1	386
4.0-5.0	17	68	92	142	133	93	27	2	5	4	4	1	9	2	7	5	611
3.0-4.0	32	67	81	123	131	121	72	19	18	19	5	7	5	5	4	21	730
2.0-3.0	39	33	53	69	86	96	88	92	73	45	25	11	6	9	4	15	744
1.0-2.0	14	17	25	26	57	44	52	57	48	38	24	16	7	6	8	13	452
< 1.0	5	7	10	10	10	8	10	11	13	9	9	12	4	6	4	4	134
Total	109	210	406	609	669	438	259	185	171	128	73	53	36	36	29	59	3472

Figure 6-72. Combined wind speed-direction frequency (October).

Source: EMPACA elaboration, 2023

Velocidad (m/s)	Dirección																Total
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	
> 10.0				8	4			1	1							1	15
9.0-10.0				25	9	1											35
8.0-9.0			10	53	27	1					1					1	93
7.0-8.0		4	41	90	88	9	1	1				1				1	236
6.0-7.0		4	64	146	134	26	1	1							1	2	379
5.0-6.0		18	73	159	192	50	5		1					1	3	4	506
4.0-5.0	8	36	99	154	159	89	8	1	2			1	1	1	11	11	581
3.0-4.0	33	49	81	117	142	88	35	13	7	10	4	1	3	7	10	31	631
2.0-3.0	33	47	43	58	73	64	45	37	24	19	14	3	11	15	15	30	531
1.0-2.0	27	13	15	16	41	22	18	26	24	24	12	5	11	3	11	13	281
< 1.0	6	11	4	3	4	2	2	4	8	5	3	3	4	4	2	7	72
Total	107	182	430	829	873	352	115	84	67	58	34	14	30	31	53	101	3360

Figure 6-73. Combined wind speed-direction frequency (November).

Source: EMPACA elaboration, 2023

Velocidad (m/s)	Dirección																Total
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	
> 10.0				26	23	1											50
9.0-10.0			5	45	43												93
8.0-9.0			11	84	98	6											199
7.0-8.0		2	16	110	195	24											347
6.0-7.0	2	2	42	155	266	51	2					1	1			1	523
5.0-6.0	4	4	88	153	275	115	3					1	3		1	3	650
4.0-5.0	8	27	86	130	177	121	12	4				1	3	5	7		581
3.0-4.0	31	44	47	89	121	81	43	8	9		1		2	3	5	13	497
2.0-3.0	14	34	29	47	57	35	32	15	18	16	11	1	5	7	6	13	340
1.0-2.0	13	12	9	14	19	22	15	10	5	6	3	4	3	6	5	7	153
< 1.0		5	5	3	4	4	3	2	2	1	1		3	3		3	39
Total	72	130	338	856	1278	460	110	39	34	23	16	5	16	26	22	47	3472

Figure 6-74. Combined wind speed-direction frequency (December).

Source: EMPACA elaboration, 2023

In general terms, the studies show the predominance of winds from the east and east-northeast, followed by east-southeast and northeast in very similar proportions. Wind speeds of 2.94 m/s

are equaled or exceeded with a probability of 0.9, while winds with speeds equal to or greater than 3.81 m/s have a probability of 0.5.

This wind system is related to the Trade Winds system, which are permanent winds of a planetary nature. The area is also occasionally affected by cold fronts from high latitudes, which cause northwesterly and northerly winds, although their frequency is low. The magnitude of these winds is often greater than the sustained easterly winds.

6.1.14.3 Tides

For the characterization of the tides in the area, the present study is based on the results obtained by AKTIS during the preparation of the project, numerical simulations performed by EMPACA to elaborate the hydrodynamic model and instrumental measurements performed by EMPACA during a one-month oceanographic campaign (November 27 to December 28, 2022).

The results presented by AKTIS were extracted from the global and regional TPXO model, which includes the complex amplitudes relative to MSL, sea surface elevations and currents for eight primary constituents (M2, S2, N2, K2, K1, O1, P1, Q1), two long-period constituents (Mf, Mm) and three nonlinear harmonic constituents (M4, MS4, MN4). To the above are added the harmonic constituents 2N2 and S1 that apply only to TPXO9. These components are used to generate the tidal currents for any reasonable time interval and for any period. The spatial resolution of the model is 10 minutes.

The Figure 6-75 summarizes the tidal descriptors relative to *Mean Sea Level* (MSL) as established in the AKTIS study. These results are based on 20 years of TPXO model data.

Datum	Description	water level [m]
HAT	Highest Astronomical Tide	0.470
MHWS	Mean High Water Springs	0.405
MHHW	Mean High High Water	0.305
MHWN	Mean High Water Neaps	0.219
MLHN	Mean Low High Water	0.143
MSL	Mean Sea Level	0
MHLW	Mean High Low Water	-0.146
MLWN	Mean Low Water Neaps	-0.226
MLLW	Mean Low Low Water	-0.288
MLWS	Mean Low Water Springs	-0.375
LAT	Lowest Astronomical Tide	-0.430

Figure 6-75. Tidal descriptors in the project area based on the TPXO model bases used by AKTIS.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

In order to develop the hydrodynamic circulation models, EMPACA conducted a detailed study of the local tide. EMPACA's studies are based on the ADCIRC model database, developed and maintained by NOAA.

ADCIRC (*ADCIRC Tidal Databases*) has a complete description of harmonics for 2,066,216 nodes in the western North Atlantic, Gulf of Mexico and Caribbean Sea. This database comprises

the 37 harmonic constituents recommended by NOAA. The Figure 6-76 shows the flexible grid used by ADCIRC to describe the harmonic constituents. Note that the mesh is refined in the nearshore area, which is where the study of local currents and sea level variations is most relevant. The Figure 6-77 shows the names of the harmonic constituents used by ADCIRC.

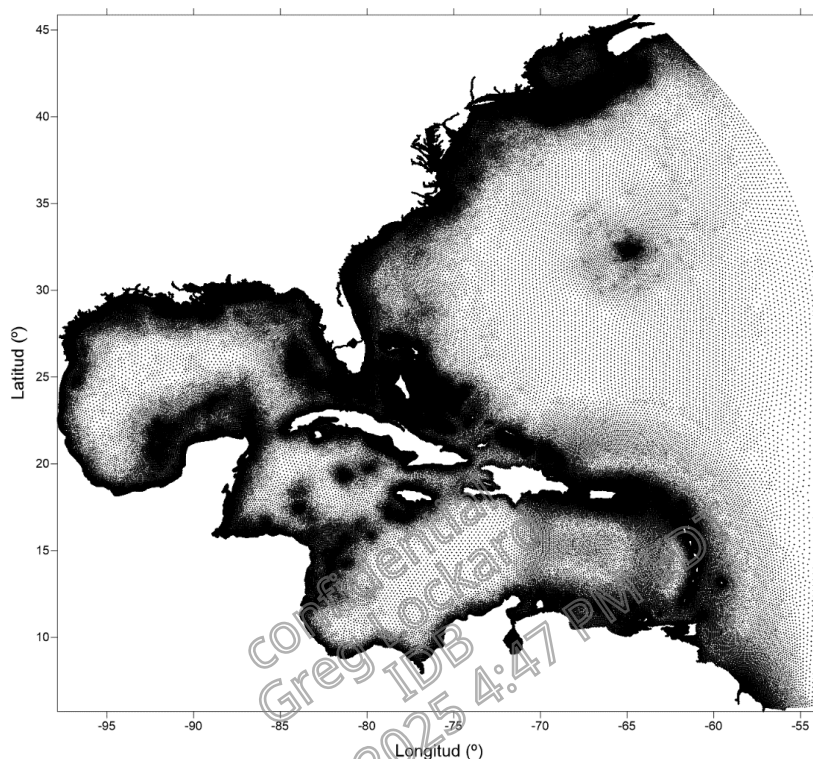


Figure 6-76. Flexible mesh used by ADCIRC to structure the harmonic constituent database.

Source: EMPACA, 2023.

M(2)	K(2)	Lambda(2)	OO(1)	M(4)	M(3)	MS(4)	Sa
N(2)	L(2)	Mu(2)	P(1)	M(6)	S(1)	2SM(2)	Ssa
S(2)	2N(2)	Nu(2)	Q(1)	M(8)	MK(3)	Mf	
O(1)	R(2)	J(1)	2Q(1)	S(4)	2MK(3)	Msf	
K(1)	T(2)	M(1)	Rho(1)	S(6)	MN(4)	Mm	

Figure 6-77. Harmonic constituents used by ADCIRC to describe sea level variations in the western North Atlantic, Caribbean Sea and Gulf of Mexico.

Source: EMPACA, 2023.

Using the local harmonics provided by ADCIRC, EMPACA developed a tide-forced hydrodynamic model using the TELEMAC-MASCARET system.

TELEMAC-MASCARET, oriented to solve free surface flow problems, is widely used in free surface fluid applications and is currently one of the most advanced models in its field.

TELEMAC-MASCARET was developed by the *Laboratoire National d'Hydraulique et d'Environnement (LNHE) of the Research and Studies Directorate of the French Electricity Board (EDF-R&D)*. Currently, TELEMAC-MASCARET is managed by a consortium with the following core members: *Artelia (formerly Sogreah, France), Bundesanstalt für Wasserbau (BAW, Germany), Centre d'Etudes et d'Expertise sur les Risques, l'Environnement, la Mobilité et l'Aménagement (CEREMA, France), Daresbury Laboratory (UK), Electricité de France R&D (EDF, France), and HR Wallingford (UK).*

To calculate the periodic variations of sea level in the project area, EMPACA used the following modules:

TELEMAC-2D: Two-dimensional flow. Based on Saint-Venant equations.

TELEMAC-3D: Three-dimensional flow. Based on the Navier-Stokes equations.

To develop the simulation of local sea level variations, EMPACA prepared a regional bathymetric mesh, which integrates specific surveys in the study area and regional data provided by GEBCO. Figure 3 in Annex 10.14 shows the flexible finite element mesh used for the simulation of sea level variations with TELEMAC-MASCARET. The outer area of the mesh is formed by triangular elements of 300 meters on each side, while in the project area the elements are 50 meters on each side to achieve maximum resolution in the simulation of tidal currents.

Along the maritime boundary of the computational domain, the harmonic constituents at each node were defined from an interpolation of the ADCIRC data.

Figures 4, 5 and 6 in Annex 10.14 show an example of the periodic sea level variations resulting from applying TELEMAC2D and TELEMAC3D. The simulation describes the sea level behavior on November 28, 2022 and shows the water level during low tide (Figure 4), at mid-tide (Figure 5) and during high tide (Figure 6).

In summary, the tide in Manzanillo Bay can be classified as a mixed semi-diurnal oscillation, since it presents two maxima and two minima throughout the day with different amplitudes.

The mean diurnal tidal amplitude is 0.593 meters, with a maximum absolute variation of 0.90 meters.

Tidal variations have an important significance in the formation of currents in channels and estuarine areas, while in deep water or open areas they have little significance.

In addition to the tidal survey using regional databases such as TPXO and ADCIRC, EMPACA deployed an ADCP (*Acoustic Doppler Current Profiler*) Teledyne Sentinel, which kept recording sea level variations for a period longer than one lunar cycle.

Measurements began on November 27, 2022 at 16:00 hours (UTC) and concluded on December 28, 2022 at 18:15 hours UTC. During the campaign, the acoustic Doppler recorder measured the velocity and direction of currents throughout the water column and also obtained a complete record of sea level variations and directional waves.

Photo 52 (Annex 11) shows an image of the placement process of the Teledyne Sentinel V20 ADCP in the project area. The equipment was placed at the point where the cooling water is expected to be discharged from the industry.

The Figure 6-78 presents the ADCP report for the entire measurement campaign. Sea level variations are expressed as changes in depth (meters).

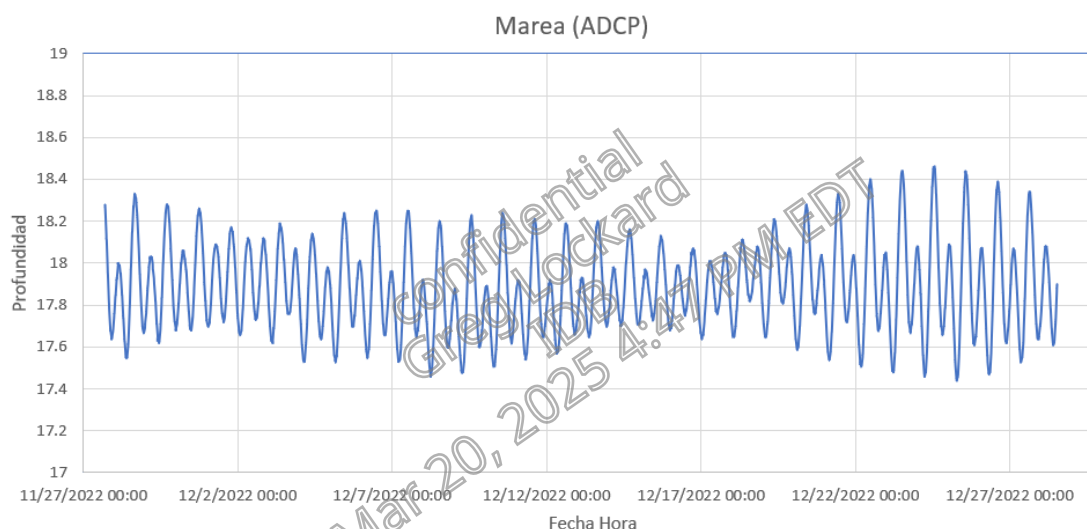


Figure 6-78. Record of sea level variations reported by ADCP Sentinel V20.

Source: EMPACA, 2023.

The record shows a maximum tidal amplitude of 1.0 meter between December 24 and 25, while the minimum amplitude occurred between December 16 and 17, with a travel of 0.43 meters. The daily displacement of the tidal cycle is approximately 55 minutes.

6.1.14.4 Usual waves in deep waters.

As in the description of wind and tides, the characterization of the usual waves in this study is based on the results presented by AKTIS during the design of the works and the specific studies developed by EMPACA.

AKTIS has developed its own spectral wave database and uses it in most of its projects around the world. For wave characterization, AKTIS employs a third-generation wave prediction model, based on the Waves Watch III code, which runs on a global grid, as well as a set of regional grids that are used for *hindcasting* purposes. The global model employed by AKTIS has a resolution of 30' x 30'. The model uses wind data provided by the European *Center for Medium-range Weather Forecast* (ECMWF). The model provides time series of the wave spectrum at one-hour intervals, covering a period of 42 years (1979-2020). For the study developed in the port of Manzanillo, AKTIS used the Caribbean regional model, which has a resolution of 10' x 10'.

The deep-water wave characterization developed by EMPACA uses data from the Waves Watch III *hindcasting* model, which is maintained by NOAA's *Marine Modeling & Analysis Brand*. The most detailed wave data in the waters surrounding the Dominican Republic are obtained from the multi_1.at_10m series, which is formed with multiple individual grids and describes the period from February 2005 to May 2019. The series provides information every 3 hours on wind speed and direction, significant swell height (hs), prevailing direction (dp) and its peak period (tp). The grid has a distance between nodes of 10 arc minutes.

The closest node to the project area is 170,120, which is located 16 kilometers to the northwest. The Table 6-48 summarizes the frequency of wave occurrence for each heading according to the WWIII model.

Table 6-48. Wave frequency by each heading for node (170,120) of the WWIII model.

Address	Cases	Frequency (%)
North	1992	4.76
North-northeast	9461	22.60
Northeast	18421	44.01
East-northeast	11293	26.98
This	25	0.06
East-southeast	3	0.01
Southeast	1	0.00
South-Southeast	0	0.00
South	2	0.00
South-southwest	6	0.01
Southwest	10	0.02
West-southwest	1	0.00
West	1	0.00
West-northwest	33	0.08
Northwest	96	0.23
North-northwest	516	1.23
TOTAL	41861	100.0

Source: EMPACA, 2023.

The graph in Figure 6-79 shows the frequency histogram of the wave direction.

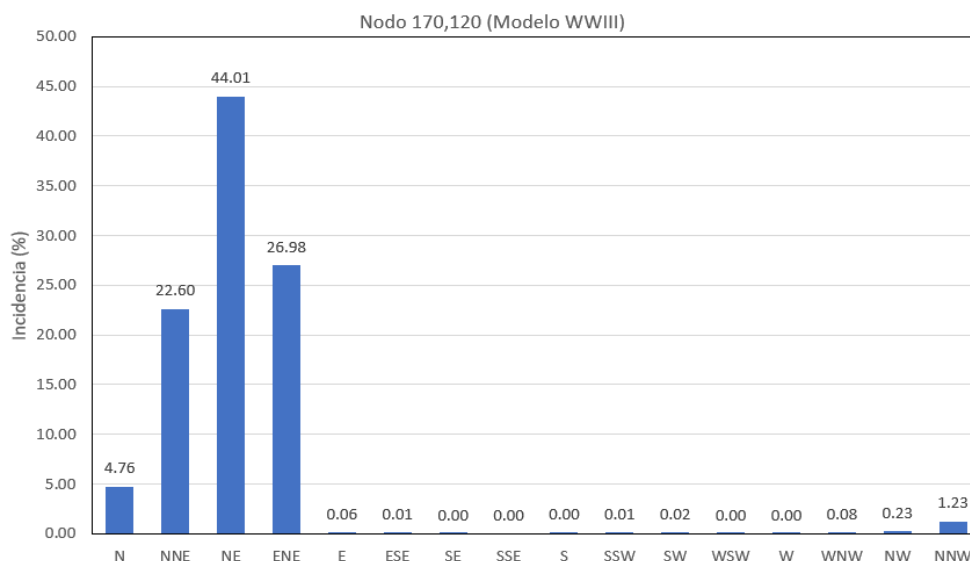


Figure 6-79. Frequency of wave occurrence by incidence heading for node (170,120) of the WWIII model.

Source: EMPACA, 2023.

Significant height analysis ($H_{1/3}$) indicates the predominance of waves with heights between 0.50 and 0.75 meters, followed by waves with heights between 0.25 and 0.50 meters. The Figure 6-80 shows the frequency of occurrence of significant heights at Node (170,120).

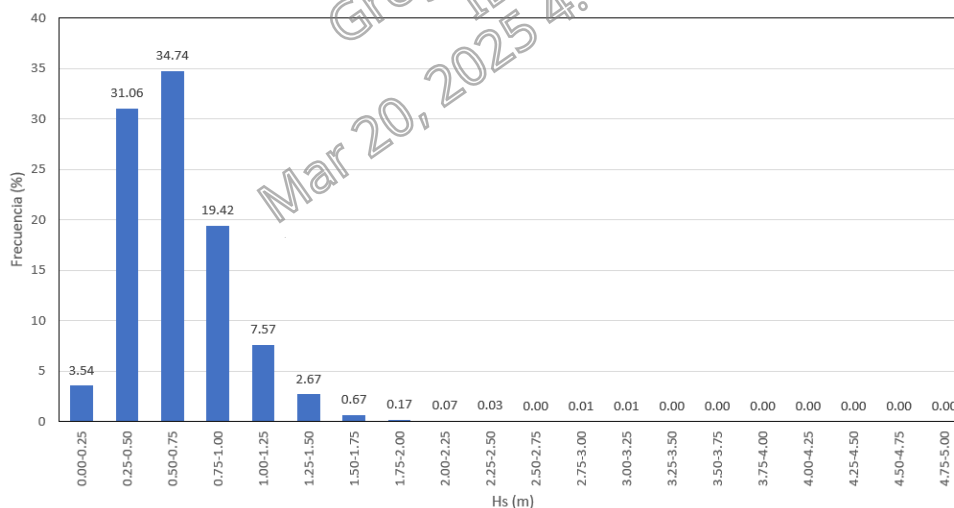


Figure 6-80. Frequency of occurrence of significant height for node (170,120) of the WWIII model.

Source: EMPACA, 2023.

As for the peak period (T_p), waves with periods between 6 and 7 seconds predominate, followed by waves of 7 to 8 seconds. The Figure 6-81 shows the frequency histogram of the peak period of the waves for Node (170,120).

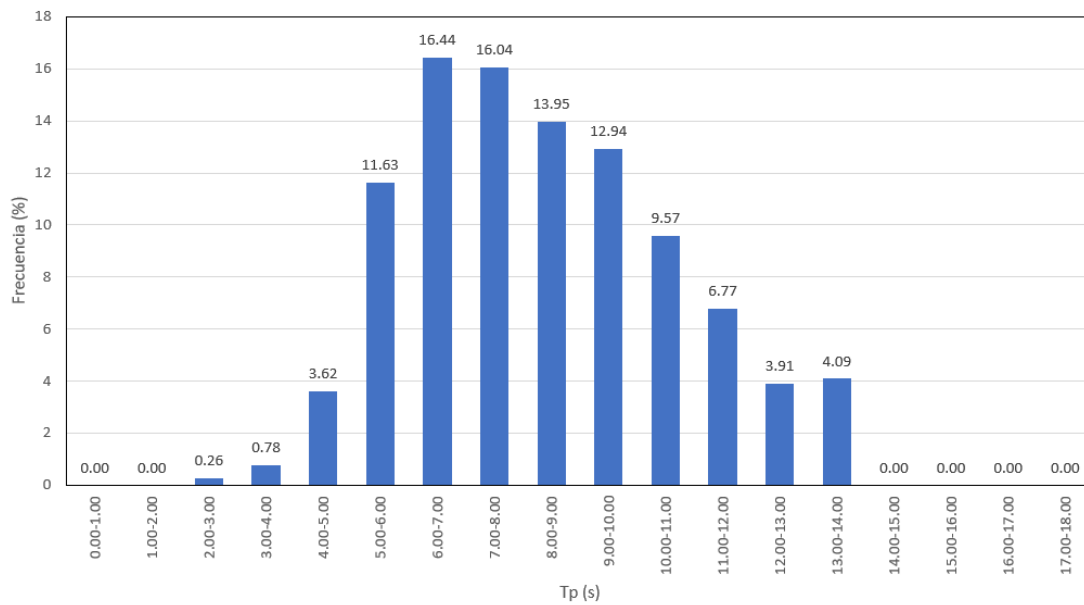


Figure 6-81. Frequency of occurrence of the peak period of waves for node (170,120) of the WWIII model.

Source: EMPACA, 2023.

The Figure 6-82 shows the wave height rose in deep water.

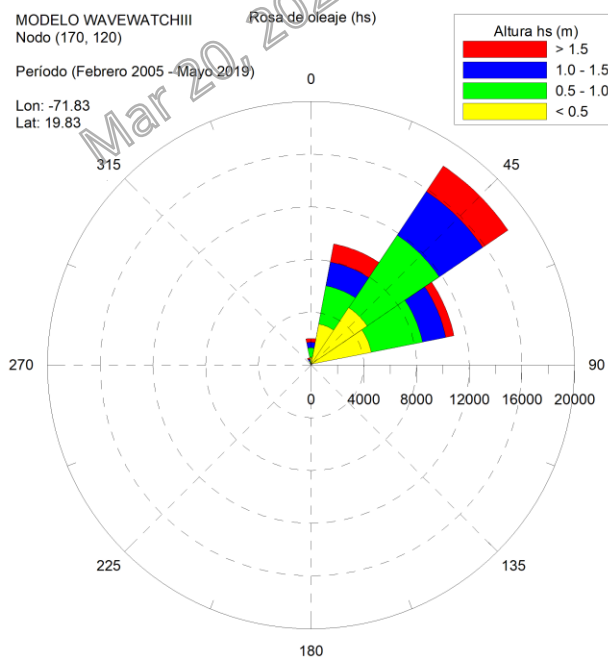


Figure 6-82. Significant wave height (hs) rose for Node (170,120) of the WWIII model.

Source: EMPACA, 2023.

The waves with the highest frequency come from the Northeast with a frequency of 44.01%, while the East-Northeast and North-Northeast maintain similar frequencies with values of 26.98% and 22.60%, respectively.

As for the peak period (T_p), the rose of the Figure 6-83 shows its annual frequency and direction.

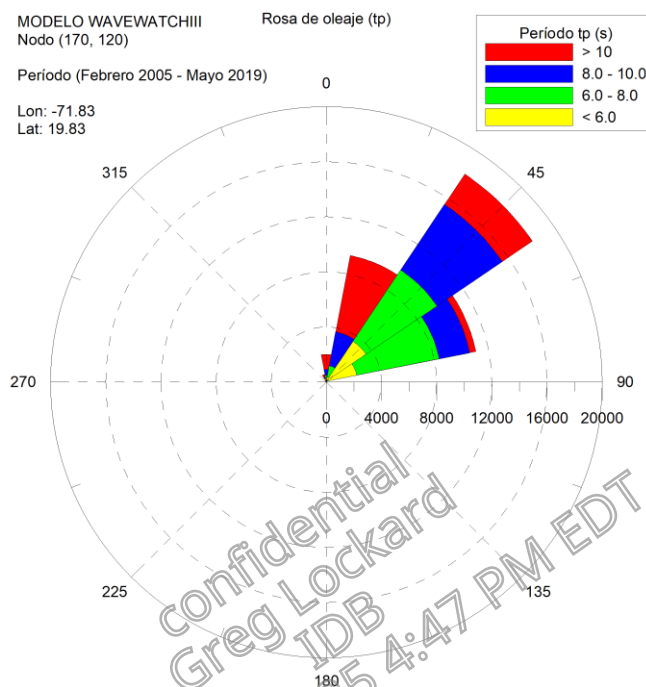


Figure 6-83. Wave peak period rose (T_p) for Node (170,120) of the WWIII model.

Source: EMPACA, 2023.

Waves frequently present periods between 6.0 and 10.0 seconds, which represent 59.37 % of the total swell.

Based on a more in-depth statistical analysis, EMPACA prepared combined height and period frequency tables for the whole year and also individual tables with the behavior of each course.

In general, the predominant swell has a significant height between 0.50 and 0.75 meters, with peak periods of 7.0 to 8.0 seconds, which accumulates 5.72% of the total swell. The Figure 6-84 shows the combined annual frequency table, for all headings, of the significant height (H_s) and peak period (T_p) of the swell.

The figures from the Figure 6-85 to Figure 6-101 show the combined frequency tables of wave height and period. In terms of frequency, waves from the northeast stand out, with a predominance of heights between 0.50 and 0.75 meters, with periods of 6 to 7 seconds.

Both the ATKIS study and the one developed by EMPACA include an analysis of the transformation process of these waves by refraction-diffraction during their approach to the coast. These analyses and their results are described in the following sections.

Altura (m)	Periodo (s)											Total
	< 4.0	4.0-5.0	5.0-6.0	6.0-7.0	7.0-8.0	8.0-9.0	9.0-10.0	10.0-11.0	11.0-12.0	12.0-13.0	> 13.0	
4.75-5.00									1		1	2
4.50-4.75									1			1
3.75-4.00									1		1	2
3.50-3.75										2		2
3.00-3.25						1			1		1	3
2.75-3.00					2	1		1		1		5
2.50-2.75					2							2
2.25-2.50					2	5	1	5		1		14
2.00-2.25				2	4	5	2	10	3	3	2	31
1.75-2.00			1	7	4	8	5	5	5	9	29	73
1.50-1.75	1		16	42	24	49	32	29	11	18	59	281
1.25-1.50		2	54	140	170	160	186	130	75	79	123	1119
1.00-1.25	2	23	264	566	425	443	446	313	292	223	172	3169
0.75-1.00	26	188	1295	1378	1059	979	946	882	649	377	351	8130
0.50-0.75	139	785	1762	2249	2394	1855	1948	1427	977	511	496	14543
0.25-0.50	258	480	1316	2319	2342	2112	1647	1044	695	361	429	13003
0.00-0.25	8	36	162	180	288	222	203	160	123	52	47	1481
Total	434	1514	4870	6883	6716	5840	5416	4006	2834	1637	1711	41861

Figure 6-84. Combined height-period frequency table, for all directions.

Source: EMPACA, 2023.

Altura (m)	Periodo (s)											Total
	< 4.0	4.0-5.0	5.0-6.0	6.0-7.0	7.0-8.0	8.0-9.0	9.0-10.0	10.0-11.0	11.0-12.0	12.0-13.0	> 13.0	
4.75-5.00									1			1
3.00-3.25						1						1
2.75-3.00					1							1
2.25-2.50					1	2						3
2.00-2.25					1	1		1				3
1.75-2.00				2							12	14
1.50-1.75			6	16	2						5	29
1.25-1.50			22	13	2			5	8	7	9	66
1.00-1.25		6	40	11	2	1	6	34	25	25	18	168
0.75-1.00		44	26	4	3	14	29	77	73	68	61	399
0.50-0.75	22	72	11	7	35	68	118	121	171	81	40	746
0.25-0.50	32	5	2	5	26	83	111	124	89	27	15	519
0.00-0.25	4			3	13	4	6	9	2	1		42
Total	58	127	107	62	86	173	270	371	369	209	160	1992

Figure 6-85. Frequency table of height - period (north).

Source: EMPACA, 2023.

Altura (m)	Período (s)											Total
	< 4.0	4.0-5.0	5.0-6.0	6.0-7.0	7.0-8.0	8.0-9.0	9.0-10.0	10.0-11.0	11.0-12.0	12.0-13.0	> 13.0	
3.50-3.75										1		1
3.00-3.25									1			1
2.75-3.00								1				1
2.25-2.50					1	2		1				4
2.00-2.25					2	5						7
1.75-2.00					2	3	2		1	2	17	27
1.50-1.75				15	7	7	5	7	6	16	52	115
1.25-1.50			10	54	21	16	35	48	51	54	101	390
1.00-1.25		2	35	55	38	50	83	126	179	136	119	823
0.75-1.00		17	86	67	74	134	264	408	363	223	197	1833
0.50-0.75	12	47	47	66	178	272	558	632	522	291	326	2951
0.25-0.50	51	9	7	54	169	445	552	527	450	250	341	2855
0.00-0.25	1		3	11	26	71	57	95	107	42	40	453
Total	64	75	188	322	518	1005	1556	1845	1680	1015	1193	9461

Figure 6-86. Height frequency table - period (north-northeast).

Source: EMPACA, 2023.

Altura (m)	Período (s)											Total
	< 4.0	4.0-5.0	5.0-6.0	6.0-7.0	7.0-8.0	8.0-9.0	9.0-10.0	10.0-11.0	11.0-12.0	12.0-13.0	> 13.0	
4.75-5.00											1	1
3.75-4.00											1	1
3.50-3.75										1		1
3.00-3.25											1	1
2.75-3.00										1		1
2.25-2.50								4		1		5
2.00-2.25							1	9	2	2		14
1.75-2.00					1	5	2	3	4	7		22
1.50-1.75				1	13	40	27	22	3	2	1	109
1.25-1.50		1	4	42	129	132	142	71	11	18	11	561
1.00-1.25		7	102	241	301	321	297	136	82	56	34	1577
0.75-1.00	11	74	694	672	714	608	521	322	173	75	71	3935
0.50-0.75	81	468	876	1191	1124	981	1010	531	222	103	75	6662
0.25-0.50	125	326	759	1039	750	825	733	322	111	65	43	5098
0.00-0.25	2	17	41	56	51	96	100	51	13	6		433
Total	219	893	2476	3242	3083	3008	2833	1471	621	337	238	18421

Figure 6-87. Height frequency table - period (northeast).

Source: EMPACA, 2023.

Altura (m)	Período (s)											Total
	< 4.0	4.0-5.0	5.0-6.0	6.0-7.0	7.0-8.0	8.0-9.0	9.0-10.0	10.0-11.0	11.0-12.0	12.0-13.0	> 13.0	
2.00-2.25									1	1	2	4
1.50-1.75					2	1			1		1	5
1.25-1.50			2	21	16	12	9	5			2	67
1.00-1.25			43	257	82	68	57	12	1		1	521
0.75-1.00		11	464	628	263	221	117	40	7	3	17	1771
0.50-0.75		170	813	981	1049	526	221	114	40	20	52	3990
0.25-0.50	15	135	542	1221	1397	744	213	56	41	16	28	4408
0.00-0.25		19	118	108	191	44	39	3		2	3	527
Total	19	335	1982	3216	3000	1616	656	230	91	42	106	11293

Figure 6-88. Height frequency table - period (east-northeast).

Source: EMPACA, 2023.

Altura (m)	Período (s)				Total
	< 4.0	7.0-8.0	8.0-9.0	10.0-11.0	
0.75-1.00	4				4
0.50-0.75	5			1	6
0.25-0.50	1		3	1	5
0.00-0.25		4	6		10
Total	10	4	9	2	25

Figure 6-89. Frequency table of height - period (east).

Source: EMPACA, 2023.

Altura (m)	Período (s)	
	< 4.0	Total
0.75-1.00	2	2
0.50-0.75	1	1
Total	3	3

Figure 6-90. Height frequency table - period (east-southeast).

Source: EMPACA, 2023.

Altura (m)	Período (s)	
	< 4.0	Total
0.75-1.00	1	1
Total	1	1

Figure 6-91. Height frequency table - period (southeast).

Source: EMPACA, 2023.

Altura (m)	Período (s)	
	< 4.0	Total
1.00-1.25	1	1
0.75-1.00	1	1
Total	2	2

Figure 6-92. Height frequency table - period (south).

Source: EMPACA, 2023.

Altura (m)	Período (s)	
	< 4.0	Total
1.50-1.75	1	1
0.75-1.00	1	1
0.25-0.50	4	4
Total	6	6

Figure 6-93. Height frequency table - period (south-southwest).

Source: EMPACA, 2023.

Altura (m)	Período (s)		Total
	< 4.0	4.0-5.0	
1.25-1.50		1	1
0.75-1.00	2		2
0.50-0.75	1		1
0.25-0.50	6		6
Total	9	1	10

Figure 6-94. Height frequency table - period (southwest).

Source: EMPACA, 2023.

Altura (m)	Período (s)		Total
	< 4.0		
0.50-0.75	1		1
Total	1		1

Figure 6-95. Height frequency table - period (west-southwest).

Source: EMPACA, 2023.

Altura (m)	Período (s)		Total
	< 4.0	4.0-5.0	
1.25-1.50		1	1
0.75-1.00	2		2
0.50-0.75	1		1
0.25-0.50	6		6
Total	9	1	10

Figure 6-96. Frequency table of height - period (Southwest).

Source: EMPACA, 2023.

Altura (m)	Período (s)		Total
	< 4.0		
0.50-0.75	1		1
Total	1		1

Figure 6-97. Height frequency table - period (west-southwest).

Source: EMPACA, 2023.

Altura (m)	Período (s)		Total
	< 4.0		
0.50-0.75	1		1
Total	1		1

Figure 6-98. Frequency table of height - period (west).

Source: EMPACA, 2023.

Altura (m)	Período (s)									Total
	< 4.0	4.0-5.0	5.0-6.0	6.0-7.0	7.0-8.0	8.0-9.0	9.0-10.0	10.0-11.0	> 13.0	
1.75-2.00								2		2
1.25-1.50					1			1		2
1.00-1.25					1			3		4
0.75-1.00	1	1	1	1		1		1		6
0.50-0.75		3	2	2	3		1			11
0.25-0.50			4							4
0.00-0.25								2	2	4
Total	1	4	7	3	5	1	1	9	2	33

Figure 6-99. Height frequency table - period (west-northwest).

Source: EMPACA, 2023.

Altura (m)	Período (s)											Total
	< 4.0	4.0-5.0	5.0-6.0	6.0-7.0	7.0-8.0	8.0-9.0	9.0-10.0	10.0-11.0	11.0-12.0	12.0-13.0	> 13.0	
1.75-2.00							1					1
1.50-1.75			2	3								5
1.25-1.50			6	7	1							14
1.00-1.25	1	1	12	2	1	2	2					21
0.75-1.00		6	6	2	4	1	7					26
0.50-0.75	5	5	3		1	5		1				20
0.25-0.50	6											6
0.00-0.25									1	1	1	3
Total	12	12	29	14	7	8	10	1	1	1	1	96

Figure 6-100. Frequency table of height - period (northwest).

Source: EMPACA, 2023.

Altura (m)	Período (s)											Total
	< 4.0	4.0-5.0	5.0-6.0	6.0-7.0	7.0-8.0	8.0-9.0	9.0-10.0	10.0-11.0	11.0-12.0	12.0-13.0	> 13.0	
4.50-4.75										1		1
3.75-4.00										1		1
2.75-3.00					1	1						2
2.50-2.75					2							2
2.25-2.50						1	1					2
2.00-2.25				1	1			1				3
1.75-2.00			1	5	1							7
1.50-1.75			8	7		1				1		17
1.25-1.50			10	3						5		18
1.00-1.25		7	32			1	1	2	5	6		54
0.75-1.00	3	35	18	4	1		8	34	33	8	5	149
0.50-0.75	6	20	10	2	4	3	40	27	22	16	3	153
0.25-0.50	18	5	2			12	38	14	4	3	2	98
0.00-0.25	1			2	3	1	1				1	9
Total	28	67	81	24	13	20	90	77	72	33	11	516

Figure 6-101. Height frequency table - period (north-northwest).

Source: EMPACA, 2023.

6.1.14.5 Wave transformation (refraction - diffraction)

One of the most important phenomena in coastal dynamics is the transformation of waves as a result of interaction with the relief. When waves approach the coast and experience friction with the bottom, a change in their height occurs, known as *shoaling*, accompanied by a change in the direction of propagation (refraction). As the waves go around an obstacle, they also undergo changes by giving up part of their energy to the sheltered areas, which is called diffraction process.

To describe the wave changes from deep water to the project area, the present study is based on the results presented by AKTIS as part of the project preparation and the results obtained by EMPACA using the wave bases of the WWII *hindcasting* (reanalysis) model and the TELEMAC-MASCARET integrated numerical simulation system.

To characterize the marine environment, AKTIS performed a simulation of deep-water wave conditions in the terminal area over a 4-year period using the SWAN wave model on a series of rectangular grids nested in geographic coordinates. Each grid is nested within the previous grid and transfers all 2D spectral wave information to the next grid. The nested grid process allows refining the resolution in the area of interest, which is indispensable in shallow coastal area surveys.

SWAN is a third-generation spectral model, developed by the *Delft University of Technology*, which calculates the generation and random propagation of sea waves (short period waves generated by the local wind) and swell (higher energy waves generated in distant regions and propagating towards the area of interest without wind influence), in coastal regions and inland waters. The model is based on the wave action balance equation, considering sources of input and losses. For situations where there are no currents, the wave action is equivalent to the energy. The sources of input and loss describe energy inputs (e.g., wind), energy dissipation (e.g., by friction with the bottom), and energy transfer between frequencies and directions by linear and nonlinear interactions (e.g., third and fourth wave interactions). Thus, SWAN considers the following processes:

- Wave propagation in time and space, *shoaling*, refraction due to currents and depth, change in frequency due to currents and non-stationary depth.
- Wave generation by wind.
- Third and fourth wave interaction.
- Wave breakup due to superelevation, friction and depth.
- Dissipation due to aquatic vegetation, turbulent flow and viscosity of the fluid silt.
- Over sea elevation due to wave stacking (not used in the project).
- Transmission and reflection (specular and diffuse) against obstacles (not applied to this project).

AKTIS has used SWAN version 41.20 in non-stationary mode for a 42-year period (February 1979 - July 2021) and produced the complete 2D wave spectrum at the site of interest for further analysis. For more information on the SWAN model, it is recommended to consult Booij et. Al. (1999).

To obtain the swell at the outer boundary of the grid, AKTIS has used a proprietary model developed for the Caribbean. In the SWAN nested grid system developed by AKTIS, each grid is

more refined than the previous one, up to a spatial resolution of 200 x 200 meters in the most detailed area. The Figure 6-102 shows the *Digital Terrain Model* (DTM) that includes all domains. The DTM has been designed to correctly describe the wind-generated waves and the changes induced by the coastal relief and the bottom, along the whole area up to the LNG Import Terminal with Storage and Regasification area.

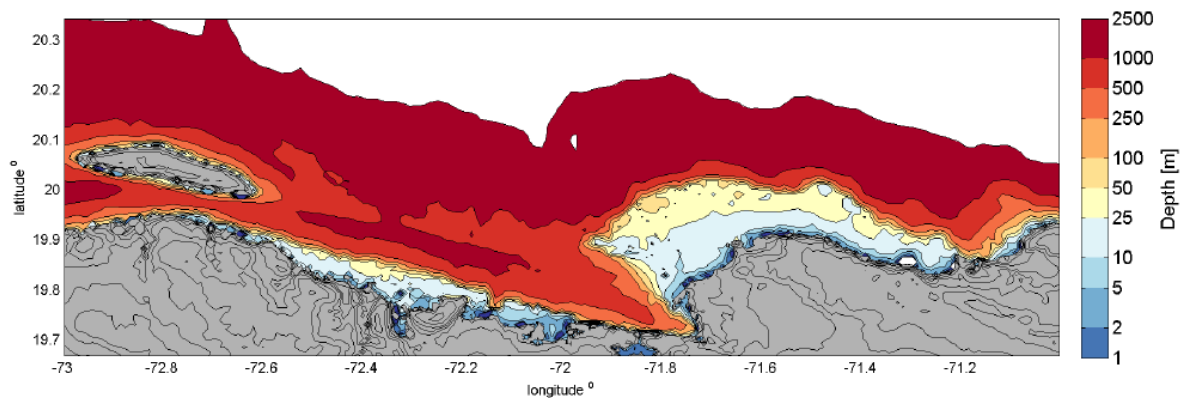


Figure 6-102. Nested grid system used by AKTIS to apply the SWAN model to the wave transformation from deep water to the LNG Import Terminal with Storage and Regasification area.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

The wave model for the Caribbean developed by AKTIS provides the time series of the 2D wave spectra at 1-hour intervals. As part of the present study, AKTIS compared the *hindcast* data for the Caribbean along the SWAN model seaward boundary with the satellite data. The wave height exceedance for the *hindcast* model and the satellite show a good correlation, although the *hindcast* data are more conservative (Figure 6-103). For this reason, no corrections were applied to the wave data at the model boundary.

The wind fields for the SWAN model were generated from the ERA5 data. The ERA5 data were validated with wind data from the Cap Haitian station (*Cap Haitien*), which confirms an east wind-dominated climate.

SWAN model results in deep water (71.9835°W, 20.18°N) were contrasted with one year of deep-water oceanographic buoy measurement data, WWII model *hindcast* data at the outer boundary of the SWAN grid, and satellite data. In the Figure 6-104 y Figure 6-105 show two snapshots of the time series in which the model apparently underestimates the wave height and wind speed compared to the measurements, while the *hindcast* data are consistent with the model results. The Figure 6-106 presents the exceedance curves of the SWAN model, the buoy records and the *hindcast* data.

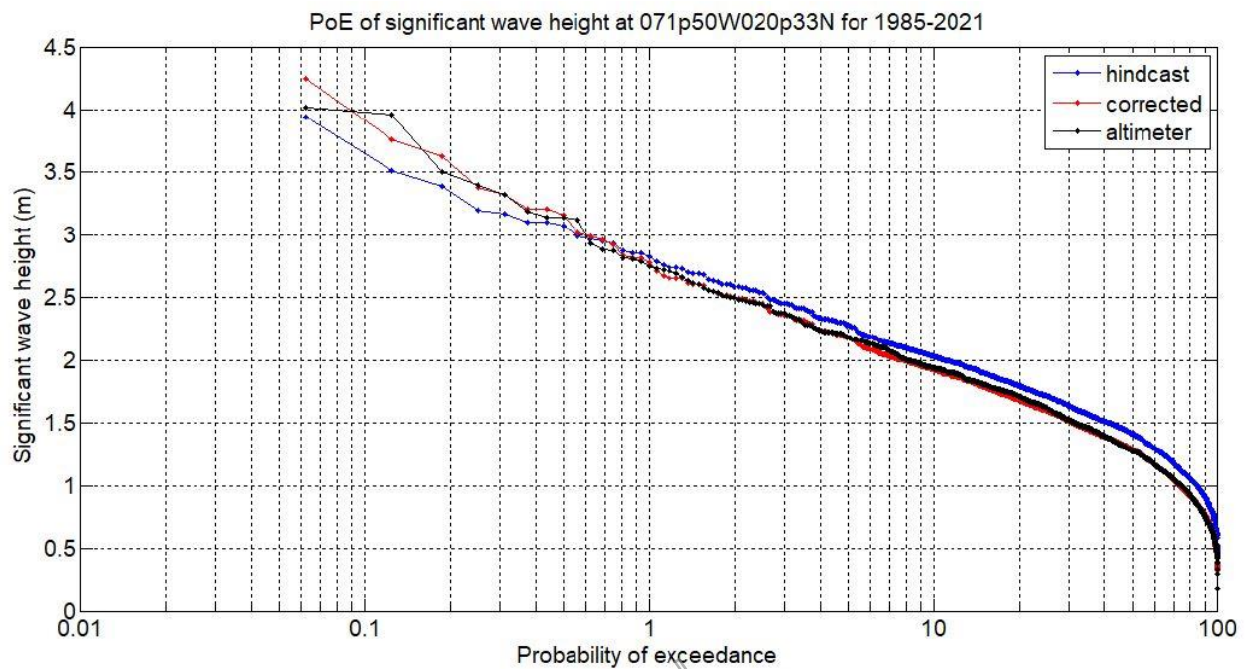


Figure 6-103. Wave height exceedance probability distribution at the SWAN model seaward boundary (ATKIS results).

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

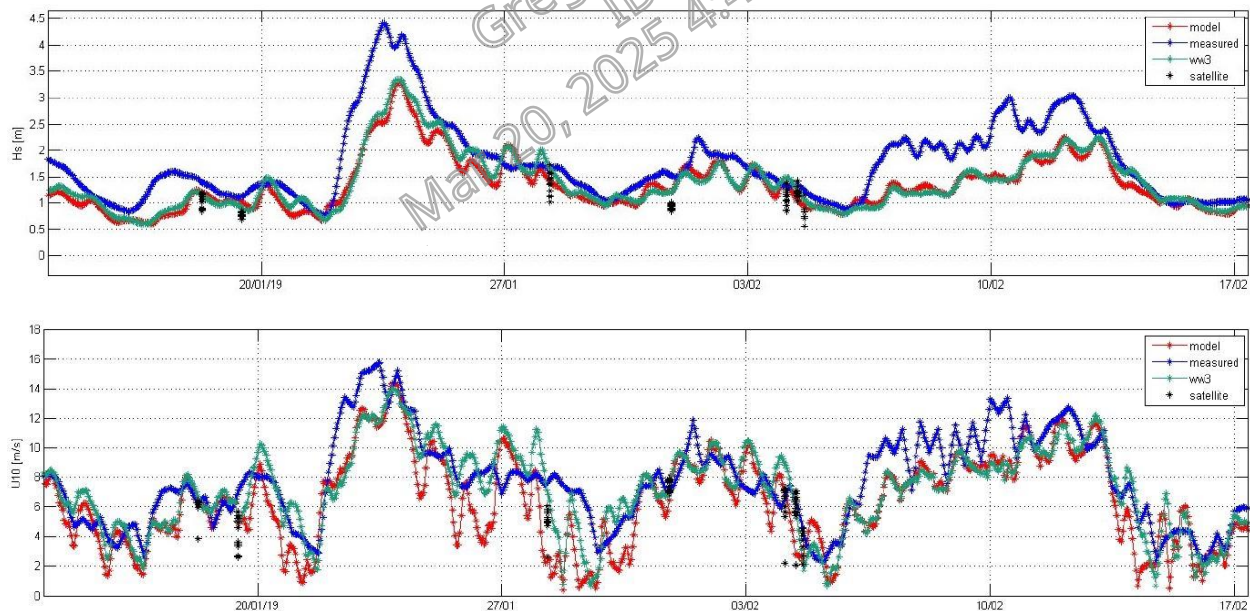


Figure 6-104. Comparison of SWAN model time series, buoy records, WWIII *hindcast* model, and satellite records in the deep-water area. Time series from January 14 to February 17, 2019.

Source: EMPACA, 2023.

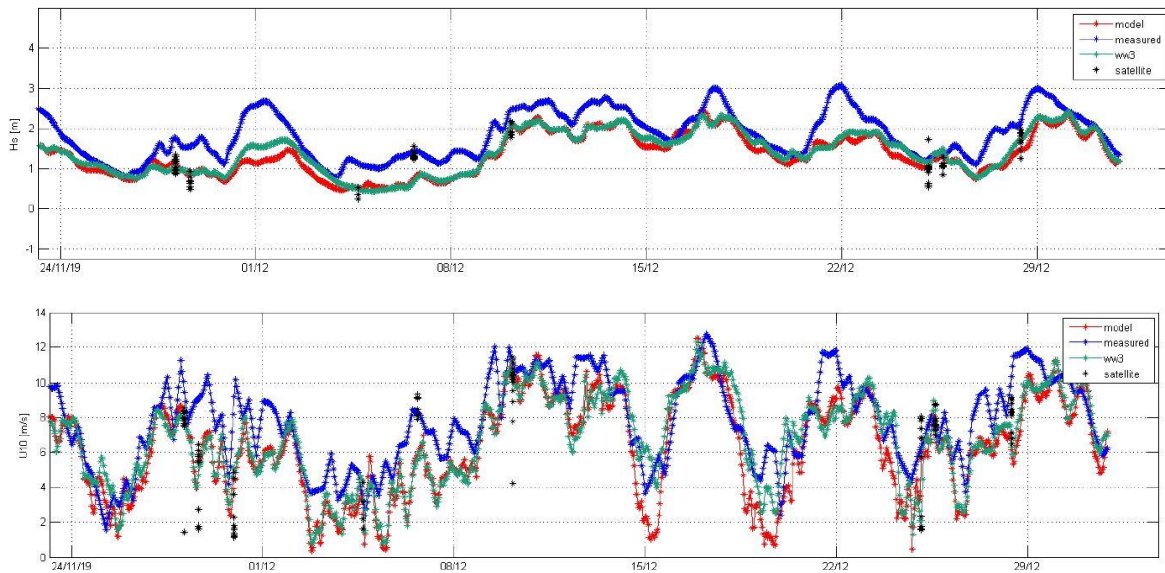


Figure 6-105. Comparison of SWAN model time series, buoy records, WWIII hindcast model and satellite records in the deep-water area. Time series from November 24 to December 31, 2019.

Source: EMPACA, 2023.

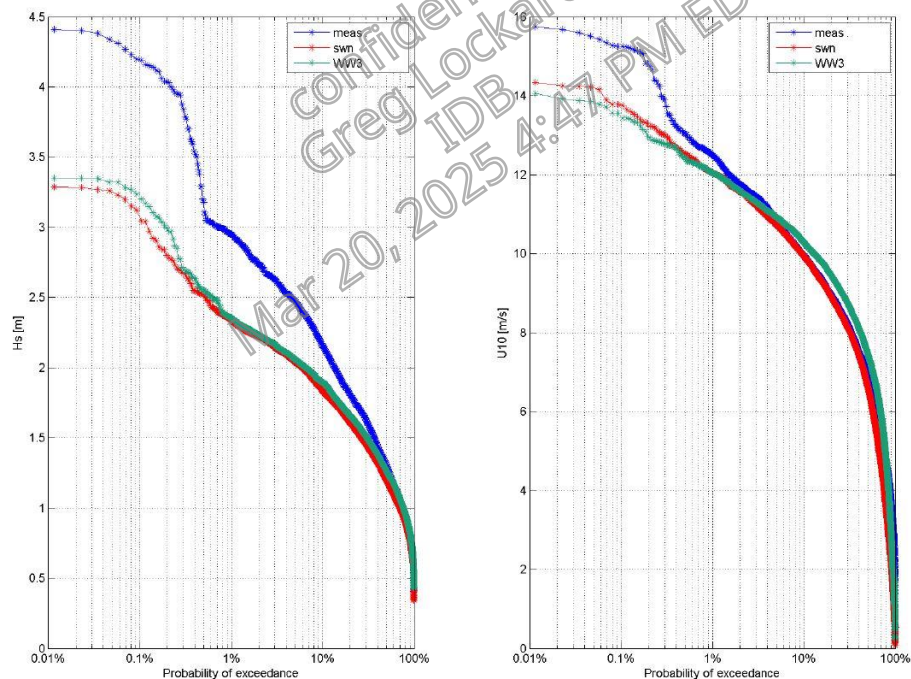


Figure 6-106. Frequency of wave height exceedance in the deep-water zone.

Source: EMPACA, 2023.

The Figure 6-107 shows the wave rose used by ATKIS on the outer boundary of the computational grid.

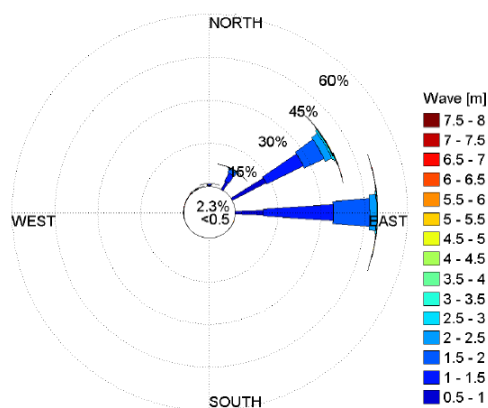


Figure 6-107. Wave rose considered by ATKIS at the outer boundary of the SWAN model computational mesh.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

For model calibration, ATKIS used data collected by an ADCP placed in the area where the project's pier will be built. The Figure 6-108. shows the calibration factors that were applied by ATKIS to the results. The bulk of the data was increased by 20%. For the ends an additional calibration factor of 1.0417 was applied, resulting in a total factor for the ends of 25%.

Parameter	α_c	β_c	θ_c	ϵ_c	Δ_c
[-]	[-]	[m/s]	[-]	[m/s]	[m/s]
H_s	1.20	0.00	1.0417	0.25	0.5

Figure 6-108. Calibration constants for H_s in shallow water.

Source: EMPACA, 2023.

The Figure 6-109 shows the wave height exceedance curves $H_{1/3}$ before and after calibration.

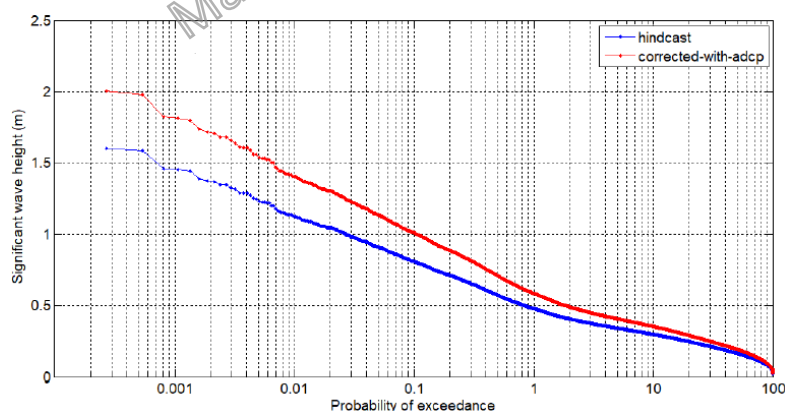


Figure 6-109. Wave height exceedance distribution obtained by ATKIS for the project area.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

As a result of evaluating the wave transformation and wave generation by the local wind using the SWAN model, AKTIS obtained the wave rose shown in Figure 6-110.

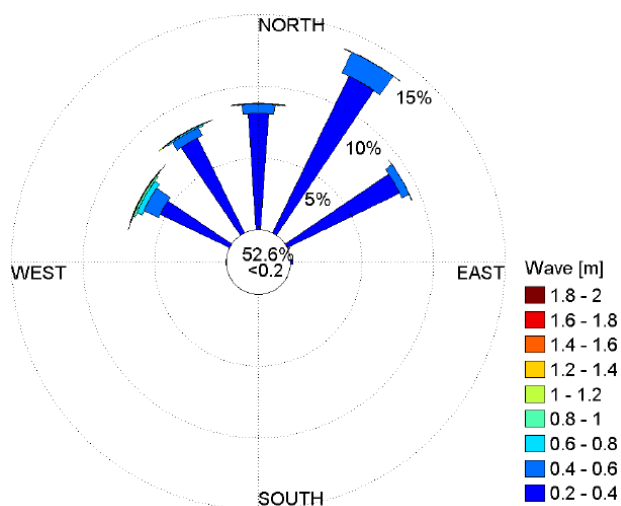


Figure 6-110. Wave rose (H_s) for sea and swell waves obtained by AKTIS for the project area.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

The Figure 6-111 shows the separate swell roses for the sea and swell type swell.

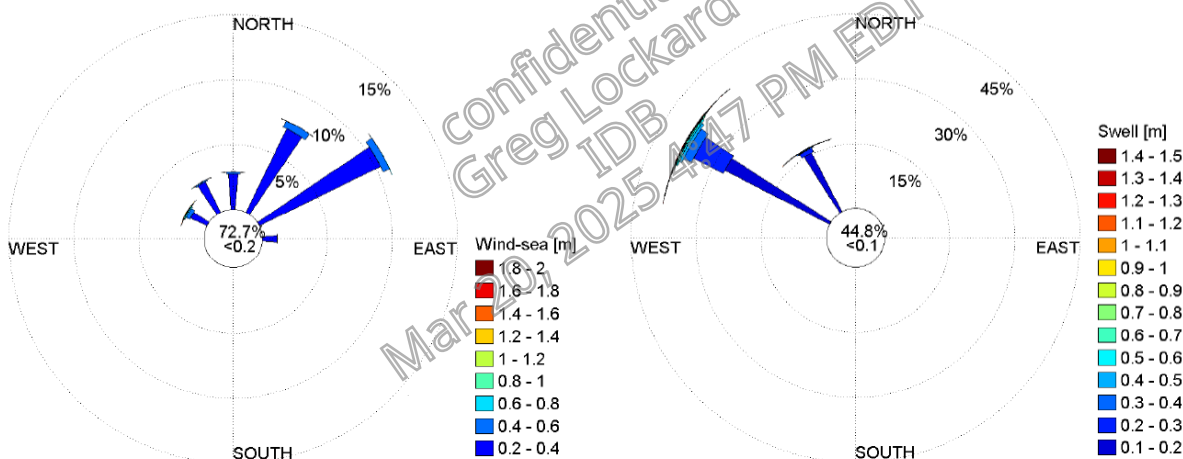


Figure 6-111. Roses for sea (left) and swell (right).

Source: EMPACA elaboration, 2023

From the local wave analysis developed by AKTIS, the combined frequency tables of wave height and direction for the total wave (Figure 6-112) and also for the sea swell (Figure 6-113) and swell (Figure 6-114).

-	$\theta_{0,upper} [^{\circ}N]$	-15.0	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	-
$H_{m0} [m]$	$\theta_{0,lower} [^{\circ}N]$	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	345.0	Total
1.6	1.7	-	-	-	-	-	-	-	-	-	-	-	-	0.00
1.5	1.6	-	-	-	-	-	-	-	-	-	-	0.001	-	0.00
1.4	1.5	-	-	-	-	-	-	-	-	-	-	0.001	-	0.00
1.3	1.4	-	-	-	-	-	-	-	-	-	-	0.003	-	0.00
1.2	1.3	-	-	-	-	-	-	-	-	-	-	0.007	-	0.01
1.1	1.2	-	-	-	-	-	-	-	-	-	-	0.014	0.003	0.02
1.0	1.1	-	-	-	-	-	-	-	-	-	-	0.031	0.004	0.04
0.9	1.0	0.002	-	-	-	-	-	-	-	-	-	0.061	0.010	0.07
0.8	0.9	0.011	-	-	-	-	-	-	-	-	-	0.090	0.027	0.13
0.7	0.8	0.010	0.001	-	-	-	-	-	-	-	-	0.134	0.037	0.18
0.6	0.7	0.035	0.016	0.009	-	-	-	-	-	-	-	0.251	0.066	0.38
0.5	0.6	0.117	0.181	0.053	-	-	-	-	-	-	-	0.425	0.146	0.92
0.4	0.5	0.530	1.408	0.513	-	-	-	-	-	-	0.001	0.722	0.484	3.66
0.3	0.4	2.304	4.917	2.116	0.003	-	-	-	-	-	0.004	1.489	1.951	12.78
0.2	0.3	5.815	7.263	6.614	0.162	0.004	0.002	0.001	0.001	0.001	0.005	3.894	5.430	29.19
0.1	0.2	4.981	5.242	6.490	1.265	0.167	0.059	0.021	0.010	0.008	0.013	12.524	9.599	40.38
0.0	0.1	0.633	0.270	0.027	0.004	0.002	0.003	0.005	0.002	0.002	0.007	5.342	5.944	12.24
-	Total	14.438	19.298	15.821	1.433	0.174	0.065	0.027	0.013	0.012	0.030	24.988	23.701	100.000

Figure 6-112. Joint probability of H_{m0} vs θ_0 .

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

-	$\theta_{0,upper} [^{\circ}N]$	-15.0	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	-
$H_{m0_sea} [m]$	$\theta_{0,lower} [^{\circ}N]$	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	345.0	Total
1.6	1.7	-	-	-	-	-	-	-	-	-	-	-	-	0.00
1.5	1.6	-	-	-	-	-	-	-	-	-	-	0.001	-	0.00
1.4	1.5	-	-	-	-	-	-	-	-	-	-	0.001	-	0.00
1.3	1.4	-	-	-	-	-	-	-	-	-	-	0.001	-	0.00
1.2	1.3	-	-	-	-	-	-	-	-	-	-	0.002	-	0.00
1.1	1.2	-	-	-	-	-	-	-	-	-	-	0.009	-	0.01
1.0	1.1	-	-	-	-	-	-	-	-	-	-	0.013	-	0.01
0.9	1.0	0.000	-	-	-	-	-	-	-	-	-	0.017	0.000	0.02
0.8	0.9	0.001	-	-	-	-	-	-	-	-	-	0.024	0.002	0.03
0.7	0.8	0.007	-	-	-	-	-	-	-	-	-	0.029	0.002	0.04
0.6	0.7	0.008	0.006	0.001	-	-	-	-	-	-	-	0.059	0.009	0.08
0.5	0.6	0.016	0.038	0.036	0.000	-	-	-	-	-	-	0.109	0.015	0.21
0.4	0.5	0.109	0.515	0.516	0.004	-	-	-	-	-	-	0.212	0.084	1.43
0.3	0.4	0.858	3.022	2.968	0.047	-	-	-	-	-	0.001	0.420	0.598	7.91
0.2	0.3	1.879	4.117	7.421	1.121	-	-	-	0.001	0.001	0.001	0.974	2.021	17.53
0.1	0.2	1.370	5.224	12.781	8.097	0.581	0.066	0.004	0.007	0.001	0.002	2.818	2.740	33.70
0.0	0.1	27.928	3.823	4.066	0.741	0.292	0.213	0.005	0.005	0.002	0.005	1.129	0.800	39.01
-	Total	32.177	16.745	27.783	10.010	0.884	0.279	0.009	0.013	0.004	0.007	5.817	6.272	100.000

Figure 6-113. Joint probability of H_{m0_sea} vs θ_{0_sea} .

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

-	$\theta_{0,upper} [^{\circ}N]$	-15.0	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	-
$H_{m0_swell} [m]$	$\theta_{0,lower} [^{\circ}N]$	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	345.0	Total
1.5	1.6	-	-	-	-	-	-	-	-	-	-	-	-	0.00
1.4	1.5	-	-	-	-	-	-	-	-	-	-	0.001	-	0.00
1.3	1.4	-	-	-	-	-	-	-	-	-	-	0.002	-	0.00
1.2	1.3	-	-	-	-	-	-	-	-	-	-	0.003	-	0.00
1.1	1.2	-	-	-	-	-	-	-	-	-	-	0.006	0.002	0.01
1.0	1.1	-	-	-	-	-	-	-	-	-	-	0.018	0.001	0.02
0.9	1.0	-	-	-	-	-	-	-	-	-	-	0.042	0.003	0.05
0.8	0.9	-	-	-	-	-	-	-	-	-	-	0.063	0.011	0.07
0.7	0.8	-	-	-	-	-	-	-	-	-	-	0.110	0.016	0.13
0.6	0.7	-	-	-	-	-	-	-	-	-	-	0.209	0.025	0.23
0.5	0.6	0.001	-	-	-	-	-	-	-	-	-	0.343	0.033	0.38
0.4	0.5	0.003	-	-	-	-	-	-	-	-	-	0.668	0.061	0.73
0.3	0.4	0.009	-	-	-	-	-	-	-	-	-	2.003	0.197	2.21
0.2	0.3	0.006	-	-	-	-	-	-	-	-	-	7.660	1.058	8.72
0.1	0.2	0.069	0.006	0.001	0.001	0.000	0.001	0.002	0.000	0.000	0.002	26.779	15.753	42.61
0.0	0.1	0.177	0.020	0.003	0.001	0.012	0.018	0.005	0.006	0.008	0.009	9.247	35.328	44.83
-	Total	0.265	0.026	0.004	0.002	0.012	0.019	0.007	0.006	0.009	0.011	47.154	52.487	100.000

Figure 6-114. Joint probability of H_{m0_swell} vs θ_{0_swell} .

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

Station SP01 is located at the position shown in Figure 6-115 and corresponds to the area where ships are planned to dock for unloading operations.



Figure 6-115. Location of local wave statistics station SP01 calculated by AKTIS.

Source: EMPACA, 2023.

AKTIS studies reveal that, while waves generated by the local wind (*sea*) come preferentially from the Northeast and North-Northeast, waves coming from deep water and moving out of the wind generation zone (*swell*), undergo intense diffraction as they contour the coast and arrive in the area of interest from the Northwest and North-Northwest.

The studies carried out by AKTIS had the main objective of describing the operational and extreme surge for the construction safety and operation of the LNG Import Terminal with Storage and Regasification. However, given the need to conduct an environmental study aimed at evaluating the thermal dispersion of the cooling water discharge plume of the power plant, and to obtain a characterization of the sediment transport to evaluate the possible impacts of the pier construction on the beaches, EMPACA conducted a complementary study of the wave transformation.

To understand the changes occurring in the wave from the *hindcast* point of the WWIII model to the project area, EMPACA used the TELEMAC-MASCARET integrated solution system, oriented to solve free-surface flow problems. TELEMAC-MASCARET is widely used in free surface fluid applications and is currently one of the most advanced systems in its field.

TELEMAC-MASCARET was developed by the *Laboratoire National d'Hydraulique et d'Environnement (LNHE) of the Research and Studies Directorate of the French Electricity Board*

(EDF-R&D). TELEMAT-MASCARET is currently managed by a consortium comprising the following core members: *Artelia* (formerly Sogreah, France), *Bundesanstalt für Wasserbau* (BAW, Germany), *Centre d'Etudes et d'Expertise sur les Risques, l'Environnement, la Mobilité et l'Aménagement* (CEREMA, France), *Daresbury Laboratory* (United Kingdom), *Electricité de France R&D* (EDF, France), and *HR Wallingford* (United Kingdom). Telemat-Mascaret has the following modules to simulate hydrodynamics:

ARTEMIS: Agitation in ports and coastal engineering works.

MASCARET: One-dimensional flow.

TELEMAT-2D: Two-dimensional flow. Based on Saint-Venant equations.

TELEMAT-3D: Three-dimensional flow. Based on the Navier-Stokes equations.

TOMAWAC: Wave propagation in coastal areas.

To describe the refraction-diffraction processes from deep water to the location of the LNG Import Terminal with Storage and Regasification, the TOMAWAC model was used. This is a scientific program that models the changes in the energy spectrum of wind waves, both in the spatial and temporal domain and wave agitation for applications in the oceanic domain, intra-continental seas and coastal zone waters. The model uses a finite element solution scheme to discretize the ocean domain.

TOMAWAC models the sea states by solving the balance equation of the directional density spectrum. To do so, the model reproduces the evolution of the directional density spectrum at each node of the computational grid. In TOMAWAC the directional wave spectrum is divided into a finite number of propagation frequencies f_i and directions Θ_i . The wave density equation is solved for component (f_i, Θ_i) . This is a third-generation model since it does not require any parameterization in the spectral or directional distribution of power.

The following basic definitions apply to the model:

Monochromatic waves:

$$\eta(x, y, t) = a \cos [k(x \sin \theta + y \cos \theta) - \omega t + \phi]$$

a - amplitude $\frac{1}{2} H$

ω - frequency (rad/m), where $T=2\pi/\omega$

k - wavenumber, considering $L=2\pi/k$

$$\omega^2 = g \cdot k \cdot \tanh(k \cdot d)$$

Θ - Direction of wave propagation in radians.

ϕ - swell phase (in radians)

The energy per unit area of these progressive waves includes kinetic and potential energy from the expression:

$$E = \frac{1}{2} \rho g a^2 = \frac{1}{8} \rho g H^2$$

Random multidirectional waves:

The random multidirectional wave field is modeled through the superposition of M monochromatic plane components.

$$\eta(x, y, t) = \sum_{m=1}^M \eta_m(x, y, t) = \sum_{m=1}^M a_m \cos [k_m(x \cdot \sin \theta_m + y \cdot \cos \theta_m) - \omega_m t + \phi_m]$$

The main element is related to the distribution of the individual phases (ϕ_m). TOMAWAC assumes that these phases are randomly distributed in the domain $[0; 2\pi)$ with uniform probability density. The energy per unit area of random multidirectional waves is expressed as:

$$E = \sum_{m=1}^M \frac{1}{2} \rho g a_m^2$$

Directional spectrum

The energy spectrum is a continuous function. The variable to describe the sea state is the directional wave energy spectrum. The function (in Joule.Hz⁻¹.rad⁻¹) depends on:

- Wave frequency (in Hertz).
- Direction of propagation (Θ).

$$\sum_{f=f}^{f+df} \sum_{\theta=\theta}^{\theta+d\theta} \frac{1}{2} \rho g a_m^2 = E(f, \theta) df d\theta$$

Then the relationship between the variance of the directional density spectrum and the free surface elevation of the ocean is defined as:

$$\eta(x, y, t) = \int_{f=0}^{\infty} \int_{\theta=0}^{2\pi} \sqrt{2E(f, \theta)} df d\theta \cos[k(x \cdot \cos \theta + y \cdot \sin \theta) - \omega t + \phi]$$

Where $F(f, \Theta)$ is expressed in m² .Hz⁻¹ .rad⁻¹ and is derived from the directional power spectrum as

$$F(f, \theta) = E(f, \theta) / (\rho g)$$

The TOMAWAC model applies to the following domains:

- Oceanic domain: Characterized by great depths. Relative depth (d/L) greater than 0.5. It considers the interaction between wind and waves, dissipation by wave breaking due to superelevation and non-linear interactions.
- Medium-depth continental seas: Characterized by relative depths (d/L) between 0.05 and 0.5. In addition to the above phenomena, it describes bottom friction, *shoaling*, and refraction due to bathymetry and currents.
- Coastal domain: Relative depths less than 0.05. Considers bottom friction, bathymetric breakage, sea level instability, tidal currents and over-elevation due to wave stacking.

The physical processes considered by TOMAWAC are:

- Energy sources and their dissipation:
 - Wind force in the generation of waves.
 - Wave breakup due to increased wave heave during generation and propagation.
 - Dissipation induced by friction with the bottom.
 - Dissipation induced by wave breaking due to bathymetry.
 - Energy dissipation due to the opposition of ocean currents.
- Conservative processes of nonlinear energy transfer.
 - Nonlinear quadruple resonance interactions. It is the prevailing exchange process at great depths.
 - Nonlinear triple interactions, which are the prevailing process in shallow zones.
- Processes related to wave propagation.
 - Wave propagation due to the group velocity and, in some cases, to the velocity of the medium in which the waves propagate (marine currents).
 - Depth-induced refraction, which in shallow areas modifies the direction of wave propagation and implies a transfer of energy in the propagation area.
 - *Shoaling* or increase in wave height with decreasing depth, due to the reduction in wavelength and variation in the speed of energy propagation.
 - Refraction induced by currents, which also causes a change in the direction of wave propagation and a transfer of energy to the propagation zones.
 - Interaction with unstable currents, which induce frequency transfer (tides).
 - Diffraction by coastal structures or shallows, resulting in energy transfer to protected areas.

The studies developed by EMPACA are based on the deep-water wave conditions described by the WWIII *hindcast* model. To apply the TOMAWAC model, available bathymetries at different scales were integrated. For the deep outer zone, GEBCO data were used; the intermediate zone was obtained by combining GEBCO data with digital nautical charts obtained as part of the project "*Digitization of nautical charts and smooth sheets for the Dominican Republic, island of Hispaniola, Caribbean Sea*", developed by the *Sea Grant College Program* of the University of Puerto Rico. The nearshore area was obtained from the multibeam surveys developed by INDEMAR and completed in the shallow and estuarine areas by EMPACA. Figure 7 in Annex 10.14 shows the integral bathymetric grid prepared by EMPACA to apply TOMAWAC.

It is a high-resolution mesh where the deep-water triangular elements have 50 meter sides, while in the project area the mesh has been refined to have triangular elements with 10 meter sides.

The Figure 6-116 shows the wave height and period roses that characterize node 170,120 of the WWIII model.

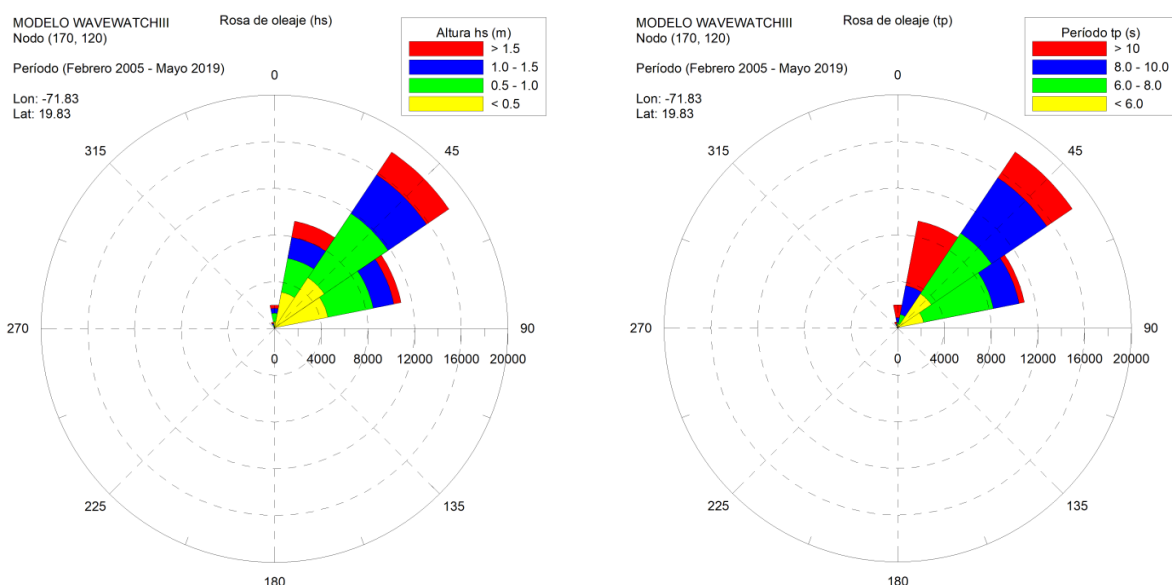


Figure 6-116. Wave height and period roses for node 170,120 of the WWIII model. Deep water wave conditions.

Source: EMPACA, 2023.

For each of the combinations of wave direction, height and period of the WWIII model, the transformation processes towards the coast until reaching the project area were simulated.

In the Table 6-49 summarizes the most frequent wave height and period conditions for each direction. These values have been selected to represent in this paper some graphical examples of the wave transformation on the flexible finite element meshes.

Table 6-49. Most frequent wave conditions for each course of effective incidence in the project area. Deep water data for WWIII model node 170,120.

Address	Cases	Frequency %	Most common condition		Cases	Relative frequency %
			Hs (meters)	Tp (seconds)		
NNE	9461	22.60	0.75	11	632	6.68
NE	18421	44.01	0.75	7	1191	6.46
ENE	11293	26.98	0.50	8	1397	12.37

Source: EMPACA, 2023.

Figures 8 to 13 (Annex 10.14) show the wave height and direction planes for the most frequent North-Northeast, Northeast and East-Northeast conditions. These are flexible finite element meshes, similar to those used for bathymetric representation. The figures include the location of node 188 208 of the computational mesh, to indicate the wave parameters in the area where the cooling water discharge is proposed to be placed.

The statistical characterization of the waves at node 188 208, applying the TOMAWAC model, indicates the almost absolute predominance of waves coming from the North-Northeast. From

this direction, the most frequent waves have significant heights (hs) between 0.10 and 0.20 meters, followed by waves with heights below 0.10 meters. Waves with heights greater than 0.2 meters accumulate only 12.64% of the cases.

The Figure 6-117 summarizes the height and period combinations for all directions at node 188 208.

Altura (m)	Período (s)											Total
	< 4.0	4.0-5.0	5.0-6.0	6.0-7.0	7.0-8.0	8.0-9.0	9.0-10.0	10.0-11.0	11.0-12.0	12.0-13.0	> 13.0	
>0.50				124	5	10		2	1	1	1	144
0.40-0.50				110	28	7	7	7	7	3	1	170
0.30-0.40				307	52	66	119	187	232	72	18	1053
0.20-0.30				747	684	311	435	504	381	370	153	3585
0.10-0.20	11	82	812	4107	2368	2708	2947	2153	1451	691	764	18094
0.00-0.10	291	1221	3834	1385	3464	2527	1537	693	320	257	600	16129
Total	302	1303	4646	6780	6601	5629	5045	3546	2392	1394	1537	39175

Figure 6-117. Combined frequency table of height (hs) - period (tp), for all directions.

Source: EMPACA, 2023.

The Figure 6-118, Figure 6-119 and Figure 6-120 show the combinations of height and period for the three main directions of incidence. In this case, the direction indicates which way the wave propagates, following the angular convention of the TOMAWAC model.

Altura (m)	Período (s)	
	> 13.0	Total
>0.50	1	1
0.40-0.50	1	1
0.30-0.40	1	1
0.10-0.20	122	122
0.00-0.10	219	219
Total	344	344

Figure 6-118. Frequency table of height (hs) - period (tp). Southeast.

Source: EMPACA, 2023.

Altura (m)	Período (s)											Total
	< 4.0	4.0-5.0	5.0-6.0	6.0-7.0	7.0-8.0	8.0-9.0	9.0-10.0	10.0-11.0	11.0-12.0	12.0-13.0	> 13.0	
>0.50						10		2	1	1		14
0.40-0.50				43		7	7	7	7	3		74
0.30-0.40				241	14	66	119	187	232	72	17	948
0.20-0.30				693	432	311	435	504	381	370	153	3279
0.10-0.20	11	82	802	4096	2199	2708	2947	2153	1451	691	642	17782
0.00-0.10	227	1146	3656	1385	3438	2527	1537	693	320	257	381	15567
Total	238	1228	4458	6458	6083	5629	5045	3546	2392	1394	1193	37664

Figure 6-119. Frequency table of height (hs) - period (tp). South-Southeast.

Source: EMPACA, 2023.

Altura (m)	Período (s)					Total
	< 4.0	4.0-5.0	5.0-6.0	6.0-7.0	7.0-8.0	
>0.50				124	5	129
0.40-0.50				67	28	95
0.30-0.40				66	38	104
0.20-0.30				54	252	306
0.10-0.20			10	11	169	190
0.00-0.10	64	75	178		26	343
Total	64	75	188	322	518	1167

Figure 6-120. Frequency table of height (h_s) - period (t_p). South.

Source: EMPACA, 2023.

The Figure 6-121 shows the wave height rose obtained for node 188 208. In this case, the direction indicates which way the wave propagates. Figure 14 in appendix 10. 14 shows the location of the node with respect to the ATKIS calculation point. The node coincides with the position of the ADCP.

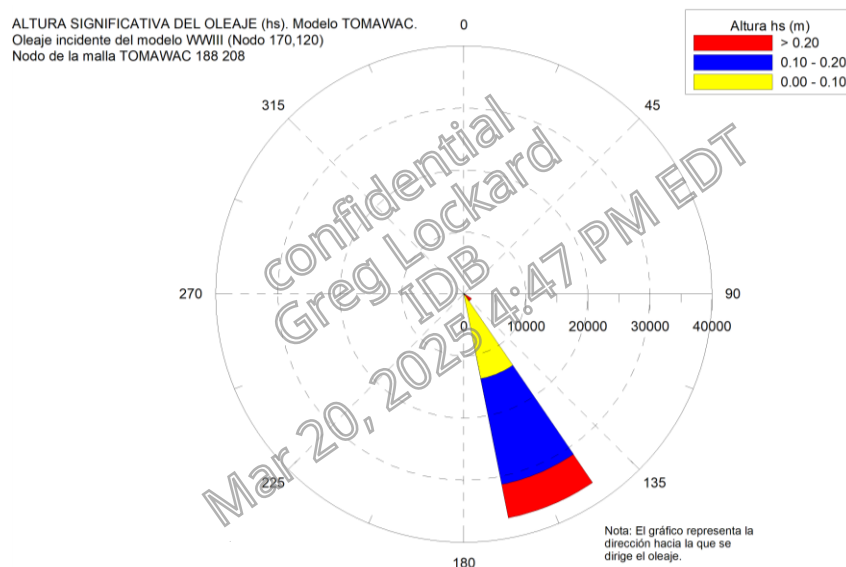


Figure 6-121. Wave rose obtained from the refraction-diffraction analysis of the TOMAWAC model, for node 188 208 of the computational grid.

Source: EMPACA, 2023.

The results of the TOMAWAC simulation of the WWIII model wave statistics were compared with the actual ADCP records between November and December 2022.

The Figure 6-122 shows the joint frequency table of the height (h_s) and period (t_p) of the waves measured by the ADCP. The predominance of waves with heights between 0.10 and 0.20 meters is highlighted.

Altura (m)	Período (s)									Total
	< 4.0	4.0-5.0	5.0-6.0	6.0-7.0	7.0-8.0	8.0-9.0	9.0-10.0	11.0-12.0	> 13.0	
0.40-0.50	1									1
0.30-0.40	1	5	19	1			1			27
0.20-0.30	5	29	52	7	2		8	6	23	132
0.10-0.20	9	31	60	77	20	8	21	38	106	370
0.00-0.10	3	8	28	48	24	11	12	12	65	211
Total	19	73	159	133	46	19	42	56	194	741

Figure 6-122. Combined frequency table of the height (hs) and period (tp) of waves recorded by ADCP Sentinel V20.

Source: EMPACA, 2023.

In the Figure 6-123, Figure 6-124 y Figure 6-125 show the combined frequency tables of height (hs) and period (tp) for the most frequent directions.

Altura (m)	Período (s)									Total
	< 4.0	4.0-5.0	5.0-6.0	6.0-7.0	7.0-8.0	8.0-9.0	9.0-10.0	11.0-12.0	> 13.0	
0.30-0.40			3				1			4
0.20-0.30			1				3		4	8
0.10-0.20	1		8	19		3	3	2	6	42
0.00-0.10		2	7	6	4	1	1	4	9	34
Total	1	2	19	25	4	4	8	6	19	88

Figure 6-123. Combined height-period frequency (West-Northwest).

Source: EMPACA, 2023.

Altura (m)	Período (s)									Total
	< 4.0	4.0-5.0	5.0-6.0	6.0-7.0	7.0-8.0	8.0-9.0	9.0-10.0	11.0-12.0	> 13.0	
0.30-0.40	1	4	14	1						20
0.20-0.30	4	25	43	7	2		5	4	14	104
0.10-0.20	6	29	45	46	15	5	16	24	64	250
0.00-0.10		5	16	36	15	5	6	5	29	117
Total	11	63	118	90	32	10	27	33	107	491

Figure 6-124. Combined frequency of height - period (Northwest).

Source: EMPACA, 2023.

Altura (m)	Período (s)									Total
	< 4.0	4.0-5.0	5.0-6.0	6.0-7.0	7.0-8.0	8.0-9.0	9.0-10.0	11.0-12.0	> 13.0	
0.40-0.50	1									1
0.30-0.40		1	2							3
0.20-0.30	1	3	7					2	5	18
0.10-0.20	2	2	5	9	5		2	12	28	65
0.00-0.10	3	1	5	6	5	4	5	1	10	40
Total	7	7	19	15	10	4	7	15	43	127

Figure 6-125. Combined height-period frequency (North-Northwest).

Source: EMPACA, 2023.

The Figure 6-126 compares the results of the wave roses obtained from the WWIII model data, transformed to the site of interest with TOMAWAC, and the ADCP Sentinel V20 instrumental records. The direction of the waves represented in the TOMAWAC simulation indicates the direction in which the wave propagates, while the directions of the ADCP wave rose indicate the direction from which the waves originate.

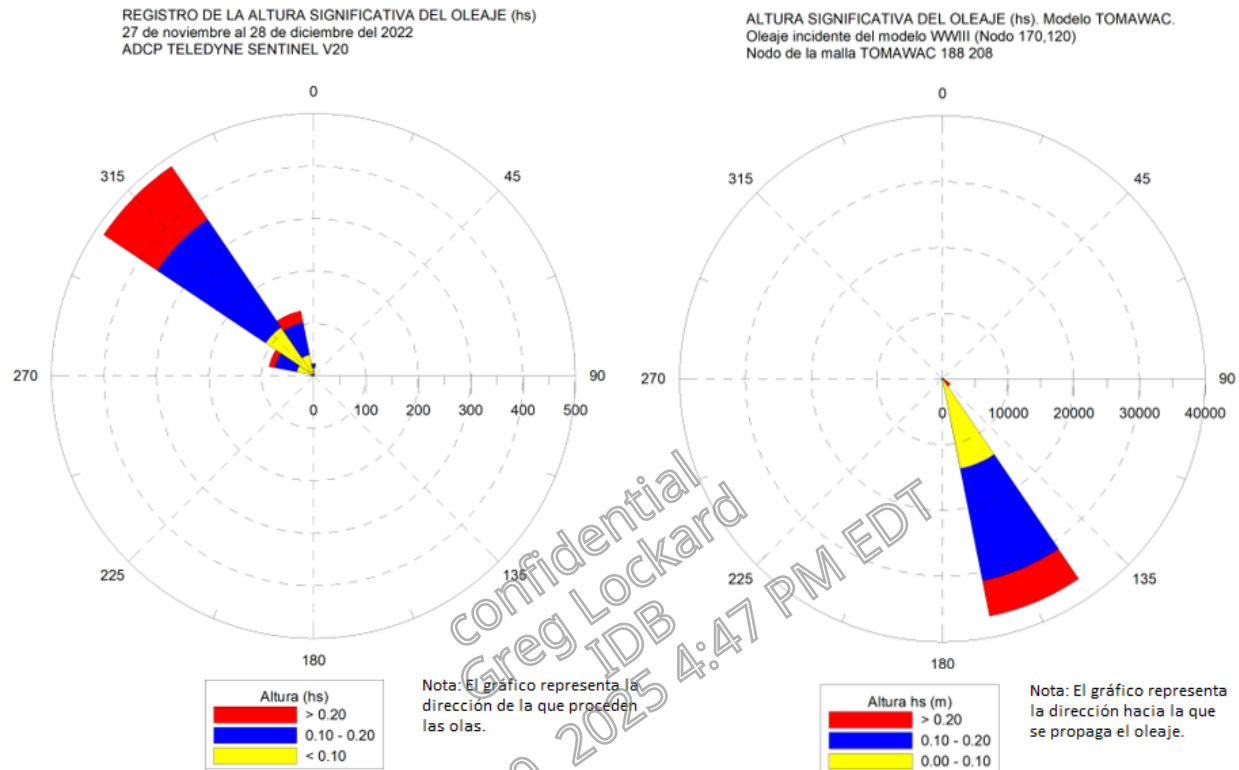


Figure 6-126. Wave roses obtained with the ADCP Teledyne Sentinel V20 ADCP and the values calculated with TOMAWAC from the WWIII hindcast model statistics.

Note: The figure on the left (ADCP) shows the direction the swell is coming from, while the figure on the right (TOMAWAC) indicates where it is heading.

Source: EMPACA, 2023.

The instrumental and model measurements show a high correlation between measured and calculated heights. In terms of direction, the ADCP measurements indicate a slight tilt in the direction of propagation towards the east-southeast, while the TOMAWAC model, which is based on the WWIII hindcast model, reflects a predominance of waves directed towards the south-southeast.

The results of the TOMAWAC simulation and ADCP measurements are used in later chapters to describe the hydrodynamic model of the area. The results are also used to describe the local sediment dynamics and the behavior of the thermal plume of water discharged from the power plant.

6.1.14.6 Hydrodynamic model (currents)

The current system in the study area is governed by multiple forces including tides, waves and wind. In this study we include the results of the current model performed by AKTIS to describe the general circulation in the project area and the specific studies performed by EMPACA to describe the tidal currents in the estuarine zone, the littoral drift on the beaches and the currents that govern the movement of the water mass in the area where the cooling water discharge will take place.

To describe the tide-independent circulation model (residual current), AKTIS used the public domain HYCOM (Hybrid Coordinate Ocean Model) data. HYCOM is a general circulation model that provides wind-derived fluxes and geostrophic fluxes with a system of vertical coordinates that are isopycnic in the open ocean. However, the isopycnic coordinates have a smooth transition to z-coordinates in the mixing layer, to coordinates that follow the terrain in the shallow regions, and back to z-coordinates in the very shallow waters.

The HYCOM model calculations are performed on a rectangular grid with a resolution of 0.08° between 40°S and 40°N , while switching to a rectangular grid of $0.08^\circ\text{lon} \times 0.04^\circ\text{lat}$ towards the poles of these latitudes. The HYCOM global grid has horizontal dimensions of 4500×3251 points. There are 41 vertical layers. The bathymetry is derived from the quality controlled NRL DBDB2 database. Surface forcing is derived from the *Navy Operational Global Atmospheric Prediction System* (NOGAPS) and includes the effect of wind stress, wind speed, heat flux and precipitation.

For the calculation of the periodic or tidal currents, AKTIS used the TPXO model, which includes the complex surface amplitudes, relative to the *Mean Sea Level* (MSL) and the current and transport system, from 8 primary harmonic constituents (M2, S2, N2, K2, K1, O1, P1, Q1), two long-period harmonic constituents (Mf, Mm) and 3 nonlinear (M4, MS4, MN4), in addition to 2N2 and S1, used only by TPX09). The spatial resolution of the model used by AKTIS was 10 minutes.

The values calculated by AKTIS were validated with instrumental measurements from regional oceanographic buoys and measurement equipment installed by INDEMAR as part of the project studies.

To develop the hydrodynamic prediction AKTIS relied on the Delft3D Flexible Meshing (Delft3D FM) system, which is a multidimensional (2D or 3D) hydrodynamic and transport program that calculates non-stationary flow and transport phenomena resulting from meteorological and astronomical forces on a grid fitted to a rectilinear or curvilinear boundary. The Delft3D FM modeling system can simulate storm surge, hurricanes, tsunamis, detailed flows and water levels, waves, sediment transport and morphology, water quality and ecology, and is able to handle the interaction between all these processes.

The resolution of the mesh used by AKTIS ranges from 10,000 meters in the outer zone to 125 meters in the project area. The computational domain used by AKTIS is rectangular in shape and depth data from different sources were integrated and interpolated to obtain the bathymetric representation shown in Figure 6-127. Figure 6-127.

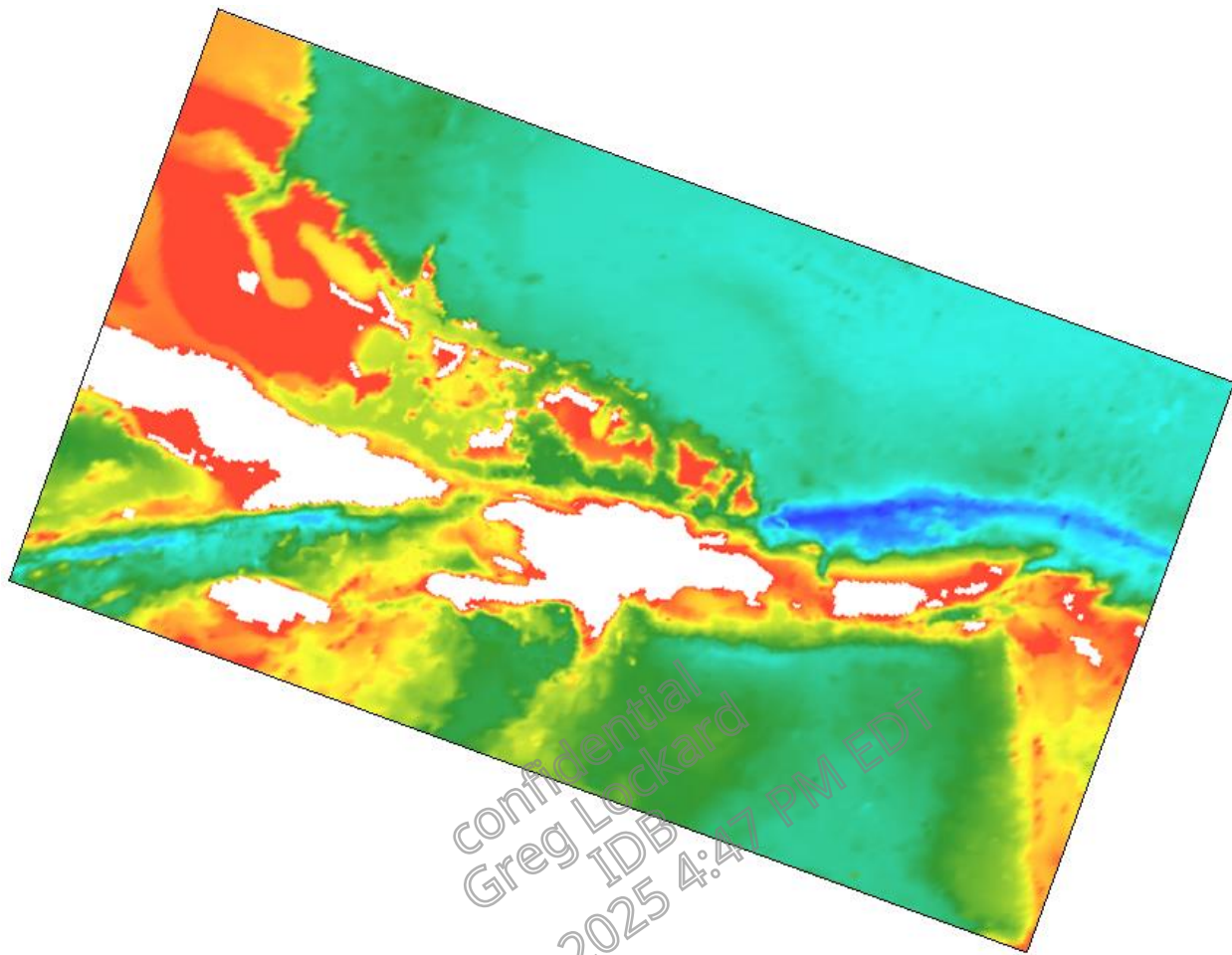


Figure 6-127. General bathymetric mesh used by AKTIS in the application of the DELFT-3D model.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

The model has 4 boundaries. The water levels at these boundaries are represented by the astronomical tide. AKTIS uses the amplitude and phase of the 14 harmonic tidal constituents obtained from the OSU TPXO model. Boundary conditions automatically determine the tidal currents at the model boundaries.

The calibration of the Delft3D model used data from coastal tide stations in Puerto Plata, Portu Ponce, South Caicos, Gibara, Punta Cana and Mon Is., PR. The selected stations are shown in Figure 6-128.

Comparison of water level variation, QQ scatter plots, and major tidal constituents for the stations is presented in the Figure 6-129 y Figure 6-130. To quantify the fit between simulation and measurements, the vector difference (VD) was used in the constituent comparison. VD is defined as:

$$VD = \sqrt{\left((H_C \cos(G_C) - H_0 \cos(G_0))^2 + (H_C \sin(G_C) - H_0 \sin(G_0))^2\right)}$$

Where H_C and G_C represent the calculated amplitude and phase, while H_0 and G_0 represent the observed amplitude and phase.

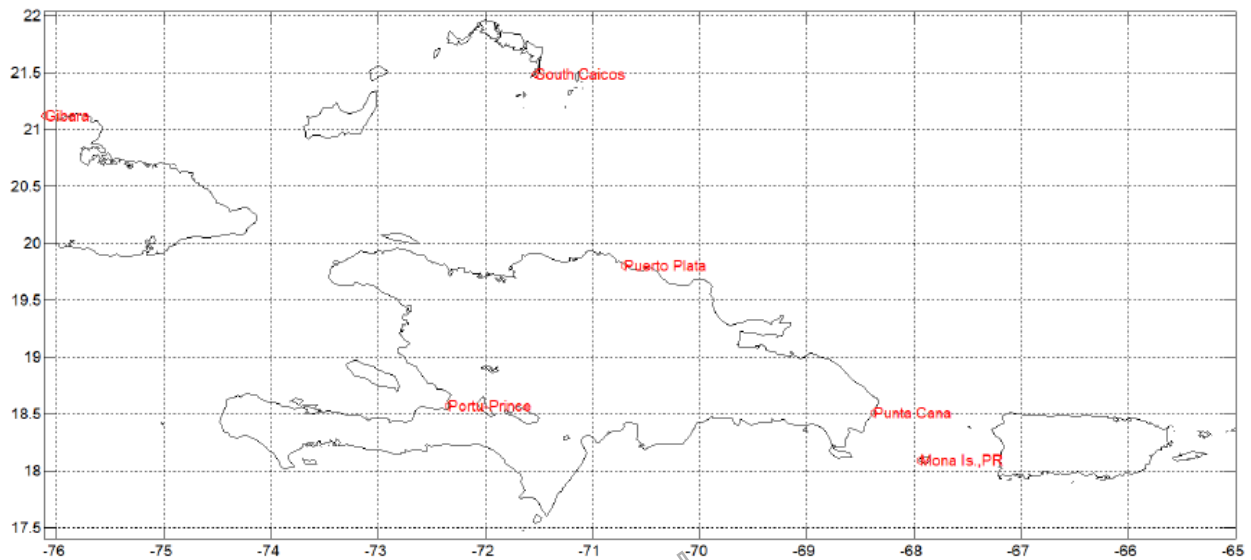


Figure 6-128. Calibration stations used by AKTIS to adjust the Delft-3D model.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

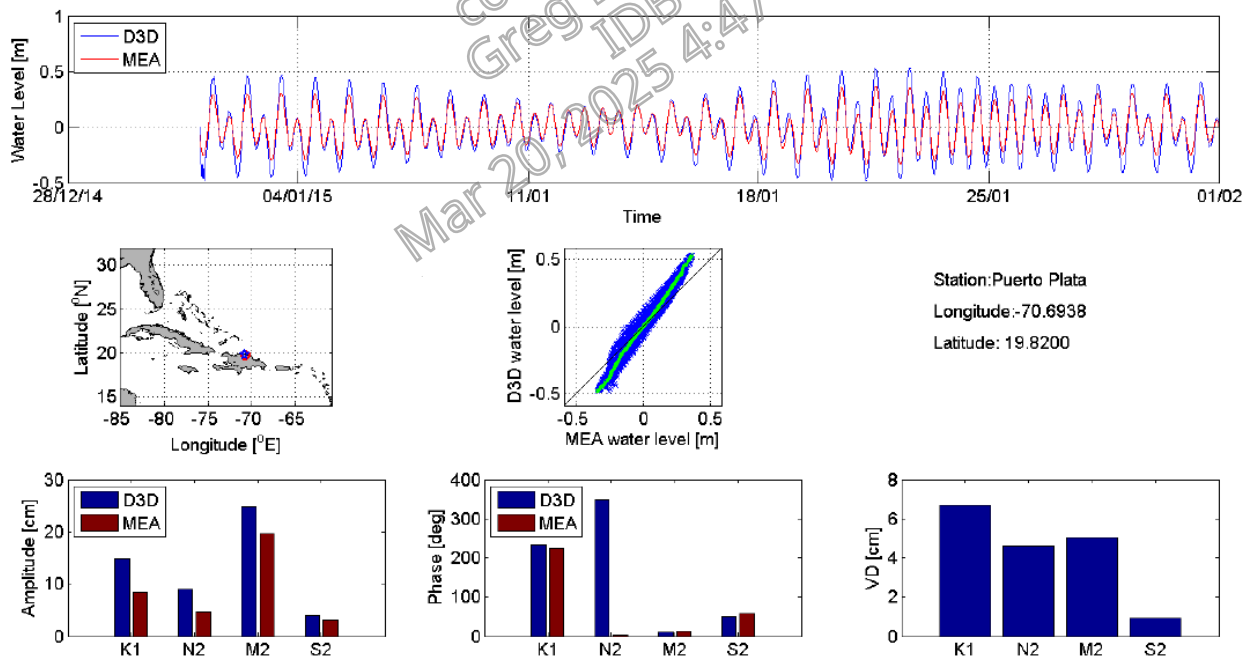


Figure 6-129. Measurements vs. uncalibrated model for the Puerto Plata tide station.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

From the comparison it is observed that the time series of modeled water level variation and actual measurements are well matched and the differences in amplitude and phase of the main tidal constituents are relatively small.

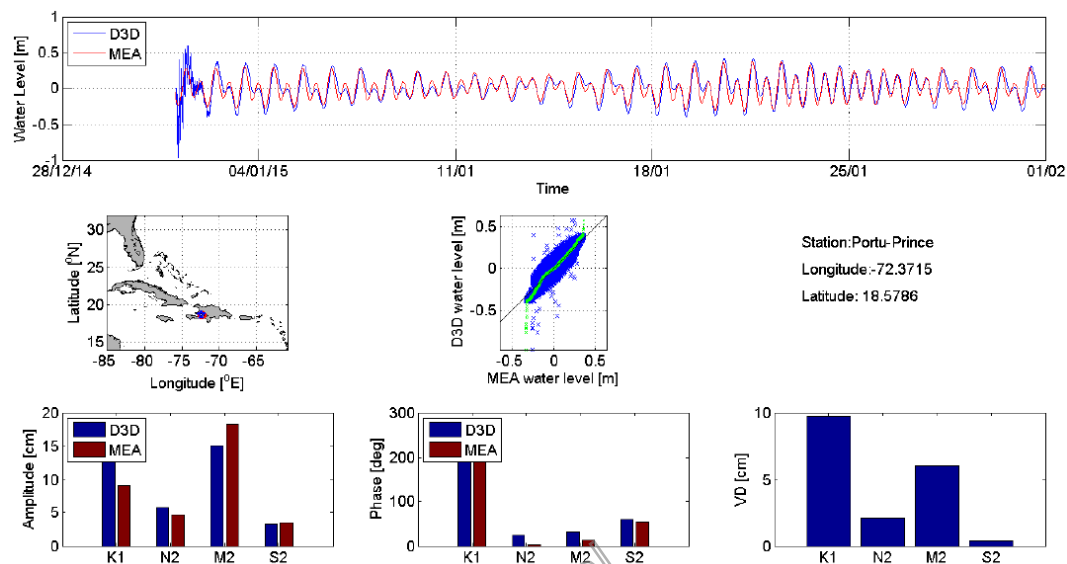


Figure 6-130. Measurements vs uncalibrated model for the Port au Prince tide station.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

To improve the fit and obtain a better prediction at the location of interest, a small calibration was implemented based on measurements from the Puerto Plata station. The effect of this calibration is summarized in the Figure 6-131 y Figure 6-132 which compare the scatter and exceedance plots of the uncalibrated tide levels and the measurements. Note that the plots contain the normal dispersion of the series (blue dots), and the ranked points (equivalent to Q-Q) where the data points (equal number because the data are contemporaneous), are ranked and plotted against points of equal category.

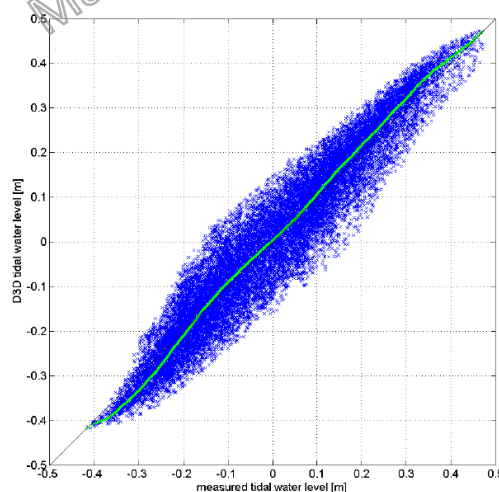


Figure 6-131. Comparison between measured tide levels and calibrated model results (Puerto Plata).

Source: EMPACA, 2023.

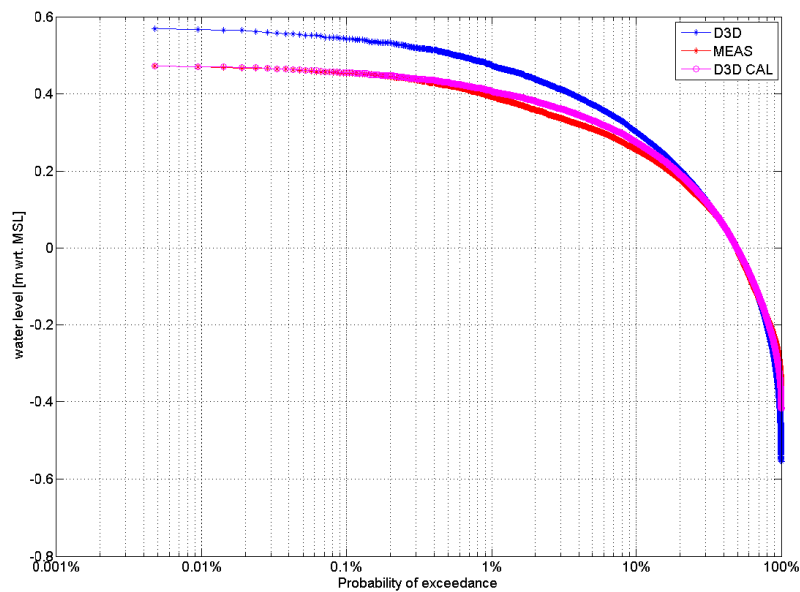


Figure 6-132. Probability of water level exceedance of the uncalibrated model, calibrated model and actual measurements in Puerto Plata.

Source: EMPACA, 2023.

The wastewater level obtained from the HYCOM model was calibrated with the water level measured at the Puerto Plata station. The Figure 6-133 presents the comparison between the calibrated HYCOM model and the wastewater level measurement.

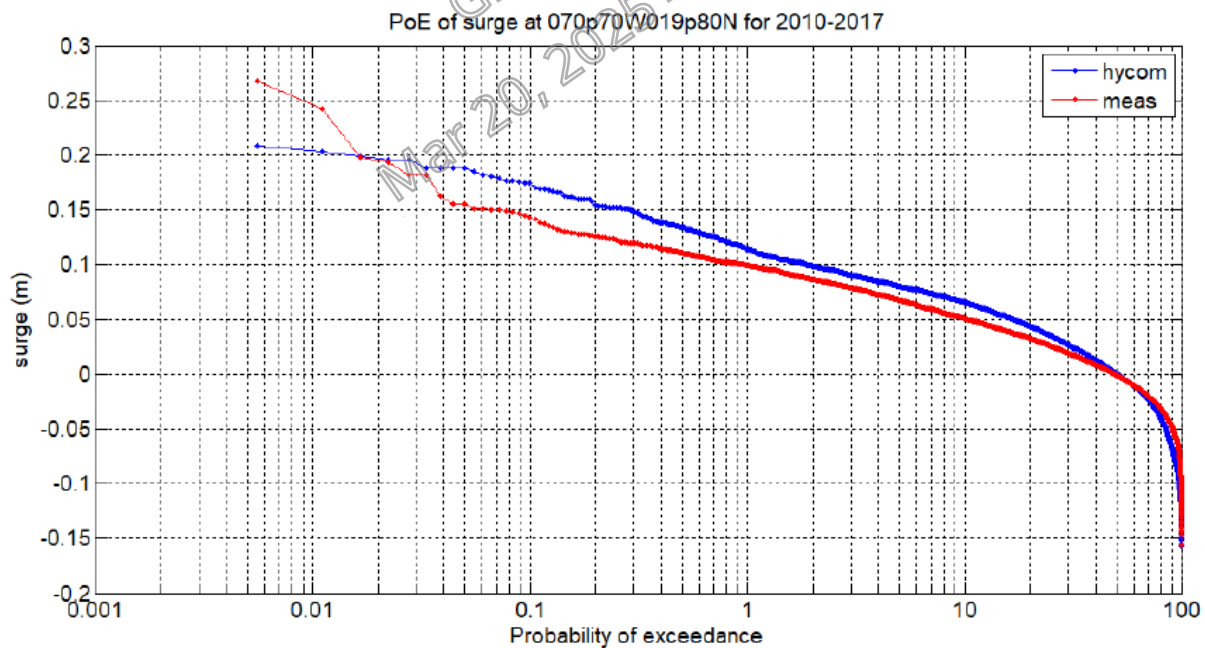


Figure 6-133. Plot of measured water level exceedance and the calibrated results of the HYCOM model at the Puerto Plata location.

Source: EMPACA, 2023.

The surface current (derived from the HYCOM database) was compared with instrumental measurements made with an ADCP placed by INDEMAR in the project area. The HYCOM data show lower current velocities than suggested by the measurements. To fit the model to reality, AKTIS used a correction factor of 2.3114 for the bulk of the data and a small correction factor for the tail of the series. The calibration factors are shown in Figure 6-134.

Parámetro	α_c	β_c	θ_c	ϵ_c	Δ_c
[-]	[-]	[m/s]	[-]	[m/s]	[m/s]
U	2.3114	- 0.0079	0.72	0.5	0.5

Figure 6-134. Surface current calibration constants.

Source: EMPACA, 2023.

The Figure 6-135 presents the measured, calibrated and uncalibrated exceedance curves of the model at the ADCP site.

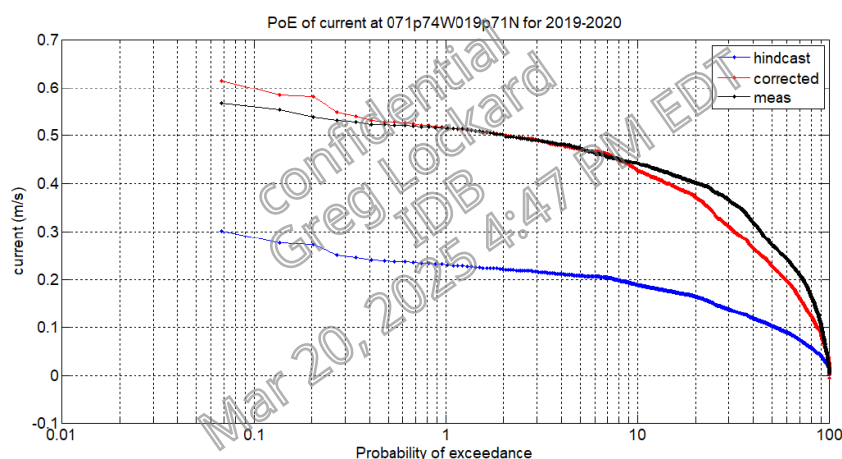


Figure 6-135. Measured, calibrated and uncalibrated surface current exceedance curves of the HYCOM model at the project location. INDEMAR ADCP location point.

Source: EMPACA, 2023.

The Figure 6-136 compares the calibrated current for the period of measurements with the estimated long-term current at the site.

Both measurements and DELFT3D simulations show that current velocity increases with decreasing depth. To simulate currents at other locations near the project, AKTIS used a linear interpolation based on the depth of the site of interest.

The DELFT3D flow model (calibrated with sea level measurements) was applied to the simulation of water level conditions due to tidal and flow conditions in the project area.

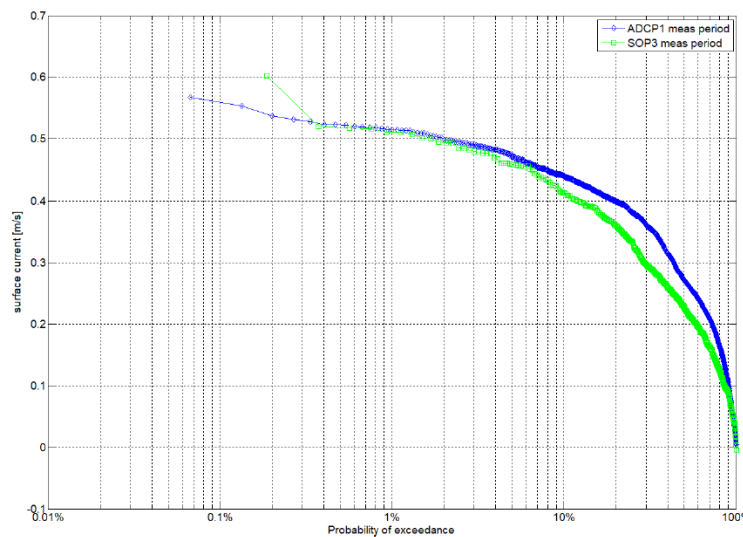


Figure 6-136. Exceedance curves of the calibrated surface current velocity at the project location for the entire period.

Source: EMPACA, 2023.

The Delft3D flow model was also applied to the wind forces for a period of one year. The results were used to incorporate the effect of wind on the total water level. The results showed that wind induces a lower water level rise than the tide. The differences in water level due to the influence between the different areas is practically negligible.

In summary, the studies developed by AKTIS determined the design water level and current conditions for a 20-year period, based on modeling using Delft3D and HYCOM, which were calibrated with instrumental measurements. The procedure followed by AKTIS is summarized in the following steps:

- Water levels and tidal currents were derived from the results of the Delft3D model.
- Wastewater levels were determined from instrumental measurements. In the case that no measurements were available, the levels obtained with HYCOM were used.
- The results of the Delft3D model made it possible to evaluate the effect of cyclones on wastewater levels.
- The total water level was obtained from the combination of the Delft3D model water level and the residual water level.
- The tidal current model was obtained from the results of the Delft3D model.
- Residual currents were obtained from the HYCOM model.
- The residual currents of the HYCOM model were calibrated with instrumental measurements.
- The effect of cyclones on the residual current was evaluated from the results of the Delft3D model.
- The total water level and currents were obtained by combining the tidal and residual components.

The vertical profile of the currents was obtained by combining the tidal current profile, which follows a 1/7 power law, with the residual current profile, derived from the HYCOM model.

The Figure 6-137 shows the surface current rose in the project area, obtained by AKTIS.

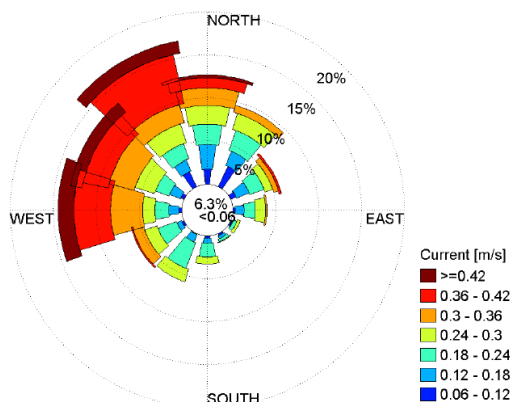


Figure 6-137. Surface current rose obtained by AKTIS for the project area near the pier construction.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

The Figure 6-138 shows the combined probability table of current velocity (U) and direction (U_{dir}) for this location.

-	U_{dir}^{lower} [deg]	-15.0	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	-
	U_{dir}^{upper} [deg]	15.0	45.0	75.0	105.0	135.0	165.0	195.0	225.0	255.0	285.0	315.0	345.0	-
U_{dir}^{lower} [m/s]	U_{dir}^{upper} [m/s]	-	-	-	-	-	-	-	-	-	-	-	-	Total
0.5	0.6	-	-	-	-	-	-	-	-	-	-	-	-	0.00
0.5	0.5	0.254	-	-	-	-	-	-	-	-	0.507	0.507	0.338	1.61
0.4	0.5	0.169	-	-	-	-	-	-	-	-	2.536	1.522	2.029	6.26
0.3	0.4	1.860	0.085	0.254	-	-	-	-	-	0.338	4.311	2.959	5.072	14.88
0.3	0.4	1.268	0.761	0.592	0.169	-	-	-	-	1.099	2.536	2.367	2.029	10.82
0.3	0.3	1.860	1.522	0.845	1.014	0.338	0.085	0.338	1.099	1.268	1.014	1.944	1.944	13.27
0.2	0.3	1.944	2.367	1.268	1.183	0.423	0.338	1.775	2.874	2.536	1.775	2.029	1.522	20.03
0.2	0.2	2.198	1.183	1.522	0.930	0.085	0.254	0.930	1.268	0.423	1.014	0.845	1.437	12.09
0.1	0.1	2.198	1.691	0.930	0.592	0.085	0.169	0.085	0.507	0.338	0.507	0.676	1.268	9.04
0.1	0.1	1.099	2.113	0.845	0.085	0.169	0.169	0.169	0.254	0.085	0.423	0.338	1.352	7.10
0.0	0.1	0.930	0.507	0.592	0.085	0.338	0.338	0.254	0.507	0.423	0.338	0.254	0.338	4.90
-	Total	13.779	10.228	6.847	4.057	1.437	1.352	3.550	6.509	6.509	14.962	13.440	17.329	100.000

Figure 6-138. Combined frequency table of surface current velocity (U) and direction (U_{dir}), determined by AKTIS from the comprehensive studies conducted in the area.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

In addition to the characterization of surface currents, AKTIS establishes a vertical distribution of the velocity profile for different probabilities. The Figure 6-139 shows the profiles for 1%, 10% and 50% exceedance probability. Note the reduction in velocity towards the lower layers of the water column.

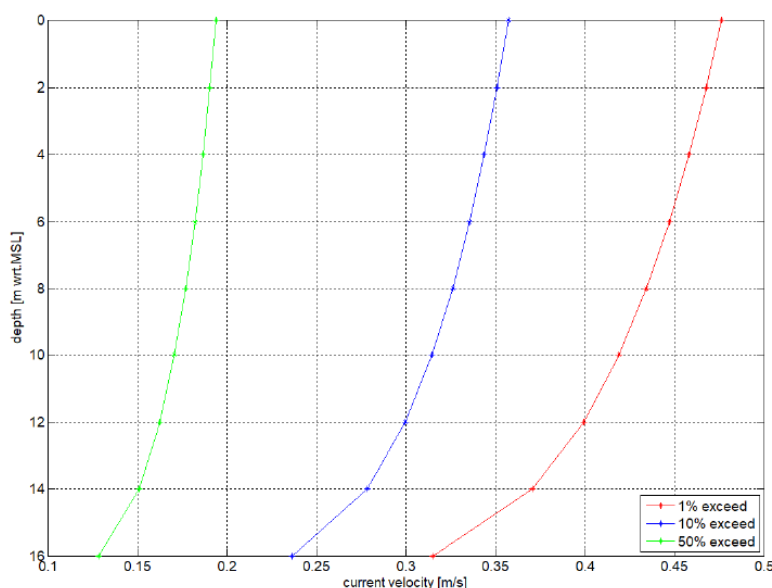


Figure 6-139. Vertical profile of current velocity in the water column.

In addition to the studies developed by AKTIS, EMPACA conducted a detailed study of the currents that included the placement of measuring instruments to evaluate the currents throughout the water column. The studies developed by EMPACA were specifically aimed at characterizing the currents to simulate the thermal dispersion of the hot water discharge plume from the industrial process. They were also aimed at characterizing the coastal drift to know the possible impact of the construction of the project works on the neighboring beaches.

The numerical modeling studies performed by EMPACA were based on the wave, tide and wind conditions described in previous chapters. The calculation grids for the models were obtained from the bathymetric surveys carried out by INDEMAR, EMPACA and the regional GEBCO bases. The TELEMAC-MASCARET system was used for the simulation.

The following is a characterization of the currents considering each of the factors involved in their formation. First of all, we address the issue of the tide, which forces the movement of water on a regional scale and has a particularly strong effect on the estuarine channels that abound in the region. Figure 15 in Annex 10.14 shows the bathymetric grid of a detailed area of the calculation domain, which includes the area where the port is located, the area where the project dock will be built and the estuary.

Using the ADCIRC databases to describe the tide and imposing the boundary conditions of the 37 harmonic components indicated by NOAA, interpolated to each node of the contour, the current scheme shown in Figures 16A and 16B in Annex 10.14 was obtained.

The figures show the maximum tidal currents of full (Figure 16A in Annex 10.14) and empty (Figure 16B in Annex 10.14), taking November 28, 2022 as an example. Since this is a semi-diurnal tide, there are actually two cycles of full and two cycles of ebb throughout the day.

In Figure 6-140 shows the behavior of the velocity and direction of the currents in the channel of communication between the estuary and the sea.

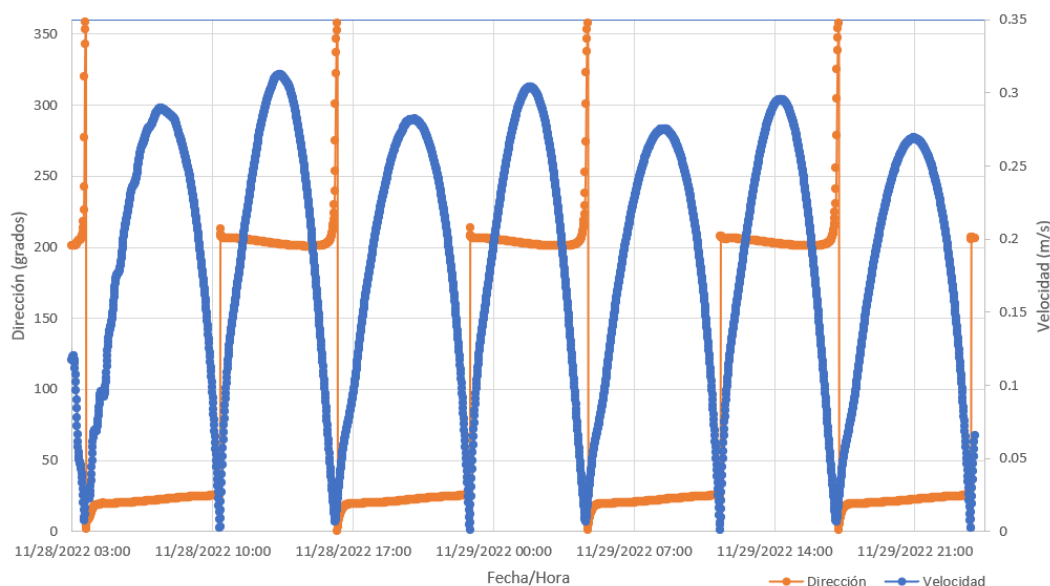


Figure 6-140. Velocity and direction of currents in the channel communicating the estuary with the sea. Simulation results with TELEMAC-MASCARET for November 28 and 29, 2022.

Source: EMPACA, 2023.

According to the results of the simulation and instrumental measurements, the most important tidal currents in the area occur in the estuary zone and its channel of communication with the sea. In the beach area, the main currents are due to coastal drift caused by waves, while in the area where the pier will be built and where the industrial process water discharge will be located, the residual currents, particularly those generated by the wind, have a determining influence.

Using the TOMAWAC and TELEMAC2D modules in an integrated manner, EMPACA evaluated the formation of coastal currents around the beaches, the estuary and the deeper waters where the pier will be built. Current velocities are most intense in the shallow areas where wave breaking occurs. These areas coincide with the reef bottoms and beaches.

As an example, Figure 17 in Annex 10.14 shows the effect of waves coming from the NNE with a deep-water height (h_s) of 0.75 meters and a peak period (t_p) of 10 seconds. These waves arrive at the project area highly transformed due to refraction-diffraction processes and generate a coastal current that converges towards the mouth of the estuary. The current velocity in the strip closest to the coast is as high as 0.20 m/s.

By considering the combined effect of tide, swell and wind, EMPACA determined environmental scenarios of currents for different exceedance probabilities. The TOMAWAC and TELEMAC3D modules of the TELEMAC-MASCARET system were used in combination for this simulation. The use of TELEMAC3D made it possible to evaluate the vertical distribution of the velocity and direction of the currents, especially in the area where the discharge of the industrial process water is proposed. Figure 18 in Annex 10.14 shows the point where the discharge is proposed.

In the three-dimensional numerical mesh used by TELEMAC3D, 10 levels of the water column were defined to describe the behavior of the currents. Level 01 represents the bottom, while Level

10 corresponds to the surface. For the representation of the examples in the figures, 3 levels have been selected: surface (10), middle (06) and bottom (01).

Figures 19A, 19B and 19C in Exhibit 10.14 show the flow pattern for a 0.90 exceedance probability environmental scenario. Similarly, Figures 20A, 20B and 20C in Exhibit 10.14 show the currents at different levels of the water column for a 0.50 exceedance probability scenario. In all cases, the figures include the current velocity and direction at the proposed discharge point of the industrial process water, where ADCP measurements were also taken.

The energetic conditions for an exceedance probability of 0.50 are of greater intensity than those occurring for an exceedance probability of 0.90. Also, the intensity of the currents is higher in the surface layer, due to the wind effect, than in the lower layers.

It is significant that the surface currents are directed towards the northwest and west-northwest, following the wind direction, while in the lower levels there is a compensating current in the opposite direction (southeast) and of much lower magnitude. Table 6-50 presents a summary of the velocity and direction of the currents at different levels of the water column, for exceedance probabilities of 0.90 and 0.50.

Table 6-50. Velocity and direction of currents in the water column for exceedance probabilities of 0.90 and 0.50. TELEMAC3D model for the proposed industrial process water discharge site.

Level	Probability 0.90		Probability 0.50	
	Speed (m/s)	Address	Speed (m/s)	Address
Surface (Level 10)	0.17	WNW	0.26	WNW
Medium (Level 06)	0.01	ESE	0.02	ESE
Background (Level 01)	0.01	ESE	0.01	ESE

Source: EMPACA, 2023.

In addition to the statistical evaluation and numerical simulation of the currents, EMPACA placed an ADCP (*Acoustic Doppler Current Profiler*) Teledyne V20, from RD Instruments (Photo 53 in Annex 11) at the point where the industrial water discharge is proposed. The equipment was kept recording between November 27 and December 28, 2022.

The results of the measurements confirmed the probabilities indicated by AKTIS for the velocity and direction of the surface current and the hydrodynamic models obtained by EMPACA with TELEMAC-MASCARET.

The ADCP recorded the velocity and direction of the currents in 16 layers of the water column and showed that at the surface the current follows a direction towards the West and West-Northwest, with average velocities between 0.20 and 0.30 m/s, while in the deeper layers the predominant direction is towards the East and East-Northeast, with velocities lower than 0.10 m/s.

The Figure 6-141 shows the combined frequency table of current velocity and direction for the bottom level (Level 01).

Velocidad m/s	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
0.150-0.175				2													2
0.125-0.150				1													1
0.100-0.125			3	8	2	1									1		15
0.075-0.100		12	15	21	19	1	1					1	2			2	74
0.050-0.075	25	50	70	63	20			1			1	2	6	18	6	6	268
0.025-0.050	88	93	128	177	104	29	30	15	12	17	40	39	45	29	37	61	944
0.000-0.025	125	127	120	178	213	97	55	93	89	93	81	95	97	51	66	80	1660
Total	238	282	336	450	358	128	86	109	101	110	122	137	150	98	110	149	2964

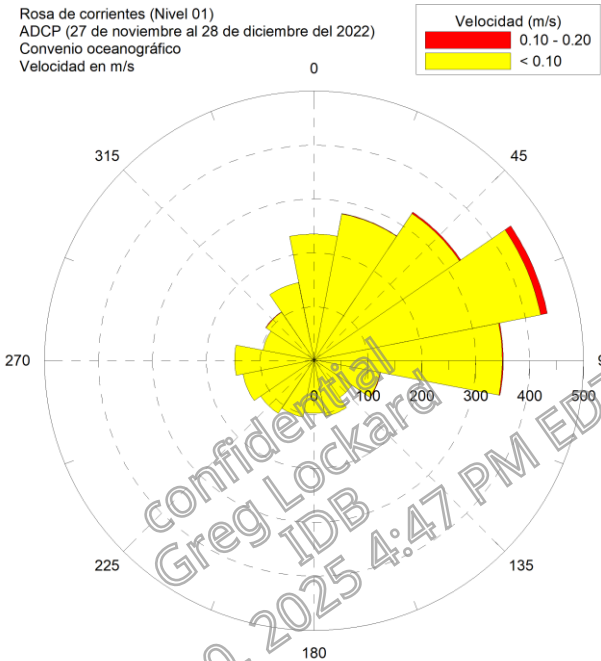


Figure 6-141. Current behavior at Level 01 (ADCP Sentinel V20).

Source: EMPACA, 2023.

The ADCP records at bottom level show a predominance of currents directed towards the East-Northeast, with velocities below 0.10 m/s.

Figure 6-142 shows the behavior of the current at Level 07, which is at an intermediate level of the water column at a depth of approximately 9.0 meters.

Velocidad m/s	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
0.175-0.200				1			1										2
0.150-0.175				8	2												10
0.125-0.150				10	4											1	15
0.100-0.125				14	26												40
0.075-0.100				26	35												75
0.050-0.075		5	10	74	169	16	5				2	18	17	9	3	4	332
0.025-0.050	13	24	57	103	312	150	58	16	19	43	128	81	51	16	11	11	1093
0.000-0.025	30	45	63	119	229	211	120	93	136	97	69	55	53	30	24	23	1397
Total	43	74	130	355	777	377	184	109	155	142	215	162	118	49	35	39	2964

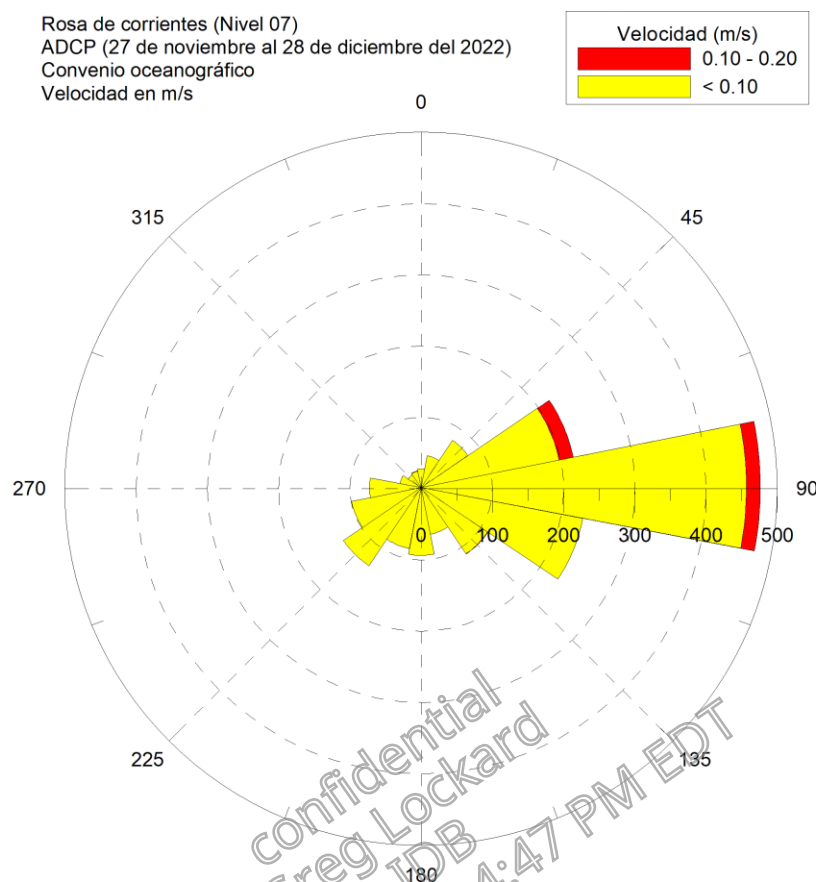


Figure 6-142. Current behavior at Level 07 (ADCP Sentinel V20).

Source: EMPACA, 2023.

In the intermediate levels of the water column (Figure 6-142), the currents are preferentially directed towards the east, and maintain velocities below 0.10 m/s. The most frequent velocities are below 0.025 m/s (47% of cases), followed by currents with velocities between 0.025 and 0.050 m/s (36.9 %).

At the surface, the behavior of the currents changes completely, and they are directed towards the west-northwest, west and north, with greater preference. The Figure 6-143 shows the combined frequency table of velocity and direction of currents in the surface layer. 40.8% of the surface currents have velocities greater than 0.30 m/s. 17.3% of the currents are directed west-northwestward, followed in frequency by westward-directed currents, which accumulate 13.6% of the total.

Velocidad m/s	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
>0.300	74	19		5	13	4	27	70	64	53	75	212	217	255	75	47	1210
0.275-0.300	17	5	3	3	6	1	2	12	17	31	12	18	41	30		17	215
0.250-0.275	25	15	1	2	2	2	1	8	18	23	11	15	27	34	5	22	211
0.225-0.250	40	11	4	2		1	1	7	23	19	12	15	18	40	19	19	231
0.200-0.225	38	13	4	2	1		1	5	9	21	17	13	22	43	27	19	235
0.175-0.200	35	17	4	2			1	1	1	14	5	1	17	17	34	26	175
0.150-0.175	30	5	2		3		1		6	8	2	1	8	19	28	30	143
0.125-0.150	22	7	1	4	1			1	3	3	8	2	6	14	10	12	94
0.100-0.125	14	5	2	5	2	1	1		5	7	3	5	2	17	11	9	89
0.075-0.100	12	4	2	3	1		1	2	5	5	2	2	11	11	8	13	82
0.050-0.075	9	7	1	2	1	1		1	3	3	1	9	7	14	12	5	76
0.025-0.050	11	7	1	8	5	2	1	2	4	5	11	9	17	13	9	10	115
0.000-0.025	9	4	8		3	2	5	2	3	1	5	10	11	7	6	7	88
Total	336	119	33	43	38	14	42	111	161	193	164	312	404	514	244	236	2964

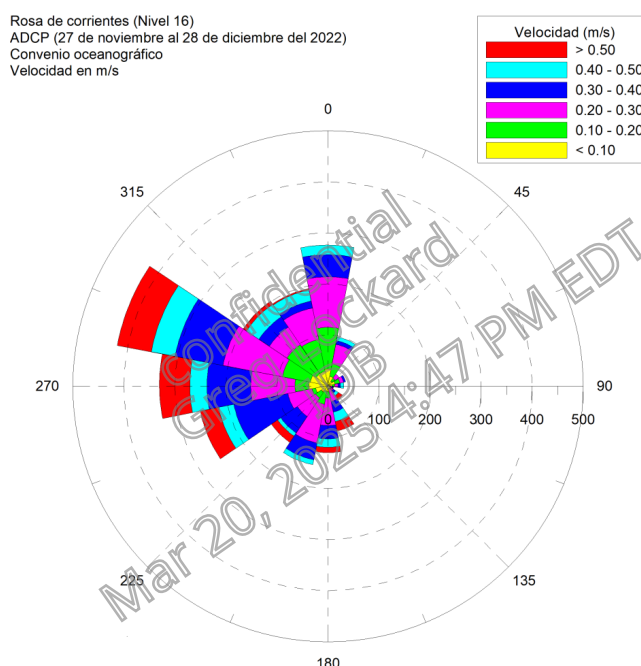


Figure 6-143. Behavior of surface streams (Level 16). ADCP Sentinel V20 records at the point where the discharge of water resulting from the industrial process is planned.

Source: EMPACA, 2023.

Because of the importance of surface currents in the thermal dilution process of the industrial water discharge plume, an analysis of the exceedance probability (Q) is presented below. Although the current measurements comprise a short series, the probability curves demonstrate some correspondence with the results of the statistical analysis developed by AKTIS and EMPACA simulations using TELEMAC-MASCARET and NOAA WWIII model databases.

The Figure 6-144 summarizes the probability of exceedance of the velocity of currents in the surface water layer at the point where the discharge is planned. These results are also presented graphically in Figure 6-145.

Q	Velocidad (m/s)	Probabilidad (%)
0.01	0.64	1.00
0.02	0.57	2.00
0.05	0.47	5.00
0.10	0.40	10.00
0.20	0.33	20.00
0.30	0.29	30.00
0.40	0.26	40.00
0.50	0.23	50.00
0.60	0.21	60.00
0.70	0.20	70.00
0.80	0.18	80.00
0.90	0.17	90.00
1.00	0.16	100.00

Figure 6-144. Probability of exceedance of surface current velocity at the proposed point of discharge of industrial process water (ADCP Sentinel V20).

Source: EMPACA, 2023.

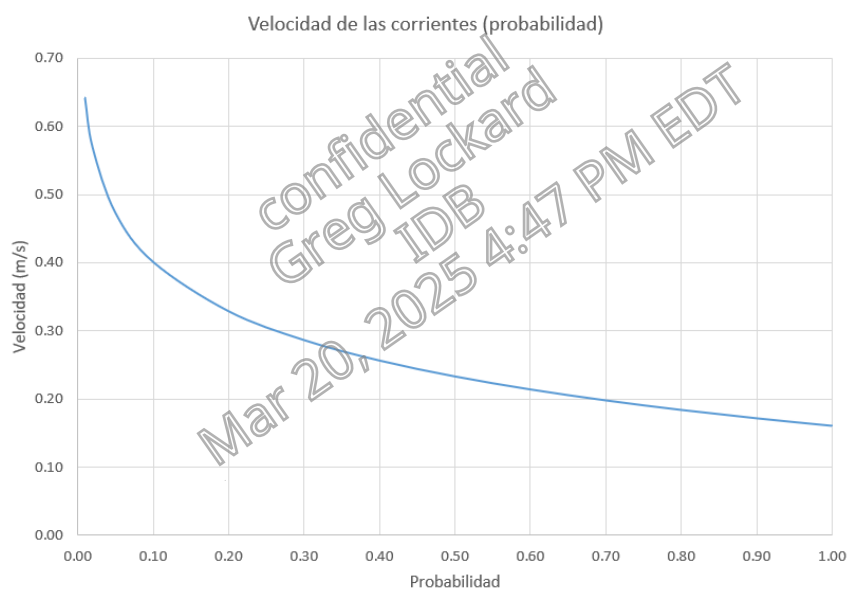


Figure 6-145. Surface current velocity exceedance curve at the proposed point of discharge of industrial process water (ADCP Sentinel V20).

Source: EMPACA, 2023.

Figure 21 in Annex 10.14 shows the complete record of the ADCP Sentinel V20 series during the measurement period. The series corresponds to the statistics reported by AKTIS and EMPACA, in addition to validating the results of numerical simulations with TELEMAR-MASCARET.

6.1.14.7 Sediment transport.

One of the elements that require greater attention in environmental studies in coastal areas is sedimentary transport since any alteration in its equilibrium leads to important changes in the configuration of beaches and submarine relief. To evaluate coastal transport, the hydrodynamic

conditions of the site and the characteristics of the materials found on the coast must be considered.

To characterize the coastal sediments, EMPACA sampled along 2,500 meters of the beach, on both sides of the current harbor breakwater and on both sides of the estuary.

The granulometric analysis was carried out by dry sieving. *GRADISTAT* Version 4.0 software (*A Grain Size Distribution and Statistics Package for the Analysis of Unconsolidated Sediments by Sieving or Laser Granulometer*), developed by the *Surface Processes and Modern Environments Research Group* of the *Department of Geology, Royal Holloway, University of London*, was used for the statistical analysis of the results.

The formulas and classification used by the software to calculate the sample statistics are summarized in the Figure 6-146 and Figure 6-147. In these formulas, f is the frequency in percent, m is the midpoint of each class interval in metric units (m_m) or in phi units (m_ϕ), P_x and Φ_x , represent the diameter of the grains in metric or phi units, respectively, at the cumulative x -percentile value.

(a) Arithmetic Method of Moments

Mean	Standard Deviation	Skewness	Kurtosis
$\bar{x}_a = \frac{\sum f m_m}{100}$	$\sigma_a = \sqrt{\frac{\sum f (m_m - \bar{x}_a)^2}{100}}$	$Sk_a = \frac{\sum f (m_m - \bar{x}_a)^3}{100 \sigma_a^3}$	$K_a = \frac{\sum f (m_m - \bar{x}_a)^4}{100 \sigma_a^4}$

(b) Geometric Method of Moments

Mean	Standard Deviation	Skewness	Kurtosis		
$\bar{x}_g = \exp \frac{\sum f \ln m_m}{100}$	$\sigma_g = \exp \sqrt{\frac{\sum f (\ln m_m - \ln \bar{x}_g)^2}{100}}$	$Sk_g = \frac{\sum f (\ln m_m - \ln \bar{x}_g)^3}{100 \ln \sigma_g^3}$	$K_g = \frac{\sum f (\ln m_m - \ln \bar{x}_g)^4}{100 \ln \sigma_g^4}$		
Sorting (σ_g)	Skewness (Sk_g)		Kurtosis (K_g)		
Very well sorted	< 1.27	Very fine skewed	< -1.30	Very platykurtic	< 1.70
Well sorted	1.27 – 1.41	Fine skewed	-1.30 – -0.43	Platykurtic	1.70 – 2.55
Moderately well sorted	1.41 – 1.62	Symmetrical	-0.43 – +0.43	Mesokurtic	2.55 – 3.70
Moderately sorted	1.62 – 2.00	Coarse skewed	+0.43 – +1.30	Leptokurtic	3.70 – 7.40
Poorly sorted	2.00 – 4.00	Very coarse skewed	> +1.30	Very leptokurtic	> 7.40
Very poorly sorted	4.00 – 16.00				
Extremely poorly sorted	> 16.00				

(c) Logarithmic Method of Moments

Mean	Standard Deviation	Skewness	Kurtosis
$\bar{x}_\phi = \frac{\sum f m_\phi}{100}$	$\sigma_\phi = \sqrt{\frac{\sum f (m_\phi - \bar{x}_\phi)^2}{100}}$	$Sk_\phi = \frac{\sum f (m_\phi - \bar{x}_\phi)^3}{100 \sigma_\phi^3}$	$K_\phi = \frac{\sum f (m_\phi - \bar{x}_\phi)^4}{100 \sigma_\phi^4}$
Sorting (σ_ϕ)		Skewness (Sk_ϕ)	Kurtosis (K_ϕ)
Very well sorted	< 0.35	Very fine skewed	> +1.30
Well sorted	0.35 – 0.50	Fine skewed	+0.43 – +1.30
Moderately well sorted	0.50 – 0.70	Symmetrical	-0.43 – +0.43
Moderately sorted	0.70 – 1.00	Coarse skewed	-0.43 – -1.30
Poorly sorted	1.00 – 2.00	Very coarse skewed	< -1.30
Very poorly sorted	2.00 – 4.00		
Extremely poorly sorted	> 4.00		

(d) Logarithmic (Original) Folk and Ward (1957) Graphical Measures

Mean	Standard Deviation	Skewness	Kurtosis		
$M_z = \frac{\phi_{16} + \phi_{50} + \phi_{84}}{3}$	$\sigma_z = \frac{\phi_{84} - \phi_{16}}{4} + \frac{\phi_{95} - \phi_5}{6.6}$	$Sk_z = \frac{\phi_{16} + \phi_{84} - 2\phi_{50}}{2(\phi_{84} - \phi_{16})} + \frac{\phi_5 + \phi_{95} - 2\phi_{50}}{2(\phi_{95} - \phi_5)}$	$K_G = \frac{\phi_{95} - \phi_5}{2.44(\phi_{75} - \phi_{25})}$		
Sorting (σ_z)	Skewness (Sk_z)		Kurtosis (K_G)		
Very well sorted	< 0.35	Very fine skewed	0.3 to +1.0	Very platykurtic	< 0.67
Well sorted	0.35 – 0.50	Fine skewed	+0.1 to +0.3	Platykurtic	0.67 – 0.90
Moderately well sorted	0.50 – 0.70	Symmetrical	+0.1 to -0.1	Mesokurtic	0.90 – 1.11
Moderately sorted	0.70 – 1.00	Coarse skewed	-0.1 to -0.3	Leptokurtic	1.11 – 1.50
Poorly sorted	1.00 – 2.00	Very coarse skewed	-0.3 to -1.0	Very leptokurtic	1.50 – 3.00
Very poorly sorted	2.00 – 4.00			Extremely	> 3.00
Extremely poorly sorted	> 4.00			leptokurtic	

(e) Geometric Folk and Ward (1957) Graphical Measures

Mean	Standard Deviation				
$M_G = \exp \frac{\ln P_{16} + \ln P_{50} + \ln P_{84}}{3}$	$\sigma_G = \exp \left(\frac{\ln P_{16} - \ln P_{84}}{4} + \frac{\ln P_5 - \ln P_{95}}{6.6} \right)$				
Skewness	Kurtosis				
$Sk_G = \frac{\ln P_{16} + \ln P_{84} - 2(\ln P_{50})}{2(\ln P_{84} - \ln P_{16})} + \frac{\ln P_5 + \ln P_{95} - 2(\ln P_{50})}{2(\ln P_{25} - \ln P_5)}$	$K_G = \frac{\ln P_5 - \ln P_{95}}{2.44(\ln P_{25} - \ln P_{75})}$				
Sorting (σ_G)	Skewness (Sk_G)	Kurtosis (K_G)			
Very well sorted	< 1.27	Very fine skewed	-0.3 to +1.0	Very platykurtic	< 0.67
Well sorted	1.27 – 1.41	Fine skewed	-0.1 to +0.3	Platykurtic	0.67 – 0.90
Moderately well sorted	1.41 – 1.62	Symmetrical	-0.1 to +0.1	Mesokurtic	0.90 – 1.11
Moderately sorted	1.62 – 2.00	Coarse skewed	+0.1 to +0.3	Leptokurtic	1.11 – 1.50
Poorly sorted	2.00 – 4.00	Very coarse skewed	+0.3 to +1.0	Very leptokurtic	1.50 – 3.00
Very poorly sorted	4.00 – 16.00			Extremely	> 3.00
Extremely poorly sorted	> 16.00			leptokurtic	

Figure 6-146. Formulas used by GRADISTAT for statistical characterization of sediment samples and classification.

Source: EMPACA, 2023.

phi	Grain Size mm	Descriptive term	
-10	1024	Very Large	Boulder
-9	512	Large	
-8	256	Medium	
-7	128	Small	
-6	64	Very small	
-5	32	Very coarse	Gravel
-4	16	Coarse	
-3	8	Medium	
-2	4	Fine	
-1	2	Very fine	
0	1	Very coarse	Sand
1	microns 500	Coarse	
2	250	Medium	
3	125	Fine	
4	63	Very fine	
5	31	Very coarse	Silt
6	16	Coarse	
7	8	Medium	
8	4	Fine	
9	2	Very fine	
		Clay	

Figure 6-147. Modified particle size classification of Udden (1914) and Wentworth (1922).

Source: Udden (1914) and Wentworth (1922).

The Table 6-51 presents the coordinates where the samples were taken.

Table 6-51. Location of samples collected along the project area and neighboring beaches.

Sample	UTM (WGS84)		Sample	UTM (WGS84)	
	X	Y		X	Y
M1	211 823	2 181 193	M10	212 962	2 181 377
M2	211 937	2 181 218	M11	213 055	2 181 369
M3	212 027	2 181 253	M12	213 135	2 181 394
M4	212 185	2 181 294	M13	213234	2181387
M5	212 290	2 181 325	M14	213 326	2 181 383
M6	212 376	2 181 364	M15	213 415	2 181 415
M7	212 564	2 181 327	M16	213 769	2 181 572
M8	212 671	2 181 324	M17	213 822	2 181 633
M9	212 790	2 181 331	M18	213 863	2 181 711

Source: EMPACA, 2023.

Figure 22 in Annex 10.14 shows a map with the location of the sampling points and a summary of their mean diameter (D_{50}) and classification.

All samples were taken in the intertidal zone of the beach, also known by the French term “estran”, which is a zone that characterizes the energetic conditions of the site. Photos 54 and 55 (Annex 11) present the collection of samples on both sides of the port pier.

Figure 6-148 to Figure 6-165 summarize the graphical results of the granulometric study for each sample. An extract of the statistics comprising mean, skewness, kurtosis is included. All graphs are presented in the international system of units (μm) and in ϕ units (ϕ).

Statistical analysis is shown by applying the method of moments and the method of Folk and Ward. The classification of the samples is based on the Udden (1914) and Wenworth (1922) scale.

Among the parameters shown in the figure is the mean diameter (D_{50}) which is used in sediment transport formulas and in the evaluation of beach profile performance.

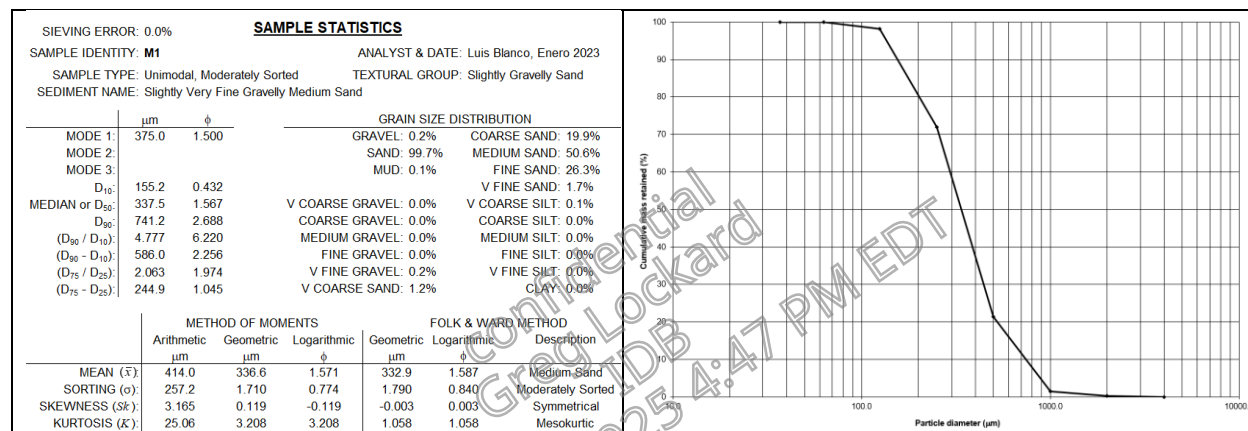


Figure 6-148. Statistical characterization of sample M1 (Gradistat).

Source: EMPACA, 2023.

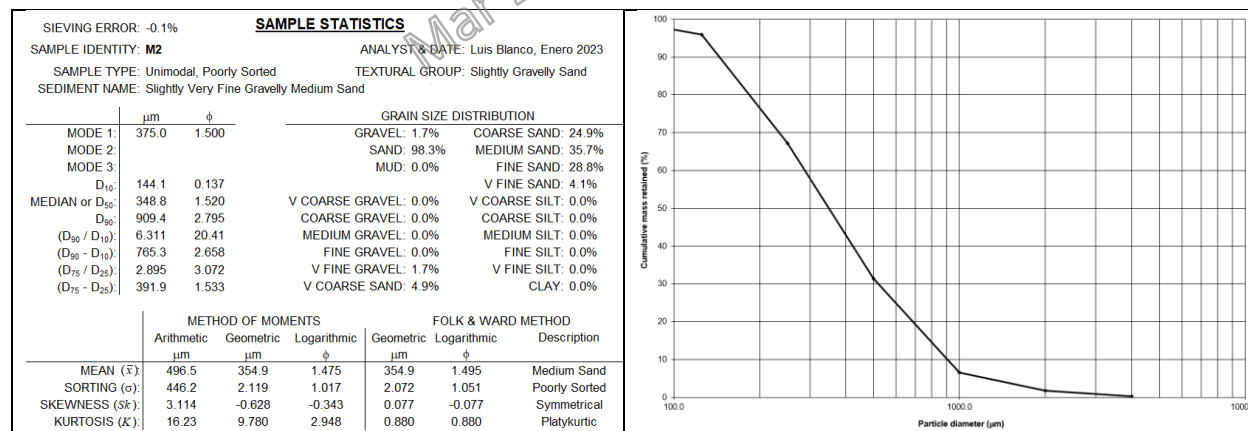


Figure 6-149. Statistical characterization of sample M2 (Gradistat).

Source: EMPACA, 2023.

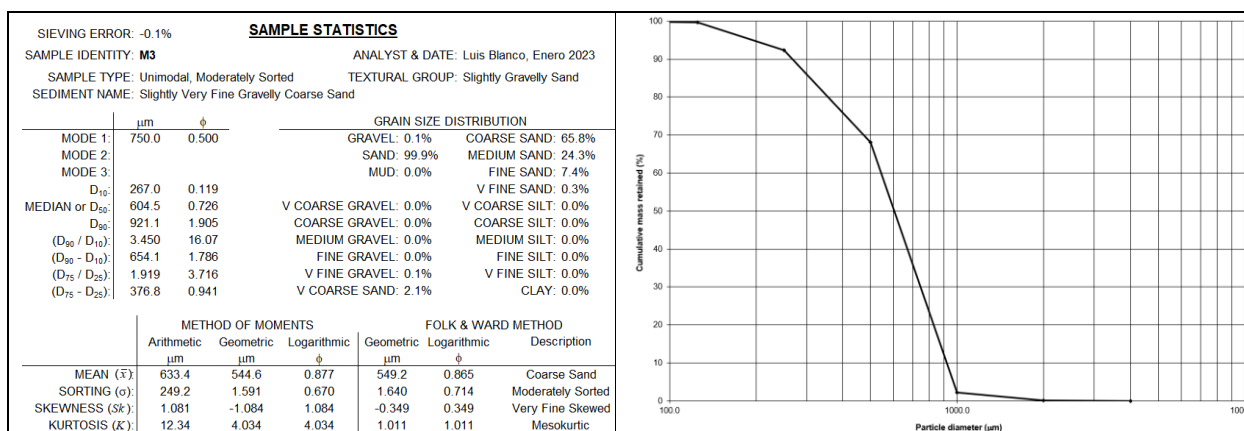


Figure 6-150. Statistical characterization of sample M3 (Gradistat).

Source: EMPACA, 2023.

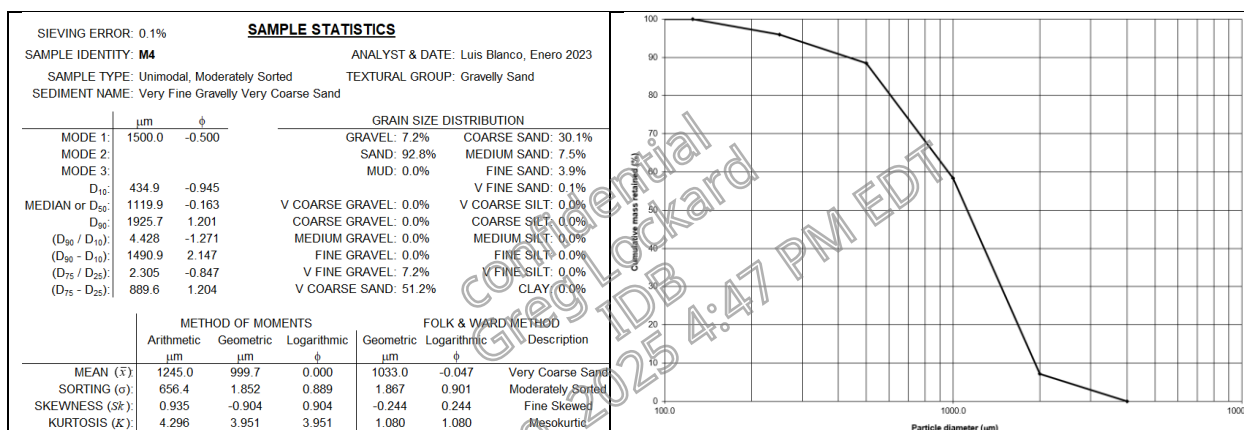


Figure 6-151. Statistical characterization of sample M4 (Gradistat).

Source: EMPACA, 2023.

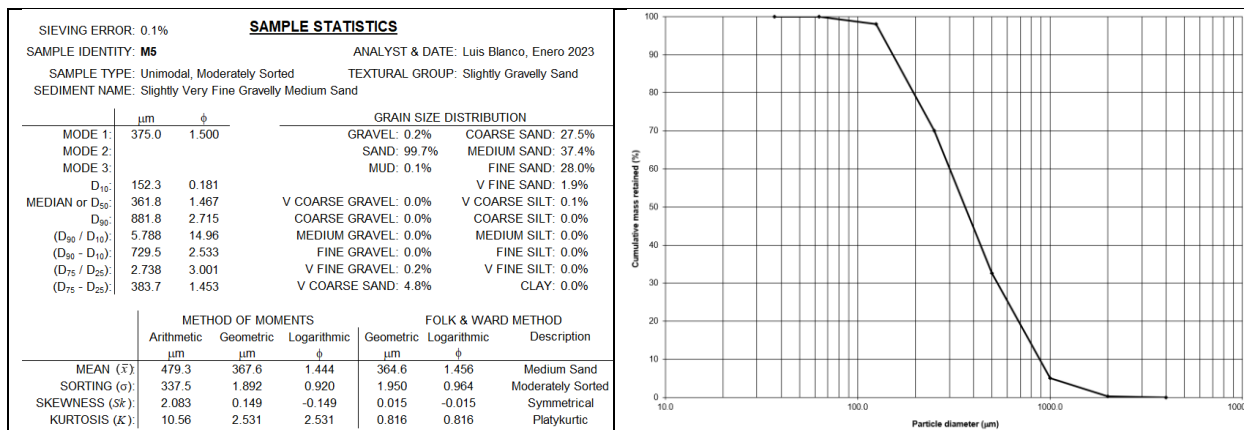


Figure 6-152. Statistical characterization of sample M5 (Gradistat).

Source: EMPACA, 2023.

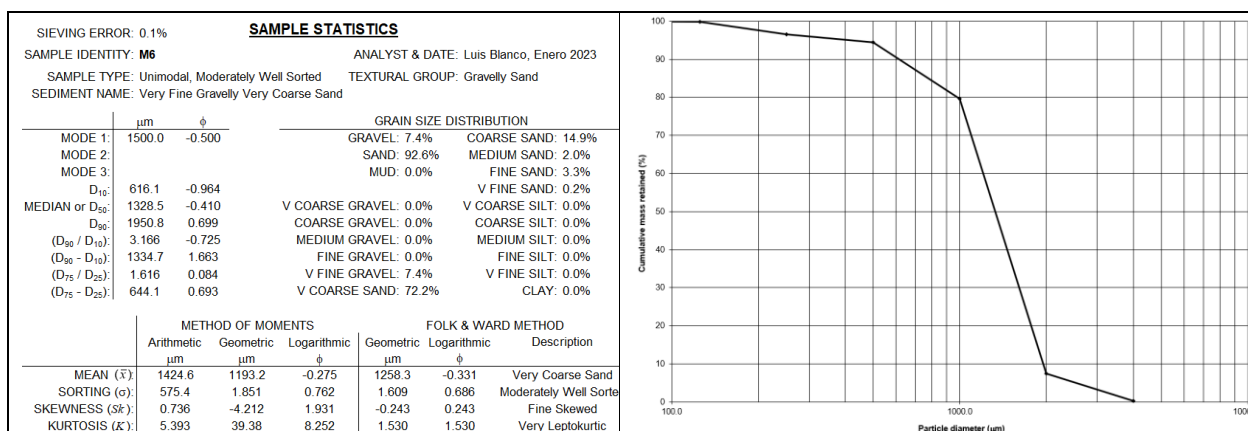


Figure 6-153. Statistical characterization of sample M6 (Gradistat).

Source: EMPACA, 2023.

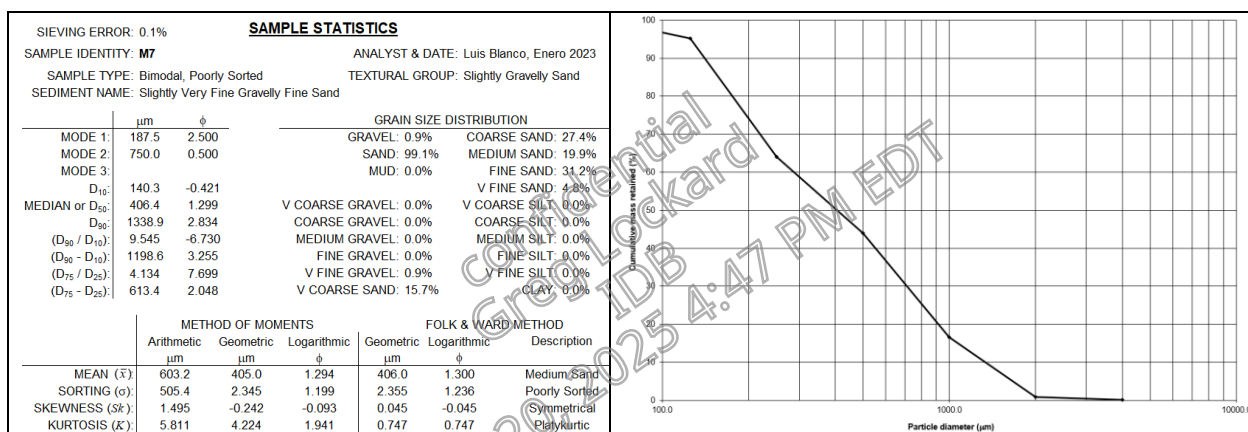


Figure 6-154. Statistical characterization of sample M7 (Gradistat).

Source: EMPACA, 2023.

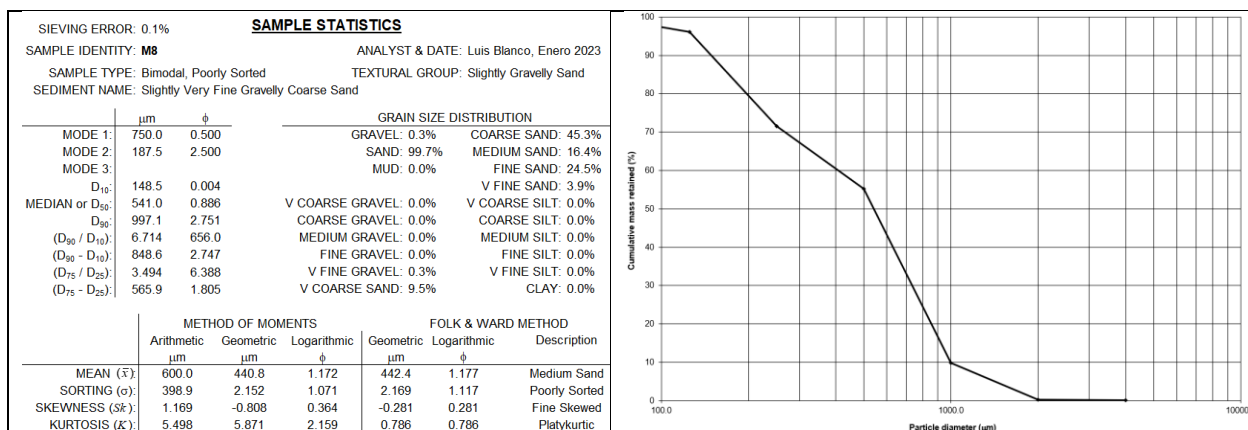


Figure 6-155. Statistical characterization of sample M8 (Gradistat).

Source: EMPACA, 2023.

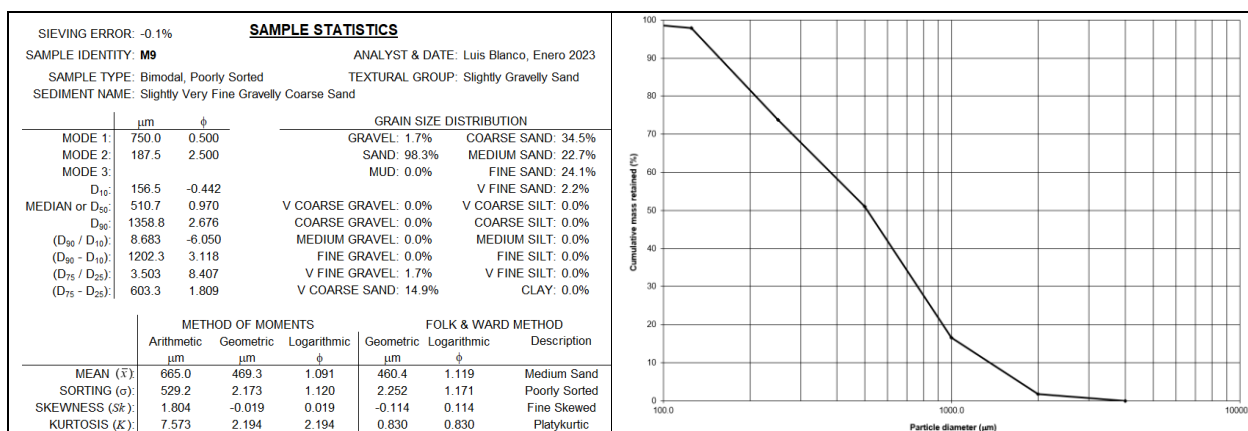


Figure 6-156. Statistical characterization of sample M9 (Gradistat).

Source: EMPACA, 2023.

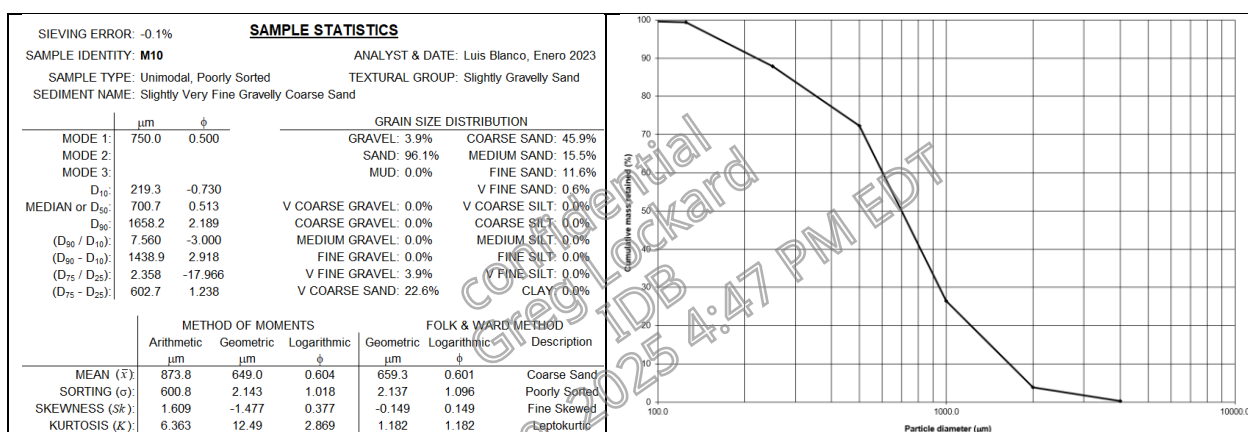


Figure 6-157. Statistical characterization of sample M10 (Gradistat).

Source: EMPACA, 2023.

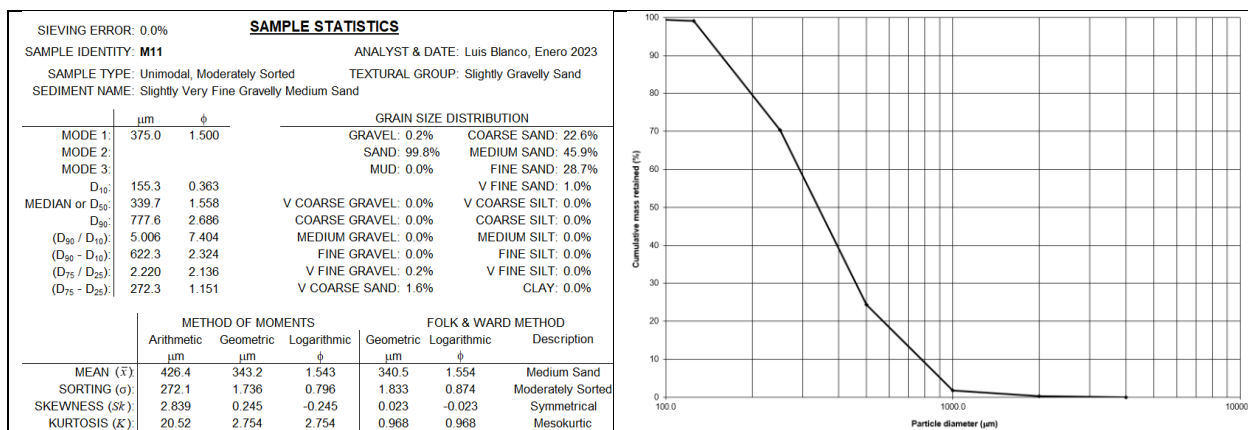


Figure 6-158. Statistical characterization of sample M11 (Gradistat).

Source: EMPACA, 2023.

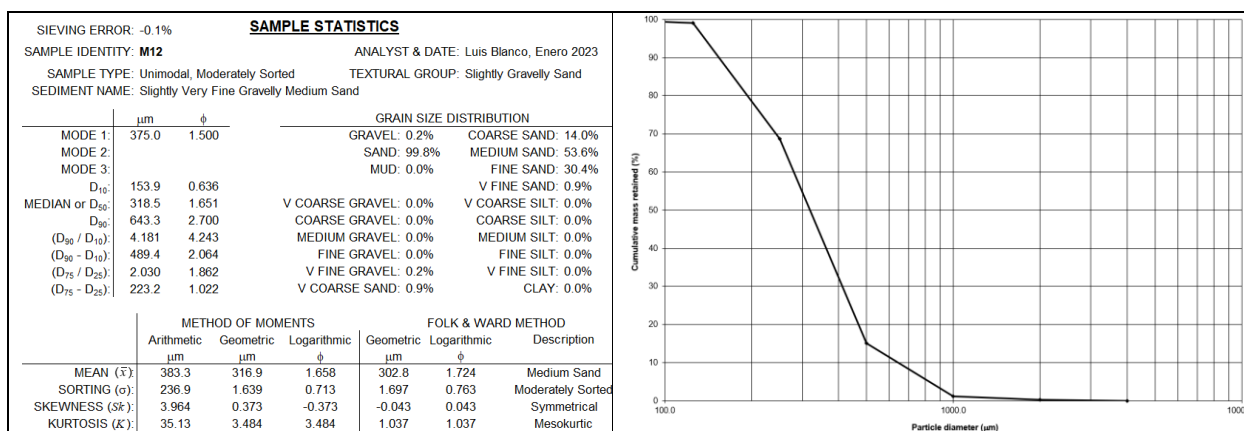


Figure 6-159. Statistical characterization of sample M12 (Gradistat).

Source: EMPACA, 2023.

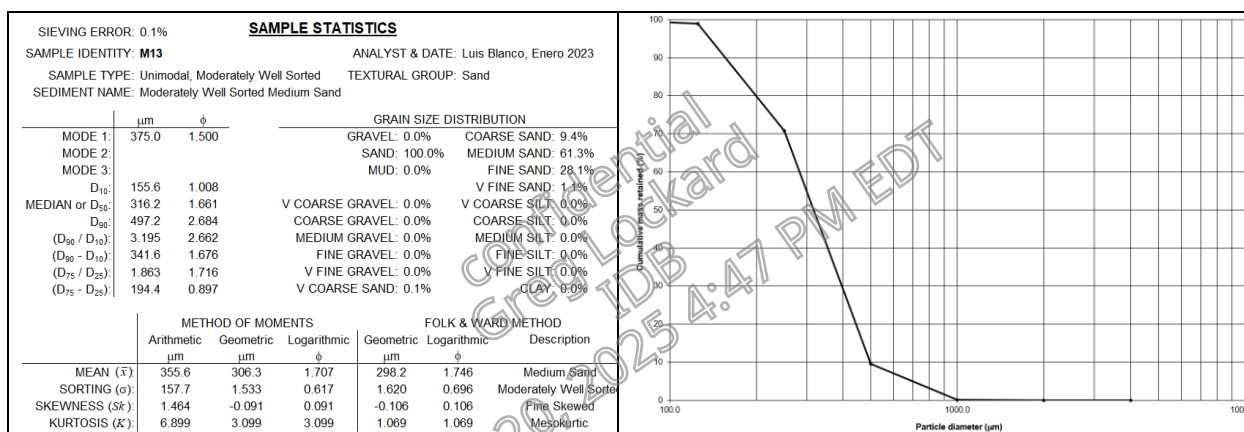


Figure 6-160. Statistical characterization of sample M13 (Gradistat).

Source: EMPACA, 2023.

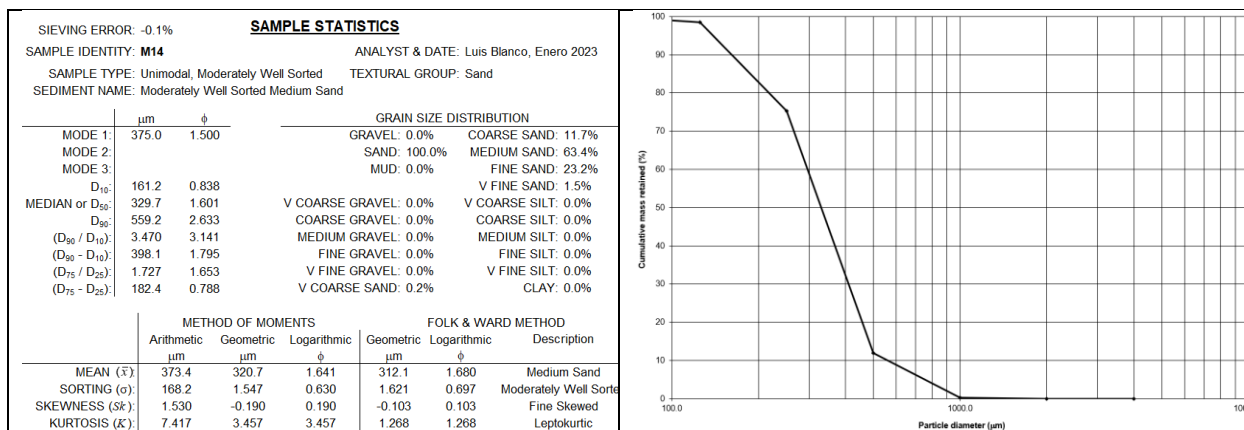


Figure 6-161. Statistical characterization of sample M14 (Gradistat).

Source: EMPACA, 2023.

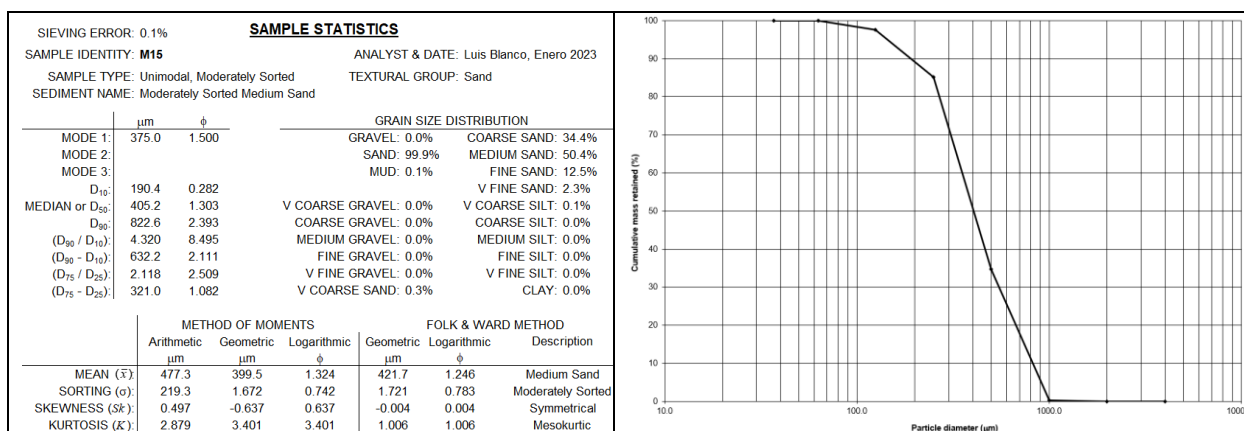


Figure 6-162. Statistical characterization of sample M15 (Gradistat).

Source: EMPACA, 2023.

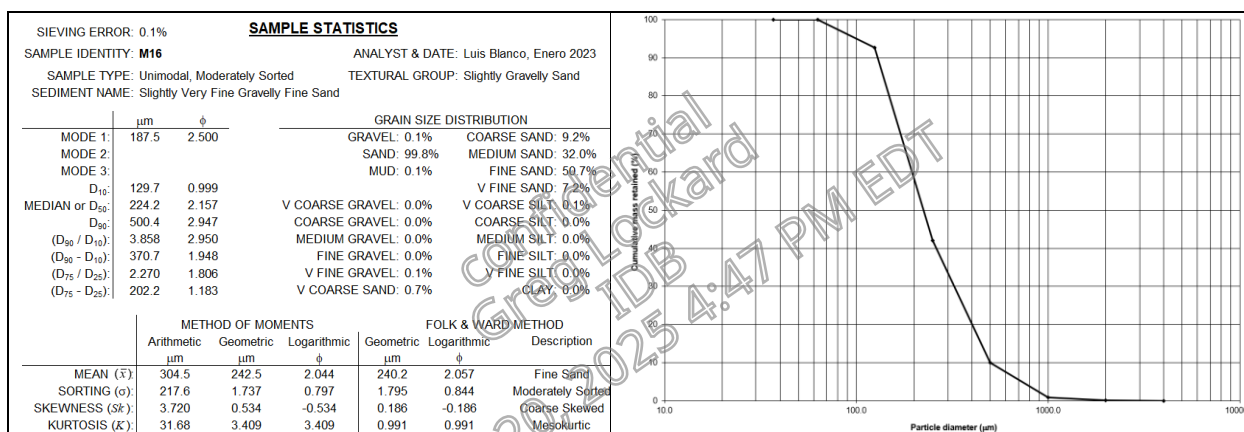


Figure 6-163. Statistical characterization of sample M16 (Gradistat).

Source: EMPACA, 2023.

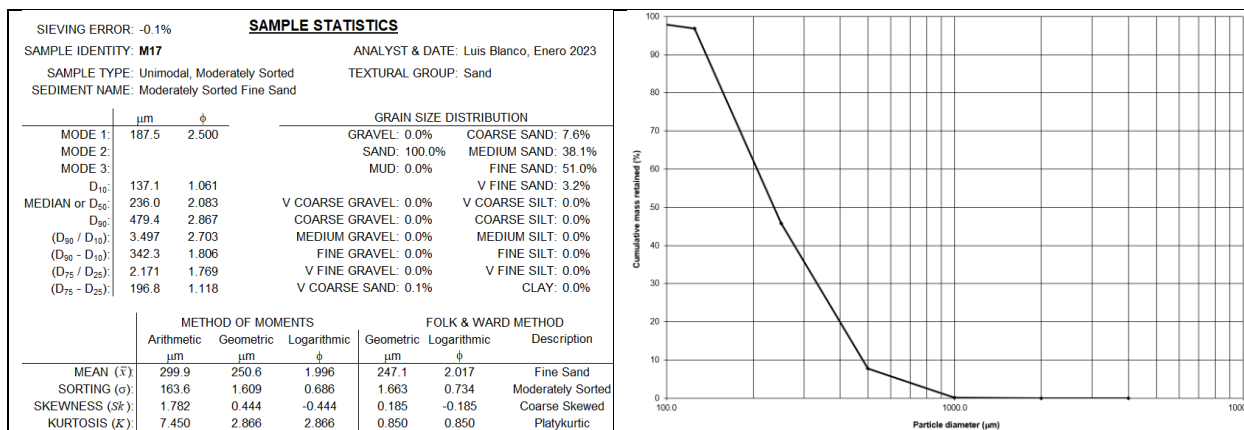


Figure 6-164. Statistical characterization of sample M17 (Gradistat).

Source: EMPACA, 2023.

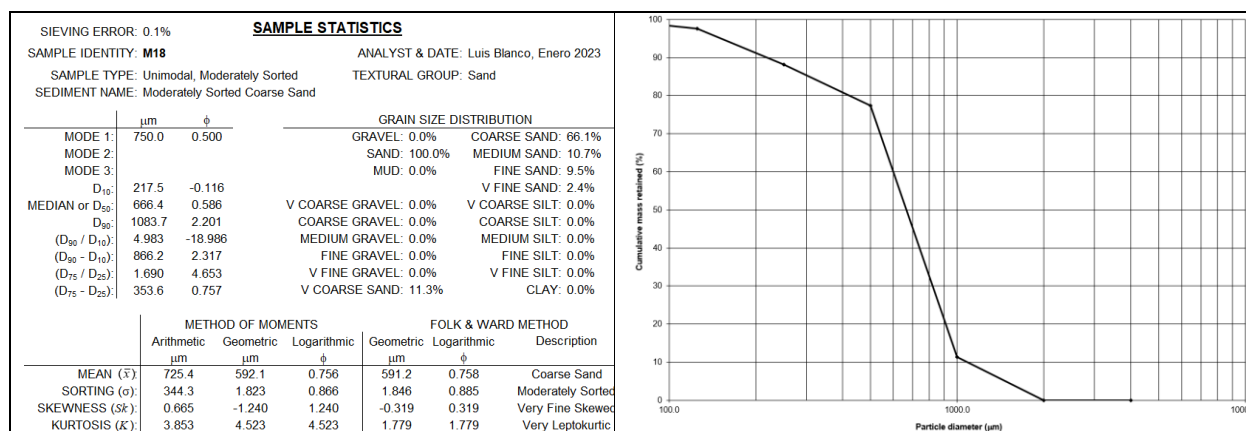


Figure 6-165. Statistical characterization of sample M18 (Gradistat).

Source: EMPACA, 2023.

To describe the sediment transport patterns on the beach and determine the possible impacts of the construction of the LNG Import Terminal with Storage and Regasification on its stability, the SISYPHE model was applied, using as initial geometric conditions the detailed bathymetric grids used in the studies of wave transformation and generation of coastal currents (ARTEMIS, TOMAWAC and TELEMAC2D).

A new mesh of refined depths was used to perform the detailed calculations of wave transformation and the current system in the project area. This mesh is nested in the regional meshes and the value of the variables at each node on the boundary is obtained from the simulations on the mesh in which it is contained.

Figure 23 shows the flexible finite element bathymetric mesh used in the calculations to run the TELEMAC2D, TOMAWAC, ARTEMIS and SISYPHE models. Figure 24 presents the transformation of the wave fronts using ARTEMIS, while Figure 25 illustrates the change in wave height using TOMAWAC. Finally, Figure 26 shows the current system obtained by applying the TELEMAC2D model. See Annex 10.14.

The system of coastal currents presented in Figure 26 (See Annex 10.14) shows a convergence of drift towards the mouth of the estuary, which is responsible for forming the sand tongue observed on the western margin. In the entire sector located to the west of the estuary, currents directed towards the east predominate, although there are individual circulation cells that give rise to the formation of inlets and outlets on the coast. In the case of the overhangs, their formation responds to the existence of submerged reefs that act as free dykes.

A particular case in point is the artificial fill at the start of the existing port pier. The fill in the pier area causes local accretion on the west side, while the beach to the east experience moderate erosion.

To evaluate the role of coastal currents in beach accretion-erosion processes, EMPACA performed detailed simulations using the SISYPHE model. SISYPHE is a sedimentary and morphodynamic transport model that is part of the TELEMAC-MASCARET finite element and finite volume system. In SISYPHE sediment transport rates are divided into bottom and suspended loads and are calculated at each node as a function of several parameters related to flow (velocity, water depth, wave height, etc.) and sediment (sediment diameter, relative density, fall velocity, etc.). The bottom load is calculated using classical transport formulas. The suspended load is solved by an additional transport equation for the depth-averaged suspended sediment concentration. The bottom evolution equation (Exner equation) is solved by both finite element and finite volume formulations.

SISYPHE applies to non-cohesive sediments (uniform or graded) as well as to mixtures of sand and mud. The sediment composition is represented by a finite number of classes, each characterized by its mean diameter, density, and sedimentation velocity. The simulation of transport processes also includes the effect of bottom slope, stiff beds, secondary currents, and slope changes. SISYPHE is also able to consider the effect of waves superimposed on tidal currents and friction coefficients (Strickler, Nikuradse, Manning, Chézy, etc.) or bottom roughness predictors can be included during the simulation.

In SISYPHE the hydrodynamic variables can be imposed on the model, or the hydrodynamic calculation can be done using one of TELEMAC's own modules, such as TOMAWAC.

For currents only, SISYPHE offers several methods for solid transport calculations, including Meyer-Peter-Müller, van Rijn and Hunziker, Engelund-Hansen and Einstein-Brown.

The dimensionless transport rates due to current are expressed as:

$$\Phi_s = \frac{Q_b}{\sqrt{g(s-1)d_{ch}^3}}$$

Where ρ_s is the sediment density and $s = \rho_s / \rho$ is the relative density, d is the characteristic sediment diameter ($=d_{ch}$ for sediments of uniform diameter) and g is gravity.

The application ranges for each method are summarized below:

Formula	Meyer-Peter& Müller	Einstein-Brown	Engelund-Hansen	van Rijn
IFC	1	2	3 or 30	7
Mode of transport	bedload	bedload	total load	bedload
Validity range (d_{50})	0.4 – 29 mm	0.25 – 32 mm	0.19 – 0.93 mm	0.20 – 2.0 mm

SISYPHE considers the effect of waves on sediment transport including bottom roughness and *ripple* formation process. To calculate the sediment transport due to waves, it uses the wave height, period and direction, which are obtained by integrating SISYPHE to the TOMAWAC module. The wave orbital velocity is calculated as:

$$U_0 = \frac{H_s \omega}{2 \sinh(kh)},$$

Where H_s is the significant height, $\omega=2\pi/T_p$ equals the angular frequency, $k=2\pi/L$ is the wavenumber and L is the wavelength. SISYPHE calculates sedimentary transport by the formulas of Bijker, Soulsby-Van Rijn, Bailard and Dibajnia and Watanabe.

The evolution of the bottom is based on the mass conservation equation and is realized interactively by layers that erode or accumulate depending on local transport rates.

The transport rates at each node of the finite element mesh were calculated for all possible wave conditions. For the purpose of showing the magnitude of transport in this report, the example of the most frequent local wave conditions was selected (see Figure 26 in Appendix 10.14). The figure describes the input parameters to the TOMAWAC model.

Based on a wave at the maritime boundaries of the grid with a significant height (H_s) of 0.2 meters, a period (T_p) of 6 seconds and a direction from the northwest, the transport grids of the project domain were developed (Figure 27 in Annex 10.14).

Sediment transport calculations provide clarity about the functioning of local dynamics and patterns of erosion, transport and sedimentation. In general terms, this is an area with low littoral transport rates, due to the configuration of Manzanillo Bay. Figure 27 in Annex 10.14 shows that the scale of sediment transport presents maximum values of $9 \times 10^{-7} \text{ m}^2/\text{s}$, which translates into maximum transport rates for the nodes under usual conditions of $30 \text{ m}^2/\text{year}$.

The highest rates of transport occur in the reef zone, while the magnitude is considerably lower on beaches and sheltered areas. Under this scenario, the greatest changes occurring on the beaches are associated with extreme storms such as hurricanes or intense cold fronts.

The coastal works, as is the case of the fill located at the start of the current port, also have an impact on the drift and there is an accumulation on the western side, at the expense of a slight retreat in the eastern region. In the following chapters, the possibility that the proposed design of the LNG Import Terminal with Storage and Regasification terminal will generate impacts on coastal transport and beach equilibrium is studied.

6.1.14.8 Thermal dispersion.

The industrial process of the LNG Import Terminal with Storage and Regasification proposed to be built in Manzanillo will use seawater in the cooling process. Once the water passes through the industrial process, it is returned to the sea through an outfall at a higher temperature than the medium.

The conditions for discharging water into the sea are governed by the Dominican Republic's "Norma Ambiental de Calidad de Aguas Superficiales y Costeras" (Environmental Quality Standard for Surface and Coastal Waters). According to Title II (Water Bodies Quality Standards), Chapter 1 (Classification of Water Bodies) of the standard, Manzanillo Bay is classified in category G. Water bodies included in this category include coastal waters used for industrial, port, and shipping activities.

The regulations regarding thermal pollution impose unique limits for all receiving bodies, except for those whose natural values require stricter conservation measures. In the case of the proposed Manzanillo energy complex discharge, the regulation establishes that the maximum allowable temperature increase ΔT is 3°C, after the waters have reached mixing with the receiving body. The present study assumes a mixing zone of 100 meters around the discharge (value recommended by environmental regulations).

To verify compliance with these regulations, the characteristics of the discharge and its incorporation into the environmental dynamics of the receiving environment were evaluated. In previous chapters, the dynamic functioning of Manzanillo Bay has been described. For this purpose, three-dimensional hydrodynamic models have been developed on flexible finite element meshes. The model input conditions have been obtained from historical oceanographic databases and have a solid statistical support.

Regarding discharge conditions, the developer considers the following discharge parameters.

- Flow rate: 6,250 m³/hour
- Discharge temperature: Ambient temperature increased by 6°C.

After evaluating multiple variants, it has been decided to discharge at a distance of 600 meters from the coast, where there are depths of 18 meters. The location of the discharge point is shown in Table 6-52. Table 6-52 and Figure 28 in Annex 10.14.

Table 6-52. Coordinates of the proposed point for the discharge of water used for cooling the industrial system.

Universal Transverse Mercator coordinate system UTM Zone 19 North (WGS84)		Depth relative to MSL (Mean Sea Level) meters
212 708	2 181 963	18.00

Source: EMPACA, 2023.

The TELEMAC3D module, which belongs to the TELEMAC-MASCARET system and uses the most advanced numerical methods in the field of free sea surface flows, was used to simulate the impact of the thermal plume of the spilled water. The calculation grids were described in the chapters dedicated to the characterization of the wave system, tides and local currents.

Taking into account the vertical difference in the behavior of the currents, a vertical stratification in the form of prisms was defined to simulate the thermal dispersion (Figure 6-166), representing equidistant layers, considering the bottom and the surface as fixed planes.

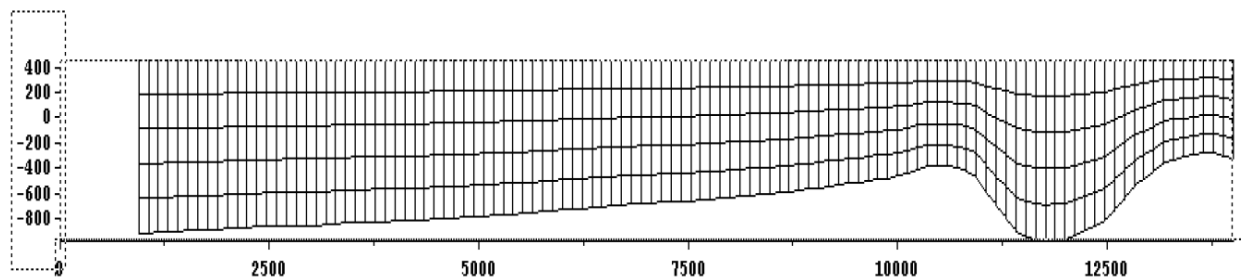


Figure 6-166. Diagram for the treatment of vertical layers in the TELEMAC3D model.

Source: EMPACA, 2023.

For the three-dimensional mesh used in Manzanillo, 10 vertical layers were considered, so that, at the point of pouring, each layer represents approximately 1.8 meters of thickness.

The use of TELEMAC-MASCARET made it possible to treat temperature as an active tracer, so that the discharge of cooling water into the medium generates a change in seawater density and modifies circulation parameters.

To evaluate the dispersion process with TELEMAC3D, different environmental scenarios of currents were simulated. Each scenario corresponds to a no exceedance probability and was chosen from the results obtained by AKTIS and the statistical analyses and models elaborated by EMPACA, in addition to the instrumental confirmations. The results obtained by AKTIS for the behavior of the currents are summarized in Figure 6-167.

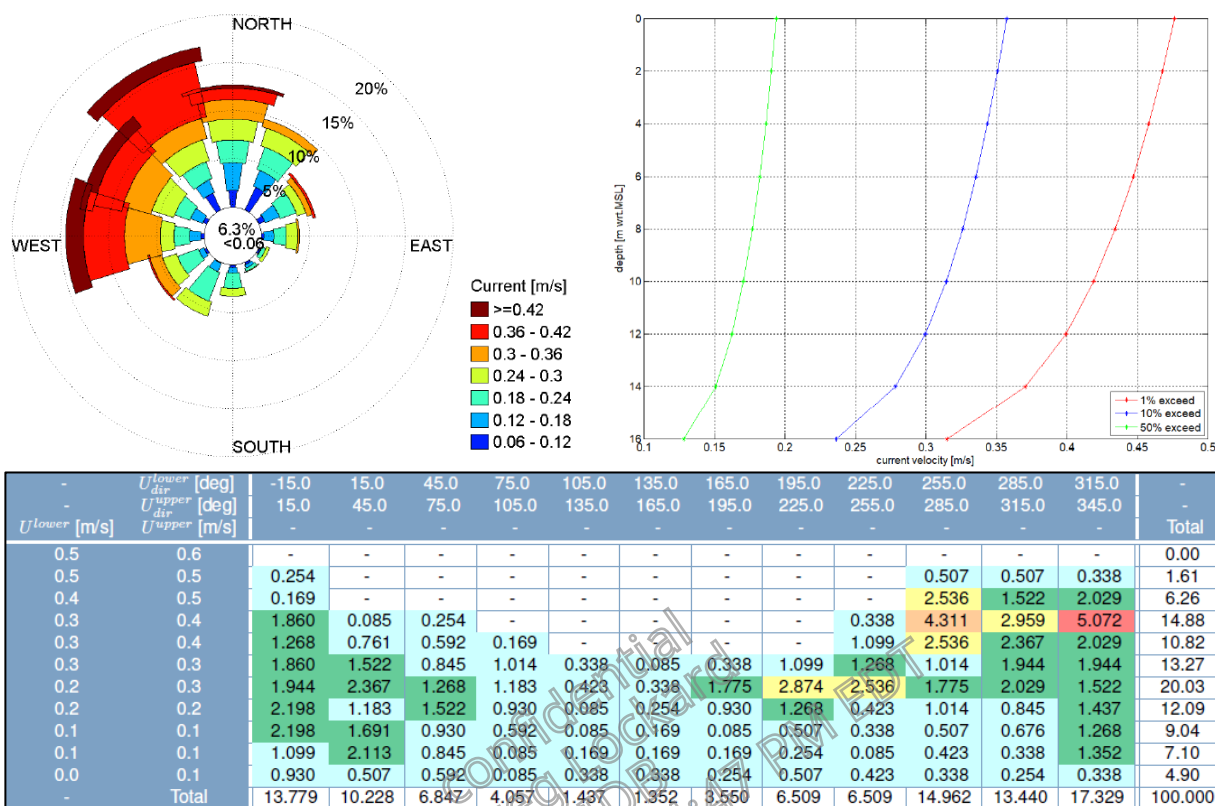


Figure 6-167. Summary of hydrodynamic conditions calculated by AKTIS for the area where the port activities will be developed.

Source: Feed Metocean, Criteria Manzanillo LNG Terminal (AKTIS Hydraulics, 2023).

The results obtained by EMPACA are in close correspondence with the data presented by AKTIS and highlight the differences in the behavior of the currents in the water column. The EMPACA studies are based on numerical simulation using TELEMAC-MASCARET and verification with measurements made with an ADCP (*Acoustic Doppler Current Profiler*), Sentinel V20. The Figure 6-168 summarizes the results obtained with the ADCP measurements at the proposed landfill site.

Behavior of currents in the surface layer of the water column.

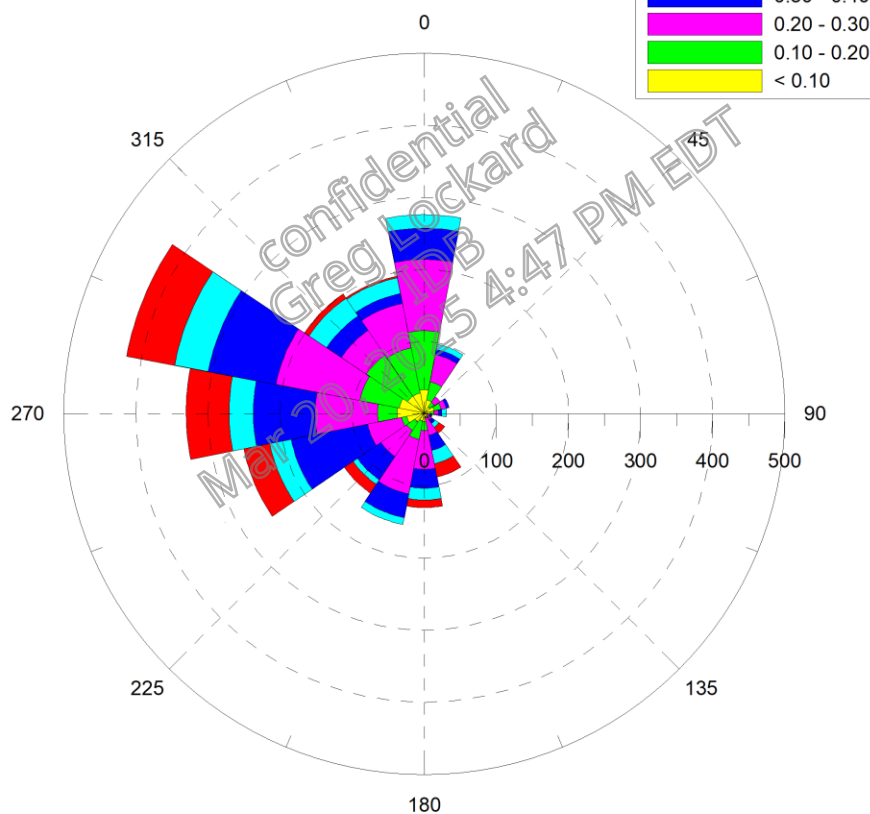
Velocidad m/s	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
>0.300	74	19		5	13	4	27	70	64	53	75	212	217	255	75	47	1210
0.275-0.300	17	5	3	3	6	1	2	12	17	31	12	18	41	30		17	215
0.250-0.275	25	15	1	2	2	2	1	8	18	23	11	15	27	34	5	22	211
0.225-0.250	40	11	4	2		1	1	7	23	19	12	15	18	40	19	19	231
0.200-0.225	38	13	4	2	1		1	5	9	21	17	13	22	43	27	19	235
0.175-0.200	35	17	4	2			1	1	1	14	5	1	17	17	34	26	175
0.150-0.175	30	5	2		3		1		6	8	2	1	8	19	28	30	143
0.125-0.150	22	7	1	4	1			1	3	3	8	2	6	14	10	12	94
0.100-0.125	14	5	2	5	2	1	1		5	7	3	5	2	17	11	9	89
0.075-0.100	12	4	2	3	1		1	2	5	5	2	2	11	11	8	13	82
0.050-0.075	9	7	1	2	1	1		1	3	3	1	9	7	14	12	5	76
0.025-0.050	11	7	1	8	5	2	1	2	4	5	11	9	17	13	9	10	115
0.000-0.025	9	4	8	5	3	2	5	2	3	1	5	10	11	7	6	7	88
Total	336	119	33	43	38	14	42	111	161	193	164	312	404	514	244	236	2964

Rosa de corrientes (Nivel 16)

ADCP (27 de noviembre al 28 de diciembre del 2022)

Convenio oceanográfico

Velocidad en m/s



Behavior of currents in the intermediate level of the water column.

Velocidad m/s	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
0.175-0.200				2			1										3
0.150-0.175				10	2												12
0.125-0.150				6	8												14
0.100-0.125				13	26										1		40
0.075-0.100				24	35	2						10	4			1	76
0.050-0.075	1	3	7	60	177	19	6			3	20	17	16	2		3	334
0.025-0.050	19	20	42	111	315	160	52	14	29	58	113	97	42	16	12	11	1111
0.000-0.025	33	35	60	100	198	211	114	93	142	103	72	66	68	32	26	21	1374
Total	53	58	109	326	761	392	173	107	171	164	205	190	130	50	39	36	2964

Rosa de corrientes (Nivel 05)
ADCP (27 de noviembre al 28 de diciembre del 2022)
Convenio oceanográfico
Velocidad en m/s

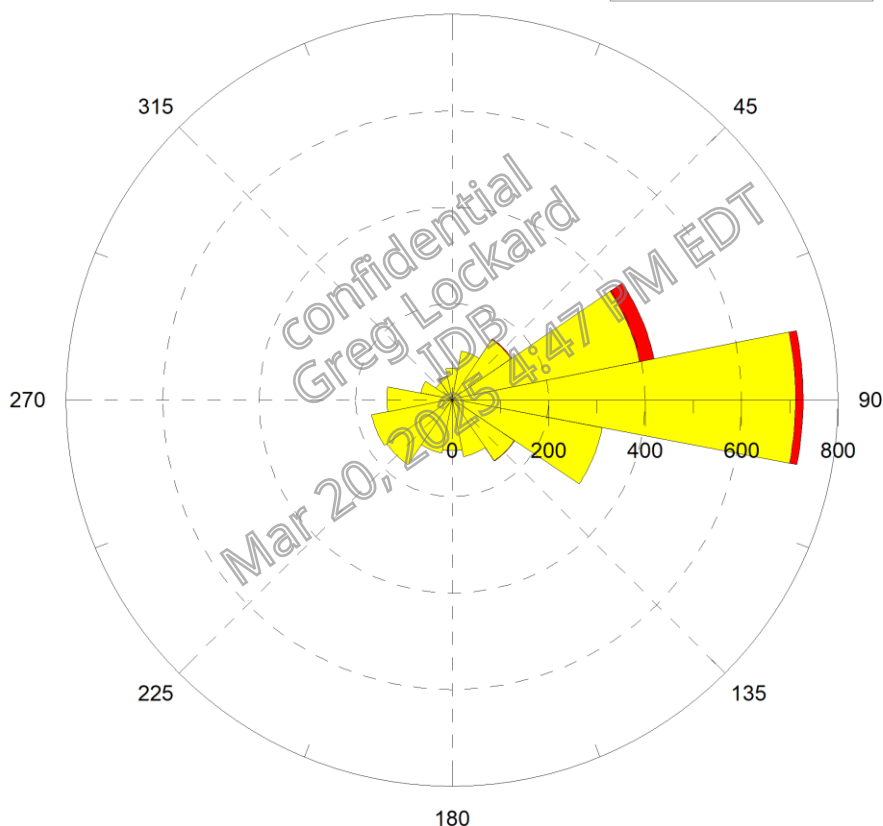
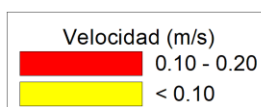


Figure 6-168. Summary of the hydrodynamic conditions measured with the ADCP at the point selected for the discharge of wastewater from the LNG plant and the Manzanillo power plant.

Based on the hydrodynamic studies conducted by EMPACA, considering the effect of the tide, winds and waves, in addition to the records obtained with the ADCP, 4 scenarios were defined to be modeled for different exceedance probabilities:

- 1- Exceedance probability of 0.90: Surface currents directed to the West and West-Northwest with velocities 0.17 m/s.
- 2- Exceedance probability of 0.50: Surface currents directed to the west and west-northwest with velocities of 0.23 m/s.
- 3- Exceedance probability of 0.10: Surface currents directed to the West and West-Northwest with velocities 0.40 m/s.
- 4- Exceedance probability of 0.01: Surface currents directed to the west and west-northwest with velocities of 0.64 m/s.

For more details on the subject, it is recommended to see the results presented in the chapter on hydrodynamics.

Regional studies indicate that the surface temperature varies between 24°C and 28°C, with January and February being the coldest months.

The models also consider that, under natural conditions, the water layer is homogeneous, which implies that there is no vertical stratification prior to discharge. The simulated water discharge is at a depth of 17 meters (one meter above the bottom), with a uniform flow rate of 6,250 m³/hour and a temperature of 34° C, which results from raising the temperature of the water in the catchment by 6° C.

Figures 29 and 30 show as an example the behavior of the thermal plume for exceedance probabilities of 0.9 and 0.5 respectively. The models assume an ambient water temperature of 28° C, which corresponds to the temperature of the warmest months reported at the sea surface. Each figure is composed of 3 parts (A, B and C), showing the behavior of the thermal plume in the surface layer (A), middle layer (B) and bottom (C) respectively. The figures include a circle with a radius of 100 meters around the discharge point, for the purpose of comparison with the standard values. A list of the figures is presented below:

- Figure 29 (Annex 10.14)
 - o A: Thermal plume for a probability of exceedance of 0.90 (Surface).
 - o B: Thermal plume for a probability of exceedance of 0.90 (Medium).
 - o C: Thermal plume for a probability of exceedance of 0.90 (Bottom).
- Figure 30 (Annex 10.14)
 - o A: Thermal plume for a probability of exceedance of 0.50 (Surface).
 - o B: Thermal plume for a probability of exceedance of 0.50 (Medium).
 - o C: Thermal plume for a probability of exceedance of 0.50 (Bottom).

It is known that the higher the energy of the currents, the greater the dilution and the lower the impacts of thermal pollution.

The figures confirm that as the energy increases (lower exceedance probability), better dilution values are achieved. Thus, the worst environmental scenario occurs for exceedance conditions of 0.90. In this case a greater extension of the surface thermal plume is observed, but even under this scenario the discharge complies absolutely with the established environmental indicators.

The Figure 6-169 summarizes the maximum temperatures reported by the simulation at 100 meters from the discharge point, at each of the water column levels.

Nivel	Temperatura a 100 m de la descarga (°C)
10	28.15
9	28.19
8	28.11
7	28.02
6	28.00
5	28.00
4	28.00
3	28.00
2	28.00
1	28.00

Figure 6-169. Maximum water temperature reported by the simulation at 100 m from the discharge point.

In summary, the hydrodynamic characterization of the area, supported by the numerical simulation, confirms the project's compliance with environmental discharge standards under the current design criteria.

6.1.14.9 Effects of the project on beach dynamics.

Among the coastal formations of the Dominican Republic that are most vulnerable to anthropogenic actions are beaches, mangroves, and coral reefs. In the case of the project for the construction of an Import Terminal with Storage and Regasification of LNG and Power Plant with a Capacity of Approximately 420 MW in Manzanillo, the developer does not envisage any modification of the estuary and, therefore, there will be no alteration to the mangroves. In the case of the reefs, the project does not interfere with their natural state either, since the design envisages the construction of a structure on piles that modifies the seabed with very specific elements. In the case of beach operations, the project avoids modifying the profile, since the pier in this strip will also be elevated on piles (Figure 6-170) and will only be affected temporarily during construction.



Figure 6-170. Proposed dock construction for LNG pipeline and other utilities.

The Figure 6-171 shows the distribution of the technical networks and road access comprising the project.

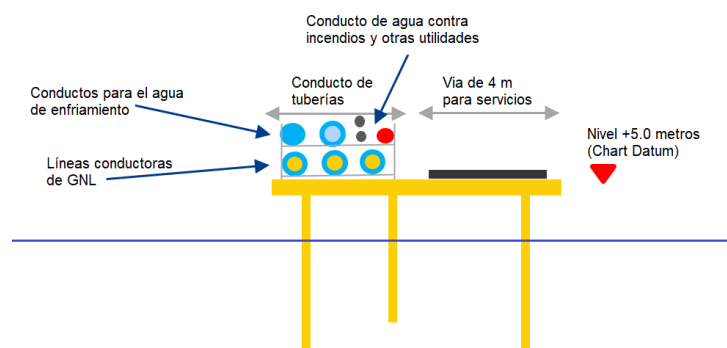


Figure 6-171. Schematic of LNG piping, cooling water and other technical networks.

Source: Manzanillo Gas & Power.

Although the project is not expected to have permanent impacts on the beaches, the studies carried out by EMPACA included a survey of the coastal profiles and sedimentological sampling to serve as a baseline to evaluate their future evolution. The profiles were carried out using GNSS techniques in differential mode (Photos 56 and 57 in Annex 11).

Figure 31 in Annex 10.14 shows the location of the beach profiles and sampling points for sedimentological characterization. These profiles were used in addition to the bathymetric soundings to obtain the finite element meshes used in the simulation of hydrodynamic processes and sediment transport.

In the figures between the Figure 6-172 and Figure 6-183 the shape of the beach in selected sections is shown. The location of these sections can be found in Figure 31 (Annex 10.14) where the letter identifies them.

In general, beaches are formed as inlets and overhangs, with a configuration that responds to the distribution of wave energy. Overhangs are formed under the shelter of the shallowest rocky areas. Regularly, concave beaches are formed between the protrusions, which adapt to the configuration of the usual wave fronts.

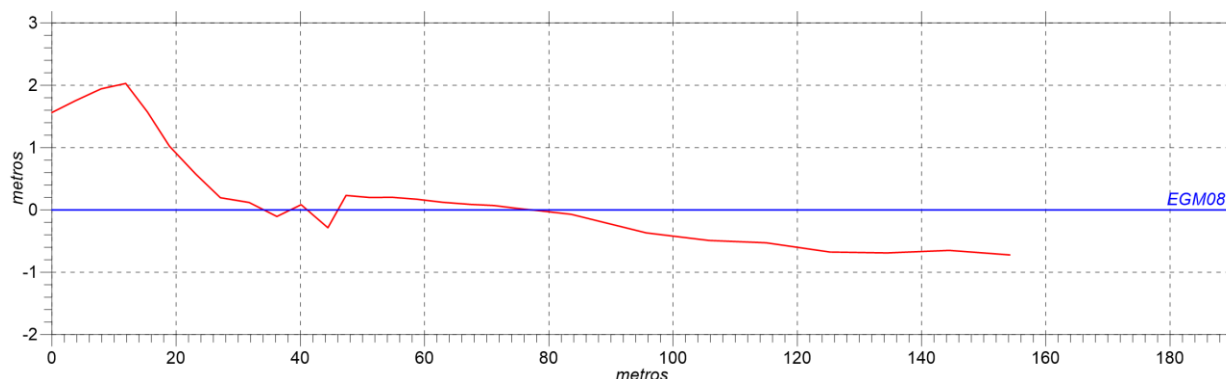


Figure 6-172. Example topographic profile (A).

Source: EMPACA, 2023.

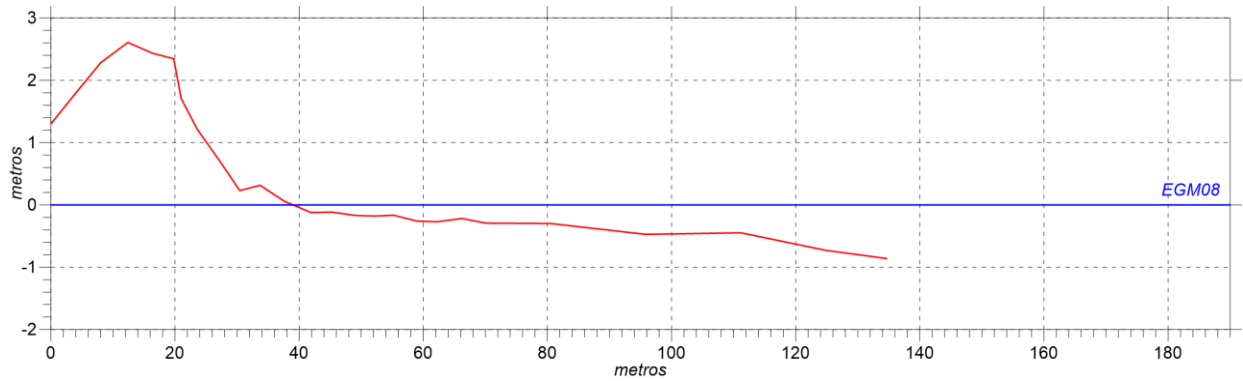


Figure 6-173. Example topographic profile (B).

Source: EMPACA, 2023.

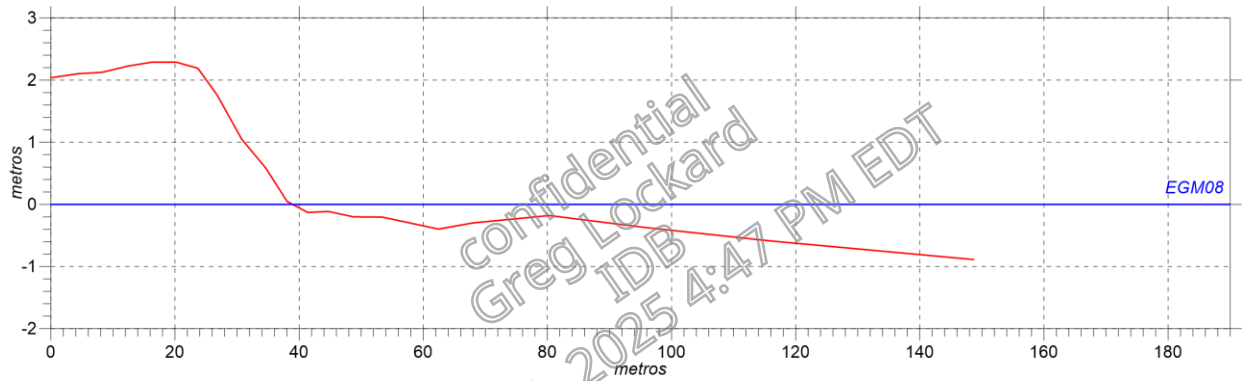


Figure 6-174. Example topographic profile (C).

Source: EMPACA, 2023.

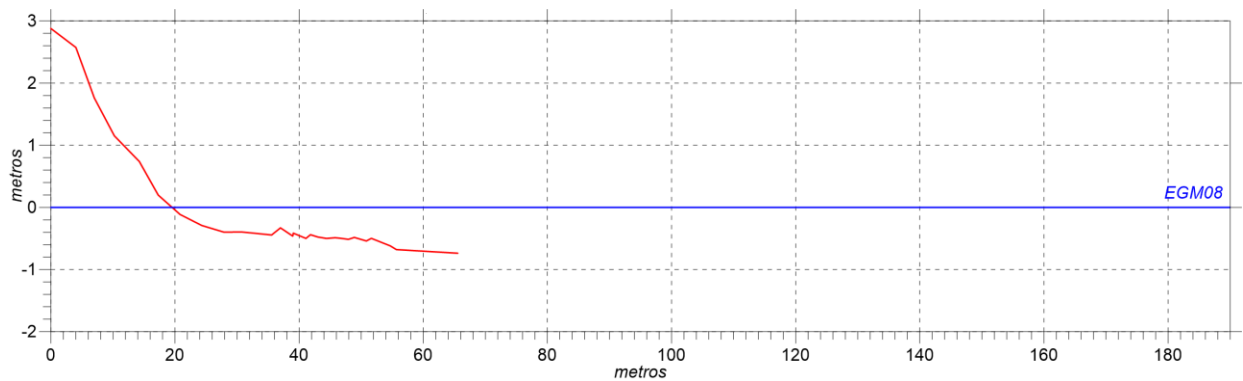


Figure 6-175. Example topographic profile (D).

Source: EMPACA, 2023.

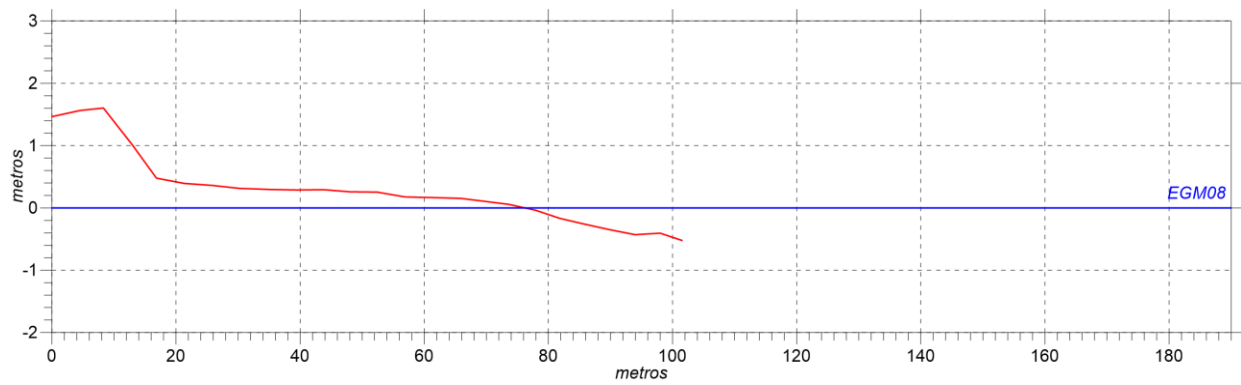


Figure 6-176. Example topographic profile (E).

Source: EMPACA, 2023.

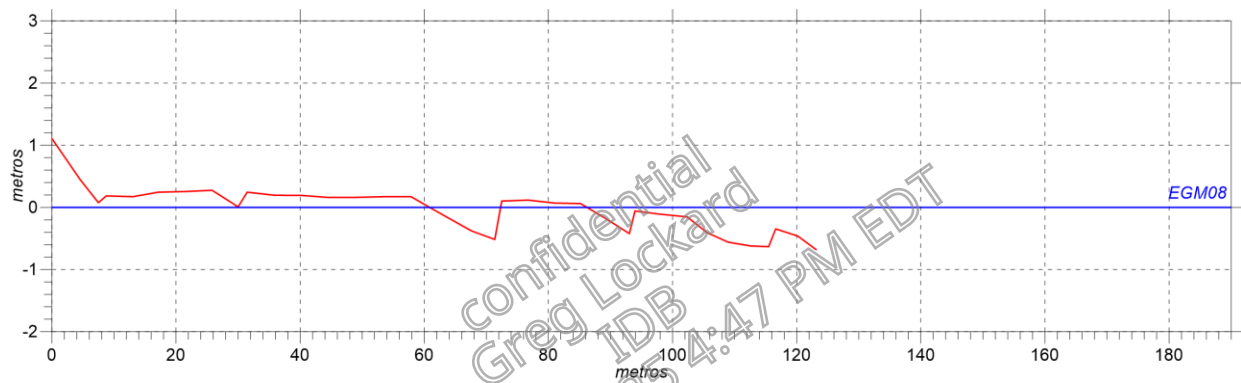


Figure 6-177. Example topographic profile (F).

Source: EMPACA, 2023.

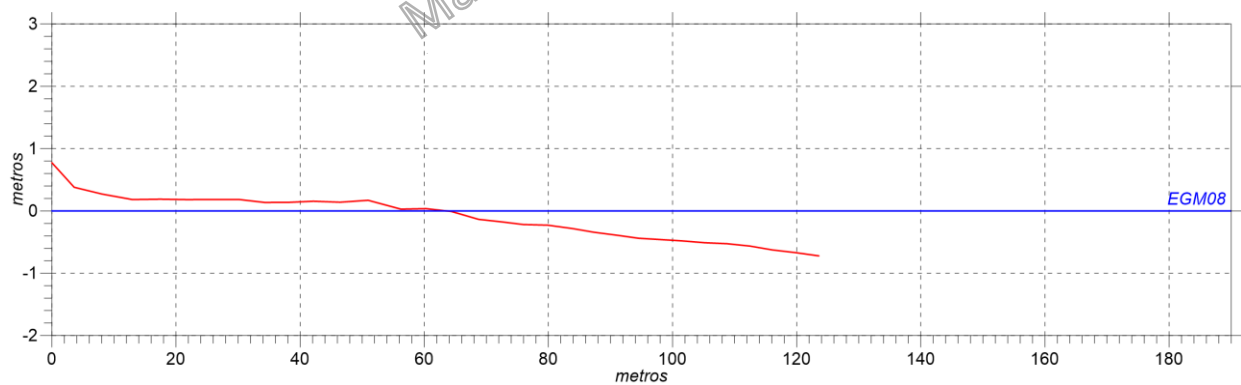


Figure 6-178. Example topographic profile (G).

Source: EMPACA, 2023.

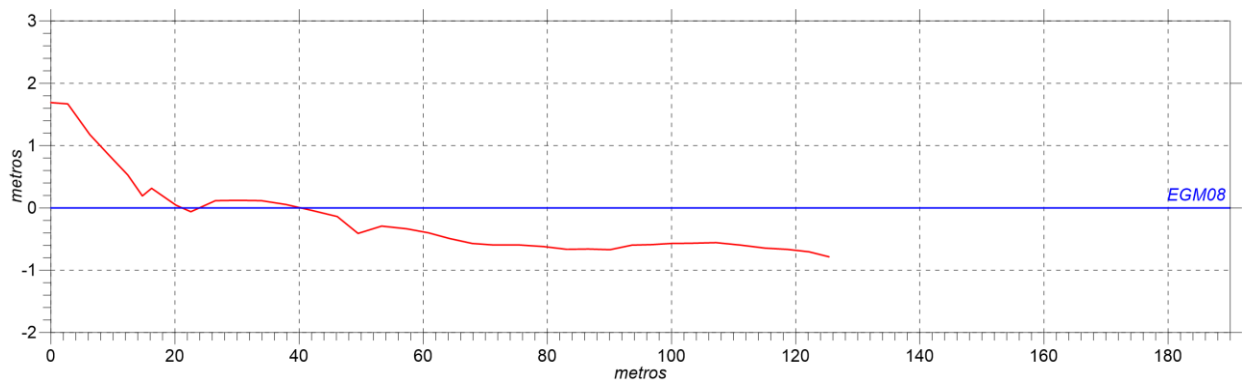


Figure 6-179. Example topographic profile (H).

Source: EMPACA, 2023.

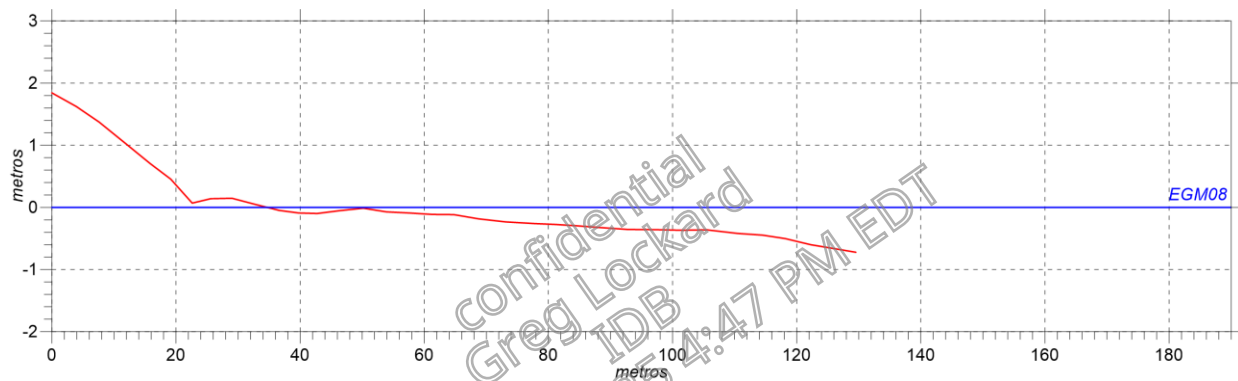


Figure 6-180. Example topographic profile (I).

Source: EMPACA, 2023.

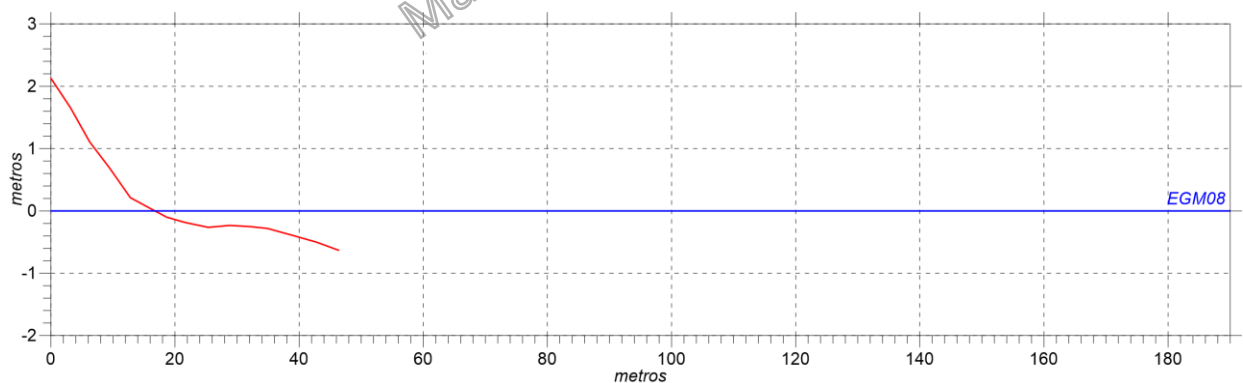


Figure 6-181. Example topographic profile (J).

Source: EMPACA, 2023.

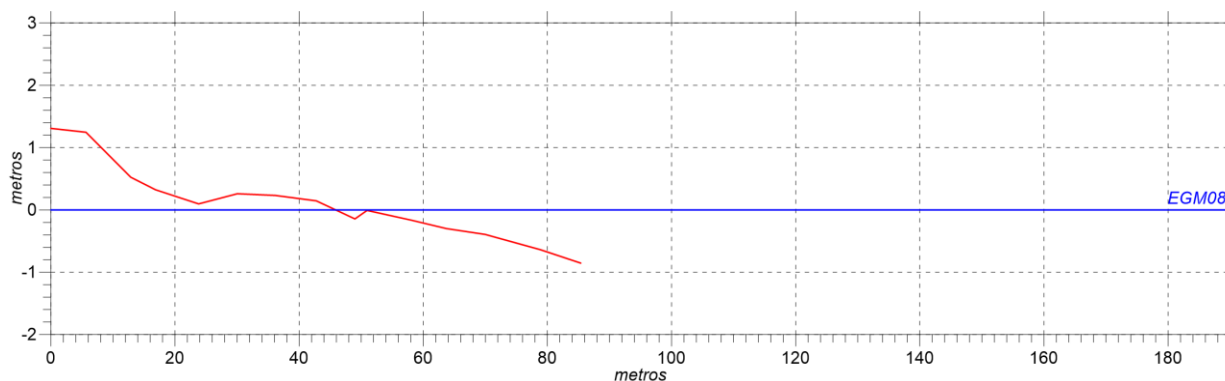


Figure 6-182. Example topographic profile (K).

Source: EMPACA, 2023.

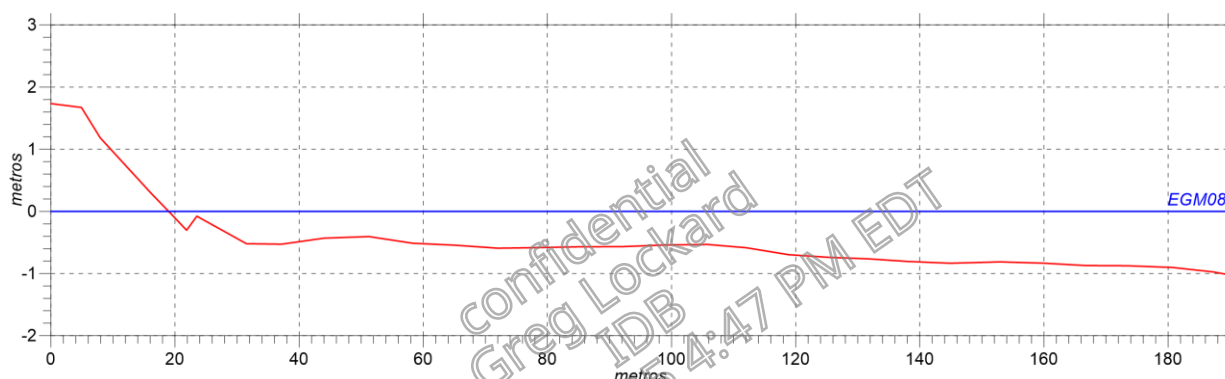


Figure 6-183. Example topographic profile (L).

Source: EMPACA, 2023.

The dry beach profile is about 20 m wide and consists of sands ranging in grain size from 224.2 μm to 1,328.5 μm . The finest sands are found on the beach extending east of the estuary, while the coarser sands about the western side of the harbor breakwater.

To describe beach dynamics and patterns of erosion, transport, and sedimentation under project conditions, EMPACA performed new simulations of wave transformation processes, current formation, sediment transport and relief evolution.

Previous chapters have explained that the simulations are based on the wave reanalysis databases provided by the NOAA Waves Watch III model, to which a propagation analysis has been applied up to the site of interest using the TOMAWAC module of the TELEMAC-MASCARET system. The combined TOMAWAC and TELEMAC2D simulations allowed describing the hydrodynamic performance and especially the littoral drift. Finally, simulations were performed with SISYPHE to calculate sediment transport.

In fact, the results of the simulations that are part of the impact assessment are very similar to those obtained in the current condition, since the pile-mounted piers are transparent to the effects of wave propagation and sediment transport.

Figure 32 in Annex 10.14 shows the flexible finite element mesh used in the representation of the depths to apply the TELEMAC-MASCARET system. Note that the bathymetry does not change with respect to its current configuration, since the piles on which the pier is built do not modify the local relief.

The transformation that the waves undergo in their height as a result of the refraction-diffraction processes is summarized in Figure 33 in Annex 10.14. It is precisely this transformation of the wave fronts that defines the orientation of the coastline and the pattern of incoming and outgoing waves that characterizes the beaches. Note the concentration that occurs in the orthogonals (lines perpendicular to the wave fronts), sheltered by the protrusions. On concave-shaped beaches, the orthogonals are separated. The example uses a wave height from the northwest with a significant height (h_s) of 0.20 meters and a peak period (t_p) of 6 seconds.

The wave height plane obtained with TOMAWAC (Figure 34 in Appendix 10.14) indicates how the bottom influences the distribution of wave energy. The example goes on to assume a local low energy wave, which is predominant in the area. The figure shows how the wave break occurs over the reefs in front of the beach, where the height exceeds 0.40 meters.

The hydrodynamic model obtained with TELEMAC2D is shown in Figure 35 (Annex 10.14). It is a scheme based mainly on wave energy, although the tests performed also include the influence of tides and wind. The figure shows that the maximum values of current velocity occur in the reef zone and are directed towards the coast. As compensation for the inflow of this volume of water, outflow currents (*rip currents*) occur, which are oriented perpendicular to the coast, following the course of the reef channels or breaks.

Figure 36 in Annex 10.14 shows the results obtained with SISYPHE to describe the transport.

The hydrodynamic characterization of the area, supported by statistical bases, instrumental verifications and the application of numerical models, indicates that the pier work will not have a permanent impact on the beaches or the functioning of the coastal system. Current erosion, transport and sedimentation patterns will not be altered and no modifications in the evolution of the coastline related to the works are expected.

Depending on the technology used to drive the piles and construct the pier, temporary impacts may occur, so the execution of the work requires strict supervision. It must also be ensured that, upon completion of the construction process, the area is free of any type of materials or temporary facilities that could affect the beach, mangroves, reefs or any other element of the natural environment.

6.1.14.10 Characteristics of seabed sediments

Three sediment samples were collected from the seafloor for analysis of their physical and chemical properties.

The optimized measurement and sampling program was carried out in compliance with the schedule at all three points (Table 6-53).

Table 6-53. Sampling and measurements at the three seafloor sediment characterization points.

Sampling point	day/month/year	Site Description	Coordinates UTM	
			X	Y
SE-1	25/10/2022	On the coastal edge (shore) where the projected pipeline route is located.	212997	2181384
SE-2		In the marine coastal sector where the projected pipeline route is located.	212991	2181484
SE-3		At the location of the jetty in Manzanillo Bay.	212995	2182163

Source: Field work and measurements EMPACA Environmental Quality Laboratory.

Each sample was collected in zip lock bags weighing more than 2 kg and, in addition to the in situ observations, granulometric composition (ASTM D422-63 standards), concentrations of oils and fats, total hydrocarbons, total organic carbon, total phosphorus, tributyltin and metals were determined.

Sampling was performed by EMPACA Environmental Quality Laboratory Division, and the Environmental Consulting Group S.R.L. (ECGroup) laboratory was used as an accredited entity for processing the samples collected.

With respect to the chemical parameters determined (metal concentrations), it is evident that the seafloor sediments of the SE-1, SE-2 and SE-3 sectors sampled are influenced by activities related to local industrial activity, boat repairs, fuel handling and navigation, where concentrations of iron, zinc, chromium and vanadium stand out.

In the Table 6-54 details the physical and chemical properties of the seafloor sediments sampled, and Annex 10.15 presents the laboratory reports of chemical parameters performed.

Table 6-54. Physicochemical parameters of sampled marine sediments.

Parameters	Unit of measure	SE-1: On the coastal edge (shore) where the projected pipeline route is located.	SE-2: In the marine coastal sector where the projected pipeline route is located.	SE-3: At the location of the jetty in Manzanillo Bay.
Gravel (grain size)	%	0	0	0
Sand (granulometry)	%	98.4	91.3	40.7
Fines (silt and clay, granulometry)	%	1.60	8.7	59.3
Uniformity coefficient	--	2.33	2.24	2.35
Curvature coefficient	--	1.01	1.18	0.79
Oils & Fats	mg/kg	<1.4	<1.4	<1.4
Total Phosphorus	mg/kg	0.23	0.32	0.21
Total Organic Carbon (TOC)	mg/kg	4.6	16.3	16.9

Parameters	Unit of measure	SE-1: On the coastal edge (shore) where the projected pipeline route is located.	SE-2: In the marine coastal sector where the projected pipeline route is located.	SE-3: At the location of the jetty in Manzanillo Bay.
Organic Matter	%	3.34	0.61	1.14
Total Hydrocarbons (TPH)	mg/kg	< 19.9	< 20.0	< 19.9
Tributyltin ("Tributyltin")	µg/Kg	< 1.39	< 1.39	< 1.39
Total Cadmium	mg/kg	< 0.0845	< 0.0891	< 0.0904
Total Iron	mg/kg	6280	7750	13600
Nickel Total	mg/kg	6.85	10.9	18.8
Total Vanadium	mg/kg	15.6	23.6	29.3
Total Copper	mg/kg	3.90	6.91	12.2
Total Lead	mg/kg	< 0.211	0.406	1.06
Total Zinc	mg/kg	9.05	12.3	17.4
Total Chromium	mg/kg	16.1	25.6	39.2
Total Cobalt	mg/kg	3.78	3.78	5.21

ND: Not detected, MCL: Maximum contaminant level, BDL: Below detection limit, MDL: Minimum detection limit, MRL = Minimum reporting level. All results are calculated on a wet weight basis unless otherwise stated.

Source: EqLab and EMPACA laboratory reports.

In relation to the granulometry, it is evident that these are sandy sediments, where the medium to fine sand fraction predominates, while the silt and clay fraction is very low. In the case of sample SE-3, its texture is from clayey sands to sandy clays, see Annex 10.16 for the results of the granulometric analysis of the seabed sediments.

6.1.14.11 Characterization of the quality of marine waters

There is secondary information from the evaluation carried out in Block 01, in which seven samples of marine waters were collected for analysis of their physical and chemical properties. Additionally, the information has been complemented with a new sample (W-12) in Estero Balsa near the route of the 345 kV transmission line. Table 6-55 shows the UTM coordinates of the location of the sampling stations and Annex 6 shows the location map of the surface and marine water sampling stations.

Table 6-55. UTM coordinates of the location of the sampling stations.

Block	Station sampling	Description of the stations	Coordinates UTM		Photos (See Annex 11)
			X	Y	
01	W-1	Coastal sector northeast of the projected plant area, in the Estero Balsa marine area.	214103	2180278	Photos from 58 to 64
	W-2	Coastal sector to the north of the projected plant area, in the Estero Balsa marine area.	213393	2180609	

Block	Station sampling	Description of the stations	Coordinates UTM		Photos (See Annex 11)
			X	Y	
	W-4	Coastal sector northeast of the low floodplain, at the marine entrance to the Estero Balsa area.	213625	2181452	
	W-5:	At the location of the jetty in Manzanillo Bay.	213049	2182134	
	W-6	Coastal sector to the east of the Port facilities.	212570	2181560	
	W-7	Coastal sector to the west of the Port facilities.	212198	2181439	
	W-8	Coastal sector to the south of the projected plant area.	213565	2179418	
02	W-12	In Estero Balsa near the route of the 345 kV transmission line.	214755	2178679	Photo 11

Source: Prepared by EMPACA, 2022 and 2023.

Photos 10, 11 and 12 in Annex 11 detail the general scope and structure of the marine and surface water sampling in the area.

The results of the measurements of the physicochemical parameters, carried out on the samples taken from the coastal waters, are presented in Table 6-56, Table 6-57 and Table 6-58. In situ measurements of physicochemical characterization parameters were made at each point (Annex 10.10 Laboratory report of surface and marine water parameters).

Table 6-56. Physicochemical parameters of the coastal waters of the samples W-1. W-2 and W-4.

Parameters	Unit From measure	W-1: Coastal sector to the northeast of the projected plant area, in the Estero Balsa marine area.	W-2: Coastal sector to the north of the projected plant area, in the Estero Balsa marine area.	W-4: Coastal sector northeast of the low floodplain, at the marine entrance to the Estero Balsa area.	Environmental Standard NA-CASC-2012 E-Class
pH	--	7.69	8.34	8.38	7.5-8.5
Water temperature	°C	29.0	30.5	30.8	--
Electrical conductivity.	µS/cm	31800	63100	63500	--
Total dissolved solids	mg/l	18700	39100	39300	--
Dissolved oxygen	mg/l	5.1	7.43	7.68	--
Oxygen saturation	%	63.9	93.3	96.5	> 60
Turbidity	NTU	1.20	0.40	0.35	--
Total suspended solids	mg/l	< 8.00	< 8.00	< 8.00	--

Parameters	Unit From measure	W-1: Coastal sector to the northeast of the projected plant area, in the Estero Balsa marine area.	W-2: Coastal sector to the north of the projected plant area, in the Estero Balsa marine area.	W-4: Coastal sector northeast of the low floodplain, at the marine entrance to the Estero Balsa area.	Environmental Standard NA-CASC-2012 E-Class
Chlorine residual	mg/l	0.00	0.00	0.00	--
Total Coliforms	NMP/100ml	460	< 1.8	9.1	1000
Fecal Coliforms	MPN/100ml	43	< 1.8	< 1.8	400
Biochemical Oxygen Demand	mg/l	1.0	< 1.0	< 1.0	--
Chemical Oxygen Demand	mg/l	45	41	56	--
Total Phosphorus	mg/l	0.05	< 0.02	< 0.02	--
Total Nitrogen	mg/l	< 0.5	< 0.5	< 0.5	--
Oils & Fats	mg/l	< 1.4	< 1.4	< 1.4	1.0
Total Hydrocarbons (TPH)	mg/l	< 0.875	< 0.875	< 0.875	--
Organic Matter	mg/l	3700	7800	7900	--
Total cadmium	mg/l	< 0.001	< 0.001	< 0.001	0.005
Total chromium	mg/l	< 0.005	< 0.005	< 0.005	0.1
Total cobalt	mg/l	< 0.003	< 0.003	< 0.003	--
Total copper	mg/l	0.0132	0.0130	0.0143	0.05
Total iron	mg/l	0.316	0.141	< 0.075	0.3
Total lead	mg/l	0.00475	< 0.002	< 0.002	0.05
Total nickel	mg/l	< 0.003	< 0.003	< 0.003	0.008
Total vanadium	mg/l	0.00868	0.00837	0.00713	--
Total zinc	mg/l	< 0.008	< 0.008	< 0.008	0.05

NA-CACS-2012, coastal waters, Class E, intended for mangrove conservation and marine habitat areas.

Source: ECGroup laboratory reports and EMPACA 2022.

Table 6-57. Physicochemical parameters of the coastal waters of samples W-5, W-6 and W-7.

Parameters	Unit of measure	W-5: At the jetty location site in Manzanillo Bay.	W-6: Coastal sector east of the Port facilities.	W-7: Coastal sector west of the Port facilities.	Environmental Standard NA-CASC-2012 G-Class
pH	--	8.32	8.31	8.35	--
Water temperature	°C	30.4	30.4	30.4	--
Electrical conductivity.	µS/cm	63400	63500	63400	--
Total dissolved solids	mg/l	39300	39700	39200	--

Parameters	Unit of measure	W-5: At the jetty location site in Manzanillo Bay.	W-6: Coastal sector east of the Port facilities.	W-7: Coastal sector west of the Port facilities.	Environmental Standard NA-CASC-2012 G-Class
Dissolved oxygen	mg/l	7.78	7.46	7.58	--
Oxygen saturation	%	97.8	93.3	95.3	> 45
Turbidity	NTU	0.5	0.38	0.36	--
Total suspended solids	mg/l	< 8.00	< 8.00	< 8.00	--
Chlorine residual	mg/l	0.00	0.00	0.00	--
Total Coliforms	MPN/100ml	< 1.8	< 1.8	< 1.8	10000
Fecal Coliforms	MPN/100ml	< 1.8	< 1.8	< 1.8	2000
Biochemical Oxygen Demand	mg/l	2.0	< 1.0	3.0	--
Chemical Oxygen Demand	mg/l	55	56	54	--
Total Phosphorus	mg/l	< 0.02	< 0.02	< 0.02	--
Total Nitrogen	mg/l	< 0.5	< 0.5	< 0.5	--
Oils & Fats	mg/l	< 1.4	< 1.4	< 1.4	1.0
Total Hydrocarbons (TPH)	mg/l	< 0.875	< 0.875	< 0.875	--
Organic Matter	mg/l	7900	8200	8300	--
Total cadmium	mg/l	< 0.001	< 0.001	< 0.001	0.005
Total Chromium	mg/l	< 0.005	< 0.005	< 0.005	0.3
Total cobalt	mg/l	< 0.003	< 0.003	< 0.003	--
Total copper	mg/l	0.0150	0.0108	0.0129	--
Total iron	mg/l	< 0.075	0.107	< 0.075	--
Total lead	mg/l	< 0.002	< 0.002	< 0.002	--
Total Nickel	mg/l	< 0.003	< 0.003	< 0.003	--
Total vanadium	mg/l	0.00728	0.00962	< 0.007	--
Total zinc	mg/l	< 0.008	< 0.008	< 0.008	--

NA-CACS-2012, coastal waters, Class G, for industrial, port and shipping activities.

Source: ECGroup laboratory reports and EMPACA 2022.

Table 6-58. Physicochemical parameters of coastal waters of samples W-8 and W-12.

Parameters	Unit of measure	W-12: In Estero Balsa near the route of the 345 kV transmission line.	W-8: Coastal sector south of the projected plant area.	Environmental Standard NA-CASC-2012 E-Class
pH	--	6.92	8.6	7.5-8.5
Water temperature	°C	30.1	36.1	--
Electrical conductivity.	µS/cm	42100	64700	--
Total dissolved solids	mg/l	26200	40300	--
Dissolved oxygen	mg/l	3.31	6.16	--
Oxygen saturation	%	33.8	77.2	>60
Turbidity	NTU	43.2	0.93	--
Total suspended solids	mg/l	95.2	< 8.00	--
Chlorine residual	mg/l	0.00	0.00	--
Total Coliforms	MPN/100ml	2400	9.1	1000
Fecal Coliforms	MPN/100ml	790	9.1	400
Biochemical Oxygen Demand	mg/l	139	8.0	--
Chemical Oxygen Demand	mg/l	350	71	--
Total Phosphorus	mg/l	8.40	0.16	--
Total Nitrogen	mg/l	16.0	4.0	--
Oils & Fats	mg/l	19.0	< 1.4	1
Total Hydrocarbons (TPH)	mg/l	< 0.845	< 0.875	--
Organic Matter	%	8.29	7300	--
Total cadmium	mg/l	< 0.001	< 0.001	0.005
Total chromium	mg/l	0.025	0.00615	0.1
Total cobalt	mg/l	0.00671	< 0.003	--
Total copper	mg/l	0.00805	0.0121	0.05
Total iron	mg/l	10.4	0.601	0.3
Total lead	mg/l	0.00901	0.00523	0.05
Total nickel	mg/l	0.00929	< 0.003	0.008
Total vanadium	mg/l	0.0392	< 0.007	--
Total zinc	mg/l	0.0218	< 0.008	0.05

NA-CACS-2012, coastal waters, Class E, intended for mangrove conservation and marine habitat areas.

Source: ECGroup laboratory reports and EMPACA 2023.

The physicochemical and microbiological results of the coastal waters show a favorable state according to the limits established in the Environmental Standard for Surface and Coastal Water Quality for Class E coastal waters. However, at point W-8 (coastal sector to the south of the planned plant area) iron concentrations are detected that could be related to anthropic industrial activities in the area.

In sample W-12 (Estero Balsa near the route of the 345 kV transmission line), very high concentrations of total iron were detected, which could be related to anthropogenic activities in the area and because it is very shallow marine water from the shores of inland aquariums where it is common to dump waste of various origins.

Similarly, in sample W-12, low concentrations of total nickel were detected, also related to anthropogenic activities. The concentration of oils and fats are at high levels, above the limit established by the Environmental Standard (NA-CASC-2012, Class E). Total and fecal coliforms are slightly higher when compared to the reference environmental standard.

6.1.15 Aspects of climate change

6.1.15.1 General context of climate change in the Dominican Republic

The United Nations Framework Convention on Climate Change (UNFCCC), in Article 1, defines climate change as "change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods". The UNFCCC thus differentiates between climate change attributable to human activities that alter atmospheric composition and climate variability attributable to natural causes.

In accordance with the approach of the Sixth Report of the Intergovernmental Panel on Climate Change -WGII AR6⁵, it places risks at the center (Figure 6-184). Climate change-related risks arise from climate-related hazards (climate trends and extremes) and the vulnerability of exposed societies, communities or systems (in terms of livelihoods, infrastructure, ecosystem services and governance systems). Effective climate change adaptation measures and the reduction of risks associated with climate change can address all three aspects of risk: hazards, vulnerability and exposure.

5 IPCC, Climate Change 2022, Impacts, Adaptation and Vulnerability. IPCC WGII Sixth Assessment Report

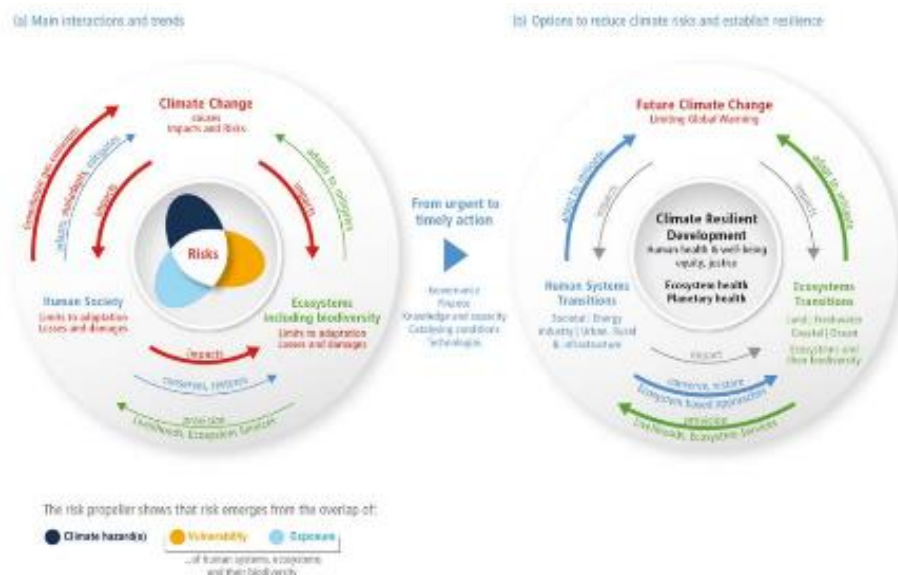


Figure 6-184. Illustration of the core concepts of WGII AR6, 2022.

The Dominican Republic, as a developing island nation, is among the most vulnerable countries in the world to climate change according to the Global Climate Risk Index report⁶ (Long-Term Climate Risk Index-CRI).

The analysis of the Critical Points of Vulnerability to climate change in the Dominican Republic⁷ shows that 13 provinces (about 40%) present high to very high levels of vulnerability (Figure 6-185). According to the future climate scenarios for the Dominican Republic⁸ prepared for the Third National Communication by the Water Center for the Humid Tropics of Latin America and the Caribbean, CATHALAC, temperature will increase, while precipitation may decrease substantially, particularly in the southern and western provinces of the country, and extreme events such as floods and droughts will increase.

6 Kreft, Sönke, David Eckstein, Lukas Dorsch & Livia Fischer (2021) Global Climate Risk Index 2021.

7 USAID/TNC/IDDI/PLENITUD (2013) Critical Points for Vulnerability to and Adaptation to Climate Variability and Change in the Dominican Republic. DR.

8 Prepared for TCNCC by Joel Pérez Fernández (coordinator), Gisell Aguilar Oro, Marcelo Oyuela and Alejandro del Castillo, members of the Water Center for the Humid Tropics of Latin America and the Caribbean, CATHALAC.

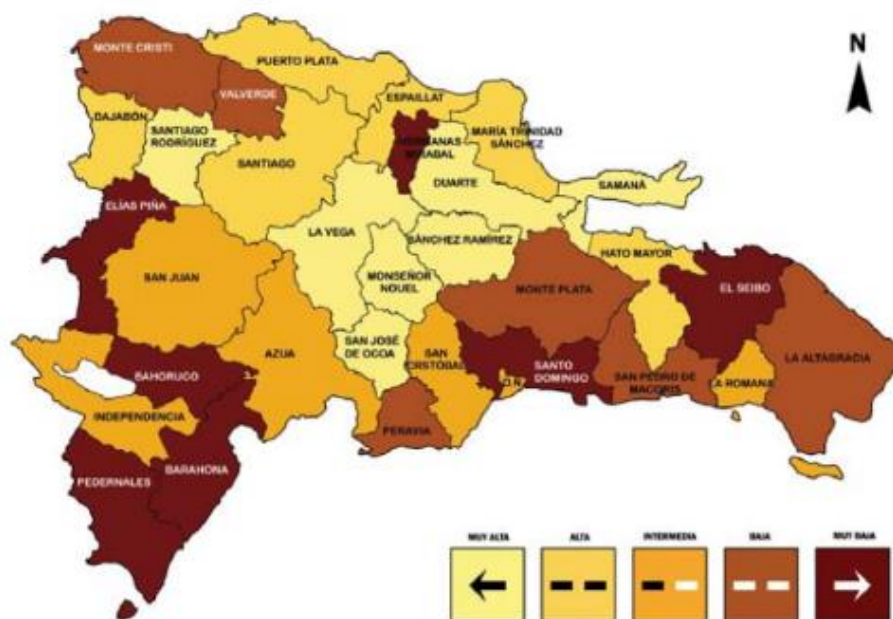


Figure 6-185. Map of vulnerability to Climate Change in the Dominican Republic, 2013.

Source: Third National Communication (2018) to the UNFCCC. National Council for Climate Change and Clean Development Mechanism, Ministry of Environment and Natural Resources, UNDP, GEF.

Dominican Republic

In terms of emissions, the Dominican Republic represents less than 0.1% of global emissions. Greenhouse gas (GHG) emissions per capita are below the average for Latin America and the Caribbean (4.9 tCO₂ eq), however, the trend in emissions from some economic sectors is significant, especially transportation, energy, manufacturing and construction, waste, and agriculture and livestock.

The Dominican Republic has a legal and institutional framework that incorporates climate change⁹ at the individual, institutional and systemic levels with the cross-cutting approach of strengthening national capacities at all three levels.

In 2015, the National Climate Change Policy (PNCC) was published, which was conceived through Decree No. 269-15. In turn in 2016, through Decree No. 23-16, (updated by Decree No. 26-17) the High Level Inter-Institutional Commission for Sustainable Development was established. The Dominican Republic also submitted its Intended Nationally Determined Contributions (NDC-DR) to the UNFCCC in 2015, which has been designed based on capacities, national circumstances and expected financing conditions.

As adaptation is a constitutional priority, due to the high level of vulnerability to extreme climate events, the Dominican Republic included the adaptation component in its NDCs, now called Nationally Determined Contributions or NDCs, after the country ratified the Paris Agreement. The

⁹ Rathe, Laura (June 2015) State of the Art of Climate Change Adaptation in the Dominican Republic. Third National Communication to the UNFCCC. National Council for Climate Change and Clean Development Mechanism, Ministry of Environment and Natural Resources, UNDP, GEF. Dominican Republic.

NDC sectors identified as most vulnerable are: water for human consumption, energy (electricity generation component), National System of Protected Areas, human settlements and tourism.

The planning blocks for the strategic approach to adaptation are as follows:

- Ecosystem-based adaptation/ecosystem resilience.
- Increased adaptive capacity and reduced territorial/sectoral vulnerability.
- Integrated water management.
- Health.
- Food safety.
- Infrastructure.
- Floods and droughts.
- Coastal-marine.
- Risk management and early warning systems.

The National Adaptation Plan integrates a gender perspective, aware that the effects of climate change have a differentiated impact on vulnerable human groups. Therefore, the role of women as agents of change is recognized and their participation is encouraged for the transformation of society towards a low-carbon and resilient development.

6.15.1.1.1 National communications

The National Communication is the main reporting instrument of the United Nations Framework Convention on Climate Change (UNFCCC), since it allows for the evaluation of emissions by country, which, when considered as a whole, provides an overview of global emissions, the vulnerability of each country and the measures for adaptation to climate change, for future decision-making on the subject.

The Dominican Republic, as a developing island state, is highly vulnerable to the impacts of climate change. Article 194 of its Constitution contemplates this phenomenon, establishing as a priority of the State the "formulation and execution of a land use plan that ensures the efficient and sustainable use of the Nation's natural resources, in accordance with the need to adapt to climate change". Likewise, one of the four axes of the National Development Strategy 2030 seeks: "a society with a culture of sustainable production and consumption, which promotes adequate adaptation to climate change". The Dominican State formulated, through a highly participatory process, its National Climate Change Policy, was one of the first Latin American countries to submit its Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) and, in early 2017, ratified the Paris Agreement. The above shows the understanding and importance for the Dominican Republic of the impacts of climate change for sustainable, global and national development. It also evidences the commitment assumed to contribute to its mitigation and adapt to its impacts.

In the 2014-2017 period, the Third National Communication of the Dominican Republic was presented, allowing to fulfill the country's commitment to the other nations of the world, but more importantly, how the Dominican Republic will face the challenges arising from the impacts of global warming as a result of climate change, a phenomenon that increasingly manifests itself with greater viciousness on the territory and population, significantly harming the most vulnerable and needy segments.

6.15.1.1.2 Climate commitments acquired from the Nationally Determined Contribution (NDC)

The Dominican Republic, in its Nationally Determined Contribution 2020 (NDC), increases its climate ambition by committing to a **27% reduction in greenhouse gas (GHG) emissions with respect to BAU or business as usual by 2030¹⁰**. This with a target of 20 % conditional on external finance and 7 % unconditional on domestic finance, with a 5 % share corresponding to the private sector and 2 % to the public sector. Within the objectives, 46 mitigation options are presented, distributed in: 27 options identified and evaluated for the Energy sector (focused on electricity generation, energy efficiency and road transportation), 4 options identified and evaluated for the Industrial Product and Process Use (IPPU) sector, 10 options identified for the Agriculture, Forestry and Other Land Use (AFOLU) sectors and 5 for the Waste sector. The country proposes to achieve, based on evaluated and proposed mitigation options, a reduction of 13,853.71 Gg CO_{2eq} which represents 27.16 % with respect to the BAU 2030 scenario estimated at 51,000 Gg CO_{2eq}, with an estimated required investment of USD \$ 8,916,950,000.00 expressed conditionally and unconditionally.

In terms of adaptation to climate change, new objectives were incorporated including measures in areas of urgency to build a more resilient country, incorporating measurable goals for the new prioritized sectors. The priorities are presented in **37 measures distributed in the sectors of water security, food security, health, resilient cities (infrastructure, human settlements), coastal-marine resources, tourism and ecosystems, biodiversity and forests**.

The NDC-DR 2020 places great emphasis on strengthening its domestic governance system, as well as the capacities of its key institutions to enable effective implementation of its decarbonization and adaptation objectives, to ensure close integration between climate change and development priorities.

6.1.15.2 Greenhouse gas inventory

6.1.15.2.1 National greenhouse gas inventory

The Third National Communication (2018) of the Dominican Republic presented the National Inventory of Greenhouse Gas (GHG) Emissions and Absorptions, corresponding to the year 2010. For the estimation of emissions, this inventory introduces, in the source categories where possible, elements of the Good Practice Guidelines in combination with elements of the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines, which are only mandatory for developed countries.

In the inventory reports for the years 1990 and 1994, the estimation of the main direct greenhouse gases as well as the indirect greenhouse gases was basically based on those provided by the report of the expert meeting (IPCC-OECD-IEA, 1997), the GHGs. However, due to data availability, it was oriented to direct greenhouse gases (carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O)).

In the 2010 inventory, because the necessary information was not available, emissions of the following direct greenhouse gases were not estimated: hydrofluorocarbons (HFCs),

¹⁰ Improving and Updating Nationally Determined Contribution 2020. NDC-RD 2020

perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆). Due to the importance of some of these gases, in refrigeration and air conditioning, it is highly recommended their incorporation in the statistics for future inventories.

The anthropogenic activities that produce GHG emissions and removals were grouped into six main source/sink categories that are used in the national inventory to report emissions and that constitute main sector modules within the inventory. These main sector modules are:

- Energy.
- Industrial Processes and Product Use (IPPU).
- Solvents and Use of Other Products (no methodology or data and therefore not applied).
- Agriculture.
- Land Use Change and Forestry.
- Waste.

Results obtained for the Greenhouse Gas Inventories for the years 1990, 1994, 1998, 2000 and 2010.

The years 1990 and 1994 were established in the framework of the UNFCCC activities as base year options for the preparation of the GHGI in non-Annex I countries of the Convention (developing countries).

In the Table 6-59 shows a summary of gross GHG emissions (excluding carbon sequestration) obtained for the Dominican Republic for the years 1990, 1994, 1998 and 2000, which are methodologically comparable through the IPCC methodology. As can be seen, in those years, CO₂ had the highest contribution to emissions, while the rest of the gases have a lower contribution. Table 6-60 highlights the increases in CO₂ emissions that are associated with the increases in fuel combustion for energy purposes observed in that period.

Table 6-59. Gross GHG emissions in GG CO₂ per year.

Gross GHG emissions (1). Dominican Republic, years 1990, 1994, 1998 and 2000.			
Year - Gas	CO₂	CH₄	N O₂
1990	8,690.81	144.74	2.71
1994	15,003.05	221.90	2.51
1998	16,417.72	214.57	9.09
2000	18,416.75	230.33	9.75

Source: Third National Communication (Ministry of Environment and Natural Resources, 2018).

Table 6-60. CO emissions and removals₂ from land use change and forestry in GG CO₂ per year.

Emissions and removals of CO ₂ from land use change and forestry in (GG CO ₂). Dominican Republic, years 1990, 1994, 1998 and 2000.				
CUTS-Year	1990	1994	1998	2000
Emissions	7,948.48	8,601.17	2,427.81	2,705.56
Removals	13,615.62	15,234.34	21,508.44	21,514.13
Net absorption	5,667.14	6,637.17	19,080.63	18,808.57

It should be noted that since the assumptions used for the calculations are not available, they are included as a reference and do not represent the recalculation of total emissions for those years.

The above data were obtained from: National Greenhouse Gas Emissions and Absorptions Inventory Report for the Years 1990 and 1994.

<http://www.ambiente.gob.do/IA/CambioClimatico/Cambio%20climatico/Inventario%20de%20Gases%20de%201nvernadero.pdf>. Second National Communication. <http://unfccc.int/resource/docs/natc/domrepnc2.pdf> (p 92 A 110)

Source: Third National Communication (Ministry of Environment and Natural Resources,2018).

The growth observed in forest biomass, together with the low extraction of commercial timber in those years, compensates for the emissions produced by slash-and-burn agriculture, forest fires and charcoal production. This aspect is important, since these removals also compensate in part for the emissions that occurred basically in the energy module, since others, such as industrial processes, make a very small contribution, given the limited number of these that are developed in the country.

The Table 6-61 y Figure 6-186 present a time series of the Greenhouse Gas Inventory for the years 1990-1994-1998-2000 and including the year 2010 for the Dominican Republic.

Table 6-61. Time series of emissions in GG CO₂ per year.

Time series of Dominican Republic's emissions in gigagrams of CO equivalent ₂					
Time Series By sector	1990	1994	1998	2000	2010
Energy	8,469.30	14,788.78	15,868.81	18,090.66	21,138.54
Processes industrial	541.10	643.80	1,045.70	811.06	1,803.45
Agriculture	2,280.12	2,489.10	5,211.49	5,701.10	6,812.21
Land use and forestry	-5,555.99	-6,504.22	Not included	-1,874.10	-3,100.64
Waste	1,305.78	2,519.37	1,615.59	1,673.36	4,390.53

*The series have not been reconstructed.

Source: Third National Communication (Ministry of Environment and Natural Resources,2018).

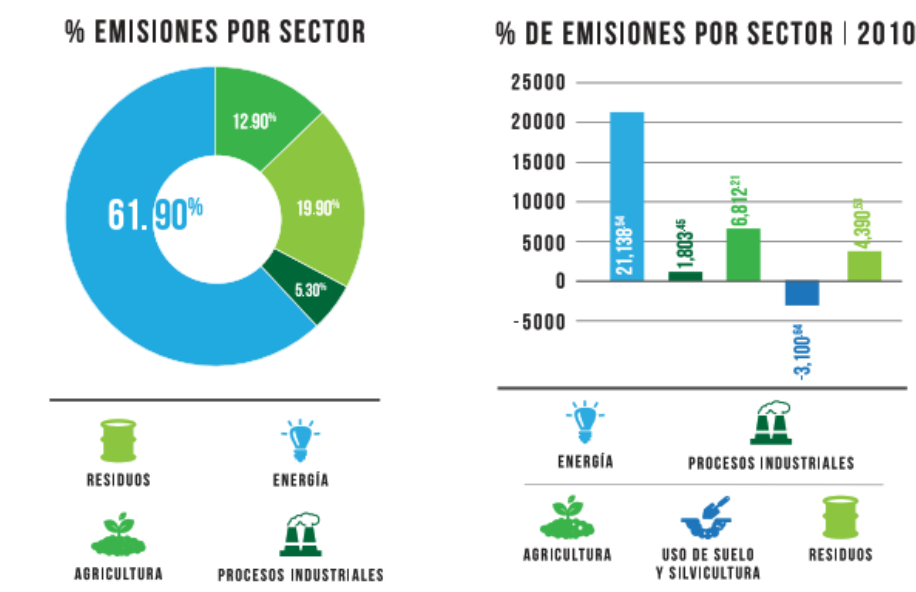


Figure 6-186. Emissions by sector from the 2010 INGEI.

Source: Third National Communication (Ministry of Environment and Natural Resources, 2018).

In February 2020, the First Biennial Update Report of the Dominican Republic to the United Nations Framework Convention on Climate Change (fBUR) was published, which includes information from the Sixth National Greenhouse Gas Inventory (INGEI). This INGEI for 2015 for the Dominican Republic was prepared following the 2006 IPCC Guidelines for National GHG Inventories and the IPCC Inventory Software 2017 (IPCC, 2017) was used for the calculations. It covers the entire national territory and includes emissions and removals of anthropogenic GHGs (CO₂, CH₄ and N₂ O) not controlled by the Montreal Protocol, in a revised time series ranging from 2010 to 2015. The results of the GHG estimates are presented at the national level; in Gigagrams (Gg), the last year of the inventory update, unless otherwise specified. Positive values represent GHG emissions, while negative values correspond to GHG removals (capture or sequestration).

According to the calculations performed, in 2015, the GHG balance is 24,634.24 Gg CO_{2eq}, while the balance of the base year (2010) is 17,224.81 Gg CO_{2eq}, for an increase of 7,409.43 Gg CO_{2eq} (43.02% with respect to the base year). Total emissions¹¹ were 35,486.03 Gg CO_{2eq}, compared to the base year (2010) which was 29,857.84 Gg CO_{2eq}, reflecting an increase of 5,628.19 Gg CO_{2eq}, equivalent to 18.85%, with respect to the base year. This increase is mostly due to CO₂.

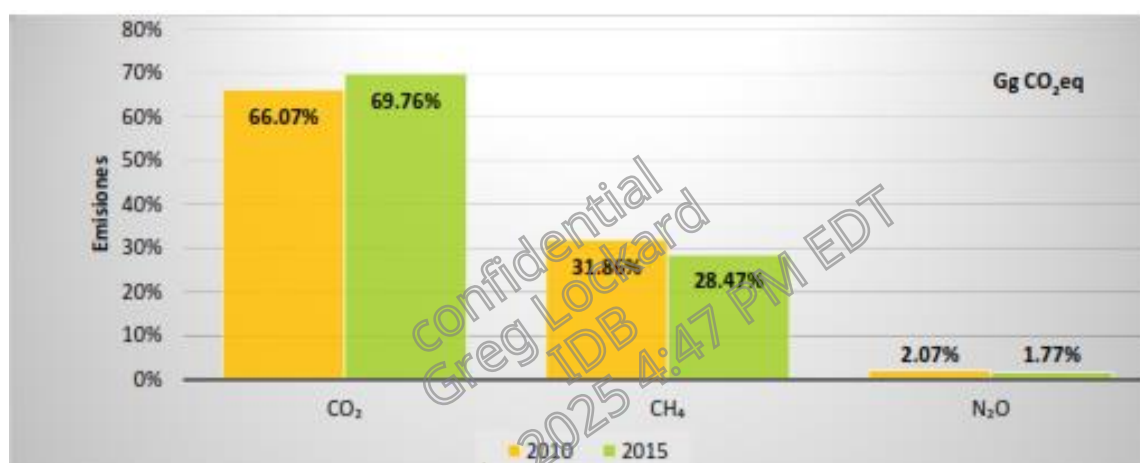
CO emissions₂ accounted for 69.76% (increasing 25.49% compared to 2010), while CH₄ and N₂ O accounted respectively for 28.47% and 1.77% (increasing 6.20% and 1.62% respectively, compared to the base year 2010). This is summarized in Figure 6-187 y Table 6-62.

¹¹ Excludes category 3.B Land, both emissions and removals.

Table 6-62. Total GHG emissions by type of gases, 2010-2015 series (Gg CO₂eq)

Types of GHG	2010	2015	Difference	
			Absolute	%
CO ₂	19,726.34	24,754.51	5,028.16	25.49
CH ₄	9,513.14	10,103.15	590.01	6.20
N ₂ O	618.36	628.37	10.02	1.62
TOTALS	29,857.84	35,486.03	5,628.19	18.85

Source: First Biennial Update Report (fBUR) Ministry of Environment and Natural Resources, National Council for Climate Change and Clean Development Mechanism and United Nations Development Program (2020).

**Figure 6-187. Total GHG emissions by type of gases, 2010-2015 series (Gg CO₂eq).**

Source: First Biennial Update Report (fBUR) Ministry of Environment and Natural Resources, National Council for Climate Change and Clean Development Mechanism and United Nations Development Program (2020).

The energy sector is the country's main emitter, with a 62.75% contribution to total emissions and a 90.39% share in the GHG balance in 2015. In this year, emissions reached 22,266.69 Gg CO₂eq, increasing by 18.05% from the base year 2010. The main cause is the sustained increase in the country's energy consumption, associated with the increase in the burning of fuels for energy purposes.

Within the categories, Fuel combustion activities is the most important, with 99.77% of emissions, and the remaining 0.23% corresponds to Fugitive emissions from fuels. Within the Fuel combustion activities category, the Energy industries subcategory is the most important, with 44.8% share, followed by Transportation (34.4%), Manufacturing and construction industries (12.4%), Other sectors (7.1%) and Unspecified (1.3%). Within the category Fugitive emissions from fuels, the subcategory Oil and natural gas is the only one present.

The IPPU sector contributed 8.15% to total emissions and represented 11.64% in the GHG balance in 2015 (2,892.61 Gg CO₂eq), increasing 147.76% since 2010. The increase is basically

explained by the increase recorded in cement and lime production since 2013. In this sector, only the Minerals Industry category was accounted for, and within this, the Cement Production subcategory is the one with the highest emissions (60.78%), and Lime Production the lowest (39.22%).

The AFOLU sector contributed -24.76% to the total GHG balance in 2015. This had a balance of 6,098.69 Gg CO_{2eq}, representing a decrease in net emissions with negative magnitude of 23.57% since 2010. Regarding sectors, emissions from Agriculture and soils (Livestock and Aggregate sources and sources of emissions other than CO₂ on land), represented a -77.94% in the sector balance and a 19.29% share in the total GHG balance. For the same year, its emissions reached 4,753.10 Gg CO_{2eq}, an increase of 2.14% compared to 2010.

Regarding categories, 74.50% of emissions correspond to Enteric Fermentation, with the highest contribution, and 8.17% to Manure Management. These two subcategories correspond to the Livestock category. In the category Aggregate sources and sources of emissions other than CO₂ on land, the largest contribution is from the subcategory Rice cultivation with 11.22%, followed with 3.18% by Indirect emissions of N₂ O resulting from manure management, with 2.46% by Indirect emissions of N₂ O from managed soils, with 0.47% by Urea application and 0.001% corresponds to Direct emissions of N₂ O from managed soils.

On the other hand, removals from the Land category represented 177.94% of the AFOLU sector balance and a -44.05% share in the total GHG balance. The removals were 10,851.79 Gg CO_{2eq} for a decrease of 14.1% since 2010. The reason for these decreases is the accumulation of forest area losses, mainly caused by forest fires. In 2015, 11,601.5 hectares of forests were set on fire, accumulating a total of 34,621.20 hectares of forests (almost 1.0% of the country's surface area) in the period evaluated (2010-2015).

The Land sector is the only one that consistently absorbs CO₂ in the country. With respect to the categories, Forest Land presents absorptions of 11,699.74 Gg CO_{2eq}, contributing 108.03% to the Land balance. On the other hand, wetlands reached 847.89 Gg CO_{2eq} for a contribution of -7.829% and croplands 0.07 Gg CO_{2eq} for a contribution of -0.001%.

The **Waste** sector contributed 15.71% to total emissions and represented 22.63% of the GHG balance. In the same year its emissions reached 5,573.64 CO_{2eq}, increasing by 7.7% from the base year 2010, due to the increase in population and waste generated. Regarding categories, 68.63% of GHG emissions correspond to Solid Waste Disposal and 31.37% to Wastewater Treatment and Disposal.

In the Figure 6-188 y Table 6-63 summarize the results of the different sectors and their evolution.

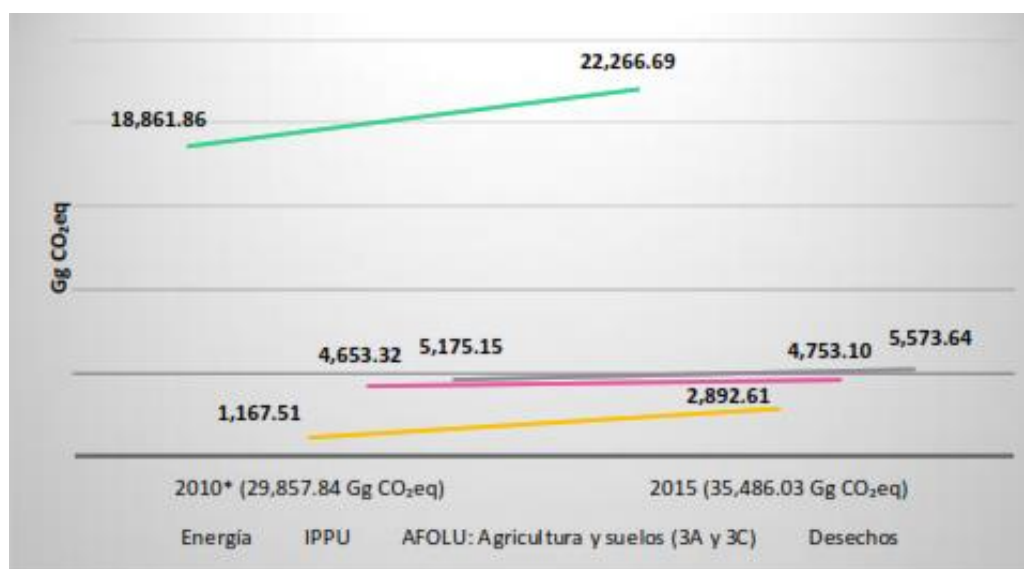


Figure 6-188. Total GHG emissions by sector, 2010-2015 series.

Source: First Biennial Update Report (fBUR). Ministry of Environment and Natural Resources, National Council for Climate Change and Clean Development Mechanism and United Nations Development Program (2020).

Table 6-63. Total GHG emissions by sector, 2010-2015 series (Gg CO)_{2eq}

Sector	2010	2015	Difference	
			Absolute	%
Energy	18,861.86	22,266.69	3,404.83	18.05
IPPU	1,167.51	2,892.61	1,725.10	147.76
AFOLU: Agriculture and Soils (3rd and 3rdC)	4,653.32	4,753.10	99.78	2.14
Afolu: Lands (3B)	-12,633.03	-10,851.79	1,781.24	-14.10
Waste	5,175.15	5,573.64	398.49	7.70
Balance Sheet (Net Emissions)	17,224.81	24,634.24	7,409.43	43.02
Total emissions (Total)	29,857.84	35,486.03	5,628.19	18.85

Source: First Biennial Update Report (fBUR). Ministry of Environment and Natural Resources, National Council for Climate Change and Clean Development Mechanism and United Nations Development Program (2020).

6.1.15.2.2 Estimate of the generation of greenhouse gases associated with the construction and operation activities of the Project.

6.1.15.2.2.1 Introduction

Global change has become one of the most important challenges facing society in the 21st century. Climate plays a fundamental role in the global economy and human well-being. Anthropogenic greenhouse gas emissions are one of the main causes of the problem. Therefore, it is humanity's responsibility to stabilize the climate at safe levels that do not compromise the opportunities of future generations.

The effort made by the international community represented in the United Nations to seek solutions to the problem requires the commitment of all sectors, especially companies.

The fight against Global Change is being joined by a multitude of organizations, both public and private, which are developing various initiatives for the standardization of GHG emissions reporting. Among the most important initiatives we can mention the following:

- Intergovernmental Panel on Climate Change (IPCC)-Intergovernmental Panel on Climate Change
- Greenhouse Gas Protocol.
- UNE-EN-ISO 14064.
- PAS 2050.
- European Environment Agency (EEA).
- Environmental Protection Agency (EPA) of the United States.

6.1.15.2.2.1.1 IPCC

Recognizing the problem of global climate change, the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) established the Intergovernmental Panel on Climate Change (IPCC) in 1988. It is open to all Members of the United Nations and WMO.

The role of the IPCC is to analyze, in a comprehensive, objective, open and transparent manner, the scientific, technical and socio-economic information relevant to understanding the scientific elements of the risk of human-induced climate change, its potential impacts and the potential for adaptation and mitigation. The IPCC does not conduct research or monitor data on climate or other relevant parameters but bases its assessment primarily on peer-reviewed scientific and technical literature published every 7 years.

One of the main activities of the IPCC is to provide governments at all levels with scientific information that they can use to develop climate policy and to make a regular assessment of the state of knowledge on climate change. The IPCC also produces Special Reports and Technical Papers on topics where independent scientific information and advice is considered necessary and supports the United Nations Framework Convention on Climate Change (UNFCCC) through its work on national greenhouse gas inventory methodologies.

6.1.15.2.2.1.2 Greenhouse Gas Protocol

The Greenhouse Gas Protocol (GHG IP) initiative is a partnership between business, non-governmental organizations (NGOs), governments and other entities, convened by the World Resources Institute (WRI), U.S.-based NGOs, and the World Business Council for Sustainable Development (WBCSD). The initiative was launched in 1998 with the mission of developing

internationally accepted accounting and reporting standards for companies and promoting their widespread adoption.

This initiative comprises two distinct but interrelated standards:

- **Corporate GHG Protocol Accounting and Reporting Standard:**

This document provides a methodology for companies and other organizations to quantify and report their GHG emissions.

The standard covers the six GHGs foreseen in the Kyoto Protocol: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂ O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆).

Table 6-64. Global Warming Potential from Greenhouse Gases

Name of gas	Chemical formula	100-year GWP
Carbon Dioxide	CO ₂	1
Methane	CH ₄	21
Nitrous oxide	N ₂ O ₂	310
Substances controlled by the Montreal Protocol		
CFC-11	CCl F ₃	4,750
CFC-12	CCl F ₂₂	10,900
CFC-13	CClF ₃	14,400
CFC-113	CCl ₂ FCClF ₂	6,130
CFC-114	CClF ₂ CClF ₂	10,000
CFC-115	CClF ₂ CF ₃	7,370
Halon-1301	BBrF ₃	7,140
Halon-1211	CBrClF ₂	1,890
Halon-2402	CBrF ₂ CBrF ₂	1,640
Carbon chloride	CCl ₄	1,400
Methyl bromide	CH ₃ Br	5
Methylchloroform	CH ₃ CCl ₃	146
HCFC-22	CHClF ₂	1,810
HCFC-123	CHCl ₂ CF ₃	77
HCFC-124	CHClF ₂ CF ₃	609
HCFC-141b	CH ₃ CCl F ₂	725
HCFC-142b	CH ₃ CClF ₂	2,310
HCFC-225ca	CHCl ₂ CF ₂ CF ₃	122
HCFC-225cb	CHClF ₂ CF ₂ CF ₃	595
Hydrofluorocarbons		
HFC-23	CHF ₃	11,700
HFC-32	CH F ₂₂	650
HFC-125	CHF ₂ CF ₃	3,500

Name of gas	Chemical formula	100-year GWP
HFC-134a	CH ₂ FCF ₃	1,430
HFC-143a	CH ₃ CF ₃	4,470
HFC-152a	CH ₃ CHF ₂	124
HFC-227ea	CF ₃ CHF ₂ CF ₃	3,220
HFC-236fa	CF ₃ CH ₂ CF ₃	9,810
HFC-245fa	CHF ₂ CH ₂ CF ₃	1,030
HFC-365mfc	CH ₃ CF ₂ CH ₂ CF ₃	794
HFC-43-10mee	CF ₃ CHFCHFCF CF ₂₃	1,640
Perfluorinated Compounds		
Sulfur hexafluoride	SF ₆	22,800
Nitrogen trifluoride	NF ₃	17,200
CBP-14	CF ₄	7,390
PFC-116	C F ₂₈	12,200
PFC-218	C F ₃₈	8,830
PFC-318	c-C F ₄₈	10,300
PFC-3-1-10	C F ₄₁₀	8,860
PFC-4-1-12	C F ₅₁₂	9,160
PFC-5-1-14	C F ₆₁₄	9,300
PFC-9-1-18	C F ₁₀₁₈	>7,500
Trifluoromethyl sulfur pentafluoride	SF ₅ CF ₃	17,700
Fluorinated ethers		
HFE-125	CHF ₂ OCF ₃	14,900
HFE-134	CHF OCHF ₂₂	6,320
HFE-143a	CH ₃ OCF ₃	756
HFE-235da2	CHF OCHClCF ₂₃	350
HFE-245cb2	CH ₃ OCF ₂ CHF ₂	708
HFE-245fa2	CHF OCH ₂₂ CF ₃	659
HFE-254cb2	CH ₃ OCF ₂ CHF ₂	359
HFE-347mcc3	CH ₃ OCF CF CF ₂₂₃	575
HFE-347pcf2	CHF CF ₂₂ OCH CF ₂₃	580
HFE-356pcc3	CH ₃ OCF CF ₂₂ CHF ₂	110
HFE-449sl (HFE-7100)	C F OCH ₄₉₃	297
HFE-569sf2 (HFE-7200)	C F ₄₉ OC H ₂₅	59
HFE-43-10-pccc124 (H-Galden 1040x)	CHF ₂ OCF ₂ OC F ₂₄ OCHF ₂	1,870
HFE-236ca12 (HG-10)	CH ₂ OCF OCHF ₂₂	2,800
HFE-338pcc13 (HG-01)	CHF ₂ OCF CF ₂₂ OCHF ₂	1,500
Perfluoropolyethers		
PFPME	CF ₃ OCF(CF ₃)CF ₂ OCF ₂ OCF ₃	10,300

Name of gas	Chemical formula	100-year GWP
Hydrocarbons and other compounds - direct effects		
Dimethyl ether	CH ₃ OCH ₃	1
Methylene chloride	CH ₂ Cl ₂	8.7
Methyl chloride	CH ₃ Cl	13

Source: World Business Council for Sustainable Development (WBCSD) & World Resources Institute (WRI), 2001.

- Protocol project quantification standard:

This document contains a guide for the quantification of GHG emission reductions derived from specific projects.

6.1.15.2.2.1.3 UNE-EN-ISO 14064

This standard was developed by the International Organization for Standardization (ISO).

ISO 14064 consists of three parts:

- **Part 1: Specifications with guidance, at the organization level, for the quantification and reporting of greenhouse gas emissions and removals.**

This first part details the principles and requirements for the design, development and management of GHG inventories for companies and organizations, and for inventory reporting. It includes requirements for determining GHG inventory boundary limits, quantifying the organization's GHG emissions and removals, and identifying specific company activities or actions to improve GHG management. It also includes requirements and guidance for inventory quality management, GHG reporting, internal auditing and the organization's responsibilities for verification activities.

- **Part 2: Specifications with guidance, at the project level, for the quantification and reporting of emission reductions or enhancement of greenhouse gas removals.**

This part focuses on project-based activities specifically designed to reduce GHG emissions or increase GHG removals. It includes the principles and requirements for determining project baseline scenarios and for tracking, quantifying and reporting project development relative to the baseline scenario, and provides a basis for GHG projects to validate or report.

- **Part 3: Guidance specifications for the validation and verification of greenhouse gas declarations.**

This part details the principles and requirements for the verification of GHG inventories and for the validation or verification of projects aimed at reducing GHG emissions.

6.1.15.2.2.1.4 PAS 2050

PAS 2050 is a tool created by the British Standards Institution for the measurement and evaluation of the carbon footprint of a product from its design, production and distribution to its arrival at the final consumer. It is therefore the evaluation of a global and complex process that involves, in

addition to the organization that wishes to evaluate its carbon footprint, its suppliers, as well as various processes.

6.1.15.2.2.1.5 European Environment Agency (EEA).

The European Environment Agency has developed a guide for conducting air pollutant emission inventories: EMEP/CORINAIR Guide to European Air Emission Inventories, which compiles different methodologies developed for conducting air emission inventories for different types of pollutants (including greenhouse gases) generated by each of the activities that pollute the atmosphere.

6.1.15.2.2.1.6 U.S. Environmental Protection Agency (EPA)

The mission of the U.S. Environmental Protection Agency is to protect human health and the environment, and the agency offers a number of publications related to the greenhouse gas inventory.

It also includes a description of the methodology followed, as well as the determination of the uncertainty of the estimated emissions.

- CO₂ emissions from fossil fuel combustion by state.
- Guidelines for national inventories (document currently under revision).
- Publications related to company inventories.
- Domestic GHG emissions publications:
- Publications related to air pollutant emission factors.

For all potentially air polluting activities, the EPA has published the AP-42 compendium of emission factors, with emission factors for numerous pollutants.

6.1.15.2.2.1.7 Carbon footprint

Carbon footprint is the total amount of carbon dioxide and other greenhouse gases caused directly and indirectly by an individual, an organization, a product or activity. In this way, it is a way of evaluating their contribution to climate change. It is expressed as a quantity of CO₂ equivalent (each greenhouse gas has a different impact on the climate change phenomenon. The CO₂ equivalent consists of transforming the impact of each gas into a unit of CO₂).

This analysis covers all the activities of its life cycle (from the acquisition of raw materials to its management as waste). Its approach is usually based on life cycle analysis (LCA), with the carbon footprint being part of it. With this approach, the carbon footprint would be only one of the impact categories analyzed when preparing a full LCA.

The calculation of the carbon footprint is a suitable tool for all those companies that want to:

- Identification of opportunities for energy and economic savings, as a result of a better knowledge of emission sources and emission reduction possibilities.
- Adhere to a voluntary GHG emissions reduction commitment system, which contributes to the demonstration to third parties of the organization's commitment to social responsibility through its climate change mitigation requirements.

The concept of carbon footprint is directly related to that of emissions inventory. The main difference is that the carbon footprint is focused on a particular good or service, while an inventory is of an entire organization, so that the corresponding part is not assigned to each product. Its approach is usually based on life cycle analysis.

Therefore, the two methods are not mutually exclusive, but are usually complementary or an integral part of the GHG emissions inventory and carbon footprint calculation. An inventory can be a first approximation of the organization's emissions, whereas to obtain a carbon footprint it will be necessary to impute a part of that total to a product or service.

On the other hand, in many cases, emissions associated with the value chain of the organization's supplies are not included. In the case of goods, the exclusion of emissions associated with the value chain of the goods incorporated in the final product is not usually accepted when calculating the carbon footprint. In most cases, supplies have a very important weight on the result.

The purpose of conducting a carbon footprint is very similar to that of conducting an inventory, with the possible advantage that it allows measures to be taken for a particular product, such as carrying out reductions or neutralizing the emissions of certain products of the company.

From a global point of view, a shift to a carbon footprint approach reveals higher quality information compared to the current boundary approach, as explained below.

Based on the assumption that greenhouse gas emissions have the same impact on the atmosphere, regardless of where they are produced, the carbon footprint solves the problems mentioned above. Its approach is based on life cycle analysis, where all emissions are included, without discarding by country of origin, use or end of life.

Consortium Manzanillo Energy is committed to promoting all initiatives and actions that favor sustainable development. It considers environmental management to be a fundamental part of its responsibility, and therefore, within the development of social policies, its commitment to improving the management of the environmental aspects derived from the activities it carries out should be highlighted. As a company that generates electricity using natural gas, this type of activity involves both direct and indirect generation of greenhouse gases. Therefore, we must know exactly the associated emissions in order to subsequently reduce the climate impact of the organization.

Purpose of project carbon footprint estimation

This document is part of the project "Carbon footprint of the Construction and Operation of the Manzanillo Energy Consortium Power Plant Project with a Capacity of Approximately 420 MW".

In particular, the purpose of this document is to show the results of the project, as well as the methodology followed.

To calculate the Carbon Footprint, we have followed the methodology of the GHG protocol ("The Greenhouse Gas Protocol"), PAS 2050, as well as the UNE-EN-ISO 14064-1:2006 standard. Greenhouse gases. Specification with guidance, at the level of organizations, for the quantification and reporting of greenhouse gas emissions and removals.

Principles

The calculation is based on UNE-EN-ISO 14064-1: Specification with guidance, at the organization level, for the quantification and reporting of greenhouse gas emissions and removals, UNE-EN-ISO 14064-2, Specification with guidance, at the project level, for the quantification, monitoring and reporting of emission reductions or increases in greenhouse gas removals, as well as on the principles of the GHG itself:

- **Transparency:** the inventory contains sufficient information on all significant or relevant issues in an objective and consistent manner on data sources, scope, calculation methodologies and assumptions made.
- **Relevance:** it ensures that the greenhouse gas inventory properly reflects the organization's emissions and therefore can be an objective and significant element in the decision-making process of both internal and external users of the company.
- **Consistency:** Accounting and reporting are done in a comprehensive manner, covering all GHG emission sources and activities included in the inventory boundary. Any exceptions to this general principle are reported and justified.
- **Consistency:** Consistent methodologies are used that will allow meaningful comparisons of emissions over time. Any changes in data, inventory boundary, calculation methods or any other relevant factors over a time series shall be transparently documented.
- **Accuracy:** ensures that the quantification of GHG emissions does not observe systematic errors or deviations from actual emissions, as far as can be assessed, and in such a way that uncertainty is reduced as far as possible. Sufficient accuracy is achieved to allow users to make decisions with reasonable confidence regarding the completeness of the information reported.
- **Participatory:** we have tried to involve a large part of the organization in the process of obtaining information and data, in order to raise awareness of the importance of the inventory and the company's commitment to climate change.

Operational limits of the carbon footprint

This involves identifying emissions associated with construction and operational activities, classifying them as direct or indirect emissions, and selecting the scope of accounting and reporting for indirect emissions.

Direct GHG emissions are defined as emissions from sources owned or controlled by the company, while indirect GHG emissions are the result of the company's activities but occur at sources owned or controlled by another company.

The processes covered within the Carbon Footprint Calculation of the Construction and Operation of the Manzanillo Energy Consortium Power Plant Project with a Capacity of Approximately 420 MW to detect the emission sources are:

Construction:

During the construction phase of the Manzanillo Energy Consortium Power Plant project with a capacity of approximately 420 MW, the following activities will be carried out:

1. Mobilization of materials, equipment and machinery to the project site.

2. Installation of temporary site facilities.

- Construction of roads and temporary perimeter fences.
- Location of the temporary facilities camp.
- Storage of construction materials.
- Provision of parking spaces.
- Water supply and consumption.
- Generation and management of liquid waste.
- Energy supply and consumption.
- Fuel supply and consumption.
- Generation and management of solid and oily waste.
- Transportation of construction materials and other supplies.

3. Land conditioning.

- Clearing and cleaning of vegetation and topsoil from the construction area.
- Stripping or cutting of unusable material.
- Stakeout.
- Earth moving and excavations.

4. Construction of thermoelectric power plant.

- Construction of buildings.
 - Administration buildings.
 - Storage.
 - Maintenance/Control.
- Installation of thermoelectric power plant equipment:
 - Gas turbine installation with generator.
 - Steam turbine installation with generator.
 - Installation of a steam generator boiler using exhaust gas heat recovery (HRSG).
 - Steam condenser.
 - Desalination water plant.
 - Saltwater cooling tower.
 - Electricity transformer and elevator substation.

5. Construction of service infrastructure.

- Drinking water supply system.
- Wastewater treatment system.

- Surface drainage system.
- DC back-up power system with battery bank and inverters
- AC backup electrical system with emergency electrical generator.
- LNG supply system inside the thermoelectric power plant.
- Liquid fuel storage and distribution system.
- Compressed air system.
- Compressed gas system.
- Security system.
- Firefighting systems.
- Natural gas and other gas leak detection system.
- Telecommunications system.
- Road system and parking lots.

6. Construction of transmission line to the National Interconnected Electric System.

7. Connection to the National Grid.

8. Hiring of temporary labor force.

9. Withdrawal of temporary facilities.

10. Transportation of construction materials and waste.

Operation:

During the operation phase of the Manzanillo Energy Consortium Power Plant project, with a capacity of approximately 420 MW, the following activities will be carried out.

- 1. Start-up and operations of the thermoelectric power plant and the power transmission line.**
- 2. Maintenance of facilities and equipment.**
 - Thermoelectric power plant machinery.
 - Thermoelectric power plant facilities.
 - Electric transmission line.
- 3. Natural Gas management and consumption.**
- 4. Liquid fuel handling and consumption.**
- 5. Generation and management of hazardous and non-hazardous solid waste.**
- 6. Generation and management of oily waste.**
- 7. Water consumption and treatment.**
- 8. Generation and treatment of industrial and domestic liquid waste.**
- 9. Vector and rodent control.**

10. Handling of chemical products.

11. Hiring of permanent labor force.

Based on the identification of the project's construction and operation activities, the sources of greenhouse gas emissions by scope will be determined.

6.1.15.2.2.2 Scope

The calculation of Greenhouse Gas (GHG) emissions from the actions of the construction and operation phases of the project is managed directly or indirectly by the organization.

The unit in which all the results of the report are expressed is in tons of carbon dioxide (CO₂) equivalent.

The sources identified in the information gathering process, and the information provided by Manzanillo Energy Consortium are as follows:

- **Emission sources**

- ✓ **Scope 1**

Direct emissions, also referred to as Scope 1 emissions, are greenhouse gas emissions associated with sources under the control of a company, such as emissions from combustion in boilers, furnaces, machinery or vehicles, and emissions from process equipment, as well as fugitive emissions from equipment or facilities.

Thus, the sources considered were:

- Construction Phase:
 - Combustion emissions from stationary sources (emergency power generators).
 - Combustion emissions from mobile sources (including vehicles and heavy machinery).
- Operation Phase
 - Combustion emissions from stationary sources produced by the combustion of natural gas for electricity generation.
 - Combustion emissions from mobile sources (including vehicles and machinery for project maintenance).
 - Fugitive emissions produced by natural gas flaring.
 - Fugitive emissions produced by natural gas losses in the system.

✓ Scope 2

Scope 2 indirect emissions are the indirect greenhouse gas emissions associated with the generation of electricity or thermal energy (steam, thermal oil, hot water, etc.) purchased and consumed by the company that physically occur at the electricity or thermal energy generation plant.

In this scope, electricity consumption in the operation phase has been included.

✓ Scope 3

Scope 3 indirect emissions include all other indirect greenhouse gas emissions. Scope 3 emissions are a consequence of the company's activities but are produced by sources that are not owned or controlled by the company, but are associated with purchased goods and services (with the exception of indirect emissions associated with the generation of purchased electricity or thermal energy, which is included in Scope 2).

Scope 3 emissions, as contemplated by the GHG Protocol or the ISO 14064-1 standard, are optional, but as it is a scope with great weight in the calculation, it has been decided to include it. Thus, the source contemplated has been:

- Construction Phase:
 - Emissions from transportation of equipment, electrical material, structures and construction materials.
- Operation Phase:
 - Emissions from transporting liquefied natural gas by ship.

6.1.15.2.2.3 Methodologies for calculating emissions by emission source.

To achieve a consistent, accurate and transparent calculation, it has been based on international GHG measurement standards of recognized prestige, such as ISO 14064-1, the GHG Protocol, PAS 2050 and its own methodology adapted to the project's activities.

The calculation of emissions derived from the construction and operation activities of the Manzanillo Energy Consortium Power Plant Project with a capacity of approximately 420 MW includes both direct and indirect emissions.

The process has had the following stages:

- Meeting with those responsible for the construction and operation of the project.
- Identification of the limits of the Carbon Footprint calculation.
- Selection of the emissions quantification methodology.
- Data collection for the agreed period.
- Application of the methodology.
- Development of the report.

The greenhouse gases reported for this study were as follows:

- CO₂ - Carbon dioxide
- CH₄ - Methane
- N₂ O -Nitrogen dioxide

Scope 1 Emissions Calculation Methodologies

• Direct emissions from combustion in stationary sources

This section develops the methodology for determining direct emissions from combustion in stationary sources for the different fuels used during the construction and operation phases.

The estimation of greenhouse gas emissions was based on calculation methodology, the greenhouse gases resulting from combustion are carbon dioxide (CO₂) and to a lesser extent, nitrogen dioxide (N₂ O) and methane (CH₄) as is the case with mobile combustion.

Since the annual emissions results should be given in tons of CO₂ equivalent, the emissions obtained from CH₄ and N₂ O should be multiplied by their corresponding global warming potential:

$$E_{(CO_2eq)} = \sum_i (E_i * PCG_i)$$

E_i being the emissions of gas "i" the activity data, and the global warming potential of the gas (GWP_i) "i".

As is the case for mobile combustion, the methodology used focuses on the calculation of emissions, which is based on the application of the following expression for each greenhouse gas emitted in each emission source:

$$E_{(GEI_i)} = DA * FE$$

This expression was applied for each identified mobile combustion source or source stream, and for each pollutant i (CO₂, CH₄ and N₂ O).

CO emissions₂ derived from combustion depend basically on fuel consumption and fuel composition (carbon content).

On the other hand, emissions of N₂ O and CH₄ also depend on the type of combustion technology used, combustion conditions, among other factors.

Methodology for the determination of CO₂ of flue gas.

The calculation of CO emissions₂ derived from fixed combustion is determined by applying the following expression:

$$E_{(CO_2)} = DA (TJ) * FE (tCO_2 / TJ)$$

Where:

Activity data (Tera Joules (TJ)): is defined as the energy content of the fuel consumed, expressed in TJ. This value was obtained from the product of the fuel consumed (expressed in mass units) and the Lower Calorific Value of the corresponding fuel.

Emission Factor: expressed in t CO₂ / TJ and depending on the type and characteristics of the fuel used in each case. For each fuel there is a specific CO₂ emission that is closely linked to the carbon content of the fuel in question.

The CO₂ emissions, since they do not depend on the type of technology, could be determined by applying this expression to the total amount of fuel consumed, since the records were aggregated.

The procedure used to determine the factors involved in the calculation is specified below.

a) Activity data

Consumption data in the specific unit of measurement was obtained through the project promoter. The pertinent conversions were made to obtain the activity data in energy units.

b) Emission factor

The factors in Chapter 2, Volume 2, Chapter 2 of the 2006 IPCC Guidelines were used.

Methodology for the determination of CH₄ and N₂ O from flue gas.

Unlike CO₂, CH₄ and N₂ O emissions depend, in addition to fuel composition, on the combustion and emission control technology of the combustion system, among other factors.

The estimation of CH₄ and N₂ O was also based on the product of the activity data by an emission factor, as shown in the following expression:

$$E_{(CH_4 \text{ or } N_2O)} = DA \text{ (TJ)} * FE \text{ (tCH}_4 \text{ or N}_2 \text{ O/TJ)}$$

Where:

Activity data: refers to the amount of fuel consumed annually in TJ.

Emission factor: data expressed in kg CH₄ or N₂ O per TJ.

a) Activity data

The activity data is the fuel consumption expressed in TJ, i.e., as for determining CO emissions₂.

b) Emission factor

The factors in Chapter 2 of Volume 2 of the IPCC Guidelines were used.

- **Direct emissions from mobile sources**

This section develops the methodology used to determine direct emissions from mobile combustion.

For the normal development of the construction and operation activities of the project, some processes related to the construction, transportation and maintenance of the facilities that are carried out with vehicles and machinery are included.

This section contains the generic methodology for the determination of direct greenhouse gas emissions from mobile combustion in vehicles and machinery during road transport. The greenhouse gases resulting from combustion are CO₂, and to a lesser extent, N₂ O and CH₄.

Since the emissions results are given in tons of CO₂ equivalent, the emissions obtained from CH₄ and N₂ O should be multiplied by their corresponding global warming potential:

$$E_{(CO_2eq)} = \sum_i (E_i * PCG_i)$$

Where E_i the emissions of gas "i" is the activity data, and GWP_i the global warming potential of gas "i".

The methodology focuses on the calculation of emissions, which is based on the application of the following expression for each greenhouse gas emitted at each emission source:

$$E_{(GEI_i)} = DA * FE$$

This expression was applied for each mobile combustion source or source stream previously identified, and for each pollutant i (CO₂, CH₄ and N₂O).

CO₂ emissions from combustion depend basically on fuel consumption and fuel composition (carbon content). On the other hand, N₂O and CH₄ emissions also depend on the type of combustion technology used, combustion conditions, among other factors.

Methodology for the determination of CO₂ of flue gas.

The calculation of CO emissions₂ derived from mobile combustion in vehicles and machinery is determined by applying the following expression:

$$E_{(CO_2)} = DA (TJ) * FE (tCO_2 / TJ)$$

Where:

Activity data (TJ): is defined as the energy content of the fuel consumed, expressed in TJ. This value was obtained from the product of the fuel consumed (expressed in mass units) and the Lower Calorific Value of the corresponding fuel.

Emission Factor: expressed in t CO₂ / TJ and depending on the type and characteristics of the fuel used in each case. For each fuel there is a specific CO₂ emission that is closely linked to the carbon content of the fuel in question. All carbon is considered to be completely oxidized to CO₂ (oxidation factor = 1).

The CO₂ emissions, as they do not depend on the type of technology, can be determined by applying this expression for each type of fuel consumed (diesel, gasoline, etc.), and it is not necessary to estimate the actual consumption for each type of vehicle and machinery.

The procedure used to determine the factors involved in the calculation is specified below.

a) Activity data

Consumption data in the specific unit of measurement was obtained through the project developer. The pertinent conversions were made to obtain the activity data in energy units.

b) Emission factor

The factors in Chapter 3 of Volume 2 of the IPCC Guidelines were used.

Methodology for the determination of CH₄ and N₂O from flue gas.

Unlike CO₂, CH₄ and N₂O emissions depend, in addition to fuel composition, on the combustion and emission control technology of the boilers, among other factors.

The estimation of CH₄ and N₂O was also based on the product of the activity data by an emission factor, as shown in the following expression:

$$E_{(CH_4 \text{ or } N_2O)} = DA \text{ (TJ)} * FE \text{ (tCH}_4 \text{ or N}_2\text{O/TJ)}$$

Where:

Activity data: refers to the amount of fuel consumed annually in TJ.

Emission factor: data expressed in kg CH₄ or N₂O per TJ.

a) Activity data

The activity data is the fuel consumption expressed in TJ, i.e., as for determining CO emissions₂.

b) Emission factor

The factors in Chapter 3 of Volume 2 of the IPCC Guidelines were used.

- **Fugitive emissions produced by natural gas flaring.**

This section develops the methodology for the determination of fugitive emissions from combustion in natural gas flares during the operation phase.

The estimation of greenhouse gas emissions was based on calculation methodology, ruling out in principle the possibility of continuous measurement.

The greenhouse gases resulting from combustion are CO₂, and to a lesser extent CH₄.

Since the annual emissions results should be given in tons of CO₂ equivalent, the emissions obtained from CH₄ should be multiplied by their corresponding global warming potential:

$$E_{(CO_2eq)} = \sum_i (E_i * PCG_i)$$

Where E_i the emissions of gas "i" is the activity data, and GWP_i the global warming potential of gas "i".

As is the case for fixed source combustion, the methodology used focuses on the calculation of emissions, which is based on the application of the following expression for each greenhouse gas emitted at each emission source:

$$E_{(GEI_i)} = DA * FE$$

This expression was applied for each identified mobile combustion source or source stream, and for each pollutant i (CO_2 and CH_4).

CO emissions₂ derived from combustion depend basically on fuel consumption and fuel composition (carbon content).

On the other hand, CH emissions₄ also depend on the type of combustion technology used, the fraction of natural gas that is burned during flaring, combustion conditions, among other factors.

Methodology for the determination of CO_2 of flue gas.

The calculation of fugitive CO emissions₂ derived from natural gas flaring is determined by applying the following expression:

$$E_{(CO_2)} = H_j (TJ) * OF * DF * FE (tCO_2 / TJ)$$

Where:

H_j (TJ): is defined as the energy content of the fuel consumed, expressed in TJ. This value was obtained from the product of the fuel consumed (expressed in mass units) and the Lower Calorific Value of the corresponding fuel.

Oxidation Factor (OF): is defined as the fraction of carbon in the fossil fuel that is completely oxidized during combustion. Companies should assume a value of 1.0, consistent with national (IPCC 2006) and corporate (API 2009) accounting practices for reporting in the industry.

Destruction Factor (DF): is defined as the fraction of fossil fuel that is destroyed during combustion. Companies should assume a value of 0.98, consistent with accounting practices for national (IPCC 2006) and corporate (API 2009) reporting in the industry.

Emission Factor (EF): expressed in $t CO_2^{12} / TJ$ and depending on the type and characteristics of the fuel used in each case. For each fuel there is a specific CO_2 emission that is closely linked to the carbon content of the fuel in question.

¹² Tons of carbon dioxide.

The CO₂ emissions, since they do not depend on the type of technology, could be determined by applying this expression to the total amount of fuel consumed, since the records were aggregated.

The procedure used to determine the factors involved in the calculation is specified below.

a) H_i

Consumption data were obtained in the specific unit of measurement. The pertinent conversions were made to obtain the activity data in energy units.

b) Oxidation factor

A value of 1.0 was taken, consistent with accounting practices for national (IPCC 2006) and corporate (API 2009) reporting in the industry.

b) Destruction factor

A value of 0.98 was taken, consistent with accounting practices for national (IPCC 2006) and corporate (API 2009) reporting in the industry.

b) Emission factor

The factors in Chapter 2 of Volume 2 of the IPCC Guidelines were used.

Methodology for the determination of CH₄ of flue gas.

Unlike CO₂, CH₄ emissions depend on the type of combustion technology used, the fraction of natural gas that is burned during flaring, combustion conditions, among other factors.

The estimation of CH₄ was also based on the product of the activity data by an emission factor, as shown in the following expression:

$$E_{(CH_4)} = H_i (TJ) * (1-DF) * FE (tCH_4 / TJ)$$

Where:

H_i (TJ): is defined as the energy content of the fuel consumed, expressed in TJ. This value was obtained from the product of the fuel consumed (expressed in mass units) and the Lower Calorific Value of the corresponding fuel.

Destruction Factor (DF): is defined as the fraction of fossil fuel that is destroyed during combustion. Companies should assume a value of 0.98, consistent with accounting practices for national (IPCC 2006) and corporate (API 2009) reporting in the industry.

Emission factor (EF): data expressed in kg CH₄ or N₂O per TJ.

The procedure used to determine the factors involved in the calculation is specified below.

a) H_i

The activity data is the fuel consumption expressed in TJ, i.e., as for determining CO₂ emissions.

b) Destruction factor

A value of 0.98 was taken, consistent with accounting practices for national (IPCC 2006) and corporate (API 2009) reporting in the industry.

b) Emission factor

The factors in Chapter 2, Volume 2, Chapter 2 of the 2006 IPCC Guidelines were used.

- **Fugitive emissions produced by natural gas losses in the system.**

This section develops the methodology for the determination of fugitive emissions due to natural gas losses in the system during the operation phase.

The estimation of greenhouse gas emissions was based on calculation methodology, and the greenhouse gases resulting from the losses are corresponding to methane (CH₄).

Since the annual emissions results should be given in tons of CO₂ equivalent, the obtained methane emissions (CH₄) should be multiplied by their corresponding global warming potential:

$$E_{(CO_2eq)} = \sum_i (E_i * PCG_i)$$

Where E_i the emissions of gas "i" is the activity data, and GWP_i the global warming potential of gas "i".

Methodology for the determination of CH₄ for natural gas losses in the system.

The estimation of CH₄ has been based on the product of the amount of natural gas fugated in the system by the fraction of CH₄ contained in the natural gas, as represented in the following expression:

$$E_{(CH_4)} = H_j (Tn) * (F)_{CH_4}$$

Where:

H_j (Tn): is defined as the amount of natural gas leaked into the system, measured in mass units.
CH fraction₄ (F_{CH₄}): is defined as the fraction of CH₄ in natural gas. Companies can assume a mass fraction of 0.95, which is typical for processed natural gas.

The procedure used to determine the factors involved in the calculation is specified below.

a) H_j

The activity datum is the amount of natural gas fugated into the system, measured in units of mass.

b) Fraction of CH₄ (F)_{CH₄}

The value of 0.95 was taken, which is typical of processed natural gas.

Scope 2 Emissions Calculation Methodologies

- **Indirect emissions associated with electricity consumption.**

This section includes the methodology used to determine indirect emissions derived from electricity consumption during the generation of the electricity consumed.

Emissions associated with the generation of purchased electricity originate from the combustion of fuels in the different electricity generation technologies.

The calculation of GHG emissions from electricity generation is based on the application of the following expression:

$$E = DA(kWh) * FE(kgGEI/kWh)$$

Where:

Activity Data (kWh): refers to the amount of electricity consumed during the scope of the inventory, expressed in kWh.

Emission Factor (kg GHG/kWh): in this case, the emission factor represents the unit GHG emissions per kWh of electricity generated.

The procedure for determining the factors involved in the calculation is specified below:

a) Activity data

The activity data represents electricity consumption expressed in kWh as determined from supplier invoices or from electric meter readings.

b) Emission factor (EF)

The EF used was based on the value of the Dominican Republic's own electricity mix (0.6216 kg CO₂ eq/kWh, Standardized baseline: Grid Emission Factor for the Dominican Republic, ASB0047-2020).

Scope 3 Emissions Calculation Methodologies

Scope 3 emissions, as contemplated by the GHG Protocol or the ISO 14064-1 standard, are optional, but due to the weight this Scope has in the calculation of the Carbon Footprint, it must be included.

Scope 3 emissions were calculated using the calculation tool developed by the Greenhouse Gas Protocol organization specifically for the calculation of gas emissions associated with transportation based on IPCC methodologies.

This section develops the methodology used to determine direct emissions from the transportation of goods in the construction phase and fuels in the operation phase.

For the normal development of the construction and operation activities of the project, some processes related to construction, operation and transportation are included, which are carried out with ships, airplanes and trucks.

This section contains the generic methodology for the determination of indirect greenhouse gas emissions from the transportation by ship and trucks of the equipment, mechanical structures, construction materials, fuels, etc., that make up the project.

The greenhouse gases resulting from transportation are CO₂, and to a lesser extent, N₂ O and CH₄.

Since the emissions results are given in tons of CO₂ equivalent, the emissions obtained from CH₄ and N₂ O should be multiplied by their corresponding global warming potential:

$$E_{(CO_2eq)} = \sum_i (E_i * PCG_i)$$

Where E_i the emissions of gas "i" is the activity data, and GWP_i the global warming potential of gas "i".

The methodology focuses on the calculation of emissions, which is based on the application of the following expression for each greenhouse gas emitted at each emission source:

$$E_{(GEI_i)} = DA * FE$$

This expression was applied for each transport source previously identified, and for each pollutant i (CO₂, CH₄ and N₂ O).

CO₂ emissions from freight transport depend basically on the type of transport, distance and weight transported. On the other hand, N₂ O and CH₄ emissions also depend on the type of combustion technology used, combustion conditions, among other factors.

Methodology for the determination of CO₂ of flue gas.

The calculation of CO emissions₂ derived from the transportation of goods is determined by applying the following expression:

$$E_{(CO_2)} = DA (TKm) * FE (tCO_2 / TKm)$$

Where:

Activity data (TKm): defined as the weight transported per km traveled, expressed in TKm. This value was obtained from the product of the total weight transported and the distance traveled by the means of transport (expressed in mass units per distance).

Emission Factor: expressed in t CO₂ / TKm and depending on the type and characteristics of the type of transport used in each case.

The procedure used to determine the factors involved in the calculation is specified below.

a) Activity data

Data on total weight transported and distance were obtained. The pertinent conversions were made to obtain the activity data.

b) Emission factor

Emission factors provided by GHG Protocol were used.

Methodology for the determination of CH₄ and N₂O from flue gas.

The estimation of CH₄ and N₂O was also based on the product of the activity data by an emission factor, as shown in the following expression:

$$E_{(CH_4 \text{ or } N_2O)} = DA \text{ (TKm)} * FE \text{ (tCH}_4 \text{ or N}_2\text{O/TKm)}$$

Where:

Activity data (TKm): defined as the weight transported per km traveled, expressed in TKm. This value was obtained from the product of the total weight transported and the distance traveled by the means of transport (expressed in mass units per distance).

Emission Factor: expressed in t CO₂ / TKm and depending on the type and characteristics of the type of transport used in each case.

a) Activity data

Data on total weight transported and distance were obtained. The pertinent conversions were made to obtain the activity data.

b) Emission factor

Emission factors provided by GHG Protocol were used.

6.1.15.2.2.4 Presentation of the results of the GHG emissions estimation for the construction and operation phases of the project.

➤ **Construction Phase**

• **Scope 1 Emissions**

✓ **Direct emissions from stationary sources**

These emissions come from the burning of diesel fuel in the emergency power generators. It has been estimated that 1 100 kV emergency power generator, with an average consumption of 22 l/h, was used during the construction process of the project (6,336 hours of total use during the 36 months of construction).

The information provided is shown below, as well as the emission data:

- Activity Data: 36,682.10 gallons of diesel.

- Greenhouse Gas Emissions:

- CO₂: 371.61 Tn CO₂.
- CH₄: 0.015 Tn CH₄.
- N₂O: 0.0030 Tn N₂ O.
- **Total: 372.83 Tn CO₂ eq**

- ✓ **Direct emissions from mobile sources**

These emissions come from the burning of fuels such as diesel in mobile sources such as heavy machinery and administrative vehicles. According to information provided by the construction contractor, 4 pieces of heavy machinery will be used with an average consumption of 4 gallons/hour during the entire construction phase of the project (3,360 hours of total use during the 36 months of construction).

The information provided is shown below, as well as the emission data:

- Activity Data: 13,440 gallons of diesel.

- Greenhouse Gas Emissions:

- CO₂: 136.15 Tn CO₂.
- CH₄: 0.0055 Tn CH₄.
- N₂O: 0.0011 Tn N₂ O.
- **Total: 136.60 Tn CO₂ eq**

- **Scope 2 Emissions**

- ✓ **Indirect emissions associated with electricity consumption.**

Emissions associated with the generation of the electricity acquired originate from the combustion of fuels in the different electricity generation technologies. Monthly electricity consumption associated with the construction phase has been estimated at 420 kWh/month (estimated monthly office electricity consumption).

The information provided is shown below, as well as the emission data:

- Activity Data: 18,900 kWh.

- Greenhouse Gas Emissions:

- **Total: 11.75 Tn CO₂ eq.**

- **Scope 3 Emissions**

- ✓ **Indirect emissions associated with transportation of equipment, electrical material, structures and construction materials.**

Indirect emissions associated with the transportation of equipment originate from the transportation by ship and truck of all the equipment, electrical material, structures and construction materials that are part of the construction of the Manzanillo Energy Consortium Power Plant project with a capacity of approximately 420 MW, from different countries around the world to the Dominican Republic and from the transportation by truck from the port of Santo Domingo to the municipality of Pepillo Salcedo, Montecristi province.

The information provided is shown below, as well as the emission data:

- Ship transportation Germany - Dominican Republic:
 - Activity Data 1: 12,516.83 tn (total weight of equipment coming from Germany).
 - Activity Data 2: 8,000 km (Germany - Dominican Republic).
 - Greenhouse Gas Emissions:
 - CO₂: 3,292.16 Tn CO₂.
 - CH₄: 0.281 Tn CH₄.
 - N₂ O: 0.096 Tn N₂ O.
 - **Total: 3,325.48 Tn CO₂ eq**
- Ship transportation Croatia - Dominican Republic:
 - Activity Data 1: 391.85 tn (total weight of equipment coming from Croatia).
 - Activity Data 2: 9,800 km (Croatia - Dominican Republic).
 - Greenhouse Gas Emissions:
 - CO₂: 126.25 Tn CO₂.
 - CH₄: 0.011 Tn CH₄.
 - N₂ O: 0.0037 Tn N₂ O.
 - **Total: 127.53 Tn CO₂ eq**
- Ship transportation China - Dominican Republic:
 - Activity Data 1: 2,590.8 tn (total weight of equipment coming from China).
 - Activity Data 2: 19,000 km (China-Dominican Republic).
 - Greenhouse Gas Emissions:
 - CO₂: 1,618.39 Tn CO₂.
 - CH₄: 0.138 Tn CH₄.
 - N₂ O: 0.047 Tn N₂ O.
 - **Total: 1,634.77 Tn CO₂ eq**

- Truck transportation:
 - Activity Data 1: 123,788.30 tn (total weight of concrete transported by truck).
 - Activity Data 2: 340 km (Puerto Caucedo SD to Pepillo Salcedo).
 - Greenhouse Gas Emissions:
 - CO₂: 8,561.90 Tn CO₂.
 - CH₄: 100.90 Tn CH₄.
 - N₂ W: 77.84 Tn N W.₂
 - **Total: 8,585.36 Tn CO₂ eq**

➤ **Operating Phase (calculations made for 25 years of useful life)**

- **Scope 1 Emissions**

- ✓ **Combustion emissions from stationary sources produced by the combustion of natural gas for electricity generation.**

These emissions come from the burning of natural gas fuel to generate electricity for the project. According to data provided by the developer, annual consumption is estimated at 20 TeraBTU of natural gas.

The information provided is shown below, as well as the emission data:

- Activity Data: 20 TeraBTU of natural gas.
- Greenhouse Gas Emissions:
 - CO₂: 1,183,822 Tn CO₂.
 - CH₄: 21.11 Tn CH₄.
 - N₂O: 2.11 Tn N₂O.
 - **Annual total: 1,184,972.26 Tn CO₂ eq**
 - **Total 25 years useful life: 29,624,306.50 Tn CO₂ eq**

- ✓ **Direct emissions from mobile sources**

These emissions come from the burning of fuels such as diesel in mobile sources such as heavy machinery and administrative vehicles. According to information provided by the developer, it is estimated that a total of about 2,000 hours per year of vehicle operation with an average consumption of 2 gallons/hour during the entire operation phase of the project (50,000 hours of total use during the 25 years of operation).

The information provided is shown below, as well as the emission data:

- Activity Data: 4,000 gallons of diesel.

- Greenhouse Gas Emissions:
 - CO₂: 40.52 Tn CO₂.
 - CH₄: 0.0016 Tn CH₄.
 - N₂O: 0.00033 Tn N₂ O.
 - **Annual total: 40.65 Tn CO₂ eq**
 - **Total 25 years useful life: 1,016.37 Tn CO₂ eq**

✓ **Fugitive emissions produced by natural gas flaring.**

These emissions come from the burning of natural gas fuel in flares as a safety device in those plants that generate, store or handle gases. According to information provided by the developer, it is estimated that 10% of the total natural gas burned for electricity generation will be burned in flares as a plant safety device (2 TeraBTU of natural gas per year).

The information provided is shown below, as well as the emission data:

- Activity Data: 2 TeraBTU of natural gas.
- Greenhouse Gas Emissions:
 - CO₂: 118,382.20 Tn CO₂.
 - CH₄: 2.11 Tn CH₄.
 - N₂ O: 0.21 Tn N₂O.
 - **Annual total: 118,497.22 Tn CO₂ eq**
 - **Total 25 years useful life: 2,962,430.65 Tn CO₂ eq**

✓ **Fugitive emissions produced by natural gas losses in the system.**

These emissions come from natural gas leaks in the plant's piping, equipment, etc., system. According to information provided by the developer, it is estimated that 1% of the total natural gas burned for electricity generation will be leaks in the plant's piping, equipment, etc. (0.2 TeraBTU of natural gas per year).

The information provided is shown below, as well as the emission data:

- Activity Data: 0.2 TeraBTU of natural gas (equivalent to about 4,320.12 Tn of natural gas).
- Greenhouse Gas Emissions:
 - CH₄: 4,104.11 Tn CH₄.
 - **Annual total: 86,186.39 Tn CO₂ eq**
 - **Total 25 years useful life: 2,154,659.85 Tn CO₂ eq**
- **Scope 2 Emissions**
 - ✓ **Indirect emissions associated with electricity consumption.**

Emissions associated with the generation of the electricity acquired originate from the combustion of fuels in the different electricity generation technologies. Annual electricity consumption associated with the operation phase has been estimated at 43.8 GWh/month.

The information provided is shown below, as well as the emission data:

- Activity Data: 43.8 GWh.
- Greenhouse Gas Emissions:
 - **Total: 27,226.08 Tn CO₂ eq.**
 - **Total 25 years useful life: 680,652.00 Tn CO₂ eq**
- **Scope 3 Emissions**
 - ✓ **Indirect emissions associated with the transport of liquefied natural gas by ship.**

Indirect emissions associated with the transportation of liquefied natural gas by ship from the place of purchase (Elba Island and Trinidad and Tobago) to the LNG Import Terminal with Storage and Regasification. The distance traveled will be about 1,600 km each way. The amount of LNG to be transported annually is 384,000 tons.

The information provided is shown below, as well as the emission data:

- Boat transportation Elba Island/Trinidad and Tobago - Dominican Republic:
 - Activity Data 1: 384,000 tn (total annual weight of LNG).
 - Activity Datum 2: 1,600 km (Elba Island/Trinidad and Tobago - Dominican Republic).
 - Greenhouse Gas Emissions:
 - CO₂: 20,199.84 Tn CO₂.
 - CH₄: 1725.40 Tn CH₄.
 - N₂ W: 589.16 Tn N₂ W.
 - **Annual total: 20,404.27 Tn CO₂ eq**
 - **Total 25 years useful life: 510,106.85 Tn CO₂ eq**

6.1.15.2.2.5 Summary of the Carbon Footprint results of the construction and operation phases of the project.

This section presents the final data by phase, scope and emission source.

The results are presented below:

➤ **Construction Phase**

• Scope 1:

Fixed Sources: **372.83 Tn CO₂ eq.**

2. Mobile Sources: **136.60 Tn CO₂ eq.**

Total scope 1: 509.43 Tn CO₂ eq.

• Scope 2:

Electricity Consumption: **11.75 Tn CO₂ eq.**

Total scope 2: 11.75 Tn CO₂ eq.

• Scope 3:

Equipment transportation: **13,673.14 Tn CO₂ eq.**

Total scope 3: 13,673.14 Tn CO₂ eq.

Total construction phase estimate: 14,194.32 Tn CO₂ eq.

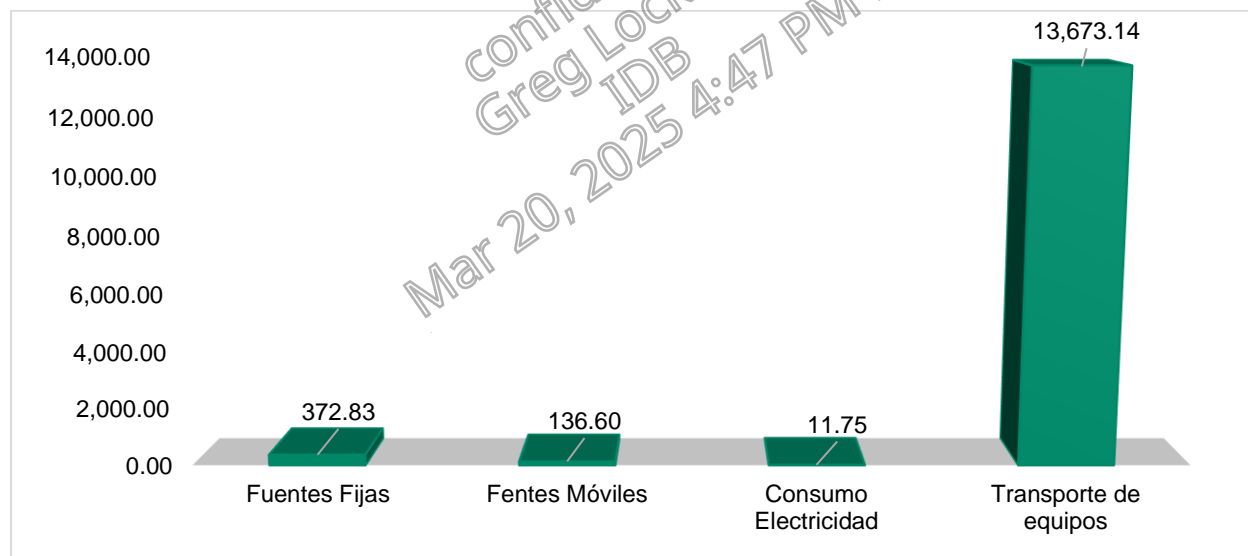


Figure 6-189. Estimated carbon footprint of the construction phase.

Source: Prepared by EMPACA, based on information provided by CME.

➤ **Operating Phase (calculations made for 25 years of useful life)**

• Scope 1:

1. Stationary Sources: **29,624,303.50 Tn CO₂ eq**

2. Mobile Sources: **1,016.37 Tn CO₂ eq.**
3. Fugitive emissions from flaring: **2,962,430.65 Tn CO₂ eq.**
4. Fugitive Emissions losses: **2,154,659.85 Tn CO₂ eq.**

Total scope 1: 34,742,410.37 Tn CO₂ eq.

- Scope 2:

Electricity Consumption: **680,652.00 Tn CO₂ eq.**

Total scope 2: 680,652.00 Tn CO₂ eq.

- Scope 3:

LNG transportation: **510,106.85 Tn CO₂.**

Total scope 3: 510,106.85 Tn CO₂ Tn CO₂ eq.

Total estimated operation phase (25 years): 35,933,169.22 Tn CO₂ eq.

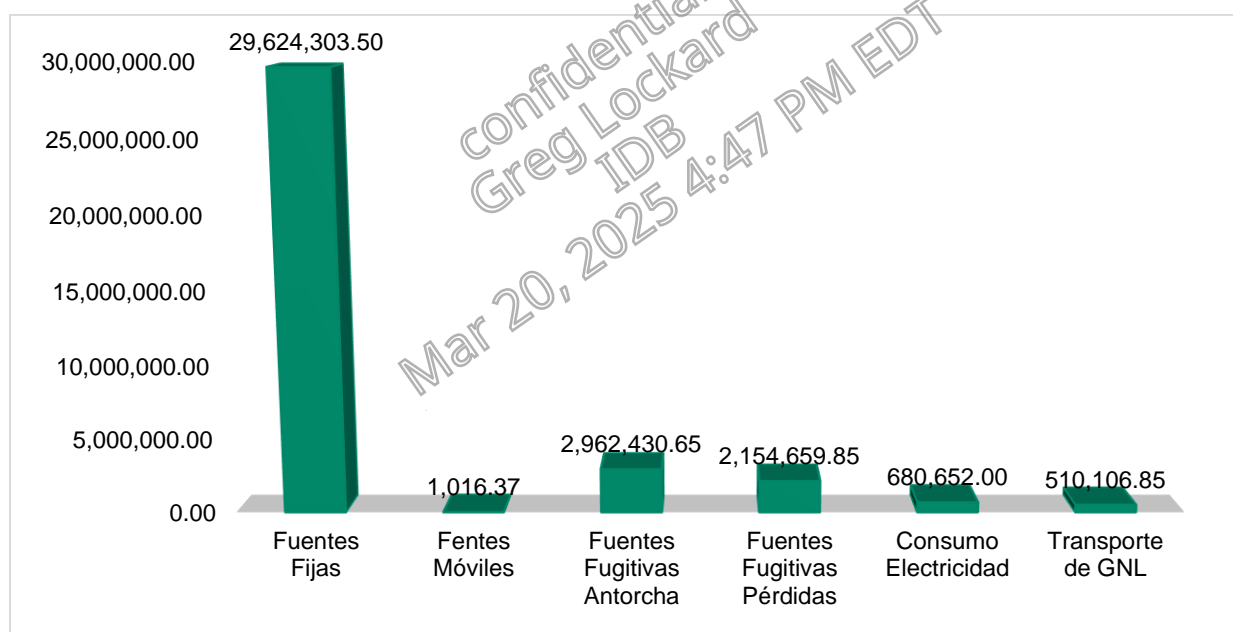


Figure 6-190. Carbon Footprint estimation of the operation phase.

Source: Prepared by EMPACA, based on information provided by CME.

➤ Consolidated Emissions by Phase

Total estimated emissions for the Construction Phase: **14,194.32 Tn CO₂ eq.**

Total estimated emissions for the Operation Phase (25 years): **35,933,169.22 Tn CO₂ eq**
(1,437,326.77 Tn CO₂ eq per year of operation).

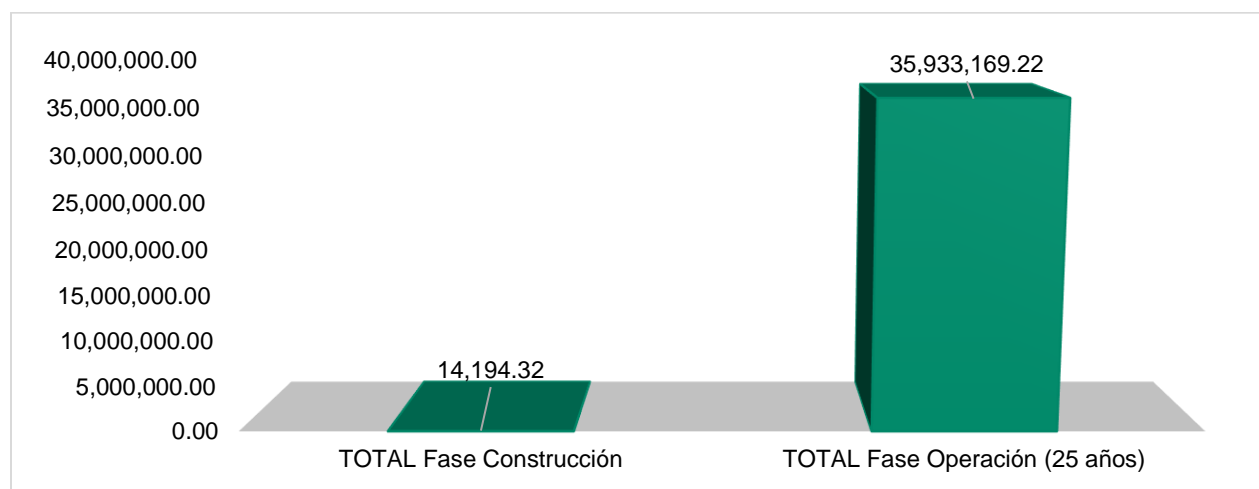


Figure 6-191. Estimated GHG Emissions by Phase. .

Source: Prepared by EMPACA, based on information provided by CME.

6.1.15.2.2.5.1 Comparison of greenhouse gas emissions produced by electricity production through the combustion of natural gas from the project and other fuels.

With the installation of the Manzanillo Energy Consortium Power Plant project with a capacity of approximately 420 MW, it has been estimated that 3,200,000 MWh per year and 80,000,000 MWh will be generated during the 25-year life of the project.

In terms of climate change mitigation, with the production of electricity from the Manzanillo Energy Consortium Power Plant project with a capacity of approximately 420 MW, the emission of a large amount of tons of CO₂ eq will be avoided annually compared to other electricity production technologies.

Table 6-65 and in Figure 6-192 show estimates of tons of CO₂ eq from burning 20 TeraBTU of natural gas compared to other electricity production technologies and fuels (Greenhouse gas Protocol and 2014 IPCC Guidelines for National Greenhouse Gas Inventories).

Table 6-65. Comparison of estimated CO emissions eq.2

Fuel condition	Fuel Type	Quantity	Unit	Tn CO ₂ eq Annual	Tn CO ₂ eq Useful Life
Gaseous fossil	Manzanillo Energy Consortium	20	Tera BTU	1,184,972.26	29,624,306.50
Solid fossil	Anthracite	20	Tera BTU	2,083,305.50	52,082,637.53
Solid fossil	Municipal waste (Non biomass fraction)	20	Tera BTU	1,975,147.20	49,378,680.00
Solid fossil	Petroleum coke	20	Tera BTU	2,062,572.79	51,564,319.65
Liquid fossil	Gas/Diesel oil	20	Tera BTU	1,568,785.99	39,219,649.65

Fuel condition	Fuel Type	Quantity	Unit	Tn CO ₂ eq Annual	Tn CO ₂ eq Useful Life
Liquid fossil	Gasoline engine	20	Tera BTU	1,467,496.39	36,687,409.65
Liquid fossil	Natural Gas Liquids	20	Tera BTU	1,359,876.19	33,996,904.65
Liquid fossil	Residual fuel oil	20	Tera BTU	1,638,422.59	40,960,564.65
Gaseous fossil	Ethane	20	Tera BTU	1,301,033.26	32,525,831.48
Gaseous fossil	Liquified Petroleum Gases	20	Tera BTU	1,332,686.26	33,317,156.48
Biomass	Charcoal	20	Tera BTU	2,503,963.32	62,599,083.00
Biomass	Landfill gas	20	Tera BTU	1,153,319.26	28,832,981.48
Biomass	Municipal wastes (Biomass fraction)	20	Tera BTU	2,150,293.80	53,757,345.00
Biomass	Wood or Wood waste	20	Tera BTU	2,403,517.80	60,087,945.00

Source: GHG Protocol Fixed Source Emissions Calculation Tool.

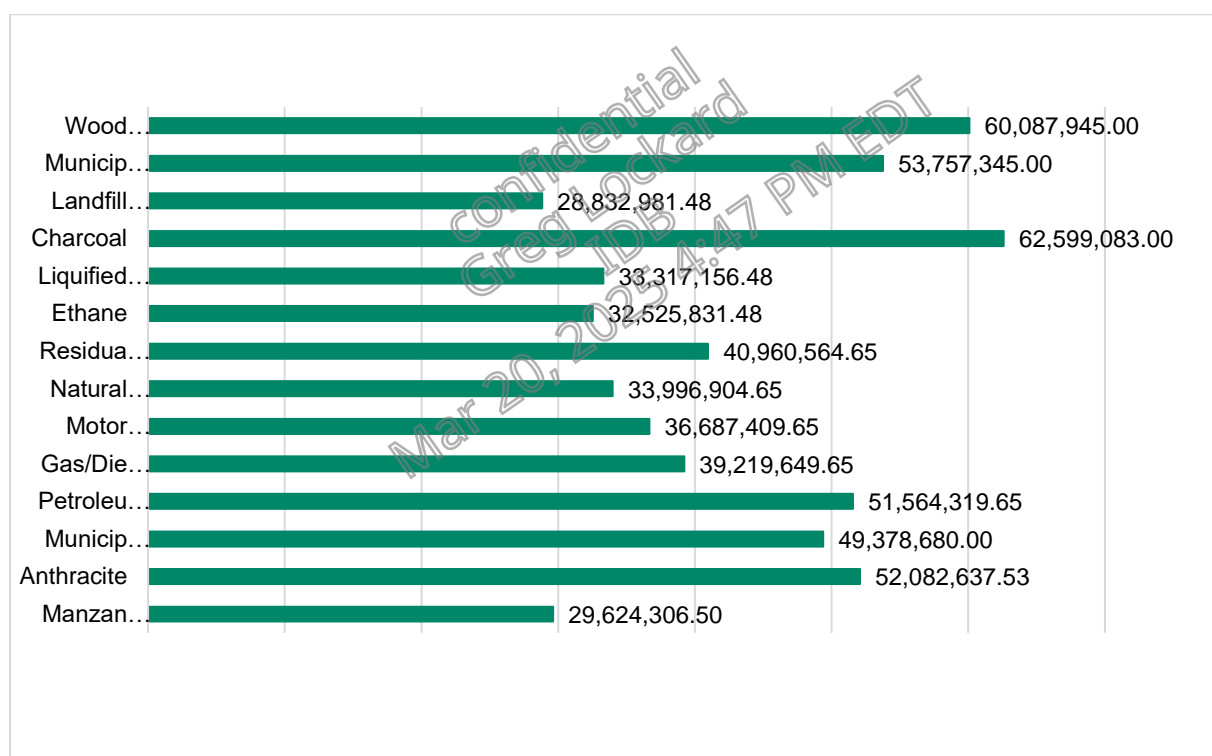


Figure 6-192. Tons of CO_{2eq} over the life of the project compared to different technologies.

Source: EMPACA.

Applied to the current Manzanillo Energy Consortium Power Plant project with a capacity of approximately 420 MW, according to the IFC performance standard, in the case of projects that are projected to produce or are producing amounts = > 25,000 tons of CO₂ eq annually, the developer must quantify emissions annually in accordance with internationally recognized methodologies.

As a conclusion of the table and figure above, it can be said that with the construction and operation of the Manzanillo Energy Consortium Power Plant project with a capacity of approximately 420 MW, a large amount of greenhouse gas emissions will no longer be emitted into the atmosphere annually and during the 25 years of the project's useful life, compared to different technologies and fuels.

6.1.15.3 Climate change risk analysis

Key concepts for climate change risk analysis:

Climate change (IPCC): The United Nations Framework Convention on Climate Change (UNFCCC), in Article 1, defines climate change as "change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. The UNFCCC thus differentiates between climate change attributable to human activities that alter atmospheric composition and climate variability attributable to natural causes".

Climate variability represents variations in the mean state and other statistics (e.g., standard deviations, occurrence of extremes, etc.) of the climate on all temporal and spatial scales beyond individual weather phenomena (IPCC 2001). Climate variability is the result of the interaction between climate variables in the short term and does not necessarily represent a trend.

According to the IPCC, **vulnerability to climate change** is the level to which a system is susceptible to, or unable to withstand, the adverse effects of climate change, including climate variability and extreme events. Vulnerability is a function of the character, magnitude and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity, each of these variables being defined as follows:

Sensitivity: The level at which a system is affected, either negatively or positively, by climate-related stimuli.

Exposure: The type and degree to which a system is exposed to significant climatic variations.

Adaptation is the result of reduced exposure and vulnerability to climate hazards and increased resilience to potential adverse effects of extreme weather events¹³.

Adaptive Capacity: The ability of a system to adjust to climate change (including climate variability and extremes) in order to moderate potential damages, take advantage of positive consequences, or withstand negative consequences.

¹³ PCC (2012), Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change, Field et al. (eds.), Cambridge University Press, Cambridge and New York.

Vulnerability (V) results from the combined expression of three variables: Exposure (E), Sensitivity (S) and Adaptive Capacity (AC) (Turner et al., 2003¹⁴ ; Downing, T. and A. Patwardhan¹⁵ 2003; IPCC, 2007).¹⁶

Resilience is the capacity of a social or ecological system to absorb a disturbance without losing neither its basic structure or modes of functioning, nor its capacity for self-organization, nor its ability to adapt to stress and change.

Climate risk is assumed to be the probability of harmful consequences or expected losses (e.g., death, injury, loss of livelihoods, reduced economic productivity, environmental damage) arising from the interaction between climate hazards and vulnerability conditions (adapted from UN/ISDR 2009).

$$\text{Climate Risk} = \text{Climate Hazard} \times \text{Climate Vulnerability}$$

6.1.15.3.1 Global climate change risk analysis

The impacts of recent climate-related extreme events, such as heat waves, droughts, floods, tropical storms, hurricanes and forest fires, highlight the significant vulnerability and exposure of some ecosystems and human systems to current climate variability.

Climate-related hazards exacerbate other stressors, often with negative livelihood outcomes, especially for people living in poverty.

Responding to climate change risks involves making decisions in a changing world, with constant uncertainty about the severity and timing of climate change impacts and limits on the effectiveness of adaptation. The adaptation and mitigation options chosen in the short term will affect climate change risks throughout the 21st century.

The risk assessment in the Working Group II contribution to the Fifth Assessment Report (IPCC, 2014) presents the relationship between hazards, exposure and vulnerability that integrally make up the climate risk of a project or ecosystem. Uncertainties about future vulnerability, exposure and responses of interconnected human and natural systems can be significant. Because of this, risk assessments require the study of a wide range of socio-economic futures.

14 Turner, B.L., R.E. Kasperson, P.A. Matson, J.J. McCarthy, R.W. Corell, L. Christensen, N. Eckley, J.X. Kasperson, A. Luers, M.L. Martello, C. Polsky, A. Pulsipher, and A. Schiller (2003). A framework for vulnerability analysis in sustainability science. Proceedings of the National Academy of Sciences. Vol. 100(4)

15 Downing, T. and A. Patwardhan (Lead Authors) (2003). Vulnerability assessment for climate adaptation. UNDP

Adaptation Policy Framework Technical Paper No. 3

16 IPCC, 2007: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Lead writing team: Pachauri, R.K. and Reisinger, A. (editors)]. IPCC, Geneva, Switzerland, 104 pp.

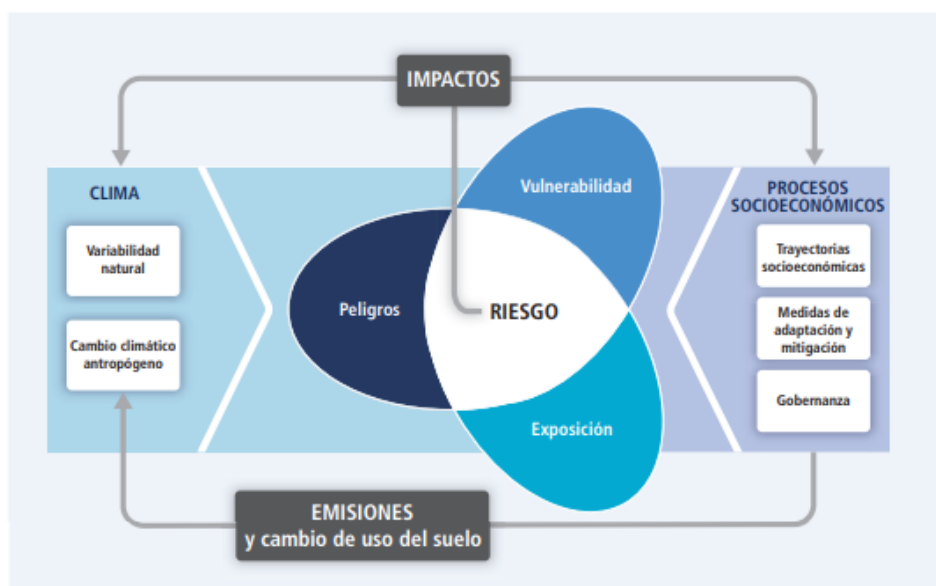


Figure 6-193. Illustration of basic climate risk concepts presented in the Fifth Assessment Report.

Source: Fifth Assessment Report (WGII AR5) (IPCC, 2014).

Climate risk derives from the interaction of climate-related hazards (including hazard events and trends) with the vulnerability and exposure of human and natural systems. Changes in the climate system (left) and socioeconomic processes, including adaptation and mitigation (right), are drivers of hazards, exposure and vulnerability.

Projections of climate change during the 21st century indicate that renewable surface water and groundwater resources will be substantially reduced in most dry subtropical regions, intensifying competition for water between sectors.

In this century, the magnitudes and rates of climate change associated with medium to high emissions scenarios will pose a high risk of abrupt and irreversible regional-scale change in the composition, structure and function of terrestrial and inland aquatic ecosystems, including wetlands.

The projected long-term impacts of climate change also include projected sea level rise throughout the 21st century and thereafter, these ecosystems will experience increasingly adverse impacts such as submergence, inundation, coastal erosion, and ocean acidification, causing alterations to coastal-marine ecosystems.

For most economic sectors, projections indicate that the impacts of drivers such as changes in population, age structure, income, technology, relative prices, lifestyle, regulation and governance will be greater than the impacts of climate change, yet scientists and experts have not been able to quantify the overall economic impacts of climate change and the implementation of climate change adaptation and mitigation measures.

Global perspective on climate-related hazards

The latest report of the Intergovernmental Panel on Climate Change (IPCC, 2023) on the impacts of global warming at 1.5 °C and 2°C, indicates that extreme land temperatures are projected to warm more than the global average surface temperature, extremely hot days in mid-latitudes will warm to about 3 °C at a global warming of 1.5 °C and about 4 °C at a global warming of 2 °C, and extremely cold nights in high latitudes may increase to about 4.5 °C at a global warming of +1.5 °C and about 6 °C at +2 °C . The number of hot days is projected to increase in most terrestrial regions, with larger increases in the tropics. Risks from droughts and precipitation deficits are projected to be greater than 2 °C compared to 1.5 °C of global warming in some regions (medium confidence). Risks from heavy precipitation are projected to be greater than 2°C compared to 1.5°C of global warming in several regions of high latitudes and/or elevations in the Northern Hemisphere, eastern Asia, and eastern North America.

With respect to precipitation, heavy precipitation associated with tropical cyclones is projected to be higher at 2 °C compared to 1.5 °C global warming. Even heavy precipitation, when aggregated on a global scale, is projected to be higher at 2 °C than at 1.5 °C global warming. As a consequence of heavy precipitation, the fraction of the global land area affected by flood risks is projected to be higher at 2 °C compared to 1.5 °C of global warming.

Rising global temperatures amplify the exposure of small islands, low-lying coastal areas, and deltas to risks associated with sea level rise for many human and ecological systems, including increased saltwater intrusion, flooding, and infrastructure damage.

The risks associated with sea level rise are greater at 2 °C than at 1.5 °C. The slower rate of sea level rise with global warming of 1.5 °C reduces these risks, allowing greater opportunities for adaptation, including management and restoration of natural coastal ecosystems and infrastructure reinforcement.

Recently, the World Meteorological Organization (WMO)¹⁷ has reported that the six major international datasets used to monitor global temperatures and consolidated show that the global annual mean temperature was 1.45 ± 0.12 °C above pre-industrial levels (1850-1900) in 2023, with this being considered the warmest year in history.

The Intergovernmental Panel on Climate Change states that climate-related risks to natural and human systems are higher for a global warming of 1.5°C than today, but lower than for 2°C.

A study last year by the WMO and the UK Met Office predicted that there is a 66% chance that the annual average near-surface temperature of the planet between 2023 and 2027 will exceed pre-industrial levels by more than 1.5 °C for at least one year. This does not mean that we will permanently exceed the 1.5 °C level specified in the Paris Agreement, which refers to long-term warming over many years.

The impacts of climate change on the critical infrastructure and territorial integrity of many states are expected to influence national security policies.

¹⁷

WMO confirms that 2023 smashes global temperature record. (2024). World Meteorological Organization. <https://wmo.int/news/media-centre/wmo-confirms-2023-smashes-global-temperature-record>

Projections indicate that, over the course of the 21st century, climate change impacts will slow economic growth, make it more difficult to reduce poverty, further undermine food security, and cause existing poverty traps to continue and new ones to be created, especially in urban areas and emerging famine hotspots.

6.1.15.3.2 Climate change risk analysis in the Caribbean Region, Dominican Republic and the area of influence of the project.

Although greenhouse gas emissions from small island developing states (SIDS) have been recognized as negligible relative to global emissions, these small states are extremely vulnerable to climate change due to their size, geographic remoteness, frequent exposure to weather and climate events, sea level rise, and relatively small populations and resources (IPCC, 2014a).

Health impacts

These conditions, in turn, pose additional challenges to their already strained health systems by increasing morbidity and mortality from extreme weather and climate events, as well as climate-sensitive diseases, including vector-, water- and food-borne infections and respiratory and non-communicable diseases (e.g., malnutrition, trauma and mental disorders). The World Health Organization (WHO) estimates that globally, between 2030 and 2050, there will be an additional 250,000 deaths per year as a result of climate change impacts on nutrition and an increase in the number of cases of malaria, diarrhea and heat exhaustion (WHO, 2014).

Climate change also affects health service delivery and access to health care in small island developing states, as most of the population and health care facilities on islands are located near coastal areas prone to tropical cyclones, floods, storms, and water supply disruptions. Damage to infrastructure and essential supplies and services affects the ability of health systems to deliver services when they are most needed in the emergency environment.

Despite the clearly defined global agenda, the international response remains slower and less ambitious than what would be needed to avoid warming greater than 1.5 °C compared to the pre-industrial period (IPCC, 2018). Moreover, globally, less than 1.5% of international resources for climate change adaptation are allocated today to health projects. Few countries are seizing the opportunity to improve health while reducing carbon emissions to protect the future of small island developing states.

Temperature changes

Climate change is already affecting Caribbean SIDS. Average surface **temperatures** in the Caribbean **have increased by about 1°C compared to pre-industrial times**. Projections indicate that, by 2070, temperatures will increase by an average of 2.8 °C across this region. Warming occurs at a rate of ~0.2 °C per decade, but is projected to accelerate if global greenhouse gas emissions are not significantly reduced (IPCC, 2018).

Rise in mean sea level and acidification

Warming oceans cause glaciers to melt faster, **raising sea levels**. The current average rate at which glaciers are melting is about **3 mm per year** and will continue to increase (IPCC, 2013). Some impacts are considered unavoidable: the projected sea level rise of more than 1 m in the Caribbean by 2100 will be a major challenge for these nations, damaging infrastructure, forcing

people to relocate, and causing devastating economic losses for tourism, agriculture and livestock, and transportation (UNDP, 2010). Freshwater systems and agriculture could also suffer damage due to salinization of groundwater reservoirs. Coral reefs, fish stocks and other ecosystem services crucial to SIDS are also affected by warming and marine acidification: at 1.5 °C warming, 70-90% of coral reefs are projected to die or be affected, and at 2.0 °C warming, up to 99% (IPCC, 2018). Among other marine species, populations of botuto or guarura (*Strombus gigas*), a mollusk that is a traditional component of the Caribbean diet may be reduced accordingly.

Intensity of tropical storms - hurricanes

Other expected impacts of ocean warming include **more violent hurricanes** and their effects, such as storm surges, **increased rainfall and flooding**. A 2 °C rise in sea surface temperatures is expected to cause a 1% to 10% increase in hurricane wind speeds and a 10% to 15% increase in precipitation near the eye of the hurricane (IPCC, 2013). Between 1966 and 2015, 449 storm, flood and drought events were recorded in the region (EM-DAT, 2018), with devastating consequences for health, livelihoods, ecosystems and socioeconomic development. For example, total damages and losses for Dominica from Hurricane Maria in 2017 have been estimated at about USD 1.3 billion, about 226% of the country's gross domestic product (GDP). Losses for Anguilla, the Bahamas, the British Virgin Islands, St. Maarten, and the Turks and Caicos Islands from Hurricanes Irma and Maria have been estimated at USD 5.4 billion (UNCTAD, 2018).

Climate change is expected to affect all Caribbean countries, but the effects could differ from country to country, depending on specific levels of vulnerability. The number of people affected by extreme events and heat-related morbidity and mortality is expected to increase, including higher incidence of vector-borne diseases, such as malaria and dengue; water-borne diseases, such as leptospirosis and gastroenteritis; and impacts on cardiovascular and respiratory diseases (PAHO, 2017a; ECLAC, 2011).

Local Climate Threats - Dominican Republic

The Dominican Republic is highly exposed to natural phenomena that repeatedly produce emergency situations and disasters of different magnitudes (IDB, 2013). Its location and geographic, topographic and orographic characteristics interact with social, economic and demographic factors, increasing risk conditions. For example, population growth and changes in demographic and economic patterns have favored uncontrolled urbanization. This, in conjunction with widespread poverty, has forced large population groups to live in disaster-prone areas. It is also important to note that the Dominican Republic shares the island with the poorest country in the Americas and is subject to strong migratory flows that also put pressure on the environment, mainly the forests¹⁸.

Critical factors in terms of vulnerability to climate change have been identified as affecting: high exposure to climate change, low adaptive capacity and the presence of potentially sensitive habitats and/or sectors¹⁹. In the country, the most devastating climate phenomena, hurricanes and tropical storms, also show strong seasonality and interannual and decadal variability²⁰. Some of the adverse impacts that are occurring and expected include:

¹⁸ Ministry of the Environment and Natural Resources/UNEP RISOE/Plenitud, 2013.

¹⁹ USAID/TNC/ IDDI/PLENITUDE, 2013.

²⁰ USAID/TETRA TECH, 2013.

- Increased extreme hydrometeorological events, risk of floods, landslides, erosion and drought.
- Pressure on drainage systems,
- Habitat loss,
- Increased risk of subsidence in prone areas,
- Heat waves and increased thermal discomfort in buildings and increased use of cooling and air conditioning,
- Increases in health problems such as heat-related illnesses and incidence of respiratory and vector problems,
- Reduced quality and yield of some crops due to high temperatures,
- Increase in drought events, diseases and agricultural pests.

According to the Analysis of Critical Points of Vulnerability to Climate Change in the Dominican Republic²¹, provinces with high to very high vulnerability include: Pedernales, Bahoruco, Barahona, Elías Piña, El Seibo and Santo Domingo. These are followed by La Altagracia, San Pedro de Macoris, Monte Plata, Peravia, **Montecristi** and Valverde. The elements that make one province more vulnerable than another to climate change are both factors of exposure to hydrometeorological events and their modifications, as well as factors of sensitivity and low adaptive capacity linked to intrinsic weaknesses of the human groups living in the territory. An important element is the significant degradation of the territory, linked to different causes, which can be observed in more or less extensive areas of the country.

In relation to climate sensitivity, the Climate Change Vulnerability Assessment report²² states that, at the household level, the agriculture and tourism sectors, which rely heavily on surface and groundwater, are sensitive to localized land use. Thus, such sectors are prone to experience declining recharge and quality due to evaporation and saline intrusion. Non-climate stressors, including population and economic pressures, exacerbate these manifestations of sensitivity and will continue to hamper efforts to reduce the vulnerability of communities and natural systems. Populations inadvertently increase their vulnerability as they exploit natural resources for their livelihoods (e.g., fishing, unsustainable forestry and farming practices) that cause irreversible damage to ecosystems.

Because the country is highly vulnerable to the impacts of climate change, it is critical to initiate an intensive adaptation process. Climate change impacts are expected to add additional stress to economic sectors, particularly tourism and agriculture. Therefore, it is important to consider climate change in sectoral policies and to strengthen local capacities to face these challenges.

Climate Change Scenarios in the Dominican Republic

A Climate Change Scenario is a representation of the climate that would be observed, under a given concentration of greenhouse gases (GHGs) and aerosols, in the atmosphere at different times in the future according to possible changes in global temperature.

Within the framework of the Third National Climate Change Communication Project of the Dominican Republic (TCNCC)²³, the Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC) carried out the simulation of national climate scenarios based on models of the selected regions of the country, and analysis of the impact of these scenarios on

²¹ USAID/TNC/IDDI/PLENITUDE, 2013

²² USAID/Tetra Tech, 2013

²³ The TCNCC implemented by the National Council for Climate Change and Clean Development Mechanism, the Ministry of Environment and Natural Resources, administered by UNDP with GEF funds.

the country's water, food and energy security. An exploratory statistical analysis of the historical daily climate records of the last three decades (1984-1993; 1994-2003; 2004-2013) of 12 surface meteorological stations in charge of ONAMET and the global climate model No. 5 (CMIP 5) was carried out. These scenarios are projections towards 2050 and 2070 of the variables: temperature, maximum, minimum temperature, maximum and minimum precipitation.

In terms of future climate scenarios for the Dominican Republic, the results are as follows:

- **Minimum temperatures will increase by between 1 °C and up to 3 °C by 2050 and will reach change values of between 2 °C and up to 6 °C by 2070**, with only the province of Independencia (Jimaní) showing negative changes (colder temperatures) of between -1 °C and -2 °C during the rainy period. By 2070, changes will increase by more than 2 °C to 6 °C, with the most evident changes in the provinces of Barahona, Monte Plata, La Romana, Hato Mayor and San Juan, the latter being the most extreme.
- **Maximum temperatures will have a more marked, generalized increase and could rise by 2°C to 3°C by 2050 and by 3°C to 5°C by 2070**. There is the exception of the provinces of Samaná and Independencia, whose changes will oscillate between values close to their natural variability, which today is between 1 °C and 3 °C. The provinces of Barahona, Monte Plata, Distrito Nacional, Hato Mayor and San Juan will be the ones where these changes will be most noticeable.
- **The dry season (December-April) could intensify even more towards 2050 and 2070**. At the point level and under any type of radiative forcing, the models coincide mostly in a decrease in total rainfall of up to 50% with respect to historical values in the provinces of Independencia, Puerto Plata, San Juan and Santiago. As well as decreases of between 10 and 30% in provinces such as Samaná, Distrito Nacional, Altagracia, Barahona and Hato Mayor.
- **Total annual precipitation by 2050 will decrease by 15% when averaged over the entire national territory, worsening to values of 17% by 2070**, compared to the historical values of 1961-1990. The consistency of the results between models under a radiative forcing of 8.5 W/m² is 87%.
- **The southern and western provinces of the country will be the most affected by the decrease in precipitation by 2050 and 2070, while the eastern and northern provinces could even show small positive changes**. The condition of decreasing total annual precipitation could be even more accentuated by 2050/2070 in the regions of Ozama (18%/20%), Valdesia (17.5%/20%), Enriquillo (17%/20%), Higüamo (16%/18%), and Cibao Sur (15%/17%). The other regions could experience changes of less than 15 %. Only one model shows positive values towards 2050 in Cibao Noroeste (1.3 %), Cibao Norte (0.9 %) and Yuma (0.1 %), where it would even increase only in Yuma (4.5 %) towards 2070.
- The onset of rainfall could present a sudden increase in total accumulated rainfall both towards 2050 and 2070. There is coincidence in the results of the Models in both time horizons of presenting increases of more than 100% (mainly in Herrera, Barahona and San Juan). This result is consistent with the occurrence of a more intensified diurnal cycle and a greater capacity for extreme rainfall events.

Temperatures may increase, while rainfall may decrease substantially, particularly in the southern and western provinces of the country.

According to global trends, the evident occurrence of climate change in the future will generate greater impacts on the regular behavior of climate regimes and intensification of extreme events.

Territorial characteristics and climate variability manifested by greater extreme events increase the climatic risk of intense droughts and highlight the high fragility of the exposed elements in the Dominican Republic.

In the Table 6-66 shows a summary of temperature and precipitation projections prepared by the Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC).

Table 6-66. Temperature and precipitation projections prepared by CATHALAC.

Variable	2050	2070
Minimum Temperature	Increase of between 1°C and up to 3°C	Increases in values between 2 °C and up to 6°C
Maximum Temperatures	It will increase between 2°C and 3°C	Increase from 3°C to 5°C
Dry season (December-April)	Intensification with decreases in total rainfall of up to 50% in the provinces of Independencia, Puerto Plata, San Juan and Santiago; decreases of between 10 and 30% in the provinces of Samaná, Distrito Nacional, Altagracia, Barahona and Hato Mayor.	Conditions equal to those projected to 2050
Beginning of the rains	Sudden increase in total accumulated rainfall, with increases of more than 100% (mainly in the provinces of Herrera, Barahona and San Juan). The most intensified diurnal cycle with the greatest capacity for extreme rainfall events.	Conditions equal to those projected to 2050
Total annual precipitation	It will decrease by 15% when averaged over the entire national territory, with the southern and western provinces most affected.	17% decrease

Source: Third National Communication on Climate Change (Ministry of Environment and Natural Resources, 2018).

Average sea level rise

Regarding mean sea level, projections were made using as a reference the RCP 4.5 scenario, CCSM4 models for the years from 2020 to 2100. The average sea level in the Caribbean region has the lowest value during the dry season, reaching an average elevation of 0.02 m with respect to the geoid. During rainy seasons, the average surface height increases, reaching the maximum peak in September, with a value close to 0.1 meters. This high sea elevation is in correspondence with the intensity of rainfall and a warmer ocean surface.

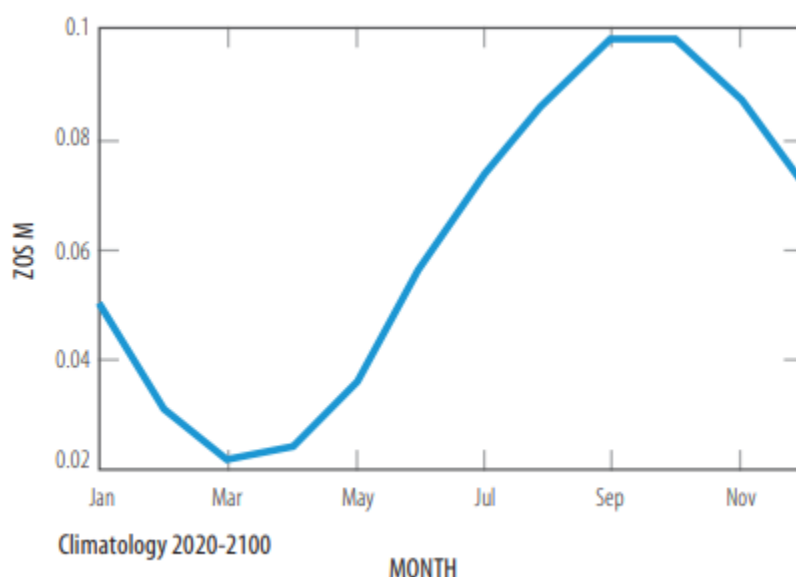


Figure 6-194. Average sea level in the Caribbean region.

Source: Third National Communication on Climate Change (Ministry of Environment and Natural Resources, 2018).

On a local scale, the synoptic scale patterns reflect a fluctuation around the mean value from 2020 to 2060 and a negative trend since 2060. Samana shows a mean dynamic ocean surface of 117.44 mm ranging from 2020 to 2060, while from 2060 a negative trend of -0.91 mm per year is simulated. In the LRS, as expected (warmer ocean surface), a higher ocean surface elevation was detected, where peaks and valleys fluctuate around 142.3 mm. Santo Domingo shows the highest ocean elevation, maintaining an annual mean value of around 180 mm (2020-2060).

Evaluation of the behavior of climatic variables in the project area.

The project is in the province of Montecristi, so a compilation and analysis of the behavior of annual rainfall data obtained from the Monte Cristi station operated by ONAMET was carried out.

In the Table 6-67 shows the total monthly distribution of precipitation for a 42-year period, with a 12-year period of missing precipitation.

Table 6-67. Interannual monthly rainfall accumulated (mm), years 1981-2022.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1981	57.8	98.1	79.1	56.5	45.8	19.6	10.7	11.6	27.0	36.2	68.6	131.7	642.7
1982	26.1	4.0	2.1	26.8	128.9	1.0	10.3	5.7	24.7	58.7	93.4	57.5	439.2
1983	32.9	8.4	29.3	12.9	88.2	106.2	4.9	30.4	42.1	44.4	6.7	40.9	447.3
1984	52.6	19.0	43.1	102.6	32.8	60.7	1.4	15.2	28.0	68.9	111.0	44.1	579.4
1985	34.1	88.7	93.7	53.8	132.4	18.0	3.3	52.2	22.8	50.1	113.0	21.6	683.7
1986	102.1	13.9	153.9	104.0	20.2	39.9	0.3	6.8	2.6	16.4	48.2	3.3	511.6

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1987	231.7	35.8	20.0	101.5	107.3	69.0	8.5	4.4	93.5	41.9	44.0	112.4	870.0
1988	254.4	25.5	10.0	4.2	61.3	75.5	3.4	76.7	67.6	42.0	1.8	48.1	670.5
1989	22.8	112.4	13.2	3.1	20.8	36.4	0.1	34.8	9.1	13.5	26.9	161.4	454.5
1990	21.4	28.9	25.9	74.8	3.2	17.1	10.5	20.6	6.0	300.2	89.4	81.9	679.9
1991	1.2	42.3	52.1	-	23.3	5.1	8.2	32.7	35.4	3.9	97.9	27.5	329.6
1992	19.2	8.7	105.5	70.2	66.6	31.9	8.0	16.3	12.2	22.2	0.7	58.9	420.4
1993	27.4	40.6	45.6	177.2	117.8	2.1	6.6	0.8	6.3	11.5	24.0	6.9	466.8
1994	269.1	4.0	75.6	7.0	67.4	0.0	0.2	1.8	88.5	19.5	-	55.9	589.0
1995	8.6	-	-	-	-	46.3	-	-	-	-	-	-	-
1996	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	-	-	-	-	-	-	-	-	-	-	-	-	-
1998	-	-	-	-	-	-	-	-	-	-	-	-	-
1999	-	-	-	-	-	-	-	-	-	-	-	-	-
2000	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	-	-	-	-	-	-	-	-	-	-	-	-	-
2002	-	-	-	-	-	-	-	-	-	-	-	-	-
2003	-	-	-	-	-	-	-	-	-	-	-	-	-
2004	-	-	-	-	-	-	-	-	-	-	-	-	-
2005	-	-	-	-	-	-	-	-	-	-	-	-	-
2006	-	-	-	-	-	-	-	-	-	-	57.5	23.8	-
2007	37.4	41.2	134.5	17.9	108.9	65.0	3.3	80.0	33.8	184.8	214.4	106.5	1027.7
2008	41.1	0.4	19.8	10.3	25.2	57.5	3.2	22.1	181.2	74.7	79.5	45.5	560.5
2009	91.0	98.5	104.1	18.8	11.5	57.9	1.7	10.9	21.0	24.8	31.3	53.6	525.1
2010	92.5	152.8	166.9	10.3	21.7	25.3	126.1	54.2	81.4	149.7	153.8	61.6	1096.3
2011	3.2	25.0	18.0	6.9	72.1	43.0	31.6	87.0	7.9	21.1	56.3	50.9	423.0
2012	24.8	27.6	62.3	354.0	27.0	3.4	0.0	19.0	7.6	41.4	612.8	171.5	1351.4
2013	6.4	29.6	45.8	46.4	66.0	51.2	28.4	24.9	35.0	88.2	18.2	4.4	444.5
2014	7.7	1.5	67.4	10.2	27.5	1.3	29.6	86.3	15.9	50.5	243.4	22.6	563.9
2015	167.1	46.1	14.9	1.0	110.2	9.7	6.1	12.5	7.4	114.0	3.8	0.8	493.6
2016	48.7	162.9	5.1	96.5	231.6	20.1	18.0	27.7	9.9	172.9	547.5	90.1	1431.0
2017	61.1	26.4	85.7	55.2	66.3	5.9	71.8	43.0	186.9	13.5	146.5	63.9	826.2
2018	83.7	28.0	26.5	0.0	37.7	0.5	2.1	32.6	18.5	45.4	113.6	8.1	396.7
2019	5.9	21.1	17.3	16.5	18.7	29.9	0.0	0.0	119.0	13.5	4.7	1.4	248.0
2020	22.6	19.7	15.2	2.5	31.0	1.5	32.8	24.9	13.7	-	-	-	163.9
2021	11.4	49.2	22.7	16.1	6.6	2.0	4.7	0.0	0.0	99.0	66.4	49.9	328.0
2022	207.9	20.8	94.9	5.8	3.0	0.0	2.1	-	-	-	-	-	

Source: ONAMET 2022.

In the Table 6-68 and Figure 6-195 shows the summary of the processing of the available series, where it was identified that the average monthly precipitation is 51.6 mm and annual precipitation is 609.1 mm, with the months of May, October and November being the months with the highest precipitation recorded, reaching regimes of 600 mm monthly (month of November).

Likewise, it was observed that the June, July and August quarter shows a reduction in the rainfall regime, with records of 0 mm/month, thus being the driest period. There are three rainy seasons in the Dominican Republic: frontal activity (November - April), convective activity (May - July) and tropical activity (August - October).

The years with the lowest rainfall records were 2019, 2020 and 2021 with averages of 248mm, 163.9mm and 328mm, respectively. While the years 2007, 2010, 2012 and 2016 recorded the highest annual rainfall regimes with 1027.7 mm, 1096.3 mm, 1351.4 mm and 1431 mm, respectively.

Table 6-68. Summary of interannual monthly rainfall accumulated (mm).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Max.	269.1	162.9	166.9	354.0	231.6	106.2	126.1	87.0	186.9	300.2	612.8	171.5	-
Min.	1.2	0.4	2.1	0.0	3.0	0.0	0.0	0.0	0.0	3.9	0.7	0.8	-
Prom.	66.9	42.7	55.0	50.4	59.4	29.1	14.6	28.8	41.6	65.1	109.8	55.4	609.1

Source: Data obtained from ONAMET and processed by EMPACA.

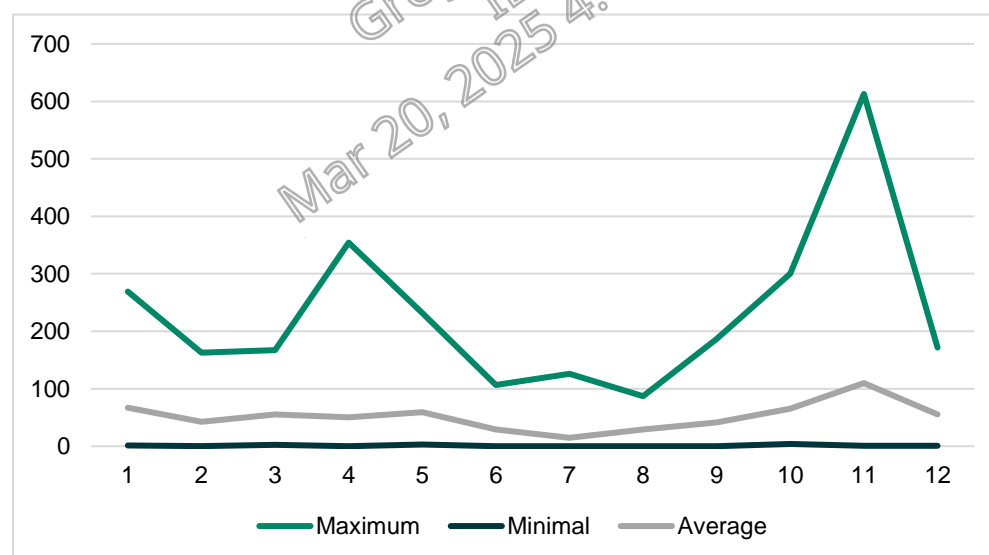


Figure 6-195. Historical behavior of maximum, minimum and average precipitation-Montecristi Station.

Source: Data obtained from ONAMET and processed by AECOM 2024.

In addition, according to information from the mean annual rainfall isohyets map for the Dominican Republic, the average for the territory where the project is located is less than 800 mm (Figure 6-196).

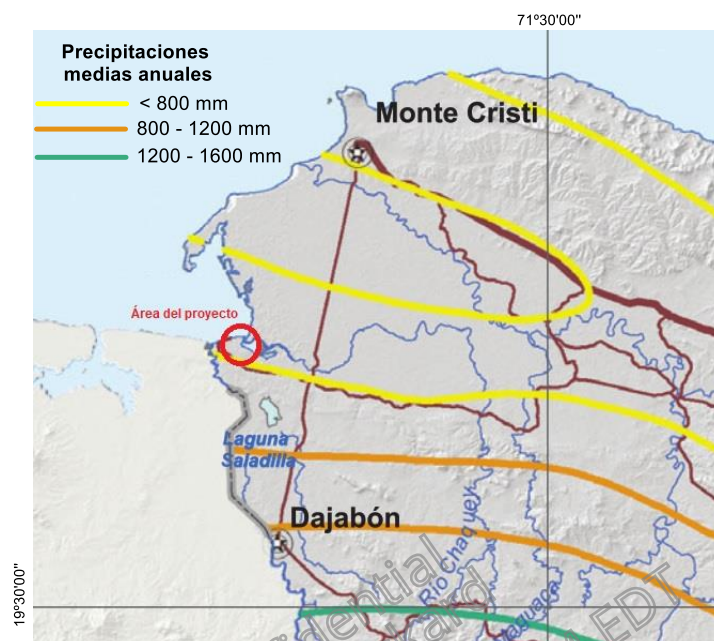


Figure 6-196. Isohyets map of mean annual precipitation (mm) in the region.

Source: Atlas MIMARENA 2012

Maximum rainfall

Using the same ONAMET station source with daily maximum rainfall data for 40 years with 10 years missing (years 1981-2020), in the Table 6-69 shows the maximum daily rainfall by month for the years of observation.

Table 6-69. Maximum 24-hour rainfall values in mm, by month, recorded at Monte Cristi Station (1981-2020).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Set	Oct	Nov	Dec	Pmax24
1981	15.2	58.7	48.8	37.6	19.8	11.7	3.8	4.6	19.4	8.3	28.2	32.7	58.7
1982	5.6	2.0	1.8	11.3	49.0	1.0	9.3	5.7	16.0	57.5	41.2	27.5	57.5
1983	16.6	3.8	7.7	5.6	60.7	48.0	2.6	20.0	26.0	19.0	4.5	33.4	60.7
1984	24.6	6.8	18.8	40.7	13.2	18.6	0.9	7.5	11.3	32.1	30.5	9.8	40.7
1985	23.5	83.5	46.5	22.5	43.3	18.0	2.8	25.2	8.0	18.2	91.3	16.0	91.3
1986	50.5	8.5	82.9	47.4	6.6	28.5	0.3	2.9	1.5	8.4	33.8	2.5	82.9
1987	107.2	27.2	14.6	33.4	39.2	31.6	7.7	2.3	81.0	32.7	23.5	41.2	107.2
1988	101.0	14.3	4.2	3.5	25.7	21.5	1.6	43.3	19.2	22.3	1.4	19.2	101.0
1989	9.2	34.9	8.4	2.3	7.2	22.3	0.1	29.6	3.2	12.9	25.9	106.2	106.2
1990	11.2	19.8	21.0	53.3	2.9	11.6	8.0	19.7	2.8	65.8	24.1	41.1	65.8

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Set	Oct	Nov	Dec	Pmax24
1991	0.8	8.5	32.2	-	16.8	2.6	6.0	29.7	30.7	3.1	53.3	22.0	53.3
1992	6.9	4.5	64.3	50.0	35.5	30.4	3.8	11.1	11.6	17.0	0.5	20.2	64.3
1993	8.9	24.3	18.7	60.0	24.4	1.8	2.7	0.8	4.0	10.0	10.2	6.7	60.0
1994	121.7	3.5	50.0	3.7	22.7	-	0.2	1.8	66.5	6.3	-	23.9	121.7
1995	4.9	-	-	-	-	38.5	-	-	-	-	-	-	38.5
2006	-	-	-	-	-	-	-	-	-	-	35.9	14.3	35.9
2007	16.6	29.6	67.0	5.7	66.4	40.5	-	39.9	-	47.5	79.9	31.1	79.9
2008	15.5	0.2	12.4	7.4	15.0	15.9	2.6	6.3	69.2	34.4	23.4	13.4	69.2
2009	18.8	38.2	51.2	18.8	9.9	25.3	1.4	8.9	10.8	12	17.9	15.4	51.2
2010	30.3	98.2	79.4	3.7	7.3	13.9	68.4	40.3	33.8	45.6	42.3	21.6	98.2
2011	2	19.4	6.8	4.5	25.9	26	23.2	40.3	3.8	8.1	43.4	11.7	43.4
2012	8.6	14	24.6	126.9	13.2	2.2	-	6.5	6.8	14.6	255.2	73.9	255.2
2013	3.3	13.9	21.8	24.6	34.8	26.3	9.7	23.9	21.6	60.7	15.7	3	60.7
2014	6.9	1.5	38.9	7.4	15.5	1.3	13.5	56.4	8.3	32.5	143.5	10.7	143.5
2015	62.2	18.3	10.5	1	105.4	3.3	4.6	10.2	3.6	72.4	3	0.8	105.4
2016	14.4	87.2	2	66	96.5	14	6.6	14.3	4.1	58.7	77.2	29.3	96.5
2017	30.2	20.3	24.1	25.9	19.6	5.1	69.5	28.2	99.6	10.7	107.2	29.4	107.2
2018	21.2	8.4	12.4	-	18.1	0.5	2.1	17.3	10	27.9	69.1	8.1	69.1
2019	5.6	8.9	10.2	16.5	14.7	25.6	-	-	69.6	10.4	47.9	40.1	69.6
2020	9.4	10.4	8.2	2.5	23.4	1.5	11.4	14.9	9.4	-	-	-	23.4

Source: ONAMET 2022.

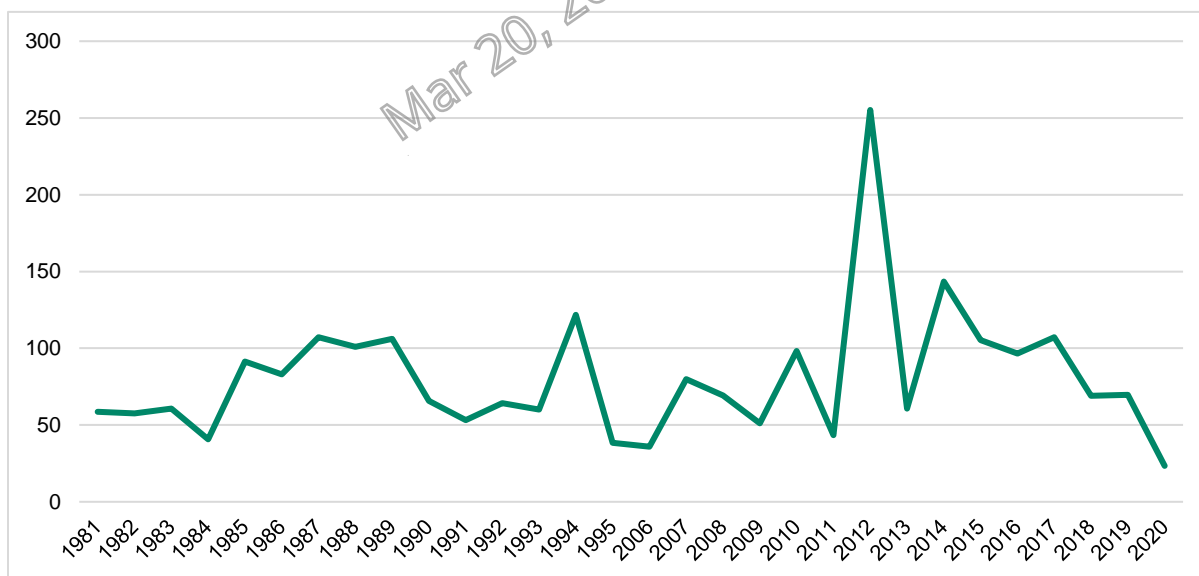


Figure 6-197. Maximum precipitation for 24-hour period - Years of evaluation 1981-2020
Montecristi Station

Source: ONAMET 2022, processed by AECOM 2024.

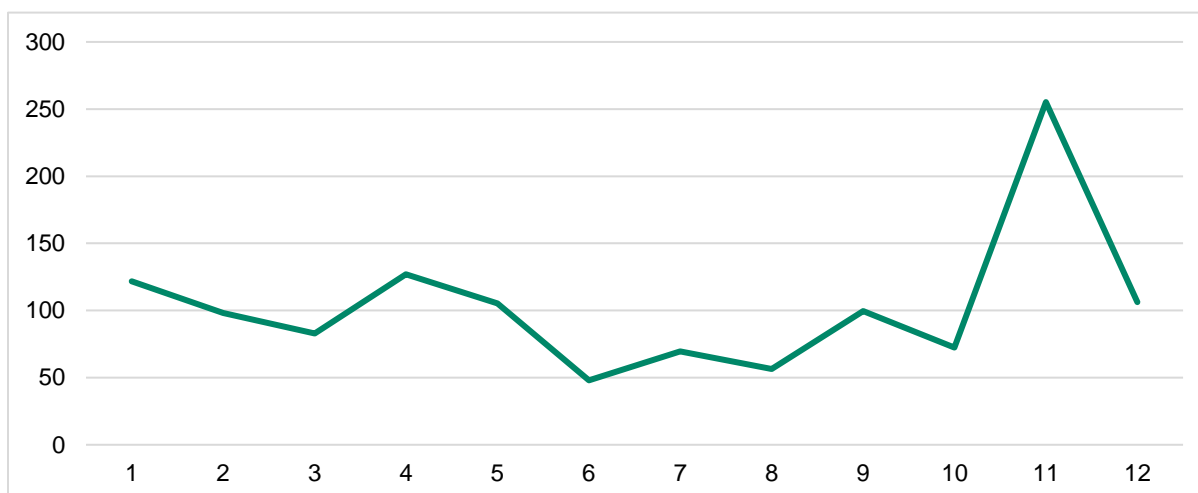


Figure 6-198. Maximum precipitation 24-hour period (Pmax 24), monthly behavior.

Source: ONAMET 2022, processed by AECOM 2024.

It was identified that the year 2012 presented the highest maximum daily precipitation (24 hours) recorded, for the month of November with 255.2 mm/day, followed by the year 2014, month of November with 143.5 mm/day. While the years 1995, 2006 and 2020, recorded the lowest maximum precipitation (24 hours). The months with the lowest maximum precipitation (p24 max) were February, June and July with 01-0.8 mm.

Based on the data analyzed, in Table 6-70 the statistical values of the series are detailed, and the histogram of the hyperannual behavior of these values of maximum rainfall in 24 hours was elaborated (Figure 6-199).

Table 6-70. Statistical summary of daily maximum rainfall characteristics for the observation time of the Montecristi station (ONAMET).

Statistical parameters	Montecristi	
	Pmax24hr	Log(Pmax24hr)
Number of data, N =	30	30
Sum, mm =	2418.2	55.735
Maximum value, mm =	255.2	2.407
Minimum value, mm =	23.4	1.369
Mean, mm =	80.6	1.858
Variance =	1884.2	0.042
Standard Deviation, mm =	43.4	0.205
Variation Coefficient =	0.539	0.111
Bias Coefficient =	2.330	0.141

Source: Processing by EMPACA based on ONAMET 2022.

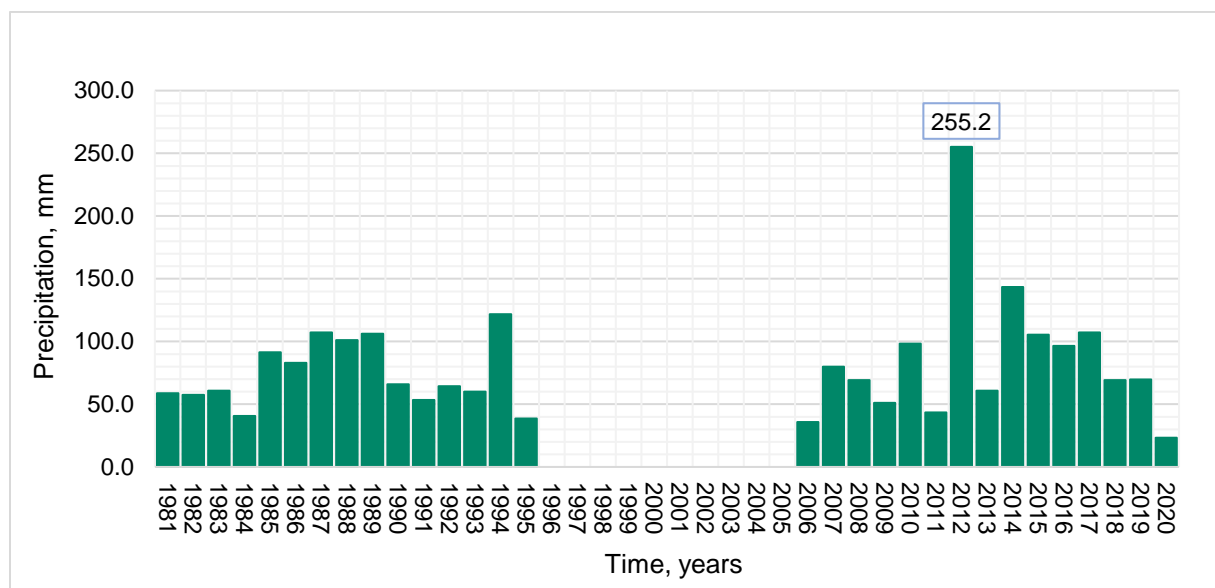


Figure 6-199. Distribution of rainfall (maximum in 24 hours in mm) recorded at the Montecristi Station (1981-2020).

Source: Processing by EMPACA based on ONAMET 2022.

In the analysis of the distribution of maximum rainfall in 24 hours, it was verified by literature review that the maximum extreme record of 255.2 mm, occurred as a result of a stationary frontal system in November 2012, so it was considered in the processing.

With the file references corresponding to the maximum daily rainfall (24 hours) and the return periods in years, we obtained the probability curve (Table 6-71 y Figure 6-200), according to the theoretical distributions of best fit GEV-Max (kappa specified), with an acceptance correlation of 99.49% (Smirnov-Kolmogorov test) and higher than 71% (Chi-Square test), in accordance with the goodness of fit tests applied.

The return period or time of occurrence of a variable, such as precipitation in our case, is the number of years in which the value of that variable will be exceeded once on average. Thus, the event associated with a return period T will have a probability of being exceeded in $1/T$ year. The risk that this precipitation will be exceeded once during a certain time interval depends on the length of the interval.

Table 6-71. Summary of maximum daily rainfall (mm) for each return period analyzed (years).

Return period (T), years	Maximum precipitation daily (Pmax), mm	Hydrological probability of excess (P), %, %, %, %, %, %, %, %, P
2	70.72	50.00
5	105.30	20.00
10	131.64	10.00
25	169.46	4.00
50	201.21	2.00
100	236.20	1.00

Source: ONAMET and EMPACA processing

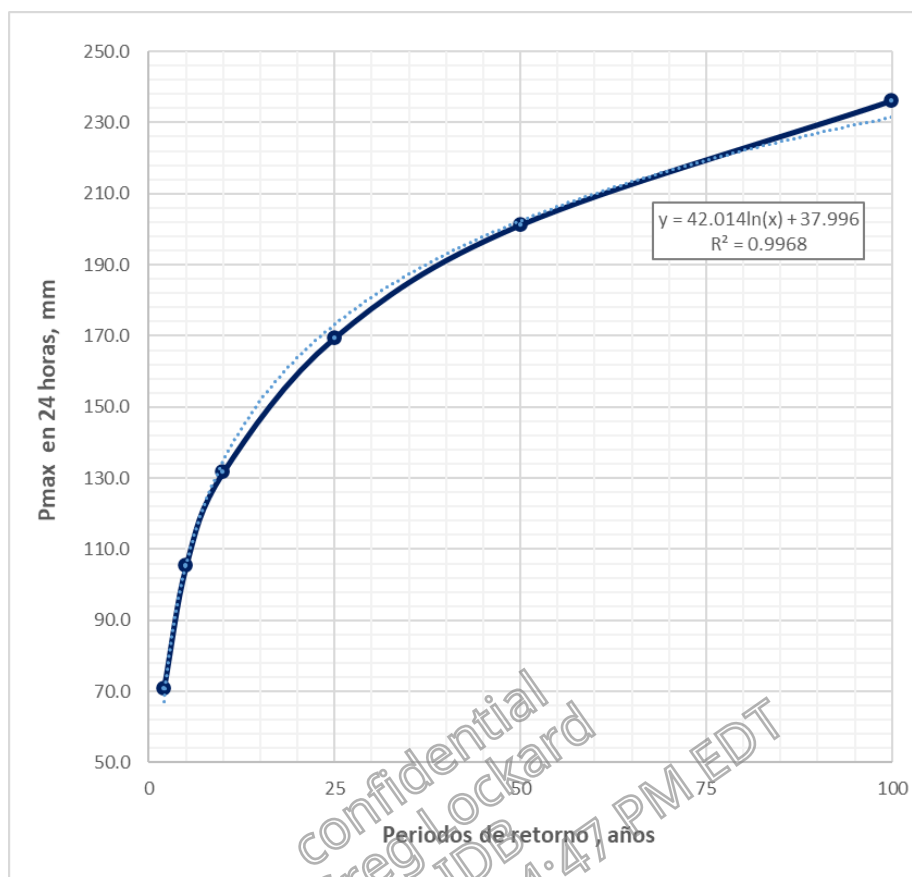


Figure 6-200. Probability plot (%) of daily maximum precipitation (Pmax) at the reference station.

Source: Processing by EMPACA based on ONAMET 2022.

This analysis identified maximum daily precipitation (Pmax) of 236.20 mm for the 100-year return period ($T_r=100$), 201.21 mm precipitation for the 50-year return period ($T_r=50$), 169.46 mm precipitation for $T_r=25$ years and 131.64 mm precipitation for the 10-year return period ($T_r=10$ years). Considering climate change events, precipitation for 100-year return time may occur with higher probability and intensity.

It is important to consider that these maximum daily rainfall values in the region are associated with extreme weather events or hurricanes that hit the northern region of the country.

Thus, in the Figure 6-201 shows the IDF (intensity-duration-frequency) curves, calculated for return times of 2, 50 and 100 years.

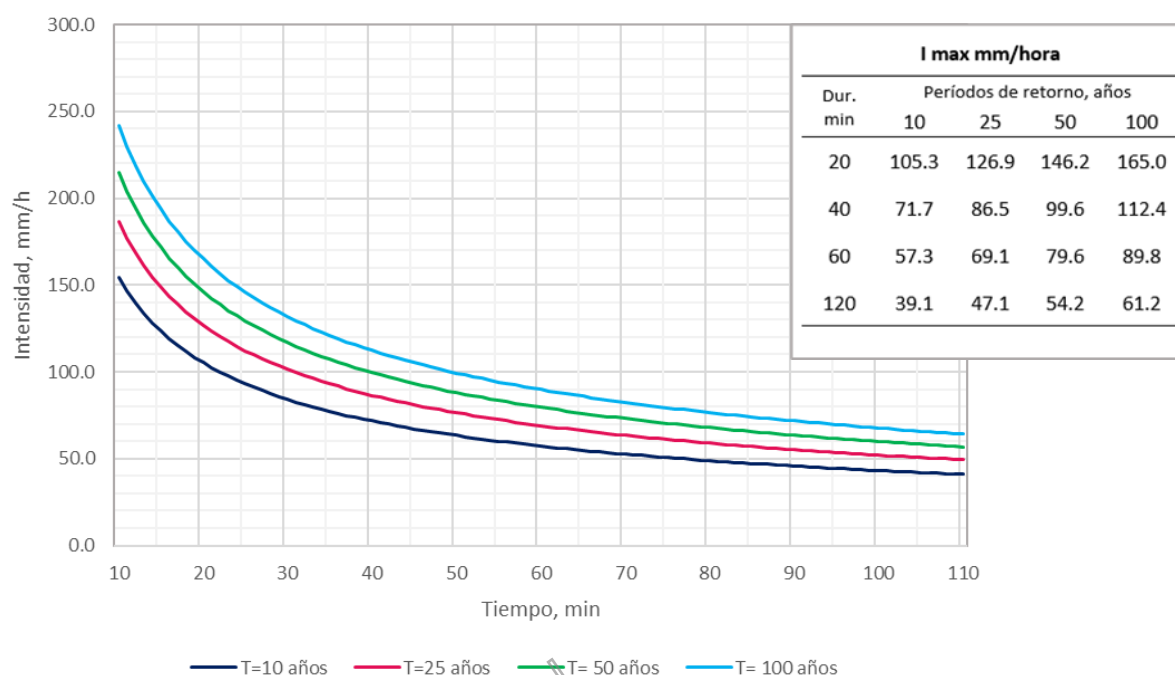


Figure 6-201. Plot of IDF curves for different return periods T

Source: Processing by EMPACA based on ONAMET 2022.

With the above processing of average rainfall and maximum 24-hour rainfall, all the calculation variables are available for the design of any drainage and/or storm drainage way.

In the Table 6-72 summarizes the results of the maximum 24-hour rainfall (Pmax), duration (D) and maximum intensity (Imax) for the return periods analyzed, and Figure 6-202 summarizes the results of the maximum 24-hour rainfall (Pmax), duration (D) and maximum intensity (Imax) for the return periods analyzed. Figure 6-202 shows the design hyetograms.

Table 6-72. Daily maximum rainfall values, duration and intensity for each return period.

Return periods, years	Maximum precipitation (Pmax) mm	Duration, hours	Maximum intensity, (mm/h)
10	131.64	6:20	105.3
50	201.21	8:00	146.2
100	236.20	8:40	165.0

Source: Processing by EMPACA based on ONAMET 2022.

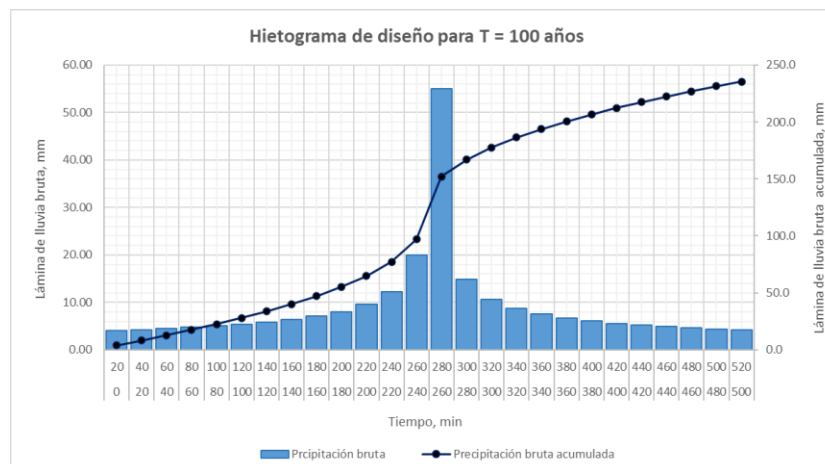
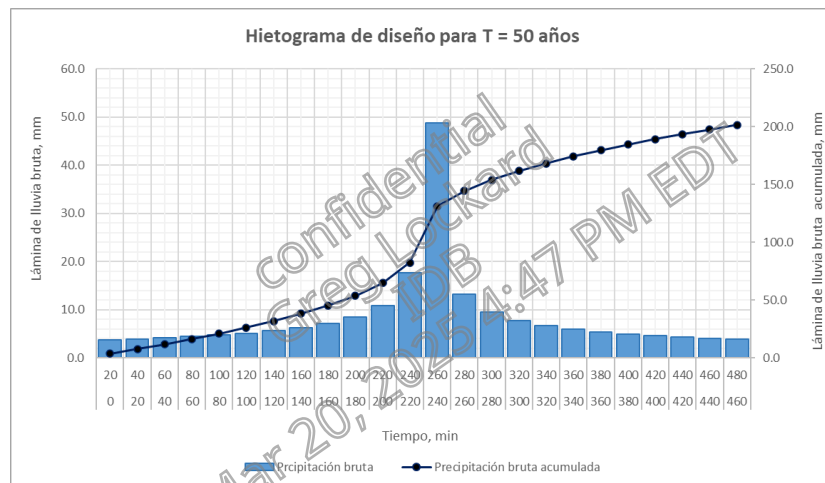
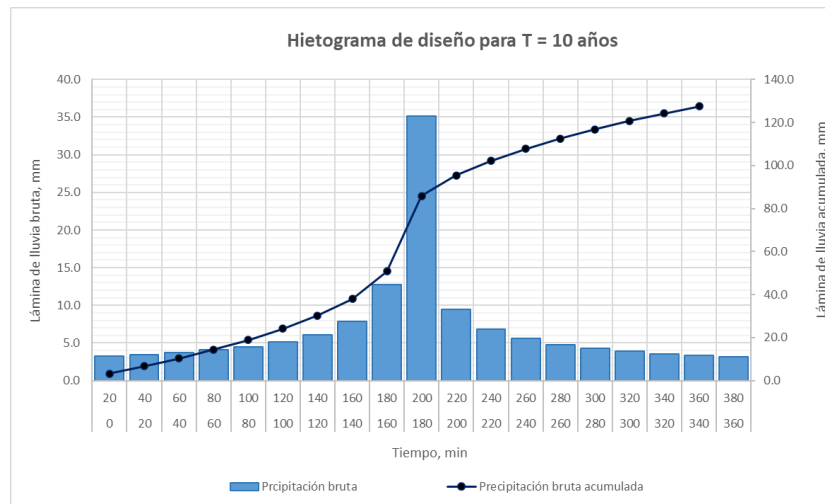


Figure 6-202. Distribution of the design hietogram for the analyzed return periods.

Source: Processing by EMPACA based on ONAMET 2022.

Maximum temperatures

The Earth's global temperature is getting higher and higher. Since the end of the 19th century, the Earth's average temperature has risen by 1.2 degrees Celsius. This is a symptom of the impact of human activities on our planet, especially greenhouse gas emissions.

On a regional scale, the Dominican Republic is within a mean annual isotherm of 25 °C, softened by about 1.5 °C, with respect to the temperature that would correspond to its latitude, due to the maritime influence and breezes.

Air temperature data for the project region are shown in Table 6-73, although there is not a high spatial variability of air temperature in the country.

Table 6-73. Monthly average temperature values, with maximum and minimum records in °C (years 1981-2022).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Prom	23.9	24.2	25.2	26.1	27.2	28.2	28.6	28.7	28.2	27.6	26.1	24.3	26.5
Max.	30.0	30.1	30.3	30.8	31.6	33.5	33.7	33.7	33.3	32.6	30.9	30.0	31.7
Min.	19.8	20.0	20.5	21.6	22.5	23.7	23.9	23.8	23.3	22.0	21.7	20.4	21.9

Source: ONAMET 2022.

From this data we have interpreted the behavior of the maximum and minimum values (Table 6-74 y Table 6-75).

Table 6-74. Interannual monthly maximum temperature records in °C (years 1981-2022).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Prom	30.0	30.1	30.4	30.8	31.7	33.5	33.7	33.7	33.3	32.7	31.0	30.1
Max.	31.5	31.9	31.6	32.9	33.6	34.6	34.7	34.6	34.6	34.1	32.8	32.5
Min.	28.4	28.1	28.0	22.6	23.3	31.8	25.5	25.4	25.0	24.2	23.1	22.5

Source: ONAMET 2022.

Table 6-75. Interannual monthly minimum temperature records in °C (years 1981-2022).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Prom	19.8	20.1	20.6	21.6	22.6	23.7	23.9	23.8	23.3	22.0	21.8	20.4
Max.	21.2	21.7	22.4	24.1	25.2	32.1	27.7	25.6	25.0	24.3	23.3	22.5
Min.	18.7	18.4	18.9	20.1	19.8	21.6	22.7	22.7	21.8	0.0	20.0	18.5

Source: ONAMET 2022.

The hottest season is between June and September, with an average daily maximum temperature of 33.5 °C. The hottest months are July and August, with an average temperature of 33.7 °C and a minimum of 25.5 °C. During these months, the highest daily temperatures are recorded in the afternoon.

The coolest season is from December to March, when the average daily maximum temperature is less than 30.0 °C. The coldest month of the year in Montecristi is January. With an average minimum temperature of 19.8 °C and a maximum of 30.0 °C. In these winter months, minimum temperatures are recorded during the early morning hours.

Extreme events - tropical storms-hurricanes

A "tropical cyclone" is defined as a seasonal atmospheric disturbance of sudden onset and oceanic origin. Indeed, these phenomena, associated with strong winds and precipitation, form in the oceans where warm water (seas with temperatures above 26°C), humid air and converging winds converge. According to the way in which they evolve until their disappearance, they can be classified as follows: Tropical disturbance, with moderate winds, cloudiness and rainfall; Tropical depression, with maximum wind speed below 63 km/h; Tropical storm, where the wind speed ranges between 63 km/h and 119 km/h and Hurricane, when the intensity of the winds reaches speeds above 119 km/h.

According to various estimates, the Atlantic area, Gulf of Mexico and the Caribbean Sea are prone to the formation of an average of 9 tropical cyclones per year. These basically develop during the rainy season from August to November, which coincides with the period of high tropical warm weather that determines the increase in sea temperatures. However, tropical cyclones can also form in earlier or later months, as was the case of tropical storm Olga in December 2007.

The Dominican Republic, located in the center of the Antillean archipelago, is particularly vulnerable to recurrent tropical cyclones that form in the Atlantic Ocean and the Caribbean Sea. The processing of the data shows the increase in the occurrence of the events, i.e., the trend towards an increase in the number of cyclones in each season, most of which cross the Caribbean and therefore Hispaniola (Figure 6-203).

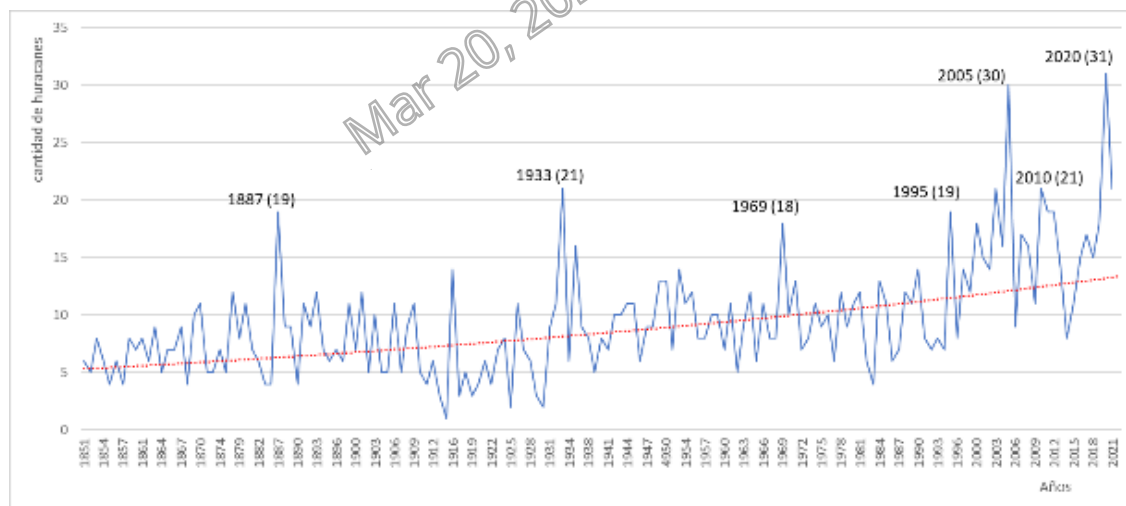


Figure 6-203. Trend of increasing cyclone numbers by decade, over the period 1851-2021, in the North Atlantic (named cyclones).

Source: Own elaboration

In the graph of the Figure 6-204 the distribution of events and their corresponding probabilities (not including the 2020-2021 season) can be seen. It should be clarified that in the adjustment of

the points on the probability curve, the value corresponding to 2005, when 30 cyclones occurred, stands out.

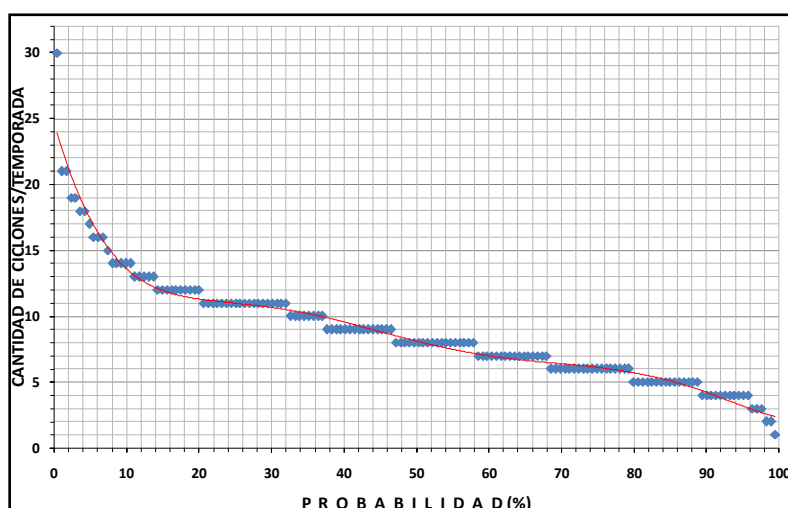


Figure 6-204. Probabilistic adjustment of the number of cyclones per season.

Source: Own elaboration

From a data of hurricanes and storms that occurred between 1851 and 2019, the greatest possibility of a tropical cyclone affecting the territory is in the month of September, followed by August and October. According to archival data provided by NOAA's *National Hurricane Center*, the region has been hit by more than 40 extreme weather events between the last 168 years (1851-2019), considering those that have directly affected the territory (Table 6-76).

Table 6-76. Distribution of weather events by region

Category of events	In the north of the country, recorded in Puerto Plata station
All events	43
Tropical storms	30
Hurricanes 1	6
Hurricanes 2	2
Hurricanes 3	2
Hurricanes 4	2
Hurricanes 5	1

Source: NOAA *National Hurricane Center*

It is worth noting that the 2005 hurricane season was characterized by the formation of 30 meteorological events that hit the Caribbean, although only storm Alpha affected the Dominican territory. This season was the most active since 1931, which showed a return period in the order of 80 years.

In the 2020 season, there was a record number of extreme events with 31. Likewise, 31 tropical depressions and 30 storms were recorded, also a historic record for the Caribbean. With respect to hurricanes, 13 events were reported, 6 of which reached the category of major hurricanes.

In terms of regional extreme storms, which are interpreted as events that can cause rainfall in a large part of the territory, it should be considered as an affectation with high hydrological probabilities, which means return periods of less than 8 years.

The coastal areas of the south, center-south and east of the country, total about 1,576 km of coastline exposed to tropical cyclones, as well as to the tides and floods they trigger. It is in these areas, particularly in the estuaries, where a large population is concentrated thanks to the favorable conditions for tourism (almost 95% of the activity is concentrated in the Atlantic coastal plains such as Bajabonico, Puerto Plata, Yasica, Nagua and Boba), agriculture and livestock, the industrial sector, port areas, power generation plants, etc.

The trajectory followed by the Hurricanes mentioned above has been as follows:

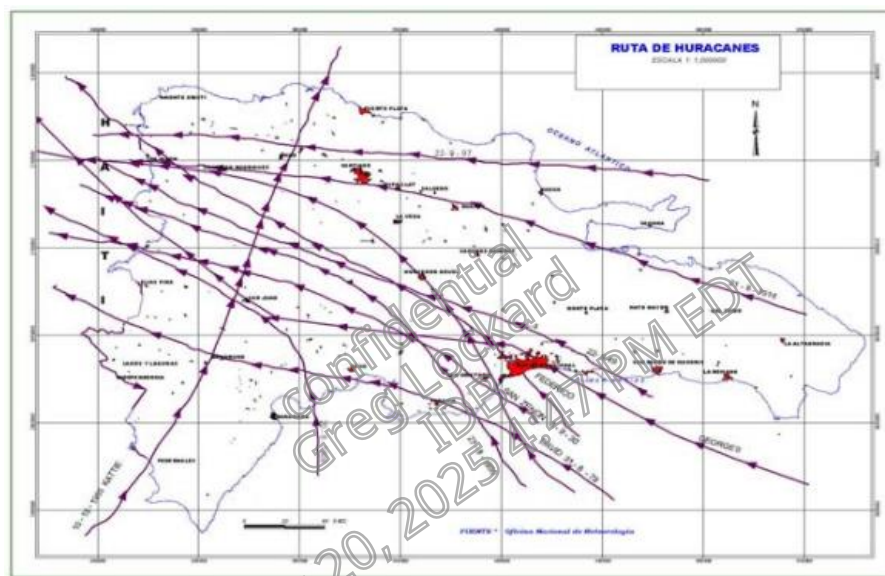


Figure 6-205. Trajectory of recent hurricanes in the Dominican Republic.

Source: DR National Meteorological Office.

Hurricanes enter from the south and east of the country, impacting with varying intensity:

- High impact zone: the entire southwest and southeast coast, from the province of Pedernales to the province of La Altagracia.
- **Medium impact zone: the northern coast, from the provinces of Montecristi to Seibo.**
- Low impact zone: the entire central part of the country, because when tropical cyclones enter the land, they weaken and disappear.



Figure 6-206. Degree of threat from tropical cyclones in the provinces of the Dominican Republic.

Source: Analysis of disaster risks and vulnerabilities in the Dominican Republic.

Average sea level rise

Rising sea levels are linked to three main factors, all of which are induced by current climate change:

- **Thermal expansion:** When water warms, it expands. About half of the sea level rise that has occurred over the past century is attributable to the fact that the oceans, as they warm, take up more space.
- **Melting of glaciers and ice caps:** large ice formations, such as glaciers and ice caps, melt naturally in summer. But in winter, precipitation in the form of snow, composed mostly of evaporated seawater, is usually sufficient to compensate for the melting. However, recent persistent high temperatures due to global warming are responsible for an increase in the amount of ice melting in summer and a decrease in snowfall due to later winters and earlier springs. This imbalance generates a significant net increase in runoff versus evaporation from the oceans, causing sea levels to rise.
- **Ice loss in Greenland and West Antarctica:** As with glaciers and ice caps, increasing heat is causing the huge ice sheets that cover Greenland and Antarctica to melt at an accelerating rate. Scientists also believe that fresh water generated by melting at the surface and seawater beneath the surface is seeping under the Greenland and West Antarctic ice sheets, lubricating the ice streams and causing them to slide faster into the sea. In addition, rising temperatures are causing the huge ice shelves attached to Antarctica to melt from the base, weaken and break away.

When sea levels rise rapidly, as they have been doing in recent times, even a small rise can have devastating consequences for coastal habitats. Sea water enters areas farther and farther from the coast, which can have catastrophic consequences such as erosion, inundation of wetlands, contamination of aquifers and agricultural land, and loss of fish, bird and plant habitat.

When severe storms make landfall, higher sea levels cause larger and more intense storms that can destroy everything in their path.

In addition, hundreds of millions of people live in areas that will become increasingly vulnerable to the risk of flooding. Rising sea levels would force them to abandon their homes and move to another area. Low-lying islands would be completely submerged.

Sounding cores, tide gauge records and, most recently, satellite measurements identified in the Dominican Republic show that, over the past century, the Mean Sea Level (MSL) has risen between 10 and 20 centimeters. However, the annual rate of rise over the last 20 years has been 3.2 millimeters, about twice the average rate of the preceding 80 years.

Floods

Floods are the phenomenon that generates the most damage globally, since more than 50% of natural disasters in which the population is affected are due to floods (Jonkman, 2005; Huang et al., 2008). According to statistics from the study developed by La Red for the IDB based on records from 1966-2000, floods are also one of the largest and most regular natural disasters in the Dominican Republic.

The island of Hispaniola is particularly sensitive to flood risks, as it is one of the phenomena with the highest social incidence (Díaz de Eira et al., 2007).

Floods in the Dominican Republic occur throughout the year (52% during the rainy season), and are not the direct and exclusive result of tropical cyclones (which would represent 13% of the total recorded). However, in the recent history of the Dominican Republic, tropical storms such as Noel and Olga caused catastrophic flooding through the overflowing of the country's main rivers (Yaque del Norte, Yaque del Sur, Yuna, Nizao), causing more than 160 deaths and considerable damage to infrastructure and agriculture. In addition, the health situation became particularly delicate as an epidemiological alert had to be declared to avoid disease outbreaks (UNDP Human Development Report, 2008).

Of a total of 464 floods recorded in the reference period (1966-2018), just over 50% were caused by rainfall typical of the rainy season, and only 8.4% by extreme weather events (tropical storms, hurricanes and tornadoes).

Over the 40 years analyzed, the floods with the greatest impact in the country have had recurrence periods of between 4 and 6 years, with particularly intense floods in 1970, 1975, 1981, 1988, 1993, 1998, 2003 and 2009.

Some types of floods, such as those produced by tropical cyclones, are markedly seasonal, which can help to plan activities around the phenomenon by considering the associated risk in terms of the vulnerability of the affected population (Handmer, 2004). Although there are not a considerable number of small and medium-scale floods, their cumulative physical and human impact can be comparable to that of larger-scale disasters.

About 46% of the floods recorded in the 1966-2018 period were concentrated in major urban areas such as the National District and several cities of the Central Cibao subregion (Puerto Plata, Santiago de los Caballeros, Concepción de la Vega, Bonao and Boca) and the Eastern Cibao (Cotuí, Nagua and San Francisco de Macorís). The rest were scattered throughout the country,

with a high incidence in rural areas. However, the total number of floods recorded in rural areas is significantly lower than in urban areas.

As a result of the study carried out by the IDB, the regions most affected by flooding are those surrounding the basins of the Yaque del Norte, Yaque del Sur, Yuna and Soco rivers, as well as the marginal areas on the banks of the rivers in the cities of Santo Domingo and Santiago, with the provinces with a high degree of flooding threat being Santo Domingo, Duarte, Montecristi, Santiago, Valverde, Bahoruco, Barahona and San Pedro de Macorís.

ENSO Phenomenon

The El Niño/Southern Oscillation (ENSO) is a natural phenomenon characterized by fluctuating ocean temperatures in the central and eastern equatorial Pacific, associated with changes in the atmosphere. This phenomenon has a great influence on climatic conditions in various parts of the world.

ENSO is one of the most important patterns of the so-called interannual climate variability, which includes changes in the circulation of the atmosphere that can last from several months to a few years. El Niño and La Niña are the oceanic components, while the Southern Oscillation is the atmospheric component, and both give rise to the term El Niño/Southern Oscillation. This phenomenon comprises three phases: El Niño, La Niña and a neutral phase.

The effects of this oscillation on our country are diverse and vary depending on the phase, the region and the time of the year. Particularly during spring and summer, the northeast of Argentina tends to record above normal rainfall during an El Niño phase. During the La Niña phase, the same area tends to record below normal rainfall.

The events have an irregular periodicity, usually occurring every two to seven years, and an El Niño/La Niña phase is declared when sea temperatures in the eastern tropical Pacific increase/decrease 0.5°C above/below average for several consecutive months (5 quarters).

Statistically, only an average of four to six cold fronts have occurred in the Dominican Republic during this period, but when there are El Niño events, they are affected. For example, El Niño in 1997 and 2015, generated very marked pluviometric deficits in different parts of the country. The Table 6-77 presents the record of ENSO events that have occurred in recent years.

Table 6-77. Historical record of ENSO events

Years of "Niño" events	Years of "Niña" events
1957-1958	1955-1956
1965-1966	1970-1971
1972-1973	1973-1974
1982-1983	1975-1976
1991-1992	1988-1989
1994-1995	1995-1996

Years of "Niño" events	Years of "Niña" events
1997-1998	1999-2000
2004-2005	2007-2008
2009-2010	2010-2011
2014-2015-2016	2017-2018
2018-2019	2021-2022
2023	

Source: Climate Prediction Center NOAA. Accessed November 2023.

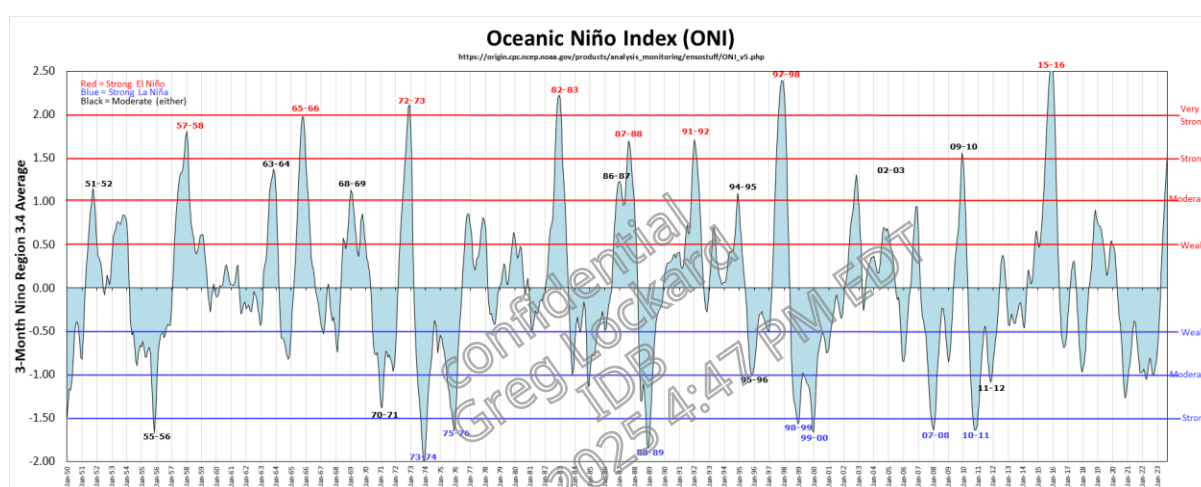


Figure 6-207. ENSO intensity index (Niño and Niña).

Source: Climate Prediction Center NOAA. Accessed November 2023.

In the last 10 years, on two occasions El Niño has caused havoc in the Dominican territory: the last time was in 2019, with weak intensity, and the previous one in 2015, with extreme effects. Our country experienced a period of extraordinary drought between 2014 and 2016 as a result of the influence of the climatic event generated in the Pacific. It was even so strong that several dams exhausted almost all the accumulated water.

Agriculture and livestock farming suffered heavy losses in 2015 due to rainfall deficits: the east, northwest and southwest of the country were severely damaged. Likewise, the supply of drinking water for the population reached an alarming level, to the point of radically rationing the flow of water.

The El Niño of 2023 is expected to be the strongest on record in the pre-industrial period (1990-2015) and may last until mid-2024.

Analysis of the environmental impacts associated with the effects of climate change in the project area.

Thus, based on the design and proposal of the Montecristi Development Plan and the current and future climate data for the region, an analysis of the main environmental impacts caused by the effects of climate change and whether these could be aggravated by the implementation of the Plan is carried out.

➤ Temperature increase

Taking into account the current temperature data for the Montecristi region and future projections of an increase in minimum temperatures of between 1°C and up to 3°C by 2050 and between 2°C and up to 6°C by 2070, and maximum temperatures of between 2°C and 3°C by 2050 and between 3°C and 5°C by 2070, it can be concluded that **in the hottest months, in Montecristi, average maximum temperatures of 34-35 °C and average minimum temperatures of 28-29 °C could be reached, and in the cooler season, average maximum temperatures of 32-33 °C and average minimum temperatures of 24-25 °C by 2050.**

➤ Extreme weather events (hurricanes, cyclones and storms)

Based on the data described in section 6.1.7 and in this section on extreme weather events in the Dominican Republic during the last 50 years, it can be concluded that the **tendency for these events to occur will increase globally and regionally, both in terms of annual frequency and intensity.**

This increase is conditioned by the trend in the generation of greenhouse gases worldwide, so that **the construction or not of the project will have little negative influence on this climate threat, but it could have a very positive influence by providing the necessary infrastructure services to improve adaptation to climate change caused by extreme weather events in the development area.**

➤ Floods

The Montecristi region is not among the areas most affected by flooding because the annual rainfall (see section 6.1.15.3.2) averages less than 800 mm, the soil has a high infiltration capacity and there is a high annual temperature that favors evapotranspiration in humid areas.

According to the Geographic Information System of the Ministry of Environment and Natural Resources, there are wetlands and mangrove areas in the project development area, as shown in Figure 6-208 which will have to be protected as indicated in the General Environmental Law 64-00, leaving a minimum 30-meter buffer zone.

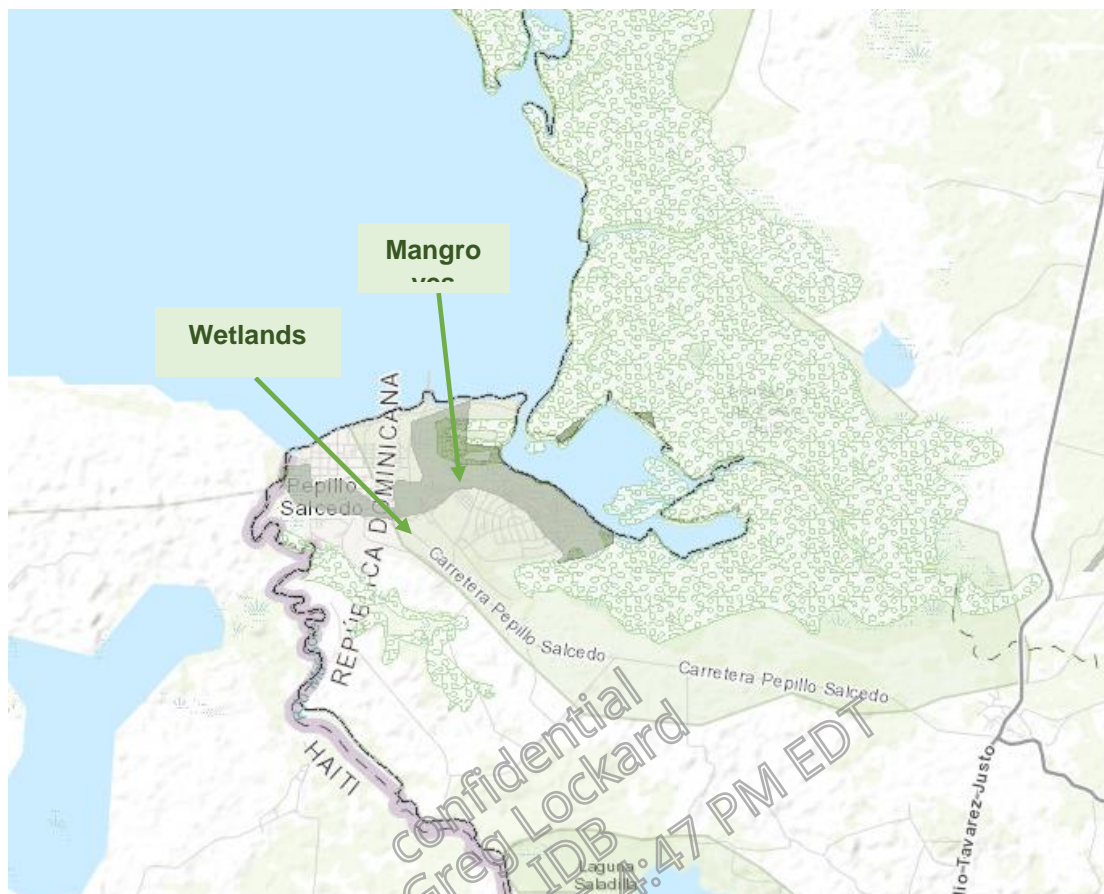


Figure 6-208. Wetland and mangrove areas within the future development area.

Source: Geographic Information System of the Ministry of Environment and Natural Resources.

In turn, these wetland and mangrove areas are catalogued as flood zones, according to the Geographic Information System of the Ministry of the Environment and Natural Resources (Figure 6-209).

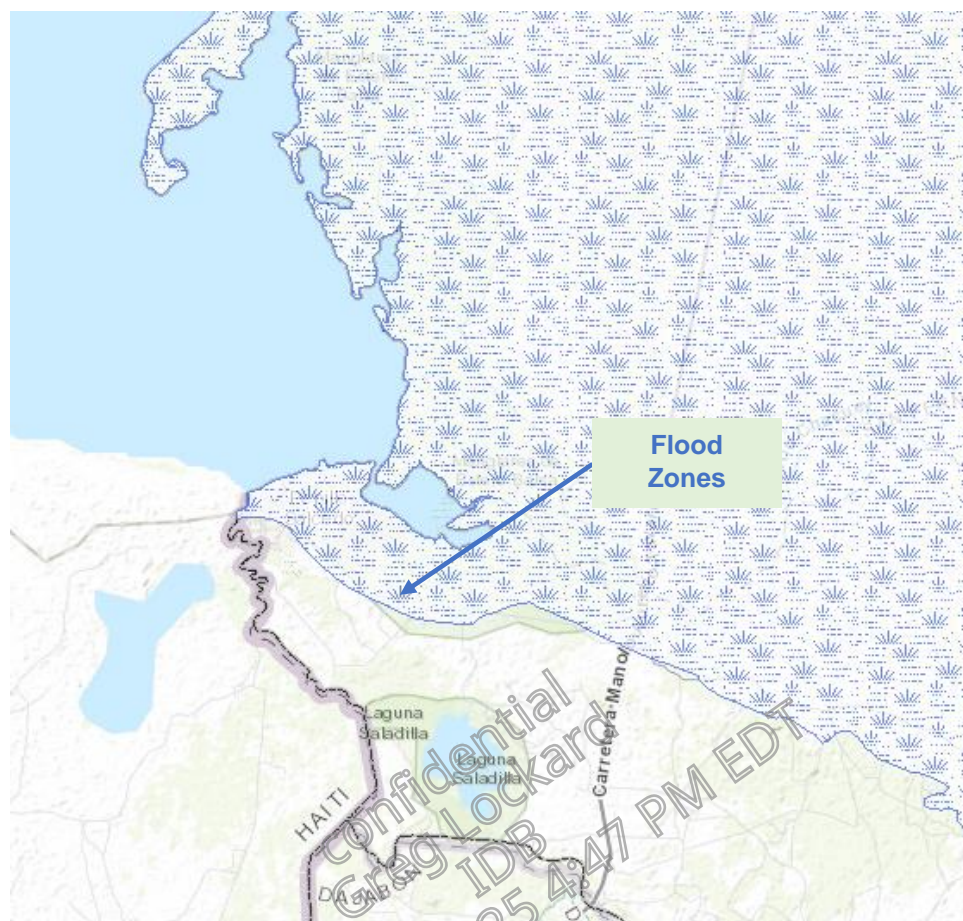


Figure 6-209. Zones cataloged as floodable within the area of future development.

Source: Geographic Information System of the Ministry of Environment and Natural Resources.

Wetlands guarantee sustainable development. They are essential for the life and prosperity of people, fauna and flora. As cradles of biological diversity, they are among the most productive environments in the world.

- *The ecological importance of wetlands:*

Essential to human health and prosperity, they provide us with fresh water, ensure our food supply, maintain biodiversity, protect us from floods and store carbon dioxide.

In addition, they protect the environment, which involves conserving and restoring terrestrial ecosystems to benefit both human life and the natural environment.

- *Functions for sustainable development:*

Thus, the main functions for the sustainable development of wetlands are as follows:

- They act as natural water filters, which is due to the fact that filter plants store and release water in a filtration process. In this sense, they will also purify the water of harmful wastes such as pesticides, heavy metals, or toxins.
- **They contribute to buffering nature. On the one hand, they absorb rainfall, which results in protection against floods. On the other hand, this storage capacity makes them effective against drought.**
- **Mangroves, saltwater marshes, and coral reefs decrease the speed and height of storm surges.**
- **Their roots provide cohesion to the coastline, reducing erosion caused by wind and waves. They also increase protection against climate change.**
- They supply fresh water, food and construction materials.
- They store carbon.
- Promote economic development: ensure that people have the means to earn their own income and prosper.
- They favor social development: they improve cooperation, respect and trust among social groups and promote gender equality.
- They play a leading role in environmental protection: they conserve and restore the Earth's ecosystems to benefit both human life and the natural environment.
- They are fundamental for biodiversity: they are home to more than 100,000 freshwater species, are essential for many amphibians and reptiles, and are a source of reproduction and migration for many birds.

Many of them treasure endemic species, that is, life forms unique to a certain place.

Whether **the Project development area is more or less vulnerable to flooding and coastal flooding due to storm surges** will depend on the proper conservation and protection of wetland and mangrove areas, establishing a buffer strip of at least 30 meters²⁴ or more and the projected storm drainage design, which was calculated based on the natural drainage parameters of the area through areas with direct flows to the sea and a terrain with a permeability that limits almost all runoff.

➤ Droughts

Generally, a drought is defined according to several elements such as its duration in time, the area affected and the intensity with which it occurs. Being a process of gradual development and causing diverse impacts, it is difficult to define it, although it is generally classified as a meteorological, agricultural, hydrological, economic, or social phenomenon, showing that its causes and effects are multiple, affecting societies and ecosystems.

According to the statistical compendium developed by La Red in 2001 for the IDB and the Presidency of the Government, droughts (in a general sense) were presented as the fifth cause of disasters in the country in the period 1966-2000, although their cause is not clearly recorded.

Regarding agricultural drought, as reflected in the synthetic report of the results achieved in the process of development and improvement of scientific knowledge on the nature, trends and frequencies of meteorological and agricultural drought-related hazards in Cuba and the Dominican Republic (UNDP Project "Development and Adaptation to Climate Change), the provinces most affected by an agricultural drought - with more than 90% of their area covered -

²⁴ General Environmental Law 64-00

in the period of analysis (1971-2000) were: Jimaní, Pedernales, San Juan, Santiago Rodríguez; Barahona; Santiago de los Caballeros, Mao; Azua ; San José de Ocoa, Bani and San Cristóbal.

On the other hand, the provinces affected with less than 20% of their area covered by agricultural drought were **Montecristi**, San José de Ocoa, Moca, Cotui, San Francisco de Macorís, Monte Plata, Nagua, Distrito Nacional, Samaná, Hato Mayor and La Romana.

In this regard, the region most affected by agricultural drought is the South, followed by the Southwest, North Central, North, Northwest and East, with the border strip with the Republic of Haiti being among the driest regions of the country.

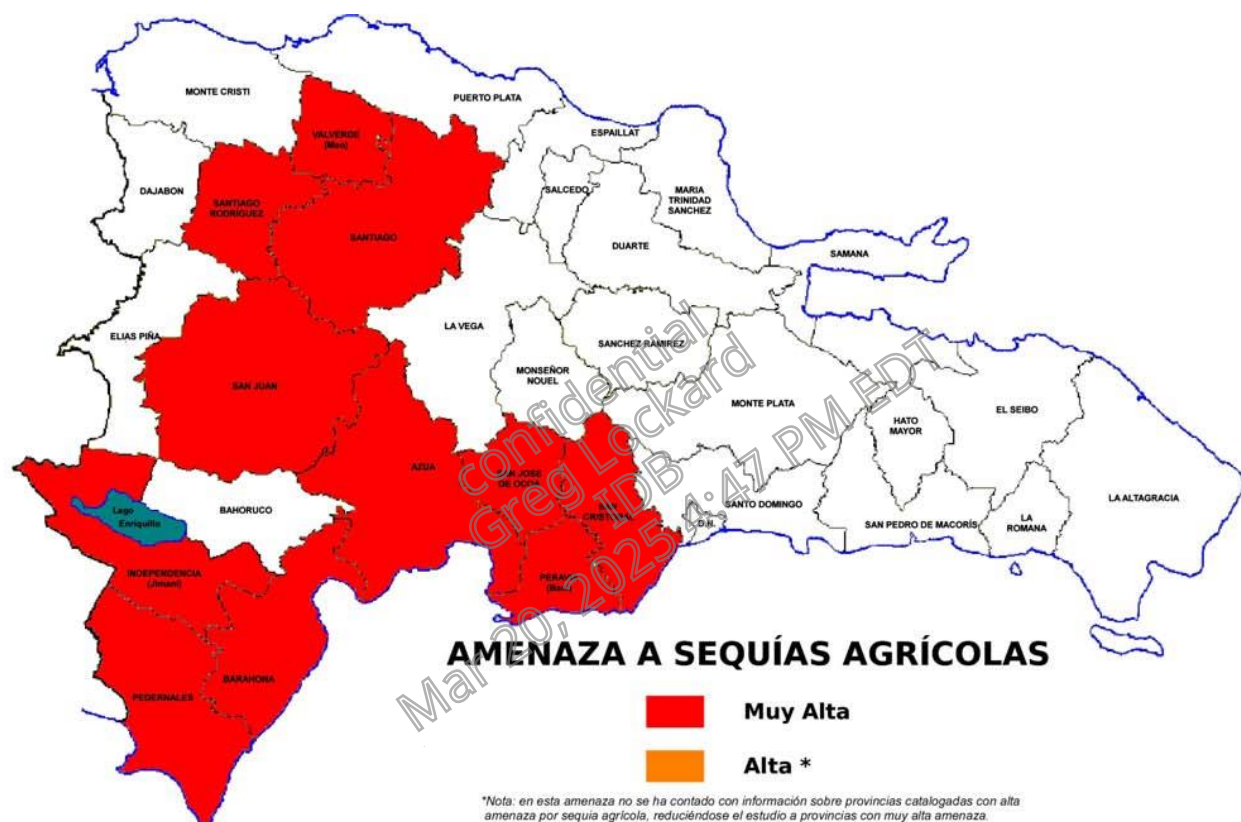


Figure 6-210. Degree of threat due to drought in the provinces of the Dominican Republic.

Source: Analysis of disaster risks and vulnerabilities in the Dominican Republic.

Analyzing the data on temperature, rainfall and other climatic elements, the region of Montecristi is not among the provinces most threatened by drought, but it could lead in the future to the depletion of water resources by gradually decreasing the natural recharge by rainfall and by the overexploitation of aquifers by the projects of the Montecristi Development Plan, population growth and agriculture.

➤ Water resources

According to the Evaluation of Technology Transfer Needs for adaptation to climate change in the water sector in the DR²⁵, although the country has a potential water availability that places it above the water security threshold (1,700 m³ per capita per year), under the criterion of safe availability, there are already hydrographic regions with a strong degree of water pressure (INDRHI, 2007), among them the cities of Santiago and Santo Domingo, which together account for more than 40% of the country's population in 2010 (ONE, 2010). The growing loss of quality of Dominican water bodies; soil degradation, associated with deforestation and unsustainable agricultural practices, contributes to the reduction of the useful life of reservoirs and threatens food security; and inefficiency in water use, as a result of a management policy governed by sectoral interests, from the supply side, without a harmonized articulation of economic, social and environmental policy objectives. All these aspects generate additional vulnerability in the face of climate change scenarios that are projected with a trend towards drought²⁶.

Vulnerability for the drinking water, irrigation and agriculture sectors was assessed according to the conceptual framework of climate risk that considers vulnerability based on exposure to climate hazards (their character, magnitude, rates of change), the sensitivity of the systems, and their capacity to adapt. This methodology is the one adopted by the IPCC from its second (IPCC, 1996), third (IPCC, 2001) and fourth (IPCC, 2007)

Drinking water service agencies face numerous challenges in planning and operating services, such as uncertain supply and demand levels, increasing urban population, aging infrastructure, and increasing competition for water resources (Figure 6-211).

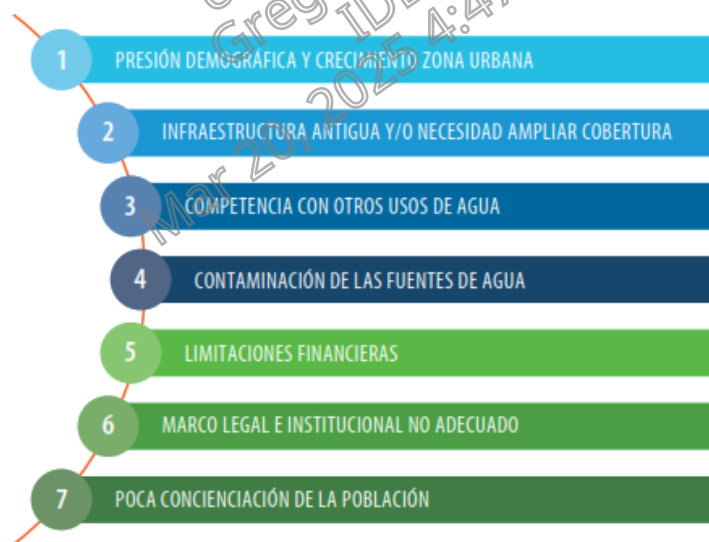


Figure 6-211. Challenges of the drinking water and sanitation sector.

Source: Danilenko et al, 2010.

25 UNDP.ODH. Chapter VI. Environmental Sustainability and Human Development.

26 Assessment of Technology Transfer Needs for Mitigation in the Energy Sector and Adaptation in the Water Systems, Forestry and Tourism Sector of the DR (TNA Project, UNEP/RISOE Centre/Ministry of Environment/PLENITUD), 2012-2013.

Climate change intensifies existing challenges and increases the economic pressure to improve operating efficiency. Therefore, it is necessary to make climate change considerations and their influence on the sustainability and quality of services.

Some of the main challenges evaluated as very high are:

- Demographic dynamics:** Demographic dynamics make water supply more complicated in two ways. On the one hand, population growth implies the challenge of meeting an increasing demand for water. In developed countries, it has been found that the growth rate of water consumption is twice the rate of population growth. The other complication is that migration from rural to urban areas makes it necessary to permanently expand coverage in order to serve the new settlements in the cities, and also puts pressure on expanding the capacity of existing water sources to meet the growing demand for urban water. Projections of the percentages of urban and rural population according to data from the Oficina Nacional de Estadística (ONE, 2014), indicate that the rural population will decrease from 21.3 % to 13.7 % in the period 2015 to 2030 (Figure 6-212), while the urban population will increase from 78.7 % to 86.3 % in this period. The absence of an effective land use plan prevents planning for the growth of the urban area and the drinking water services that these areas require.

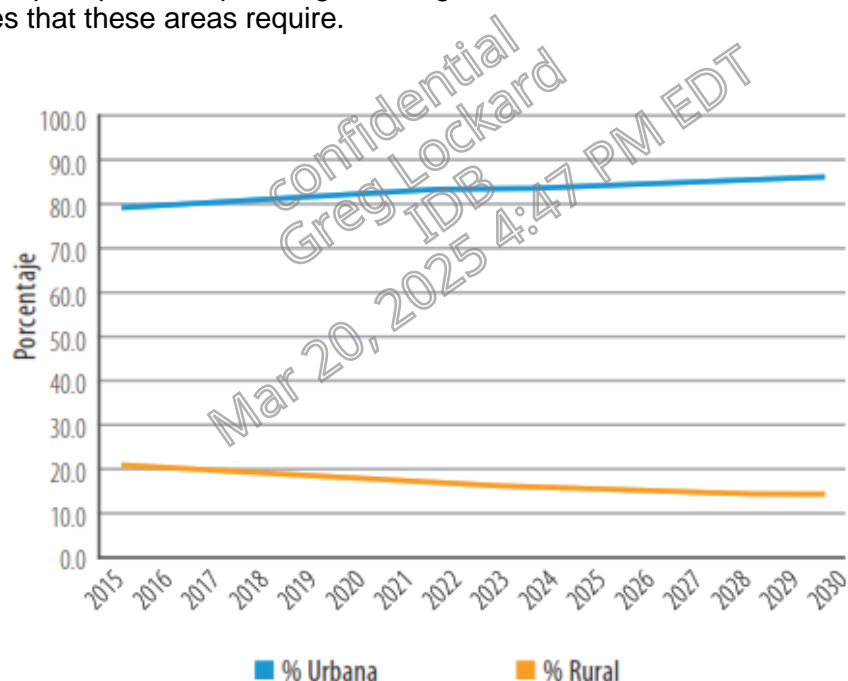


Figure 6-212. Projections of the percentage of urban and rural population (2015-2030) in Dominican Republic.

Source: ONE, 2014

- Condition and age of infrastructure:** Drinking water distribution networks with a certain age, and whose useful life has been exceeded, have high maintenance costs when infrastructure rehabilitations and/or replacement are not carried out. Utilities often lack the financial capacity to invest in substantial infrastructure replacement programs. The result

is that utilities continue to operate fully depreciated assets for 20 to 50 years after the time when replacement should have occurred (INDHRI-Grusamar, 2009). Although new aqueducts are built year after year, service coverage does not keep pace with population growth, and coverage currently reaches 80% of the population. In general, it is the poorest areas of the country that have the lowest service coverage.

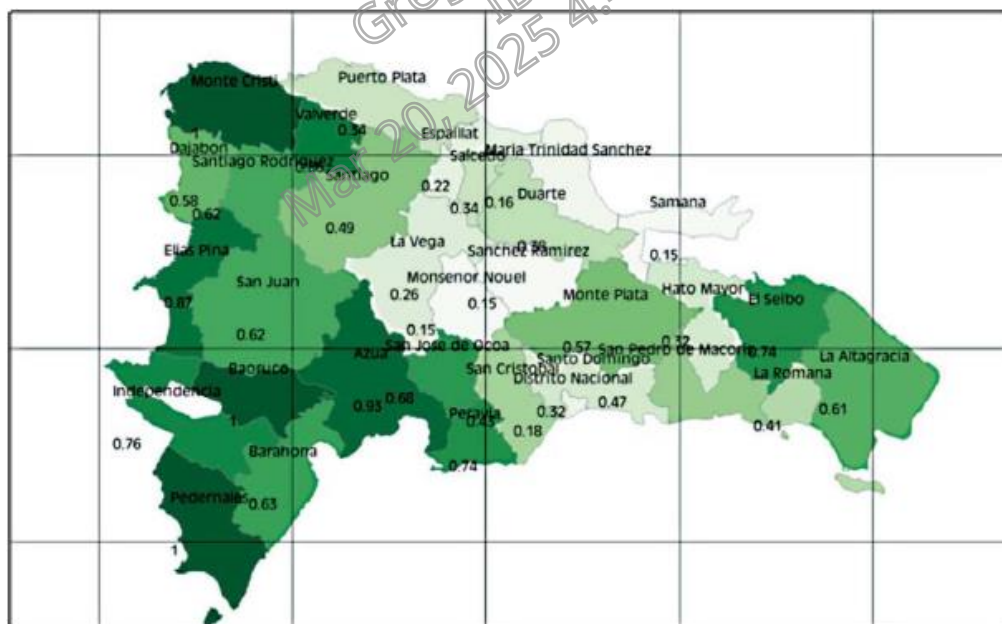
- **Quality and continuity of services:** It is highly inefficient, despite the fact that the investment made in the PHC (Sanitary Potable Water) sector during the last decades has been substantial. Employment in all cases is more than double the necessary for an efficient management, due to political interference in the appointment of personnel.

The vulnerability assessment developed by the Ministry of Environment and Natural Resources in the Third National Communication on Climate Change was carried out at the geographic level of provinces. For this analysis, the results for the project development area of the province of Monte Cristi were used as a reference. The results of the exposure, sensitivity, adaptive capacity and vulnerability indexes are shown in Table 6-78 and a map with the vulnerability index is also shown (Figure 6-213).

Table 6-78. Evaluation of water resource vulnerability in the Montecristi region.

Province	Exhibition	Sensitivity	Adaptive Capacity	Vulnerability	Level
Montecristi	0.91	0.62	0.269	1.23	Very High

Source: Third National Communication of the Dominican Republic



NOTA: Los colores más oscuros representan mayor vulnerabilidad al cambio climático.

Figure 6-213. Evaluation of water resource vulnerability in the Montecristi region.

Source: Third National Communication of the Dominican Republic. (Ministry of Environment and Natural Resources, 2018).

According to the results obtained, the province of **Montecristi** has a **very high vulnerability to water resources**.

Water resources, according to future climate scenarios due to the effects of climate change, are highly vulnerable for the region of Montecristi, due to the fact that the forecasts regarding temperature increase, annual rainfall, droughts and extreme weather events are, to a certain extent, alarming, and that they are also coupled with the high demand for water needed to meet the Montecristi Development Plan, population increase due to the demand of workers for the projects, among other factors.

If the aquifer in the area is not recharged more by precipitation than the expected demand, it will be overexploited and gradually depleted, lowering the water table and favoring the intrusion of seawater from the coast, resulting in the salinization of groundwater.

This salinization of the aquifer will have the following negative consequences:

- The worsening of water quality generates health, social, industrial and domestic infrastructure problems, as salt acts as a corrosive agent.
 - The salt stress caused in vegetation leads to physiological and biochemical changes that compromise its survival and that of other living beings for which it is a source of food.
- Sea level rise and saline intrusion

According to projections made for the Montecristi region, approximately 2-3 meters of coastline width will be lost by 2030 and by 2050 approximately 4-5 meters due to the effect of sea level rise.

The Table 6-79 presents the results of the vulnerability calculations for each coastal province, based on all the data generated for exposure, sensitivity and adaptive capacity. It should be noted that these results refer to the union of the different assessments for exposure and sensitivity. Therefore, even if a province is, under these terms, not very vulnerable, it does not imply that it cannot present high levels of exposure or sensitivity in the factors analyzed.

The analysis carried out indicates that, based on the combination of the indicators used, the following conclusions can be drawn:

- Very High Vulnerability: La Altagracia, Barahona and Samaná
- High Vulnerability: Puerto Plata, **Montecristi**, Pedernales, Azua, El Seibo, Esppaillat, San Cristóbal and San Pedro de Macorís.
- Medium Vulnerability: Hato Mayor, María Trinidad Sánchez, Peravia and Santo Domingo.
- Low Vulnerability: La Romana.

The factors that influence the very high vulnerability of La Altagracia can be specified as follows: La Altagracia is very vulnerable in terms of water resource management, due to its high-water demand and inadequate management of the territory where the resource is located. This has resulted in a progressive deterioration of the resource. This has placed the province of La Altagracia within the very high vulnerability with respect to the Coastal-Marine Sector and may happen to the province of Montecristi if it does not include within the design of the Development Plan all these measures for adaptation to climate change that led to the resilience of the Plan.

Due to the tourism industry model implemented, the very high demand for water in La Altagracia is due, on the one hand, to the intrinsic requirements of the resorts (water for cleaning, sanitary and food services), and on the other hand, to all the landscape and golf course requirements. This level of demand contrasts with the scarcity of water that characterizes the area, since geologically the strong presence of limestone makes superficial water sources very scarce.

Table 6-79. Vulnerability of each coastal province

Provinces Coastal	Valuation Exhibition Integrated	Valuation Sensitivity Integrated	Valuation Capacity Integrated Adaptive	Vulnerability
Azua	3.25	2.44	1.77	4
Barahona	4.25	2.27	1.60	5
El Seibo	2.75	2.78	1.56	4
Españolat	2.75	3	1.63	4
Hato Mayor	2.25	2.6	1.58	3
La Altagracia	3.38	3.47	1.85	5
La Romana	2.00	2.45	2.25	2
María Trinidad Sánchez	2.00	2.75	1.77	3
Montecristi	2.88	2.96	1.40	4
Pedernales	3.25	2.04	1.71	4
Peravia	2.75	2.47	2.04	3
Puerto Plata	2.25	3.87	1.88	4
Samana	3.13	3.63	1.62	5
San Cristobal	2.50	3.12	1.99	4
San Pedro de Macorís	2.50	3.57	2.07	4
Santo Domingo	3.00	2.77	2.51	3

Source: PNACC.

As a consequence of poor management of subway aquifers, there has been an increasing salinization of these aquifers. In fact, it should be noted that La Altagracia is the province with the highest percentage of subway aquifers affected by salinization due to marine intrusion. Therefore, it is necessary to make a more efficient use of this resource (use of devices that use less water, recycling, among others) to minimize the rate of salinization of aquifers.

For the province of La Altagracia (and for the future Development Plan of Montecristi), where the strong pressures of the current system of environmental tourism use show elements of deterioration of natural resources, it is a priority to implement actions to reduce its vulnerability to climate change.

In the case of our country, considering the aforementioned variables, the following can be concluded in general terms with respect to the factors that affect vulnerability:

- Exposure: High degree of exposure.
- Sensitivity: Ecosystems and/or sectors with high sensitivity.
- Adaptation: Low adaptability.

6.1.15.3.3 Economic assessment of climate change risks in the Caribbean region

Tourism and water are important contributors to the Dominican Republic's GDP, yet they are the ones potentially projected to be affected by climate change: At the same time, energy supply is a cornerstone for the country, with great potential not only for greenhouse gas mitigation, but also for cost savings.

The Climate and Development Report for the Dominican Republic (CCDR) (World Bank, 2023)²⁷, concludes that the projected effects of climate change could jeopardize some of the development gains achieved. By 2050, climate change is expected to have a significant impact on people's health, infrastructure, and natural ecosystems such as forests and coastal zones. In some cases, crop yields could decrease by up to 30%, and poverty rates could increase. Without adaptation measures, the country could fail to generate almost 17% of its GDP relative to a scenario without climate change-induced damage. This would be caused mainly by reduced tourism demand, increased tropical storms and flooding, and reduced labor productivity due to higher temperatures caused by climate change.

Under a warm/dry climate scenario, up to 16.7% of GDP could be lost relative to the baseline scenario. Taking measures to reduce direct damage from erosion on agricultural production, inland flooding, sea level rise and tropical storms could reduce potential macroeconomic impacts by up to 10 percentage points (60% reduction) by 2050.

In the latest Dominican Republic Climate and Development Report, the World Bank Group emphasizes that investments in a resilient, low-carbon development pathway, while costly upfront, bring broad benefits in terms of reduced emissions, lower fuel consumption, fewer traffic accidents, and greater resilience.

In an ambitious scenario (Table 6-80), new energy infrastructure will require significant upfront investments: 1.1% of cumulative GDP in 2050. Electricity sector mitigation efforts are an important investment to support the fulfillment of national climate change commitments and offer the largest mitigation impacts. They also enable deep electrification of the transport sector. Transport decarbonization investment costs are estimated at 1.1% of cumulative real GDP by 2050, including hybrid electric vehicles and mode shift. Although both investments are costly, their long-term economic benefits together outweigh their costs as a result of avoided emissions, reduced fuel costs and road damage, and reduced fatalities due to improved air quality.

In addition, there are opportunities for mobilizing the private sector to support a portion of these investments, for both sectors, and future technological advances are likely to result in further cost reductions to make this transition sustainable.

Investments in resilience can provide substantial economic benefits and complement the transition to a low-carbon growth path. In this analysis, the greatest investment needs are identified to address sea level rise, coastal flooding and cyclone damage, followed by adaptations to address heat stress, and then crop production and water storage needs. Combined, these investments in total require an outlay of at least 1.6% of cumulative GDP by 2050. However, they bring significant benefits associated not only with direct damage reduction, approximately 3.4

²⁷ The World Bank group (2023). Country Climate and Development Report. Dominican Republic. November 2023. 1818 H Street NW, Washington, DC 20433 Available at <https://openknowledge.worldbank.org/server/api/core/bitstreams/a2ba9542-128d-4d17-b9db-7a55c3ace89a/content>

percent of cumulative GDP, but also economic multiplier effects, along with broader social benefits, not all quantifiable in the context of the Dominican Republic.

Studies in other contexts have identified that economic productivity and entrepreneurship benefits from investments aid disaster reduction. Model results estimate that efforts to reduce exposure to heat stress, in addition to reducing productivity losses by 50% in the service sector and 50% in industry annually by 2050, could have significant impacts on health and energy use that could be particularly beneficial to disadvantaged communities.

Table 6-80. Additional investment needs for resilient and low-carbon development.

	Cumulative emission reductions (MtCO ₂ e)		Investment cost (Cumulative % of GDP)		Investment costs (Millions USD year 2022)		Total Profits (%Cumulated of GDP)		Net Profits (Cumulative % of GDP)	
	2030	2050	2030	2050	2030	2050	2030	2050	2030	2050
Combined Energy/Transportation	14	221	1.0%	2.2%	7,660	38,037	0.4%	2.3%	-0.6%	0.1%
Energy	10	207	0.3%	1.1%	5,221	18,399	0.2%	0.9%	-0.1%	-0.2%
Transportation	4	14	0.7%	1.1%	2,439	19,638	0.2%	1.3%	-0.5%	0.3%
AFOLU	23	57	0.0%	0.0%	215	417	0.1%	0.1%	0.1%	0.1%
Tropical Cyclones / Mean Sea Level Rise	-	-	1.5%	1.6%	11,689	2,398	2.1%	5.0%	1.4%	3.4%

Note: *Gross investment needs estimated at a discount rate of 6%. *Agriculture investments amount to \$291 million in 2030 and \$658 million in 2050 but are not explicitly incorporated into the macro model. Monetized benefits include avoided emissions, avoided fuel use, and, in the case of transportation and energy, reduced mortality from improved air pollution, fewer accidents, and less road damage for transportation. In the case of AFOLU, the net benefit relative to other land uses is used.

Source: Climate and Development Report for the Dominican Republic (CCDR) (World Bank, 2023).

According to the UNDP report (Climate change in the Dominican Republic: estimation of investments needed to address it), US\$ 4451 million will be needed to adapt to the impacts of climate change in the tourism and water sectors, while activities to mitigate greenhouse gas emissions in the energy sector will save US\$ 7102 million.

6.2 Biological Baseline

With regard to the characterization of the terrestrial biotic environment, it is important to note that the land where the project will be developed is a space that has been modified.

6.2.1 Methodology for the description of the biotic environment

6.2.1.1 Methodology for the description of flora and vegetation.

For the characterization of the vegetation, walks and observations were made throughout the project area during the second week of October 2023 during the dry season, where the types of plant associations and their floristic composition were determined; no samples were taken during the rainy season because there was no marked difference between the floristic inventory and the vegetation from one season to another (see section 6.2.4). The botanists in charge of conducting the study were Ricardo García, former director of the National Botanical Garden of the Dominican Republic, and Francisco Jiménez, deputy director of the same institution and authors of the Red List of Vascular Flora in the Dominican Republic, 2016, used to identify threatened and endangered species, in order to determine whether the habitat where the project will be developed is a critical habitat or not (Figure 6-214).

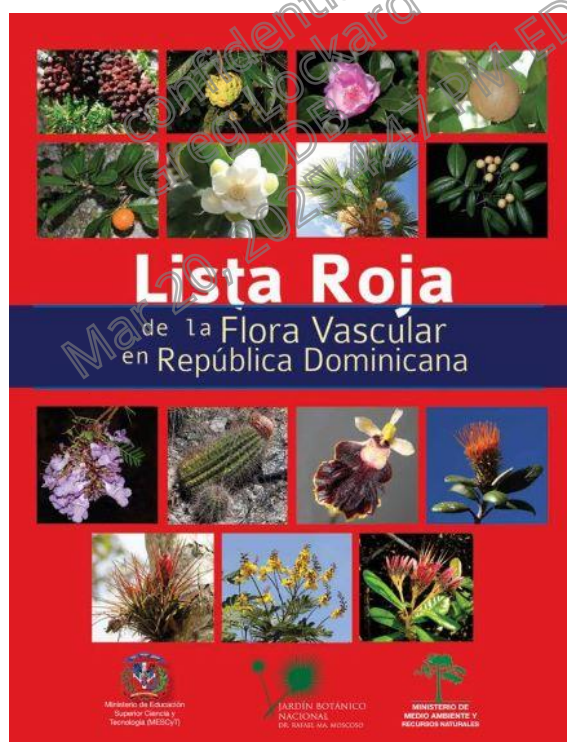


Figure 6-214. Red List of Vascular Flora in the Dominican Republic (2016), based on the criteria used by the International Union for Conservation of Nature (IUCN) and published by the National Botanical Garden "Dr. Rafael M. Moscoso" and the Ministry of Environment and Natural Resources.

Source: National Botanical Garden "Dr. Rafael M. Moscoso" and the Ministry of Environment and Natural Resources (2016).

In the area of Block 02, 10 transects of 50 X 50 m were carried out, considering the physiognomic characteristics of the vegetation and the particularities of each environment. The 8 transects carried out for Block 01 were also used as secondary information since they are located in the area of influence of Block 02. The transects of Block 02 were selected considering the different types of vegetation present in the area, following the preferential method according to Matteuci & Colma (1982). Each of the transects was georeferenced (Table 6-81 and Map 13 in Annex 6).

Table 6-81. UTM coordinates of location of vegetation and flora sampling transects (VF).

Blocks	Transects sampling	UTM coordinates		Types of vegetation
		X	Y	
01	VF - 1	212798	2180635	Secondary xerophytic vegetation
	VF - 2	213843	2180254	
	VF - 3	213575	2180415	
	VF - 4	213184	2180809	Mangrove
	VF - 5	213054	2180642	Secondary xerophytic vegetation
	VF - 6	212776	2180748	
	VF - 7	212995	2180873	Mangrove
	VF - 8	212880	2181358	Coastal vegetation on sand with a predominance of mangle botón (<i>Conocarpus erectus</i>).
02	VF - 9	212843	2179905	Secondary xerophytic vegetation
	VF - 10	212856	2179852	
	VF - 11	213126	2179257	
	VF - 12	213171	2179147	Pasture
	VF - 13	213963	2178880	
	VF - 14	214037	2178641	
	VF - 15	215054	2178409	Secondary xerophytic vegetation
	VF - 16	214962	2178483	
	VF - 17	215142	2178469	
	VF - 18	216441	2178414	Secondary xerophytic vegetation in transition to mangrove.

Source: EMPACA, 2024.

To complement the characterization of the vegetation and the flora inventory, the area was traveled along the entire length of the electric transmission line, with the objective of collecting and identifying the species that do not appear within the transects, as well as identifying the state of the vegetation and observing the impacts on it.

The taxonomic identification of the species was done in situ for most of them, and the others were collected and identified in the National Herbarium of Santo Domingo (JBSD), by comparison with specimens from the collection and with the use of taxonomic keys contained in the flora of Hispaniola (Liogier, 1982, 1983, 1985, 1985, 1986, 1989, 1994, 1995, 1996, 2000 and Acevedo, 2003) (Photo 1 in Annex 13).

The common names were taken mostly from the Diccionario Botánico de Nombres Vulgares de La Española (Liogier, 2000), and others were contributed by the botanist authors of this study.

The species identified were included in a list indicating family, status, estimated abundance, scientific and common names, as well as conservation status: Endangered (EN); Critically Endangered (CR); Vulnerable (VU) according to the categories of the International Union for Conservation of Nature IUCN and those included in CITES; as well as the georeferencing of threatened and/or protected species to be removed or conserved.

For the conservation status of the species, we used the Red List of Vascular Flora in the Dominican Republic (2016), based on the criteria used by the International Union for Conservation of Nature (IUCN) and published by the National Botanical Garden "Dr. Rafael M. Moscoso" and the Ministry of Environment and Natural Resources, as well as those included in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

The field work was supported by photographic material, taken by the flora and vegetation specialists themselves, showing the characteristics of the habitats, the soils, and the particularities of the species in question.

Once the information was updated, a list of biodiversity values and the vegetation map was prepared, which was the starting point for preparing the plan of measures to prevent, mitigate, restore and compensate, when necessary, for the impacts on biodiversity that will be caused by the project.

For the elaboration of the map of vegetation types, the Map of Life Zones presented in the Atlas of Biodiversity and Natural Resources (Ministry of Environment and Natural Resources (2012) was taken as a reference, which allowed to establish a priori the points to draw the transects according to Matteucci & Colma (1982) which were verified in the field visits. This made it possible to define the vegetation types and georeference their limits. See Figure 6-223 in subsection 6.2.5.3

6.2.1.2 Methodology for the description of the fauna

Sampling techniques for amphibians and reptiles: standardized methodologies were used (Suárez and Mena, 1994; Rueda (2006) in Angulo *et al*; 2006), which consisted of stations or sampling points in which free and unrestricted searches were conducted, paying special attention to the available microhabitats, 5 sampling stations were used to evaluate the area of Block 02 and the transmission line. This technique consists of walking within a radius of 50 meters during the day and night, for an established time of 25 minutes for each station or sampling point. This method is very efficient for obtaining the greatest number of species in the least amount of time by experienced collectors.

Sampling was done by combining two types of surveys: VES (Visual Encounter Surveys) and AES (Auditive Encounter Surveys), which maximized the possibilities for recording. This method is effective as long as no attempt is made to count large choruses of singing males in a given area.

Taking into account the periods of activity of the different species of amphibians and reptiles in the dry forests of the island, sampling for Block 02 was carried out from 1 to 5 October 2023 (May-October wet season) and from 15 to 20 December 2023 (November-April dry season), throughout the day and most of the night, emphasizing the hours of greatest activity of the species of interest (starting at 8:30 am, which can extend until 1:00 am). The 7 sampling points of Block 01 were included as secondary information (Table 6-82 and Map 14 in Annex 6).

Table 6-82. UTM coordinates of the sampled stations of amphibian and reptile species (H) in the study area.

Blocks	Sampling station	Vegetation Formation	UTM coordinates	
			X	Y
01	H-01	Mangrove heavily impacted	212847	2181317
	H-02	Coastal vegetation on sand with a predominance of mangle boton (<i>Conocarpus erectus</i>).	213179	2181352
	H-05	Mangrove	212557	2180910
	H-06		213031	2180733
	H-07	Secondary xerophytic vegetation	213540	2180451
	H-09		213197	2179231
	H-10		213975	2179853
02	H-11	Secondary xerophytic vegetation.	213207	2179207
	H-12	Pastures.	213018	2179967
	H-13	Degraded secondary xerophytic vegetation.	214292	2178645
	H-14	Secondary xerophytic vegetation in transition to mangrove.	215420	2178430
	H-15		216610	2178340

Source: EMPACA, 2024.

The search through the VES method was carried out both on the substrate and among the vegetation present, checking potential places of refuge and activity (under leaves, on leaves and under trunks). It is worth mentioning that this sampling technique did not cause any impact to the individuals or their environment. The records were made through manual captures and photographic records for their identification, and they were later released at the same capture site.

For the identification of species in situ, reference publications were used, such as: the Guide for the identification of amphibians and reptiles of Hispaniola by Schwartz and Henderson (1991) and the Caribbean Amphibian and Reptile Database (Caribherp, 2020).

To determine the biogeographic status and the threat status of the species recorded, the lists of endangered, threatened and/or protected species of the Dominican Republic were taken into account (MIMARENA, 2018), as well as the database of the Red List of Threatened Species of the International Union for Conservation of Nature (IUCN, 2022) the Caribbean Amphibian and Reptile Database (Caribherp, 2020; GBIF, 2024 and IBAT, 2024).

Sampling techniques for birds: in the case of the taxonomic group of birds, the most practical and appropriate methods for collecting data on landbird populations in the Caribbean were used to obtain information in the field, combining three sampling techniques: fixed point counts, the interview technique and opportunistic observations (Ralph *et al.* 1981, 1995 and Wunderle *et al.* 1994).

Each of the techniques used is described below:

Fixed counting points: a total of seven fixed sampling points were worked (see Table 6-83), with this technique the number of species and individuals observed and heard within the perimeter were identified and recorded, for which an average observation radius of 25 m and a maximum of 50 m was considered at each point (Map 15 in Annex 6). Sampling began in the early morning at sunrise, from 6:20 am with continuous activity until 10:00 am, then began again at 4:00 pm until 7:00 pm to complete the daytime sampling; twilight and nighttime sampling began at 7:00 pm to end at 11:00 pm.

It should be noted that the distance between points was equal to or greater than 200 meters from one to another (Ralph *et al.* 1981, 1995; Wunderle, 1994; Allen, 1986; Lack, 1954 and 1966; Call, M. W. 1981 and Lancia, *et al.* 2005). From the data recorded it was possible to elaborate a list of presence, calculate relative abundance, species richness, determine movement routes, make comparisons between the different types of vegetation and habitat use where they occur. The 10 sampling points of Block 01 were included as secondary information.

Table 6-83. UTM coordinates of bird sampling stations (A).

Blocks	Sampling station	UTM coordinates		Type of vegetation cover unit or habitat
		X	Y	
01	A-1	212236	2181241	Mangrove
	A-2	212499	2181057	
	A-3	212995	2181369	Area of coastal vegetation on sand with a predominance of mangle boton.
	A-4	213523	2181296	
	A-5	213265	2180993	Mangrove
	A-6	212940	2180690	Secondary xerophytic vegetation
	A-7	212261	2180436	
	A-8	213366	2180592	
	A-9	212797	2180004	
	A-10	212901	2179816	
02	A-11	212797	2180004	Secondary xerophytic vegetation.
	A-12	212901	2179816	
	A-13	213407	2178996	Pasture
	A-14	214135	2178686	Secondary xerophytic vegetation.
	A-15	215158	2178457	Secondary xerophytic vegetation in transition to mangrove.
	A-16	215796	2178716	
	A-17	216660	2178200	Secondary xerophytic vegetation.

Source: EMPACA, 2024.

The duration of sampling at each fixed point did not exceed 10 minutes, since sampling for longer than this time may cause an increase in the standard error of the results during the analysis (Smith *et al.* 1997; Cox and Ricklefs, 1977).

For the appreciation of individuals of the same species, which are only heard in flocks, a maximum of two individuals were considered. In the case of mixed flocks, only one sound was recorded for each species heard. This method allows the observer to remain fixed for a certain period,

increasing the probability of detecting birds and reducing the degree of disturbance generated during transect movements (Chávez-León and Velázquez, 2004).

Interview: with this technique, information is sought on the history of the avifauna of the site, for details of a particular species and possible impacts that have affected the taxonomic groups treated (Vicente, 1998).

Opportunistic observations: as the name suggests, these are observations made at random, providing new species that are located outside the techniques used during the process and serve to add qualitative data to the list of the site (Allen, 1986).

The work was carried out using the hours of greatest bird activity (the first three hours of the morning and the last two hours of the afternoon), identifying individuals by observation or by identification of their songs; this technique allows the greatest number of species possible to be recorded in short samplings (Allen, 1986).

For the identification and taxonomic classification of bird species, we followed the standards and rules of the American Ornithological Society (AOS); the Guide to the Birds of the Dominican Republic and Haiti and A Guide to the Birds of the West Indies (AOS, 2020; Latta *et al.* 2006 and Raffaele *et al.* 1998; GBIF, 2024 and IBAT, 2024/Devenish, C. *et al* 2009) .

For the biogeographic status categories we used the categories proposed by Raffaele *et al.* (1998) and Latta *et al.* (2006); AOS, 2020; AOU, 2022) GBIF, 2024 and IBAT, 2024/Devenish, C. *et al* 2009) which include:

- Resident: species of permanent presence in a natural way, which reproduce in Hispaniola.
- Endemic: species that occur only on the island and its territories, and whose presence is not found elsewhere in the world.
- Migratory: species that reproduce outside the island and come to the island during their non-breeding season, generally from September to April.
- Introduced: species not native to the island, but which, for unnatural reasons such as releases and escapes, are present in wild areas where they can even reproduce.

The following categories were used to classify the trophic guilds:

- Insectivores: species whose diet is based primarily on insects.
- Frugivores: species that feed mainly on fruits and seeds.
- Nectarivores: species whose diet is based on the nectar produced by plant flowers.
- Piscivores: species that depend strictly on fish for food.
- Raptors: are "birds of prey", carnivores that hunt and feed on animals including other birds (Guariguata and Kattan, 2002 and Reales *et al.* 2009).

- Scavengers: species that feed on animal carcasses, without having participated in their hunting.
- Omnivores: opportunistic and generalist species, with the ability to eat seeds and insects and small vertebrates (Guariguata and Kattan, 2002 and Reales *et al.* 2009).

For the identification of the conservation status of species and critical habitats, the considerations of the Red List of the World Conservation Union (IUCN, 2022), the Red List of Threatened Species of Fauna and Flora in the Dominican Republic (MIMARENA, 2018) and the World Bank's Environmental and Social Framework document (World Bank, 2016); Biodiversity Database (GBIF, 2024, Devenish *et al.* 2009, Perdomo, *et al.* 2009) were taken into account.

Sampling techniques for terrestrial mammals: two techniques were used to collect information on terrestrial mammals in the field: transects or line trails and intensive search (Birriones, 2004; Reid, 1997; Bilenca *et al.* 1999; Garrido G. *et al.* 2009; Barrull and Mate, 2007).

Linear transect or trajectory: five linear transects of 200 m were established, which were worked during two days and two nights, these were georeferenced with Garmin MAP 64s GPS; during the routes, we searched exhaustively for any indication of the presence of endemic mammals (Table 6-84). The following signs were considered as evidence: footprints on the ground, feces, bites on leaves and tree bark, burrows, carcasses, skeletons, sightings etc. In this case only 3 of the sampling points of Block 01 were taken as secondary information since two of the points coincided in both Blocks.

Table 6-84. UTM coordinates of the transects for the sampling of terrestrial mammals (MT) in the project area.

Blocks	Transects	UTM coordinates				Type of vegetation
		Home		Final		
		X	Y	X	Y	
01 y 02	MT-1	212796	2179847	213132	2179606	Secondary xerophytic vegetation
01	MT-2	213101	2181303	213414	2181390	Mangrove
	MT-3	213130	2180600	213433	2180457	Secondary xerophytic vegetation
	MT-4	213037	2180700	212829	2180170	
01 y 02	MT-5	212786	2179959	212756	2180170	
02	MT-6	213132	2179328	213560	2179021	Secondary xerophytic vegetation in transition to mangrove.
	MT-7	214600	2178609	215100	2178460	
	MT-8	215324	2178554	216246	2178613	

Source: EMPACA, 2024.

Intensive search: this was the technique used to search for and record evidence of the presence of the species; it was applied while walking along the transects combined with daytime walks to detect species and records that could be located during movements in the area outside the established transects and schedules (Reid, 1997 and Sáenz, 1999) in order to search for tracks, excreta, active burrows, marks on plants or signs of feeding and scavengers (Bilenca *et al.* 1999). Records of tracks were evidenced by photographs.

Sampling technique for flying mammals: to collect information for this group, two techniques were used: the use of mist nets for capture and the use of transects or 200-meter routes. In this case, information from two sampling points in Block 01 was added as secondary information, because one of the stations was included in the monitoring for both blocks. See Table 6-85.

Table 6-85. UTM coordinates of the transects and stations where the nets were placed for flying mammals (MV).

Blocks	Stations	UTM coordinates where the trapping nets were placed		UTM coordinates of the transects				Type of vegetation
				Home		Final		
		X	Y	X	Y	X	Y	
01	MV-1	213265	2180993	213203	2180896	213355	2181051	Mangrove
01 y 02	MV-2	212901	2179816	212807	2179870	212994	2179762	Secondary xerophytic vegetation
02	MV-3	214293	2178646	214181	2178698	214400	2178567	Secondary xerophytic vegetation in transition to mangrove.
	MV-4	216611	2178342	216493	2178393	216717	2178274	

Source: EMPACA, 2024.

Use of mist nets: two nights were spent working in the project area and mist nets were placed to capture the bats (Baillie *et al.* 1986 and Peach *et al.* 1991). The nets have the following dimensions: six meters long by two meters wide (Photo 2 in Annex 13).

The sampling stations were selected considering the places of passage and frequent use of this group. At each station, five mist nets were placed for capture for two nights, which were opened at 18:00 hours until 22:00 hours to cover the hours of greatest activity of this group. The total time spent with the nets open at each site was four hours. The captured individuals were identified and marked with a harmless ink so as not to duplicate the information, and then released (Photo 3 rainy season and Photo 3b dry season in Annex 13).

For species identification, the illustrated identification guide to the chiroptera of Hispaniola, published in 2019 in the journal NOVITATES CARIBAEA, was used (Núñez Novoa *et al.* 2019).

Use of 200-meter transects or routes: two 200-meter linear transects were made in the sampling sites for this group, to detect and verify the crossings of individuals, these were made close to the capture sites, and by observation the number of individuals and the height of the flights were considered. The routes were carried out within the four hours of greatest activity of this group. This technique only works for counting individuals.

6.2.1.3 Methodology for defining critical habitat.

For the characterization of habitat types, the concepts of modified, natural and critical habitats of the International Finance Corporation (IFC) Performance Standard 6 on Biodiversity Conservation and Sustainable Management of Living Natural Resources were considered.

Modified habitats: Modified habitats are areas that may contain a large proportion of non-native plant or animal species, or where human activity has substantially modified the primary ecological functions and species composition of the area. Modified habitats include areas managed for agriculture, forest plantations, reclaimed coastal areas and reclaimed wetlands.

Natural habitats: natural habitats are areas composed of a viable assemblage of plant or animal species, mostly native, or where human activity has not produced any substantial modification of the primary ecological functions or species composition of the area.

Critical habitats: critical habitats are areas with high biodiversity value, such as:

- (i) Habitats of significant importance for the survival of threatened or critically endangered species (according to the IUCN Red List of Threatened Species). *The determination of critical habitats on the basis of other lists is carried out as follows: (i) if the species is listed nationally or regionally as threatened or critically endangered species, in countries adhering to IUCN guidelines, the critical habitat determination will be made by assessing each project individually, in consultation with competent professionals, and (ii) in cases where nationally or regionally listed species categorizations do not correspond well with those of the IUCN (e.g., some countries use more general categories such as "protected" or "restricted" species), an assessment will be carried out to determine the rationale and purpose of the categorization. In this case, the critical habitat determination was based on such an assessment;*
- (ii) Habitats of significant importance for the survival of endemic species or species restricted to certain areas;
- (iii) Habitats that support the survival of globally significant concentrations of migratory or congregating species;
- (iv) Unique or highly threatened ecosystems, or
- (v) Areas associated with key evolutionary processes.

Criteria

Criterion 1: Threatened or critically endangered species. Globally endangered species listed as CR and EN on the IUCN Red List of Threatened Species are part of Criterion 1. Critically endangered (CR) species face an extremely high risk of extinction in the wild. Endangered (EN) species face a high risk of extinction in the wild.

The thresholds for Criterion 1 are as follows:

- a) areas that support globally significant concentrations of an IUCN Red List species as CR or EN ($\geq 0.5\%$ of the global population AND ≥ 5 reproductive units (NO16) of a CR or EN species);
- b) areas that support globally significant concentrations of a species identified as Vulnerable (VU) on the IUCN Red List, the loss of which would result in a change in the Red List status of the species to CR or EN and which would meet the thresholds in a) above;
- c) if applicable, areas containing significant concentrations of a species listed nationally or regionally as CR or EN.

Criterion 2: endemic or geographically restricted species. For the purposes of the guidance note, the term "endemic" is defined as "geographically restricted". This means that the species has a limited extent of occurrence.

The threshold for Criterion 2 is as follows:

a) areas that typically contain $\geq 10\%$ of the world's population AND ≥ 10 breeding units of a species.

Criterion 3: Migratory species or species that form congregations. Migratory species are all those species in which a significant proportion of their members move cyclically and predictably from one geographic area to another (even within the same ecosystem).

The thresholds for Criterion 3 are as follows:

a) areas that support, on a cyclical or regular basis, $\geq 1\%$ of the world population of a migratory species or that congregate at any point in the life cycle of the species;

b) areas that are expected to support $\geq 10\%$ of the world population of a species during periods of environmental stress.

Criterion 4: Highly threatened or unique ecosystems

The thresholds for Criterion 4 are as follows:

a) areas representing $\geq 5\%$ of the global extent of an ecosystem type that meets the criteria for IUCN CR or EN status;

b) other areas not yet assessed by IUCN but considered to be of high conservation priority in regional or national systematic conservation planning.

Criterion 5: Evolutionary processes of key importance.

The structural attributes of a region, such as its topography, geology, soil, temperature, and vegetation, and combinations of these variables, can influence the evolutionary processes that give rise to regional configurations of species and ecological properties. In some cases, unique and specific characteristics of a landscape have been linked to genetically unique populations or subpopulations of plant or animal species. Physical or spatial features have been described as surrogates or spatial catalysts for evolutionary and ecological processes, and such features are often associated with species diversification.

Maintaining these key evolutionary processes in a landscape, as well as the resulting species (or subpopulations of species), has become a central theme of biodiversity conservation in recent decades, particularly the conservation of genetic diversity. By conserving species diversity in a landscape, the processes that drive speciation, as well as genetic diversity within species, evolutionary flexibility in a system is ensured, which is especially important in a context of rapid climate change.

6.2.2 Vegetation characterization and results of the terrestrial flora inventory

Three types of vegetation were identified in the project area: secondary xerophytic vegetation in the area where the Block 02 facilities will be built and along the transmission line route; grassland and secondary xerophytic vegetation in transition to mangrove along the transmission line route. See Map 13 in Annex 6. of vegetation types and location of sampling stations.

The xerophytic vegetation corresponds to the Monte Espinoso and Subtropical Dry Forest life zones, according to Hartshorn (1981).

6.2.2.1 Secondary xerophytic vegetation

This type of vegetation is found in almost the entire route of the power line and in the area where the power plants of both blocks will be built. There was no variation in the floristic composition at the points where it is present.

The area corresponding to Block 02 was cleared so data were taken from sampling transects VF-1 and VF-2, located adjacent to Block 02 (Photo 4 in Annex 13).

The vegetation in the area has been altered for cattle ranching, timber, firewood, and charcoal extraction, and the tree stratum has been the most affected. The trees reach between 6 and 7 meters in height. Even with the effect of anthropogenic activities, the vegetation preserves most of the species typical of this type of environment.

The vegetation is dominated by bayahonda (*Prosopis juliflora*) (Photos 5 and 6 in Annex 13), associated with this are other trees such as: aroma (*Vachellia macracantha*); *Vachellia tortuosa*; guayacán (*Guaiaacum officinale*); raqueta (*Euphorbia lactea*) (Photo 7 in Annex 13); cabrita (*Bunchosia glandulosa*); vera (*Guaiaacum sanctum*); mabi (*Colubrina elliptica*); arboreal cacti such as cayuco (*Lemaireocereus hystrix*); *Pilosocereus polygonus*; candelon (*Senegallia skleroxyla*) frijolito (*Capparis cynophallophora*); guácima (*Guazuma guazuma*); almacigo (*Bursera simaruba*); palo de chivo (*Senna atomaria*); quina (*Exostema caribaeum*); palo de leche (*Rauvolfia nítida*) and neem (*Azadirachta indica*), the latter is a very aggressive invasive exotic species (Photo 8 in Annex 13).

Shrubs are represented by: doña sanita (*Lantana camara*); *Pictetia spinifolia*; chicharrón (*Casearia illicifolia*); serrazuela (*Randia aculeata*); doncella (*Solanum polyacanthum*); bean *Capparis flexuosa*; *Turnera diffusa* and bolsa de gato (*Helicteres jamaicensis*) among others.

The herbaceous group is represented by: Escobita (*Bastardia bivalvis*) (Photo 9 in Annex 13), dominant species in the understory, associated with these we find: *Opuntia taylori*; *Evolvulus arbuscula*; espartillo (*Leptochloopsis virgata*); pajón (*Bothriochloa pertusa*); grama (*Setaria monostachya*); tostón (*Allionia incarnata*); *Bouteloua juncea*; patagón (*Boerhavia scandens*); tuna brava, *Opuntia dillenii*; feafa, (*Talinum paniculatum*) (Photo 10 in Annex 13); as well as the epiphytic bromeliad piña de alambre (*Tillandsia recurvata*). Among the climbers and creepers, the following were observed: *Stigmaphyllon emarginatum*; Indian creeper (*Gouania lupuloides*) and *Cissus trifoliata*.

6.2.2.2 Secondary xerophytic vegetation in transition to mangroves

At point VF-10 there is secondary xerophytic vegetation connected to the mangrove (Photo 11 in Annex 13). The dominant species in the xerophytic vegetation are: bayahonda (*Prosopis juliflora*); guayacan (*Guaiaecum officinale*); palo de chivo (*Senna atomaria*); raqueta (*Euphorbia láctea*); aroma (*Vachellia macracantha*); neem (*Azadirachta indica*); *Selenicereus pteranthus*; cayuco (*Lemairocereus hystrix*); dona sanita (*Lantana camara*); mulito de pollo (*Opuntia taylori*) and escobita (*Bastardia bivaldi*), among others.

The mangrove area registers a mature state with individuals up to 15 meters tall, maintaining the same characteristics as the mangrove found in Block 01, along the entire length of the border with Estero Balsa. It is composed of three of the four species of mangroves present on the island, these being: mangle prieto (*Avicennia germinans*); mangle blanco (*Laguncularia racemosa*) and scarcely the mangle boton (*Conocarpus erectus*).

6.2.2.3 Pasture

At points VF-5 and VF-6 there is an area that was cleared and planted with pasture for sheep, leaving few trees. Until recently, the area was in production because the pipes to irrigate the pasture still remain. The pasture is almost entirely dominated by pangola (*Digitaria decumbens*), an exotic grass (Photo 12 in Annex 13). Associated with it were observed yaragua (*Rhynchelytrum repens*); escobita (*Bastardia bivaldi*); *Helicteres jamaicensis*; higuera (*Ricinus communis*); *Waltheria indica*; dona sanita (*Lantana camara*); *Stigmaphyllon marginatum*; *Pectis ciliaris*; *Stylosanthes hamata*; tua tua (*Jatropha gossypifolia*), some juveniles of neem (*Azadirachta indica*); aroma (*Vachellia macracantha*); *Vachellia tortuosa* (Photo 13 in Annex 13), among other trees present are the baítoa, (*Phyllostylon rhamnoides*); guácima (*Guazuma ulmifolia*), among others.

6.2.2.4 Floristic composition

In the project area, 106 species of vascular plants were identified, distributed in 43 families and 95 genera, including 4 endemics to Española Island, 94 native and 8 naturalized exotic species.

Annex 12.1 presents the list of flora species existing on the Project site.

Due to the extreme ecological characteristics of this ecosystem, its flora is very specialized and can be considered low in the number of species, if we compare it with the general flora of the island; but it is very important because it is a specialized flora. Garcia & Alba (1989) studied two zones of dry forest in the Dominican Republic, including from Rincon to Villa Elisa, Montecristi, which is similar to the Project area, they found a total of 245 species, of which 20.8% are endemic to the Spanish Island, many of these species are present in the area covered by this study.

6.2.2.5 Protected and/or threatened species.

Along the route of the power transmission line and in areas surrounding Block 02, 11 species (Table 6-86) that are protected by the Convention on International Trade in Endangered Species (CITES), the Red List of the World Conservation Union (IUCN, 2022) and the Red List of Vascular Flora in the Dominican Republic according to the criteria of the International Union for Conservation of Nature (JBN/MIMAREMA, 2016).

Table 6-86. Threatened and protected species.

Family	Species		CITES 2022	IUC N 2022	JBN/ MIMARENA 2016
	Scientific name	Common name (See Annex 13)			
AVICENNIACEAE	<i>Avicennia germinans</i>	Mangle (Photo 14)	-	LC	VU
CACTACACEAE	<i>Harrisia divaricata</i>	Pitahaya (Photo 15)	AP II	-	EN
	<i>Opuntia taylorii</i>	Mulito de pollo (Photo 16)	AP II	-	VU
	<i>Pilosocereus polygonus</i>	Cayuco (Photo 17)	AP II	LC	VU
	<i>Lemaireocereus hystrix</i>	Cayuco (Photo 18)	AP II	-	-
	<i>Selenicereus pteranthus</i>	(Photo 19)	AP II	-	-
COMBRETACEAE	<i>Conocarpus erectus</i>	Mangle boton (Photo 20)	-	LC	VU
	<i>Laguncularia racemosa</i>	Mangle blanco (Photo 21)	-	LC	VU
FLACOURTIACEAE	<i>Casearia ilicifolia</i>	Chicharrón (Photo 22)	-	-	CR
ZYGOPHYLLACEAE	<i>Guaiaicum officinale</i>	Guayacán (Photo 23)	AP II	EN	VU
	<i>Guaiaicum sanctum</i>	Vera (Photo 24)	AP II	NT	VU
Appendix II (AP II): Species that are not necessarily threatened with extinction but could become so unless trade is strictly controlled (CITES, 2022).					
Near Threatened (NT): A taxon that has been assessed against the criteria and does not currently meet the criteria for Critically Endangered, Endangered or Vulnerable, but is close to meeting the criteria, or is likely to meet the criteria in the near future (IUCN, 2022).					
Least Concern (LC): Taxon that has been assessed but does not meet any of the criteria defining the categories of Critically Endangered, Endangered, Vulnerable or Near Threatened (IUCN, 2022).					
Vulnerable (VU): A taxon that is facing a high risk of extinction in the wild (IUCN, 2022).					
Critically Endangered (CR): A species or taxon that faces an extremely high risk in the wild for the immediate future or whose survival is unlikely unless the factors causing the threat do not cease (JBN/MIMARENA, 2016).					
Endangered (EN): Taxon that does not reach the category of Critically Endangered but faces conservation problems for the near future in the wild, facing a high risk of extinction (JBN/MIMARENA, 2016).					
Vulnerable (VU): A species or taxon is considered in this category when it is below Critically Endangered and Endangered status but faces a high risk of extinction in the medium term if the factors that determine the threat continue to operate. These factors include: demographic rarity or reduction of their populations due to overexploitation, destruction of their habitats or other affectations (JBN/MIMARENA, 2016).					

Source: EMPACA, 2024.

It is recommended that individuals of protected species whose development and characteristics allow their removal and relocation, mainly cacti, be moved to the areas surrounding the project.

6.2.3 Characterization and results of the terrestrial wildlife inventory

6.2.3.1 Herpetofauna

6.2.3.1.1 Amphibians

A total of nine individuals belonging to two species and two families, both of the order Anura, were recorded for this group. Of these two species, the best represented in the study area was the Bufonidae, represented in the area by the species *Rhinella marina*, which is catalogued as introduced to the island and represents a threat to other native species. The other family is the Hylidae and is represented by *Osteopilus dominicensis*, which is an endemic species. Both families are nocturnal and dependent on water bodies for part of their life cycle (Table 6-87).

Table 6-87. Amphibian species located in the study area, rainy season.

Family	Scientific name	Common name	Biogeographic status	IUCN (2022)	MIMAREMA (2018)
Hylidae	<i>Osteopilus dominicensis</i>	Rana Platanera	Endemic	LC	NE
Bufonidae	<i>Rhinella marina</i>	Maco Penpen	Entered	LC	NE
Least Concern (LC): When, having been evaluated, it does not meet any of the criteria that define the threatened categories, therefore, it is equivalent to out of danger (IUCN, 2022).					
Not Evaluated (NE): Species that were not considered in the evaluation of the Red List of Threatened Species of the Dominican Republic, because their populations are stable (MIMAREMA, 2018).					

Source: EMPACA, 2024.

6.2.3.1.2 Reptiles

As for the reptile group, a total of 47 individuals were recorded, distributed in 12 species and belonging to 7 families and 8 genera. The family with the best representation in the Project area was the Dactyloidae with 3 species and 13 individuals. This family is represented by arboreal lizards of the genus *Anolis* and most of them are endemic lizards of the island, which have a very wide distribution. Next in order of abundance are the families Gekkonidae, Leiocephalidae and Dipsadidae; the first is composed of medium and small nocturnal lizards, which generally emit sounds and have combined biogeographic status between resident and introduced; while the other 2 families, with a representation of two species in the area each, are made up of both arboreal and terrestrial lizards and snakes; these species are all endemic. Finally, the other 3 families: Teiidae, Sphaerodactylidae and Boidae; present in the area have one species each (Table 6-88).

Table 6-88. Species of reptiles located in the study area, rainy season.

Family	Scientific name	Common name	Biogeographic status	IUCN (2022)	MIMAREMA (2018)
Dactyloidae	<i>Anolis distichus</i>	Lagarto Común	Resident	LC	NE
	<i>Anolis hispaniolae</i>	Lagarto Cabezón	Endemic	NA	NE
	<i>Anolis olssoni</i>	Lagarto de Grama	Endemic	LC	NE
Leiocephalidae	<i>Leiocephalus personatus</i>	Lagarto Cara Enmascarada	Endemic	LC	NE
	<i>Leiocephalus schreibersi</i>	Lagarto Cola Rizada	Endemic	LC	NE
Teiidae	<i>Pholidoscelis chrysolaemus</i>	Lagarto Gigante de la Hispaniola	Endemic	LC	NE
Gekkonidae	<i>Hemidactylus frenatus</i>	Gecko de Casa	Entered	LC	NE
	<i>Hemidactylus angulatus</i>	Gecko Africano Doméstico	Introduced	LC	NE
Sphaerodactylidae	<i>Sphaerodactylus difficilis</i>	Gecko moteado de la Española	Endemic	LC	NE
Dipsadidae	<i>Uromacer catesbyi</i>	Culebra Verde	Endemic	LC	NE
	<i>Hypsirhynchus parvifrons</i>	Culebra Corredora	Endemic	LC	NE
Boidae	<i>Chilabothrus striatus</i>	Boa de la Hispaniola	Endemic	LC	NE
Least Concern (LC): When, having been evaluated, it does not meet any of the criteria that define the threatened categories, therefore, it is equivalent to out of danger (IUCN, 2022).					
Not Assessed (NA): Not Assessed (IUCN, 2022).					
Not Evaluated (NE): Species that were not considered in the evaluation of the Red List of Threatened Species of the Dominican Republic, because their populations are stable (MIMARENA, 2018).					

Source: EMPACA, 2024.

Biogeographic status: This group was represented by 3 categories: endemic, introduced and resident species; of which the group of Hispaniolan island endemics was the best represented with nine species, for 75%, with more than 50% of the species present in the study area; In many cases, these species compete with native and endemic species for the acquisition of resources, resulting in an impact that decreases the population numbers of our species; finally, the resident species had only one representative within the monitored area, for 8% (Figure 6-215).

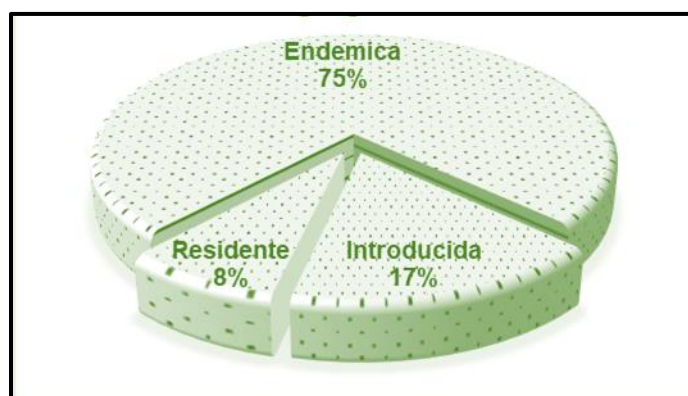


Figure 6-215. Biogeographic status of the species present in the area.

Source: EMPACA, 2024.

Threatened species. According to the Red List of the World Conservation Union (IUCN, 2022) and the Red List of Threatened Species of Flora and Fauna of the Dominican Republic (MIMARENA, 2018); none of the observed species of this group are included in the lists of threatened species, because their populations are stable and are very common throughout the island being found mainly throughout the lowlands of the Dominican Republic. See Table 6-88.

6.2.3.1.3 Diversity of amphibian and reptile species (Herpetofauna)

The most abundant species recorded for this group was *Leiocephalus personatus* with 10 individuals, followed by *Leiocephalus schreibersi* with 9 and *Anolis distichus* with 8 (seen Table 6-89 y Figure 6-216).

Table 6-89. Number of individuals and totals per season of amphibians and reptiles recorded in the project area, rainy season.

Scientific name	Sampling stations in Block 02					Total
	H-1	H-2	H-3	H-4	H-5	
<i>Osteopilus dominicensis</i>		1	1		2	4
<i>Rhinella marina</i>	1		2	1	1	5
<i>Anolis distichus</i>		2	1	2	3	8
<i>Anolis hispaniolae</i>		1		1	1	3
<i>Anolis olssoni</i>		1		1		2
<i>Leiocephalus personatus</i>		1	2	4	3	10
<i>Leiocephalus schreibersi</i>		2	3	2	2	9
<i>Pholidoscelis chrysolaemus</i>	1		2		1	4
<i>Hemidactylus frenatus</i>	1		2			3
<i>Hemidactylus angulatus</i>	2		1			3

Scientific name	Sampling stations in Block 02					
	H-1	H-2	H-3	H-4	H-5	Total
<i>Sphaerodactylus difficilis</i>					2	2
<i>Uromacer catesbyi</i>					1	1
<i>Hypsirhynchus parvifrons</i>		1				1
<i>Chilabothrus striatus</i>					1	1
Number of individuals	5	9	14	11	17	56
Number of species	4	7	8	6	10	-

Source: EMPACA, 2024.

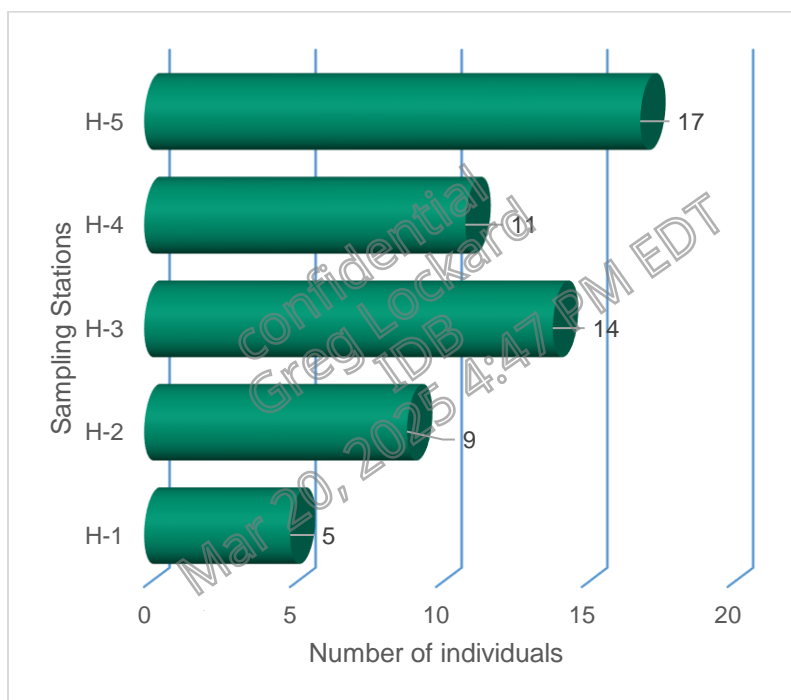


Figure 6-216. Number of herpetofauna individuals by sampling stations.

Source: EMPACA, 2024.

The sampling station with the highest abundance and richness of species was H-5, with 17 individuals for 30% and 10 species for 71% of the species found in the area. On the other hand, sampling station H-1 presented the worst quantitative composition, with about five individuals belonging to four species for 9% and 29% of the total found.

6.2.3.1.4 Importance of endemic species

The presence of endemic species enhances the biological importance of a given area, as it implies a unique and/or restricted distribution to a specific geographic area or region. Of the 93% of the endemic species reported for the island of Hispaniola, 3% were recorded in this study.

This is supported by the fact that there are protected areas in the area (El Morro National Park, Estero Balsa Mangrove National Park, Monte Cristi Submarine National Park, Saladilla Lagoon Wildlife Refuge and Callos Siete Hermanos Wildlife Refuge, all included in what was formerly the large Monte Cristi National Park), where other species have been recorded (Schwartz and Henderson, 1991; Caribherp, 2022). See Map 1 in Annex 6.

6.2.3.1.5 Species with restricted geographic distribution

A restricted geographic distribution may be due to numerous factors, among which the following may be highlighted:

- Species with low mobility: which limits movement and colonization of other regions;
- Geographic barriers: which limit a wider geographic distribution;
- Ecological requirements: some species may have very specific ecological requirements that are only found in a particular region or geographic area.

In Hispaniola, a large number of species have restricted distributions, which makes them very vulnerable to any disaster, whether natural or anthropogenic (Schwartz and Henderson, 1991). Habitat loss and degradation is the main reason why amphibian and reptile populations are declining worldwide (IUCN, 2022).

The results indicate that, although there are endemic species, none of them have a restricted geographic distribution in the Project area; most of them are widely distributed on the island and there are no significant concentrations in the Project concession. In terms of threats, none of the species recorded are under the extinction threat criteria of the National Red List and the International Union for Conservation of Nature (Schwartz and Henderson, 1991; Atlas of Biodiversity, 2012; Caribherp, 2022; IUCN, 2022 and GBIF, 2022). See Figure 6-217 y Figure 6-218.

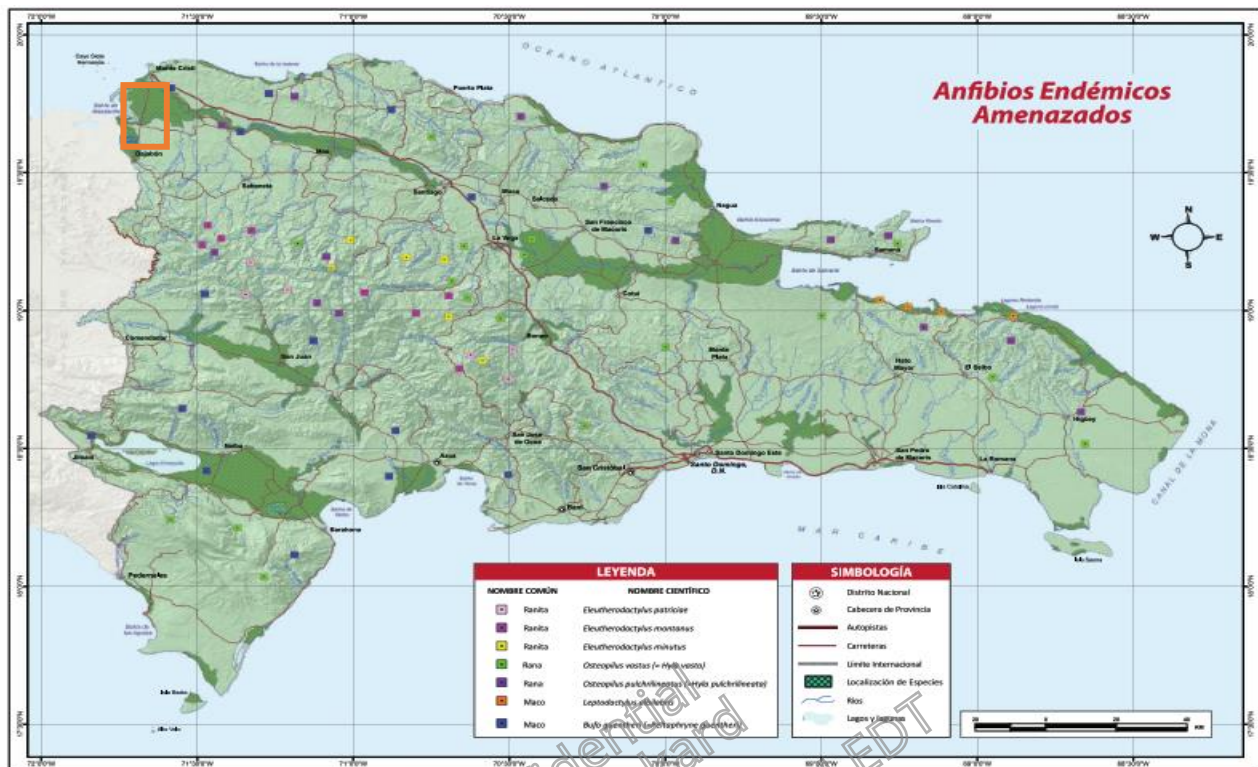
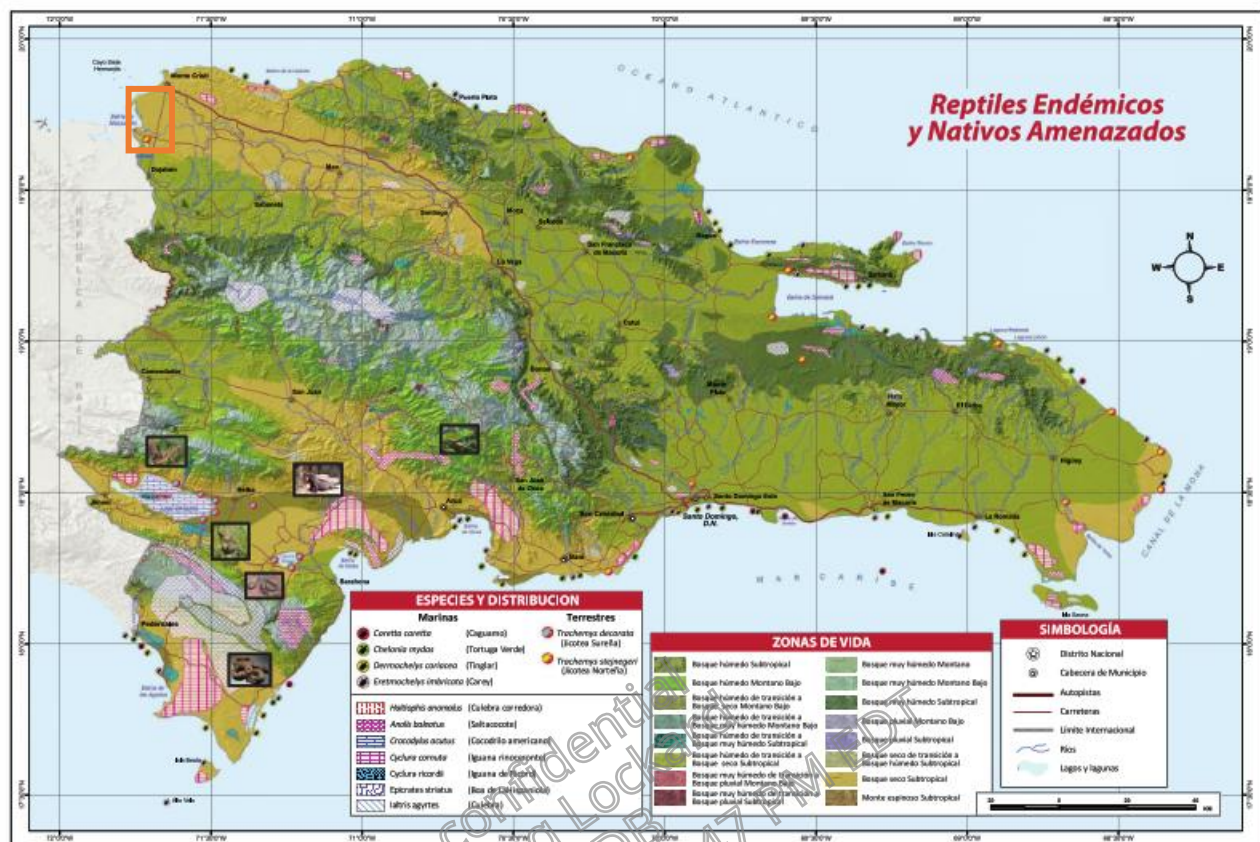


Figure 6-217. Distribution of threatened amphibians in the Dominican Republic.

Note: Low concentrations of threatened species for the area (orange box) can be seen in the upper part of the image.

Source: Atlas of Biodiversity and Natural Resources (MIMARENA 2012).



ESPECIES Y DISTRIBUCION	
Marinas	Terrestres
<i>Caretta caretta</i> (Caguamo)	<i>Trachemys decorata</i> (Jicotea Sureña)
<i>Chelonia mydas</i> (Tortuga Verde)	<i>Trachemys stejnegeri</i> (Jicotea Norteña)
<i>Dermochelys coriacea</i> (Tinglar)	
<i>Eretmochelys imbricata</i> (Carey)	
<i>Haitiophis anomalus</i> (Culebra corredora)	
<i>Anolis baletus</i> (Saltacocote)	
<i>Crocodylus acutus</i> (Cocodrilo americano)	
<i>Cyclura cornuta</i> (Iguana rinoceronte)	
<i>Cyclura ricardii</i> (Iguana de Ricord)	
<i>Epicrates striatus</i> (Boa de La Hispaniola)	
<i>Ialtris agrytes</i> (Culebra)	

ZONAS DE VIDA	
	Bosque húmedo Subtropical
	Bosque muy húmedo Montano
	Bosque muy húmedo Montano Bajo
	Bosque muy húmedo Subtropical
	Bosque pluvial Montano Bajo
	Bosque pluvial Subtropical
	Bosque seco de transición a Bosque húmedo Subtropical
	Bosque seco Subtropical
	Monte espinoso Subtropical

Figure 6-218. Distribution of threatened reptiles in the Dominican Republic.

Note: Low concentrations of threatened species for the area (orange box) can be seen in the upper part of the image.

Source: Atlas of Biodiversity and Natural Resources (MIMARENA 2012).

6.2.3.1.6 Threats to herpetofauna

Although no endangered species were recorded, the loss and degradation of the typical ecosystems of this area, such as the dry forest, wetlands and mangroves, is an important aspect to take into account. The conservation of amphibian and reptile fauna has come to the forefront because almost all of the island's original forest has been destroyed. The IUCN concluded in 2007 that 86% of the island's amphibians are in danger of extinction (Hedges, 2007). According to the IUCN (2013), habitat loss is one of the main threats to globally endangered species.

Species that have specific requirements such as vegetation cover, water bodies and specific temperatures are highly sensitive to changes or modifications in habitats (Pettinicchi, 2000, Akcakaya, 1992), thus understanding that the protection of these habitats is of utmost importance for the conservation of the species in the future.

6.2.3.2 Birds

The information presented below is the result of the sampling carried out during field work in October 2022 and October 2023, using the 17 sampling points, which were evenly distributed in four habitats present in the Project area and its area of influence, using the methodology described in previous sections. The results presented below will consider the monitoring in both blocks, due to the high mobility of this group.

The results for birds indicate that a total of 3833 individuals belonging to 92 species and distributed in 39 families and 17 orders were recorded (Annex 12.2).

At this time of year and in this sector where the Project is located, the bird community is characterized by a high presence of the Parulidae family (Order Passeriformes) with 15 species; this family consists mostly of migratory species, which feed mostly on insects. Of the 15 species recorded, only one is catalogued as a resident, which is *Setophaga petechia* (Cigüita del Manglar) and is only present in the mangrove area and its surroundings. It is listed as a threatened species in the Red List of Threatened Species of Flora and Fauna of the Dominican Republic with the category of Vulnerable (VU) (MIMARENA, 2018) (Annex 12.2).

It should be noted that from the point of view of trophic guilds, most of these species are insectivorous and their subsistence depends largely on the vegetative component, where they consume large quantities of insects, they are only present in the area during the migratory season, they travel motivated by the winter in North America, starting in the first months of winter: August and September, from North America to the Neotropical area, to then begin their return between March and April of each year. (Butcher, 1992) (Annex 12.2):

Another family with very good representation in the area is the Ardeidae, of the order Pelecaniformes, which recorded 10 species, they are resident and insectivorous; they are waders and most of their survival depends on aquatic environments, which in this case are the wetlands present in the area, the species with the highest number of individuals of this family were *Bubulcus ibis* with 39 and *Egretta thula* with 27 individuals (Annex 12.2).

The Scolopacidae family (Order Charadriiformes) is represented in the Project's area of influence with 7 species recorded; all migratory species. It is the best represented family in the area in terms of number of individuals with 1994 and they are closely linked to the wetlands present in the area (Annex 12.2).

The Columbidae family (Order Columbiformes), a total of 7 species were identified, where all members of this group are frugivorous and resident, so all species reproduce in the area, the presence of this family in the area was represented by 420 individuals (Annex 12.2).

Then the families Cuculidae (Order Cuculiformes) and Tyrannidae (Order Passeriformes), recorded 4 species each, which represent insectivorous and frugivorous species, also resident, endemic and migratory, presenting a combination between the biogeographic status categories and the trophic guilds located in the area. These species are present in the mangroves and dry forest (Annex 12.2).

The family Thraupidae (Order Passeriformes) recorded 3 species and is formed by resident individuals, with combined trophic behavior having frugivorous and nectarivorous individuals; these species are present in rivers, mangroves and dry forest (Annex 12.2).

A group of families that are represented with only 2 species in the Project area are the Apodidae, Trochilidae, Rallidae, Charadriidae, Tytonidae, Picidae, Falconidae, Hirundinidae, Estrildidae, Icteridae, belonging to the Orders Apodiformes, Gruiformes, Charadriiformes, Strigiformes, Coraciiformes, Piciformes, Falconiformes and Passeriformes; These families combine biogeographic status, presenting migratory, resident and endemic species, as is the case of the genera *Melanerpes* and *Phaenicophilus*, which are endemic species. The same happens with the trophic guilds, these families have insectivorous, nectarivorous and frugivorous species; with a wide distribution in the vegetation types worked on during the evaluation (Annex 12.2).

Finally, 22 families recorded one species in the study area, which have different biogeographic statuses, including endemic and resident species, as well as diverse trophic guilds including frugivorous, insectivorous, nectarivorous, raptors and scavengers. See (Annex 12.2)

6.2.3.2.1 Biogeographical status

Of the 92 species recorded in the Project area, 51 species are resident, representing 55%, the highest percentage of the total, while 8 species are endemic, representing 9% of the total recorded, and 6 species are introduced, representing 7%; of the group of migratory species, a total of 27 species were found, representing 29%, the second highest value recorded in the project area. (Annex 12.3 and Figure 6-219).

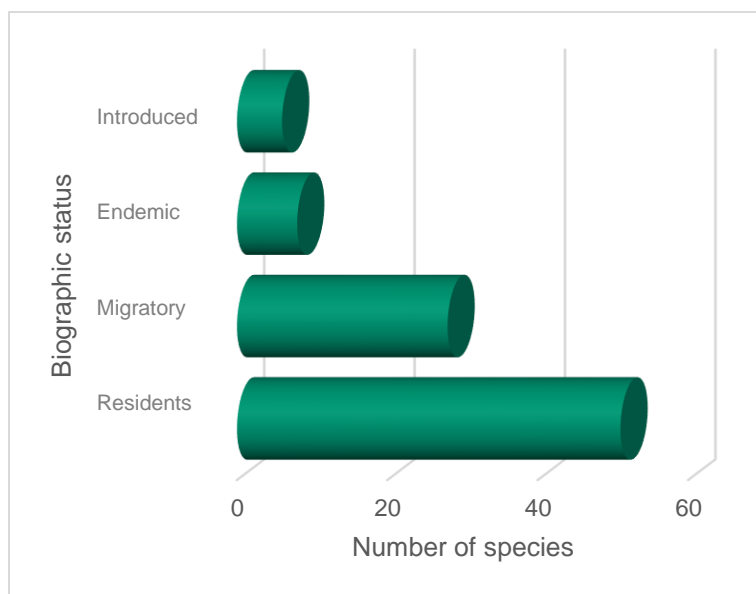


Figure 6-219. Biogeographic status of the species present in the area.

Source: EMPACA, 2024.

6.2.3.2.2 Trophic distribution

During the study, seven trophic groups were considered, of which the best represented was the insectivores with 62 species, 26 of which are aquatic, representing 68% of the total number of species found. These were followed by species that feed on seeds and fruits, called frugivores, which totaled 16, representing 17% of the total recorded.

Species that feed on flower nectar, or nectarivores, 3 species were recorded at this level, representing 3%; while 6 species of raptors were recorded, equivalent to 7%, of which 3 are nocturnal and 3 are diurnal. Of the species capable of ingesting both insects and fruits, known as omnivores, 3 species were identified, equivalent to 3%. Finally, within the group of fish-eating species (piscivorous), 2 species were recorded, representing 2% of the total number of species found in the work area (Annex 12.3 and Annex 12.4). Figure 6-220).

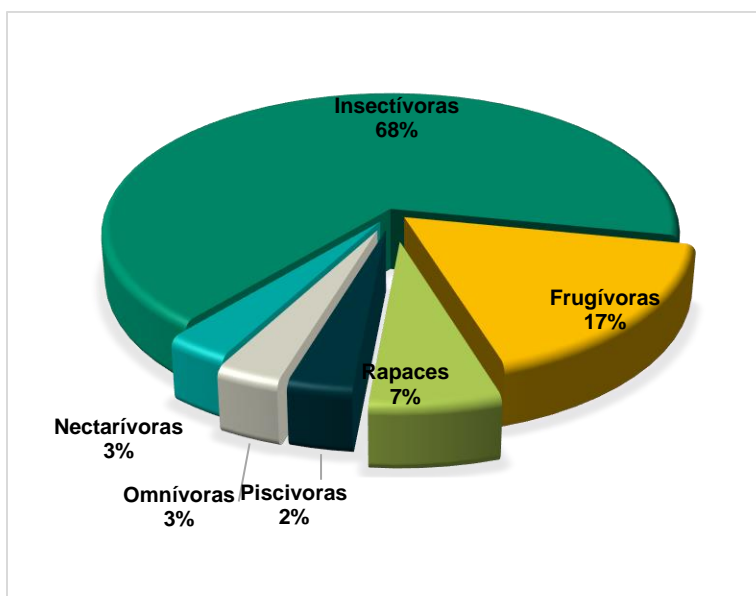


Figure 6-220. Trophic guilds present in the area.

Source: EMPACA, 2024.

6.2.3.2.3 Species with the highest number of individuals located

According to the results obtained in the field in the Project area, the three species best represented in the area or with the greatest number of individuals were *Calidris fuscicollis* with 675 individuals, *Calidris mauri* with 468, *Calidris pusilla* with 458, these three species are aquatic and migratory, belonging to the families Charadriidae and Scolopacidae, which feed mainly on insects and aquatic invertebrates (Annex 12.4).

6.2.3.2.4 Endemic species

There are a total of 32 endemic bird species on the island of Hispaniola, representing 11% of the total number of species present on the island. One of the endemic species, the Palm Cigua (*Dulus dominicus*), is endemic at the family level, while four are endemic at the genus level and the rest at the species level (Raffaele, 1998 Check-List AEO 2020; Keith *et al.* 2003).

During sampling in the study area, a total of 8 endemic species were recorded, representing 9% of the total species found in the area during the evaluation. These 7 species located in the Project area represent 25% of the total number of endemic birds present on the island (32). Of the 7 species reported, 189 individuals were recorded in the study area, where *Dulus dominicus* (Cigua Palmera) recorded 53 individuals, being the species that recorded the highest number of individuals, observing a wide distribution throughout the area, during the field phase three nests were observed (Annex 12.3).

Other endemic species with high representations in the area were *Melanerpes striatus* (Woodpecker) with 46 individuals with a wide distribution throughout the sampled area, followed by *Coccyzus longirostris* (Woodpecker) with 31 individuals, *Phaenicophilus palmarum* (Cuatro Ojos) with 24 individuals and *Todus subulatus* (Barrancolí) with 23 individuals.

6.2.3.2.5 Migratory species

Currently, the island of Hispaniola is considered the place in the Caribbean where the largest number of neotropical migratory birds, mainly from the United States and Canada, winter and spend the night (Terborgh, 1989; Arendt, 1992; Wunderle and Waide, 1993; Liechti, 2003, Liechti, 2004).

According to the latest data from BirdLife International (2015) in the Dominican Republic bird list there are 175 species migrating from the Neotropics. The most conspicuous group of migratory species in the Dominican Republic is formed by aquatic birds, the country has a great importance for migratory bird species due to the great diversity of ecosystems: terrestrial, lacustrine, coastal and marine that characterize it. Among the most important areas are the Cabral, Oviedo, Saladilla, Limón, Nisibón, Gran Estero, Perucho, Lago Enriqueillo and Cayo Tuna lagoons (GIZ, 2020).

According to Lincoln *et al.* 1998, there are several migratory routes used by birds in their movements from North America to their winter refuges in the Caribbean, Central and South America, which can be systematized into six general routes: a) oceanic route over the Atlantic, b) Atlantic route bordering the islands of the Antilles, c) direct route to South America, d) direct route to Central America, e) coastal route of the Gulf of Mexico and f) route to western Mexico.

The migratory process is a movement activity that takes place approximately every six months, beginning in the early winter months in North America, September or October to the Neotropical area, and then returning in mid-March or early April (Lincoln, 1979; Barton and Sandercock, 2018).

During the study a total of 28 species belonging to 7 families were recorded, where the families Scolopacidae and Parulidae recorded the highest number of species, the group of migratory species represents 30% of the total number of species found in the study area; This total exceeds the groups of endemic and introduced species, so we believe that this situation should be considered important, because the presence of this group in the area increases the activity and movements during the migratory season; a situation that should be taken into account for the development of management plans related to the use of the habitats (Annex 12.3).

Many of these species are highly dependent on bodies of water and surrounding vegetation, for example, members of the Scolopacidae family feed on aquatic invertebrates, crustaceans and insects, while members of the Parulidae family are insectivores that forage in vegetation, so the height of their flights is determined by the height of the vegetation present in the place or habitats of use (Stephens & Krebs, 1986). Krebs, 1986), this group presents two species included in the list of threatened species as Vulnerable (VU), being these *Setophaga petechia* and *Charadrius melodus* (MIMARENA, 2018).

6.2.3.2.6 Threatened species

According to the Red List of the World Conservation Union (IUCN, 2022), none of the observed species of this group are included in lists of threatened species, because their populations are stable. However, 4 species, *Colinus virginianus* and *Patagioenas inornata*, *Charadrius melodus*, *Calidris pusilla*, *Egretta rufescens*, are in the category of Near Threatened (NT), the rest of the species register the status of Least Concern (LC) (Annex 12.5).

In the case of the Red List of Threatened Species of Flora and Fauna of the Dominican Republic (MIMARENA, 2018), of the species located in the area, 5 are in the Vulnerable (VU) category, these being *Patagioenas inornata*, *Phoenicopterus ruber*, *Setophaga petechia*, *Charadrius melodus* and *Egretta rufescens*. The remaining species are in the Not Evaluated (NE) category (Annex 12.5).

According to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 2022), 9 species are listed in Appendix II, these being *Anthracothonax dominicus*, *Mellisuga minima*, *Pandion haliaetus*, *Buteo jamaicensis*, *Tyto alba*, *Tyto glaucops*, *Athene cunicularia*, *Falco sparverius* and *Falco columbarius* (Annex 12.5).

Of the 92 bird species recorded in the study area, none of their populations or species within the island are considered to have restricted distribution for some particular areas (Latta *et al.*; 2006) and Raffaele *et al.* 1998. GIZ, 2020).

6.2.3.2.7 Fragile habitats of conservation importance

Based on the significant biodiversity values found in the area for the Project and surrounding areas; considering the criteria established in standard number 6 of the IFC technical note, IDB 932, (Guide to assess and manage impacts, 2016), it was concluded that the Project's evaluated area is a modified habitat, which although it is part of a protected area and contains some wetland areas composed of several species of mangroves, which function as habitats and refuges for many species of resident and migratory birds. It is evident that these areas have suffered modifications as a result of anthropogenic activities of the surrounding communities, which has considerably modified the composition of the original habitats, affecting the ecological functions and the species that depend on them. Mainly related to fishing, cutting and elimination of vegetation, presence of domestic mammals such as *Capra aegagrus hircus* (goats), *Ovis orientalis aries* (sheep), *Felis silvestris* (cats), *Canis familiaris* (dogs), among others.

No habitats with significant importance for the survival of threatened or critically endangered species have been found in the Project area; no habitats with significant importance for the survival of endemic species or species restricted to certain specific areas were located. Nor is the area part of unique or highly threatened ecosystems and is not associated with key evolutionary processes, consequently, this site does not have any critical habitat features with high biodiversity value (Guidance for Assessing and Managing Impacts, 2016).

6.2.3.3 Mammals

6.2.3.3.1 Terrestrial mammals

The island of Hispaniola is poor in endemic mammals, only two native terrestrial mammals of scientific importance are known, *Plagiodontia aedium* (hutia) and *Solenodon paradoxus* (Solenodonte), which are the only endemic mammals that have survived from a list of 25 species that existed on the island of Hispaniola (Reeder, 2005); both species are very similar to rats, confusing people and therefore mistreating them.

These species are included in the IUCN Red List as LC and VU respectively (IUCN 2022), according to the national standard (MIMARENA, 2018), they are within the category of Endangered (EN), that is why there is special attention on these mammals. The information

available affirms that as a result of the pressure these species have suffered due to the destruction and fragmentation of their habitats and predation by introduced animals, their populations have suffered a notable decrease in their habitats.

Its populations are restricted to the most remote places, such as the National Parks of Los Haitises, Jaragua, Sierra de Bahoruco, in the Central Cordillera; also in the Parque Nacional del Este and in the case of the Jutia it is also present in the private protected area of the Ecological Foundation of Punta Cana.

During the work, the Project area was searched in order to verify the presence of these species in the area. The searches were conducted both during the day and at night, but no individuals or traces of native mammals were observed.

During the field work for this group, a total of 114 individuals were recorded, distributed in 6 belonging to 5 families and 6 genera. All the species recorded in this group are not native species but introduced species, these being *Rattus norvegicus* (Gray Rat) with 4 individuals; *Canis familiaris* (Dog) with 6 individuals; *Felis catus* (Cat) with 3 individuals; *Capra aegagrus hircus* (Goat) 76 individuals, *Ovis orientalis aries* (Sheep) 23 individuals and *Herpestes auropunctatus* (Ferret) with 2 individuals (Table 6-90).

Table 6-90. List of introduced terrestrial mammal species, rainy season.

Family	Scientific name	Common name	Biogeographic Status	Quantity
Muridae	<i>Rattus norvegicus</i>	Gray Rat	Entered	4
Felidae	<i>Felis silvestris</i>	Cats	Introduced	3
Canidae	<i>Canis familiaris</i>	Dog	Entered	6
Bovidae	<i>Capra aegagrus hircus</i> (Photo 25 in Annex 13)	Goats	Entered	76
	<i>Ovis orientalis aries</i>	Sheep	Entered	23
Herpestidae	<i>Herpestes auropunctatus</i>	Ferret	Entered	2

Source: EMPACA, 2024.

As they are introduced species, they are not included in the lists of protected species; on the contrary, many of these species have a negative impact on native species, generating an imbalance in their populations.

6.2.3.3.2 Protected species and fragile habitats with conservation significance

According to what has been observed in the Project area and according to the preliminary results of the terrestrial fauna obtained in the study area, we believe that these areas of the Project are not part of critical habitat and do not possess unique characteristics to host some species that have habitat specialization category.

These sites represent basic habitats and altered by anthropogenic activities of the surrounding communities, so they do not represent special places in terms of conservation, even and when they support the survival of the species present, providing shelter areas, feeding and breeding sites on site (IDB Technical Note, 932. 2015, World Bank, 2016).

As they are introduced species, they are not included in lists of protected species; on the contrary, many of these species impact native species, generating an imbalance in their populations.

6.2.3.3.3 Results for bats

During the work with the taxonomic group of bats, only one family containing 4 species and 45 individuals was recorded in the Project area, of which 16 were captured using mist nets (Photo 26 in Annex 13), where 7 individuals were caught in the area of secondary xerophytic vegetation and 9 in the secondary xerophytic vegetation with transition to mangrove, the remaining 29 were observed by the method of observation in full flight, with an average height of 4.0 m.

The bat community found in the Project area was restricted only to the *Phyllostomidae* family; this family has species that live in small groups in caves, burrows of other mammals, hollow trees, trunks or large leaves, mines, buildings and others (Marcelo *et al.* 2012).

The species recorded were *Artibeus jamaicensis* (Jamaica bat) with 7 individuals captured and present in the 3 established sampling stations; *Phyllops falcatus* (Cuban fig bat) with 4 individuals captured, also present in the 3 sampling stations; *Monophyllus redmani* with 3 individuals captured at the stations located within the secondary xerophytic vegetation with transition to mangrove (MV-3 and MV-4) and *Erophylla bombifrons* (Brown Flower bat) with 2 individuals recorded at points MV-2 and MV-3; this last species is included in the national red list as threatened species in the category of Vulnerable(VU) (Table 6-91).

Table 6-91. List of bat species, rainy season.

Scientific name (See Annex 13)	Secondary xerophytic vegetation	Secondary xerophytic vegetation in transition to mangrove.		Total
	MV-1	MV-2	MV-3	
<i>Artibeus jamaicensis</i> (Photo 27a in Annex 13)	4	1	2	7
<i>Phyllops falcatus</i> (Photo 28 in Annex 13)	2	1	1	4
<i>Monophyllus redmani</i>	-	1	2	3
<i>Erophylla bombifrons</i>	1	1	-	2
Total individuals captured	7	4	5	16
Total species	3	4	3	-

Source: EMPACA, 2024.

6.2.3.3.4 Biogeographic status

All species recorded within the study area are island residents; *Erophylla bombifrons* is a species that is present on Hispaniola including Haiti and Dominican Republic and on the island of Puerto Rico (Solari, 2019), *Phyllops falcatus* and *Monophyllus redmani* are only present on Hispaniola,

Cayman Islands, Puerto Rico and Cuba (Homan *et al.* 1975; Solari, 2019) constituting an endemism at the Caribbean level; while *Artibeus jamaicensis* has a wider distribution and extends from Mexico to northern Argentina, including most of the Caribbean islands (Simmons *et al.* 2005 and Wilson, 2005), (Table 6-92).

Table 6-92. List of bat species located in the project area.

Scientific name	Biogeographic Status	Trophic Guilds	State of conservation	
			IUCN 2022	MIMARENA 2018
<i>Artibeus jamaicensis</i>	Resident	Frugivore	LC	NE
<i>Phyllops falcatus</i>	Resident	Frugivore	LC	NE
<i>Monophyllus redmani</i>	Resident	Insectivore	LC	NE
<i>Erophylla bombifrons</i>	Resident	Omnivore	LC	VU
4	-	-	-	-
Least Concern (LC): When, having been assessed, it does not meet any of the criteria defining the categories above. Equivalent to out of danger (IUCN 2022).				
Not Evaluated (NE): Species that were not considered in the evaluation of the Red List of Threatened Species of the Dominican Republic, because their populations are stable (MIMARENA, 2018).				
Vulnerable (VU): When the best available evidence indicates that it faces a moderate risk of extinction or population decline in the medium term (MIMARENA, 2018).				

Source: EMPACA, 2024.

6.2.3.3.5 Trophic guilds

The species present in the study mainly use three trophic groups, of which the best represented group was that of frugivores, with two species for each group; *Artibeus jamaicensis* and *Phyllops falcatus* fall into the category of frugivores, representing 50%, it is worth noting that during the work, some individuals were caught carrying fruits and seeds attached to their bodies. In the case of *Monophyllus redmani*, it belongs to the insectivorous category, representing 25%. *Erophylla bombifrons* is an omnivorous species, because it can be opportunistic and generalist, with the ability to eat seeds and insects and use flower nectars, which is its greatest capacity. (Table 6-92 y Figure 6-221).

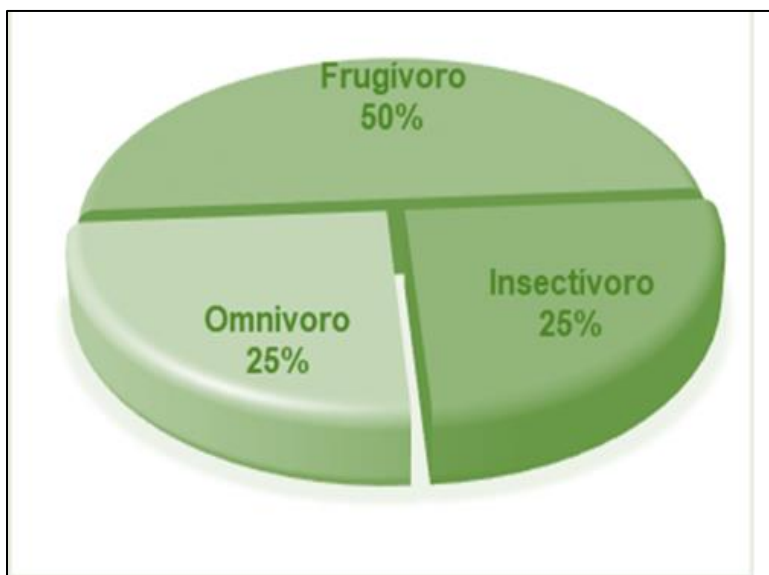


Figure 6-221. Trophic guilds present in the area.

Source: EMPACA, 2024.

6.2.3.3.6 Threatened species

According to the Red List of the World Conservation Union (IUCN 2022), the species recorded in the study area are listed as Least Concern (LC). Table 6-92.

In the case of the Red List of Threatened Species of Fauna and Flora in the Dominican Republic (MIMARENA, 2018), one of the four species, *Erophylla bombifrons*, is listed as a threatened species, under the category of Vulnerable (VU); the other three species located in the area are not listed as threatened species and are classified as Not Evaluated (NE).

6.2.3.4 Over-sampling in dry and rainy season

The project area is located in an area of dry subtropical forest with low rainfall, so there is no marked rainy season that generates the appearance and disappearance of monocarpic species whose vegetative cycle disappears in the dry season and reappears in the rainy season, affecting this, the floristic inventory, this climatic characteristic makes a floristic inventory and description of the vegetation does not present differences throughout the year, there may be differences in phenology (flowering and fruiting); But not in the presence of species, therefore, an inventory was not completed according to rainfall (dry season from November to April and rainy season from May to October, six months each). This opinion is supported by the results of studies that have been carried out in the nearby area during different times of the year.

The difference between the dry and wet seasons for the fauna species will present variations, mainly in the number that represents the presence of the species in the area. For the group of birds specifically, it can be marked by migration and reproductive activity.

The following is a report on the differences found in the fauna samplings for the dry season (December 2023) with respect to the rainy season (October 2023):

In the case of herpetofauna no significant differences were found, during the rainy season for amphibians a total of 2 species and 9 individuals were found; while in the dry season there were 3 species and 15 individuals (compare Table 6-87 y Table 6-93). For this group there was a difference of 1 species and 6 more individuals that were located during the dry season samplings. The species recorded in the dry season and not reported in the rainy season was *Eleutherodactylus weinlandi* (Red-legged Frog), which is an endemic species, but of great abundance throughout the island as can be seen in Figure 6-222.

Table 6-93. Amphibian species located in the study area in the dry season.

Family	Scientific name	Name Common	Geographic status	IUCN (2022)	MIMAREMA (2018)
Eleutherodactylidae	<i>Eleutherodactylus weinlandi</i>	Rana Pata Roja	Endemic	LC	NE
Hylidae	<i>Osteopilus dominicensis</i>	Rana Platanera	Endemic	LC	NE
Bufonidae	<i>Rhinella marina</i>	Maco Penpen	Entered	LC	NE
Least Concern (LC): When, having been evaluated, it does not meet any of the criteria that define the threatened categories, therefore, it is equivalent to out of danger (IUCN, 2022).					
Not Evaluated (NE): Species that were not considered in the evaluation of the Red List of Threatened Species of the Dominican Republic, because their populations are stable (MIMAREMA, 2018).					

Source: EMPACA, 2024.

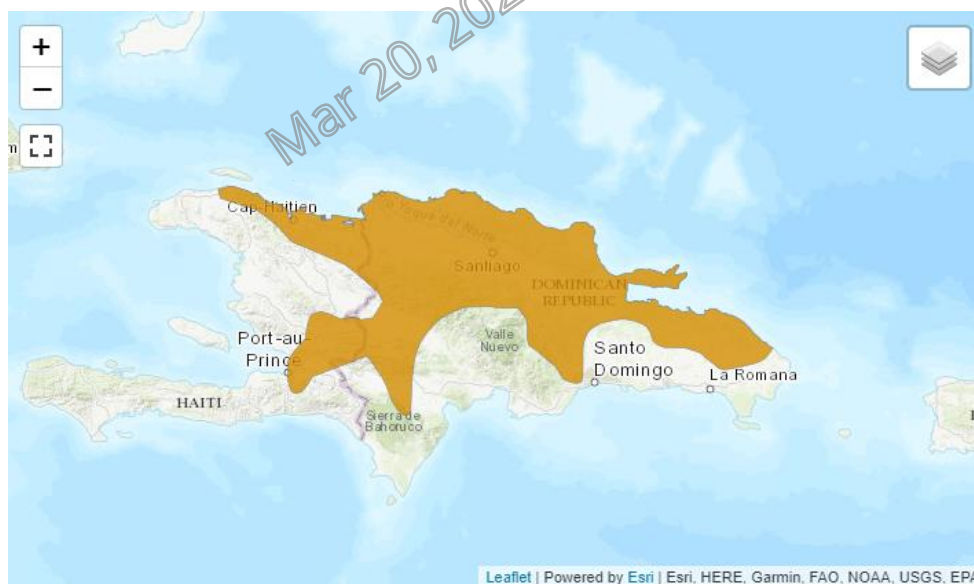


Figure 6-222. Presence of the species *Eleutherodactylus weinlandi* on the island of Hispaniola.



Geographic location of the species

Source: IUCN Red List 2022

As for reptiles, 12 species were recorded in the rainy season, while 11 species were reported in the dry season (compare Table 6-88 and Table 6-94). In terms of the number of individuals, 47 were recorded during the rainy season, while 44 were recorded in the dry season, with 3 more individuals observed in the rainy season.

Table 6-94. Species of reptiles located in the study area in the dry season.

Family	Scientific name	Common name	Biogeographic Status	IUCN (2022)	MIMAREMA (2018)
Dactyloidae	<i>Anolis distichus</i>	Lagarto Común	Lagarto Común	Lagarto Común	Lagarto Común
	<i>Anolis hispaniolae</i>	Lagarto Cabezón	Lagarto Cabezón	Lagarto Cabezón	Lagarto Cabezón
	<i>Anolis olssoni</i>	Lagarto de Grama	Lagarto de Grama	Lagarto de Grama	Lagarto de Grama
Leiocephalidae	<i>Leiocephalus personatus</i>	Lagarto Cara Enmascarada	Lagarto Cara Enmascarada	Lagarto Cara Enmascarada	Lagarto Cara Enmascarada
	<i>Leiocephalus schreibersi</i>	Lagarto Cola Rizada	Lagarto Cola Rizada	Lagarto Cola Rizada	Lagarto Cola Rizada
Teiidae	<i>Pholidoscelis chrysolaemus</i>	Lagarto Gigante de la Hispaniola	Lagarto Gigante de la Hispaniola	Lagarto Gigante de la Hispaniola	Lagarto Gigante de la Hispaniola
Gekkonidae	<i>Hemidactylus frenatus</i>	Gecko de Casa	Gecko de Casa	Gecko de Casa	Gecko de Casa
	<i>Hemidactylus angulatus</i>	Gecko Africano Doméstico	Gecko Africano Doméstico	Gecko Africano Doméstico	Gecko Africano Doméstico
Sphaerodactylidae	<i>Sphaerodactylus difficilis</i>	Gecko moteado de la Española	Gecko moteado de la Española	Gecko moteado de la Española	Gecko moteado de la Española
Dipsadidae	<i>Hypsirhynchus parvifrons</i>	Culebra Corredora	Culebra Corredora	Culebra Corredora	Culebra Corredora
Boidae	<i>Chilabothrus striatus</i>	Boa de la Hispaniola	Boa de la Hispaniola	Boa de la Hispaniola	Boa de la Hispaniola
Least Concern (LC): When, having been evaluated, it does not meet any of the criteria that define the threatened categories, therefore, it is equivalent to out of danger (IUCN, 2022).					
Not Assessed (NA): Not Assessed (IUCN, 2022).					
Not Evaluated (NE): Species that were not considered in the evaluation of the Red List of Threatened Species of the Dominican Republic, because their populations are stable (MIMAREMA, 2018).					

Source: EMPACA, 2024.

For the group of terrestrial mammals, the same 6 species were recorded in both seasons (compare Table 6-90 y Table 6-95), with 190 individuals in the dry season and 114 individuals in the rainy season, which gives a difference of 76 individuals more in the dry season.

Table 6-95. List of introduced terrestrial mammal species located in the project area, dry season.

Family	Scientific name	Common name	Biogeographic status	Quantity
Muridae	<i>Rattus norvegicus</i>	Gray Rat	Introduced	5
Felidae	<i>Felis silvestris</i>	Cats	Entered	3

Family	Scientific name	Common name	Biogeographic status	Quantity
Canidae	<i>Canis familiaris</i>	Dog	Entered	4
Bovidae	<i>Capra aegagrus hircus</i>	Goats	Entered	120
	<i>Ovis orientalis aries</i>	Sheep	Entered	57
Herpestidae	<i>Herpestes auropunctatus</i>	Ferret	Entered	1

Source: EMPACA, 2024.

As for the bats, 3 species were recorded during the dry season and 4 during the rainy season; the species not recorded during the dry season with respect to the rainy season was *Phyllops falcatus* (compare Table 6-91y Table 6-96). The number of individuals recorded in the rainy season was 61 and 206 in the dry season, with 145 more individuals recorded in the dry season. For this group, the differences between the seasonal values are basically between the number of individuals. This situation is related to the greater effort that individuals have to make to find resources during the dry season, which implies a greater number of flights and displacements, due to the low availability of fruits, seeds and insects in the foraging sites, which implies greater activity and movement, and increases the possibility of capture.

Table 6-96. List of bat species located in the project area, dry season.

Scientific name	Biogeographic Status	Trophic Guilds	State of conservation	
			IUCN 2022	MIMARENA 2018
<i>Artibeus jamaicensis</i> (Photo 27b in Annex 13)	Resident	Frugivore	LC	NE
<i>Monophyllus redmani</i>	Resident	Insectivore	LC	NE
<i>Erophylla bombifrons</i>	Resident	Omnivore	LC	VU
3	-	-	-	-
Least Concern (LC): When, having been assessed, it does not meet any of the criteria defining the categories above. Equivalent to out of danger (IUCN 2022).				
Not Evaluated (NE): Species that were not considered in the evaluation of the Red List of Threatened Species of the Dominican Republic, because their populations are stable (MIMARENA, 2018).				
Vulnerable (VU): When the best available evidence indicates that it faces a moderate risk of extinction or population decline in the medium term (MIMARENA, 2018).				

Source: EMPACA, 2024.

The results for avifauna indicate that 92 species were recorded in the rainy season, while 84 species were recorded in the dry season, with 8 more species recorded in the rainy season than in the dry season. The abundance of individuals during the dry season was higher with 927, while in the rainy season it was 892 individuals, with a difference of 35 individuals more in the dry season (Compare Annex 12.4a and Annex 12.4b).

Regarding the movements recorded for the birds over the area designated for the transmission line, from the Estero Balsa Mangroves towards the Laguna Saladilla Wildlife Refuge and the cultivated area located in the southwest of the Project area, during the sampling carried out during the rainy season, the movements were close to the coordinates E 213267.94 - 2179221.98 N and

during the dry season they were carried out near the coordinates E 215110.23 - 2178543.69 N, there was a change of direction when crossing the area marked for the line. We do not have a reason to explain this behavior of change in the travel route of this group, most of which are resident Columbidae that breed in the area.

6.2.4 Critical habitat assessment

According to the criteria of the flora specialists in the area of the transmission line route and Block 02, there are two habitats:

- Modified Habitat represented by Secondary Xerophytic Vegetation and by Grassland
- Natural Habitat represented by the Mangrove that is in transition with the Secondary Xerophytic Vegetation.

6.2.4.1 Modified Habitat represented by secondary xerophytic vegetation and grassland.

This type of vegetation is fundamental in the project area, as it covers the entire area where the 2 generation blocks and most of the transmission line route will be built.

The vegetation in the area has been impacted by the extraction of timber, firewood and charcoal, as well as livestock activities, especially goat raising, where the tree stratum was the most affected. Despite the indiscriminate extraction, the vegetation still conserves species typical of this type of environment. The vegetation is dominated by bayahonda (*Prosopis juliflora*), associated with it are aroma (*Vachellia macracantha*); *Vachellia tortuosa*; guayacán (*Guaiaacum officinale*); raqueta (*Euphorbia lactea*) (Photo 7 in Annex 13); cabrita (*Bunchosia glandulosa*); vera (*Guaiaacum sanctum*); mabi (*Colubrina elliptica*); arboreal cacti such as cayuco (*Lemaireocereus hystrix*); *Pilosocereus polygonus*; candelon (*Senegallia skleroxyla*) frijolito (*Capparis cynophallophora*); guácima (*Guazuma guazuma*); almacigo (*Bursera simaruba*); palo de chivo (*Senna atomaria*); quina (*Exostema caribaeum*); palo de leche (*Rauvolfia nítida*) and neem (*Azadirachta indica*), the latter being a very aggressive invasive exotic species.

Shrubs are represented by: doña sanita (*Lantana camara*); *Pictetia spinifolia*; chicharrón (*Casearia illicifolia*); serrazuela (*Randia aculeata*); doncella (*Solanum polyacanthum*); bean *Capparis flexuosa*; *Turnera diffusa* and bolsa de gato (*Helicteres jamaicensis*) among others.

The herbaceous group is more frequent and is represented by several species, many of them are of monocarpic type, whose cycle is short and after fructifying they die, generally they grow in the rainy periods and during the drought they disappear. Among them we find: *Opuntia taylori*; *Evolvulus arbuscula*; espartillo (*Leptochloopsis virgata*); pajón (*Bothriochloa pertusa*); grama (*Setaria monostachya*); tostón (*Allionia incarnata*); *Bouteloa juncea*; patagón (*Boerhavia scandens*); tuna brava, *Opuntia dillenii*; feafa, (*Talinum paniculatum*) (Photo 10 in Annex 13); there are also epiphytic wire pineapple bromeliads (*Tillandsia recurvata*). Among the climbers and creepers, the following were observed: *Stigmaphyllon emarginatum*; Indian creeper (*Gouania lupuloides*) and *Cissus trifoliata*.

Shrub species are represented by chicharrón, *Casearia illicifolia*; *Pictetia spinifolia*; salvia, *Pluchea carolinensis*; serrazuela, *Randia aculeata*; doncella, *Solanum polyacanthum*, frijol,

Capparis flexuosa; *Turnera diffusa*; bolsa de gato, *Helicteres jamaicensis*; *Croton discolor* and doña sanita, *Lantana cámara*, among others.

Once the salvage of the protected species identified in this Project area has been completed, a Biodiversity Action Plan (BAP) will not be necessary.

6.2.4.2 Natural Habitat represented by the Mangrove Forest

In the area where the transmission line will be established, specifically further east of the alignment, there is secondary vegetation in transition to mangrove.

The mangrove that connects with the secondary xerophytic vegetation, as an ecosystem has not been modified and three of the four species of mangroves that grow in the Dominican Republic are present in it, being the mangle blanco (*Laguncularia racemosa*), mangle prieto (*Avicennia germinans*) and mangle botón (*Conocarpus erectus*).

This habitat is in the area surrounding the Estero Balsa Mangroves National Park, which is protected by Law 202-04 on protected areas and Law 64-00 on Environment and Natural Resources of the Dominican Republic. See Map 1 in Annex 6.

6.2.4.3 Criteria used to define whether the Project is located in critical habitat.

In the area where the Project will be developed, no space was identified as critical habitat according to what is expressed in Table 6-97. Where the fundamental reasons are presented, based on criteria 1, 2, 4 and 5 established by IFC Performance Standard No. 6, criterion 3 is not evaluated because it is not applicable, those cited in Notes. 70, 71, 72, 74, 75, 76, 82, 83, 89, 90, 94 and those of High Conservation Value (HCV) for flora, considering endemic species and those with some degree of threat.

Table 6-97. Summary of the critical habitat assessment in relation to the flora species present in the Project.

FAMILY/SPECIES	Common name	Criterion evaluated	Evaluation Rationale/Criteria 1,2,4 and 5 to define that the project is not located in critical habitat.
AVICENNIACEAE			
<i>Avicennia germinans</i>	Mangle Prieto	Criteria 1: Native species included in the National Red List, 2016, in the Vulnerable category.	The Life Zone Map and Annex 12.6: Distribution maps of flora species found in the project area and included in the Red List of Vascular Plants of the Dominican Republic show that the species has a wide distribution within the Dominican Republic and also a wide distribution outside the Spanish Island, according to the International Plant Names Index (IPNI). In addition, the species is included in a natural area according to paragraph 13 of Performance Standard 6.

FAMILY/SPECIES	Common name	Criterion evaluated	Evaluation Rationale/Criteria 1,2,4 and 5 to define that the project is not located in critical habitat.
			<p>It is also present in numerous protected areas and in mangrove zones.</p> <p>This species, although found in natural habitat, does not define the project development area as critical habitat, according to Paragraph 11 of Performance Standard 6.</p> <p>Does not meet criteria 2, 4 and 5.</p>
CACTACACEAE			
<i>Selenicereus pteranthus</i>		<p>Criteria 1 and 2: Endemic species protected by CITES in Appendix II and included in the National Red List, 2016, in the Vulnerable category.</p>	<p>The Map of Life Zones and Annex 12.6: Distribution maps of the flora species found in the project area and included in the Red List of Vascular Plants of the Dominican Republic show that it has a wide distribution within the Dominican Republic and also a wide distribution outside the Spanish Island, according to the International Plant Names Index (IPNI).</p> <p>The species is present in numerous protected areas, as well as in dry forest areas outside protected areas.</p> <p>This species does not define the project development area as being in critical habitat, according to Paragraph 16 of Performance Standard 6.</p>
<i>Harrisia divaricata</i>	Pitajaya	<p>Criteria 1 and 2: Endemic species protected by CITES in Appendix II and included in the National Red List, 2016, in the Endangered category.</p>	<p>The life zones map and Annex 12.6: Distribution maps of flora species found in the project area and included in the Red List of Vascular Plants of the Dominican Republic show that it has a wide distribution within the Dominican Republic. The species is present in numerous protected areas, as well as in dry forest areas outside of them.</p> <p>This species does not define the project development area as critical habitat, according to Paragraph 11 of Performance Standard 6.</p> <p>Does not meet criteria 4 and 5.</p>

FAMILY/SPECIES	Common name	Criterion evaluated	Evaluation Rationale/Criteria 1,2,4 and 5 to define that the project is not located in critical habitat.
<i>Opuntia taylori</i>	Mulito de pollo	Criterion 1: Native species protected by CITES in Appendix II and included in the National Red List, 2016, in the Vulnerable category.	<p>The Map of Life Zones and Annex 12.6: Distribution maps of the flora species found in the project area and included in the Red List of Vascular Plants of the Dominican Republic show that it has a wide distribution within the Dominican Republic and also a wide distribution outside the Spanish Island, according to the International Plant Names Index (IPNI).</p> <p>This species does not define the project development area as critical habitat, according to Paragraph 11 of Performance Standard 6.</p> <p>Does not meet criteria 2, 4 and 5.</p>
<i>Pilosocereus polygonus</i>	Cayuco	Criterion 1: Native species protected by CITES in Appendix II and included in the National Red List, 2016, in the Vulnerable category.	<p>The Map of Life Zones and Annex 12.6: Distribution maps of the flora species found in the project area and included in the Red List of Vascular Plants of the Dominican Republic show that it has a wide distribution within the Dominican Republic and also a wide distribution outside the Spanish Island, according to the International Plant Names Index (IPNI).</p> <p>This species does not define the project development area as critical habitat, according to Paragraph 11 of Performance Standard 6.</p> <p>Does not meet criteria 2, 4 and 5.</p>
<i>Lemairocereus histrix</i>	Cayuco	Criterion 1: Native species protected by CITES in Appendix II and included in the National Red List, 2016, in the Vulnerable category.	<p>In the Map of Life Zones and Annex 12.6: Distribution maps of the flora species found in the project area and included in the Red List of Vascular Plants of the Dominican Republic where it is shown that it has a wide distribution within the Dominican Republic and also a wide distribution outside the Spanish Island, according to the International Plant Names Index (IPNI).</p> <p>This species does not define the project development area as critical</p>

FAMILY/SPECIES	Common name	Criterion evaluated	Evaluation Rationale/Criteria 1,2,4 and 5 to define that the project is not located in critical habitat.
			<p>habitat, according to Paragraph 16 of Performance Standard 6.</p> <p>Does not meet criteria 2, 4 and 5.</p>
FLACOURTIACEAE			
<i>Casearia illicifolia</i>		<p>Criteria 1 and 2: endemic included in the National Red List, 2016, in the Critically Endangered category.</p>	<p>The map of life zones and Annex VII: Distribution maps of the species found in the project area and included in the Red List of Vascular Plants of the Dominican Republic show that the species has a wide distribution within the Dominican Republic. The species is present in numerous protected areas, as well as in dry forest areas outside of these.</p> <p>This species does not define the project development area as critical habitat, according to Paragraph 11 of Performance Standard 6.</p> <p>Does not meet criteria 4 and 5.</p>
COMBRETACEAE			
<i>Conocarpus erectus</i>	Mangle botón	<p>Criterion 1: Native species included in the National Red List, 2016, in the Vulnerable category.</p>	<p>The Life Zone Map and Annex 12.6: Distribution maps of flora species found in the project area and included in the Red List of Vascular Plants of the Dominican Republic show that it has a wide distribution within the Dominican Republic and also a wide distribution outside of the Spanish Island, according to the International Plant Names Index (IPNI). The species is included in a natural area according to the section. The species is present in numerous protected areas, and in mangrove zones.</p> <p>This species, although found in natural habitat, does not define the project development area as critical habitat, according to Paragraph 11 of Performance Standard 6.</p> <p>Does not meet criteria 2, 4 and 5.</p>

FAMILY/SPECIES	Common name	Criterion evaluated	Evaluation Rationale/Criteria 1,2,4 and 5 to define that the project is not located in critical habitat.
<i>Laguncularia racemosa</i>		Criterion 1: Native species included in the National Red List, 2016, in the Vulnerable category.	<p>The life zone map and Annex 12.6: Distribution maps of the flora species found in the project area and included in the Red List of Vascular Plants of the Dominican Republic show that it has a wide distribution within the Dominican Republic and also a wide distribution outside of the Spanish Island, according to the International Plant Names Index (IPNI). The species is included in a natural area according to section.</p> <p>The species is present in numerous protected areas, and in mangrove areas. However, despite being in natural habitat, it does not define the project development area as critical habitat, according to Paragraph 11 of Performance Standard 6.</p> <p>Does not meet criteria 2, 4 and 5.</p>
ZYGOPHYLLACEAE			
<i>Guaiacum officinale</i>	Guayacán	Criterion 1: Native species protected by CITES in Appendix II, included in the National Red List, 2016, in the Vulnerable category and the IUCN Red List in the Endangered category.	<p>The Map of Life Zones and Annex 12.6: Distribution maps of the flora species found in the project area and included in the Red List of Vascular Plants of the Dominican Republic show that it has a wide distribution within the Dominican Republic and also a wide distribution outside the Spanish Island, according to the International Plant Names Index (IPNI).</p> <p>This species does not define the project development area as critical habitat, according to Paragraph 11 of Performance Standard 6.</p> <p>Does not meet criteria 2, 4 and 5.</p>
<i>Guaiacum sanctum</i>	Vera	Criterion 1: Native species protected by CITES in Appendix II and included in the National Red List, 2016, in the Vulnerable category.	<p>The Map of Life Zones and Annex 12.6: Distribution maps of the flora species found in the project area and included in the Red List of Vascular Plants of the Dominican Republic show that it has a wide distribution within the Dominican Republic and also a wide distribution outside the Spanish Island,</p>

FAMILY/SPECIES	Common name	Criterion evaluated	Evaluation Rationale/Criteria 1,2,4 and 5 to define that the project is not located in critical habitat.
			<p>according to the International Plant Names Index (IPNI).</p> <p>This species does not define the project development area as critical habitat, according to Paragraph 11 of Performance Standard 6.</p> <p>Does not meet criteria 2, 4 and 5.</p>

Source: EMPACA, 2024.

CRITERIA EVALUATION SUMMARY:

Criteria 1: In the Project area we find in the case of flora, 9 species with some degree of threat for the national red list (7 species with the category of Vulnerable, 1 with the category of Endangered and 1 with the category of Critically Endangered), *Guaiaacum officinale* which in the national red list is in the category of Vulnerable is also protected by the IUCN red list, being in the category of Endangered; Of these 9 species, 3 belong to the natural habitat (xerophytic vegetation in transition to mangrove) and the rest belong to the modified habitat (secondary xerophytic vegetation).

As explained above, none of these 9 species is found in a habitat that supports $\geq 10\%$ of its population, the area of the Secondary Vegetation that will be occupied in the project contains the same species as in the ecological zone or life zone Dry Forest and Thorny Forest (Arid and Semi arid), both together occupy a total area for the Dominican Republic of 13,273 km² (Figure 6-223); while the mangrove area is a small portion of the mangrove surfaces in the Dominican Republic which is 293.16 km² (MIMARENA, 2020.) Its distribution on the island allows us to ensure that this project does not affect the long-term survival of any of the species.

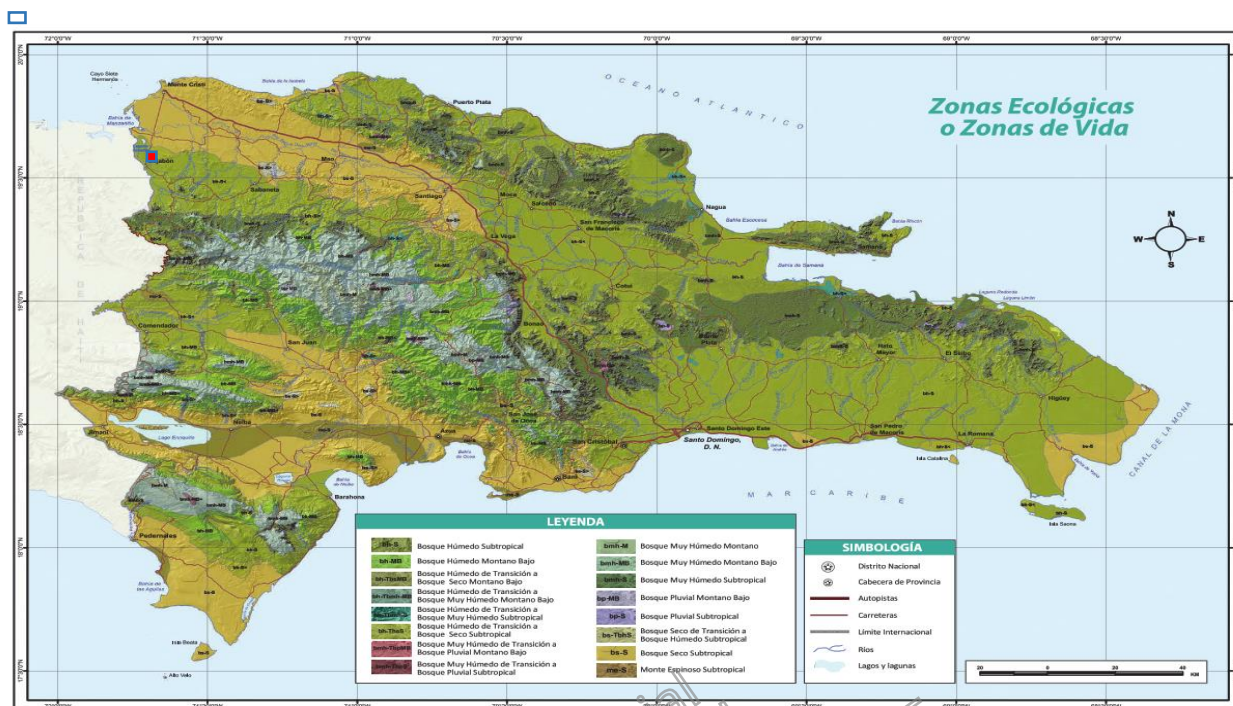
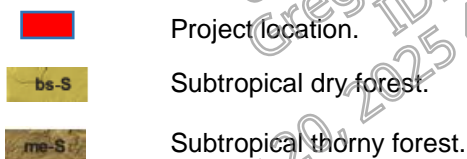


Figure 6-223. Map of Life Zones of the Dominican Republic, in dark green shows the distribution of the dry forest and thorny forest, both environments where the protected species found within the modified habitat of the project are present.



Source: Atlas of Biodiversity and Natural Resources (MIMARENA, 2012).

In the case of birds, according to the studies carried out in the Project, we have a total of 5 species considered Vulnerable in the National Red List; for a better understanding of their geographic distribution and habitat, we will separate them into three groups:

The species *Setophaga petechia* and *Charadrius melodus*, both are migratory species with abundance in the continental zone as well as in the coasts that bathe the Caribbean Sea, this occurs due to the migratory process that the birds have from north to south in this zone of the planet, looking for the warmest zones in their geographic area at each time of the year, GBIF, 2024 and IBAT, 2024. (Annex 12.7).

In another group we have the species *Phoenicopiterus ruber* and *Egretta rufescens*, both are residents within the island, but also inhabit all the coasts that bathe the Caribbean Sea, including areas of North, Central and South America; in the case of *Egretta rufescens* its presence also extends to much of the coasts of Central America bathed by the Pacific Ocean, the distribution of both species can be seen in the following figures. Figure 6-224 and Figure 6-225.



Figure 6-224. Presence of the species *Phoenicopterus ruber* on the coasts of the Caribbean Sea and on the coasts of Central America facing the Pacific Ocean.



Geographic location of the species

Source: IUCN Red List 2022.

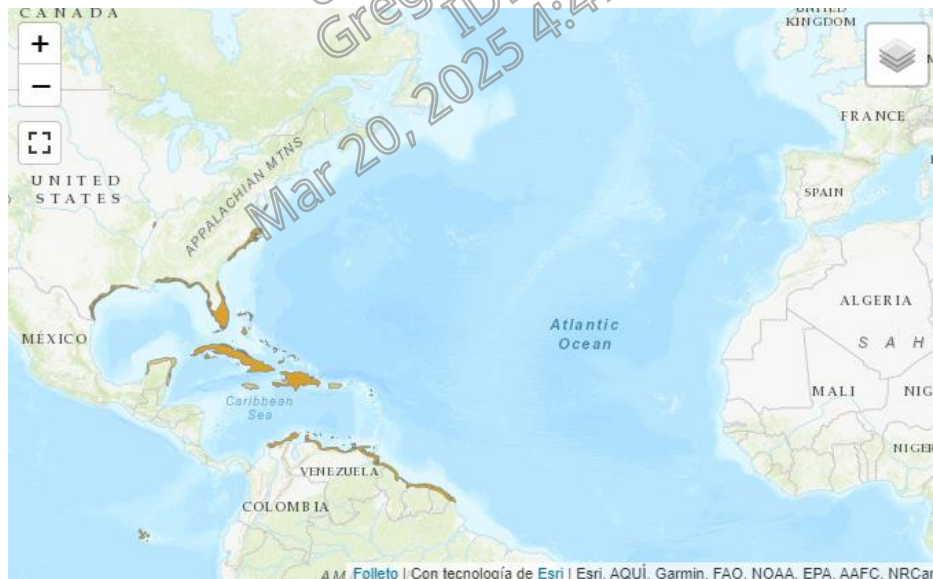


Figure 6-225. Presence of the species *Egretta rufescens* on the coasts of the Caribbean Sea.



Geographic location of the species

Source: IUCN Red List 2022.

Finally, we have the species *Patagioenas inornata*; this is a resident species of the islands of the Greater Antilles and some small islands such as Virgin Islands, although it must be recognized

that on the island of Hispaniola great efforts are being made for its conservation and it has the largest population of this species with respect to the other three large islands. Figure 6-226.

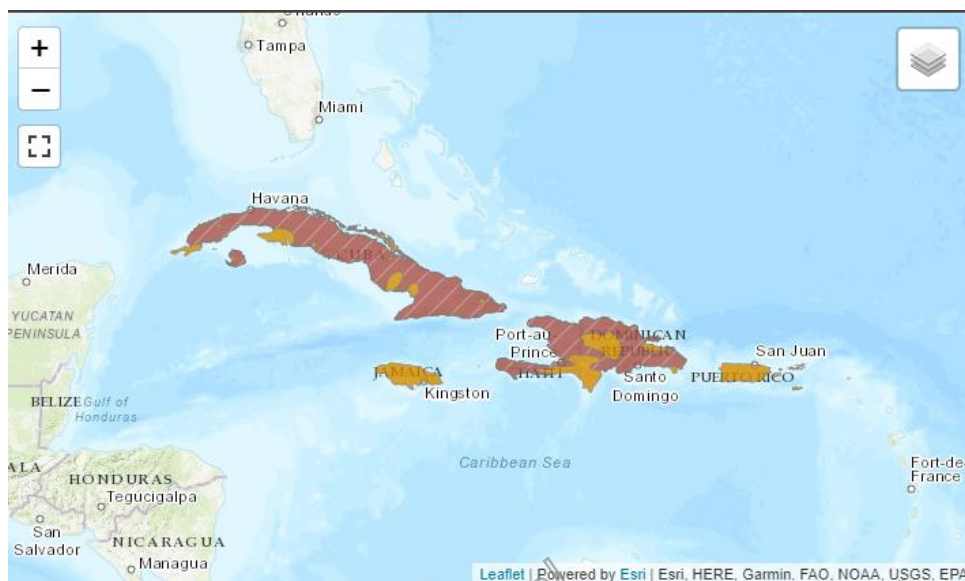


Figure 6-226. Presence of the species *Patagioenas inornata* in the islands of the Caribbean Sea.

- Geographic location of the species in a stable form.
- Geographical location where sightings of the species have been made.

Source: IUCN Red List 2022.

Making an analysis of the possible fulfillment of criterion 1 for Birds, we can see that no species has a presence in the project area that corresponds to a habitat that supports $\geq 10\%$ of its population. In the case of *Patagioenas inornata*, the species that currently has the most reduced habitat and has a wide presence in the project area, it is not expected to suffer considerable impacts with the actions involving the installation of the project, it is a species that avoids dense forests and prefers grassland habitats and sparsely wooded places (Latta *et al.* 2006; Raffaele *et al.* 1998), actually this species sees its populations reduced by the hunts it suffers, being a species of large size and appreciated for its meat.

The species is currently included in the National Red List, in the Vulnerable category (MIMARENA, 2018) A distribution map is presented and shows that the species is present in the Greater Antilles. Protected areas adjoin the project area, where it is guaranteed that this species will be protected and conserved.

In the case of flying mammals, we have the presence of *Erophylla bombifrons* as a Vulnerable species in the National Red List of the Dominican Republic, this is a resident species on the island, with stable populations and habitats that are not fragmented (IUCN 2022), as can be seen in Figure 6-227.



Figure 6-227. Presence of the species *Erophylla bombifrons* on the island of Hispaniola and the island of Puerto Rico.



Geographic location of the species

Source: IUCN Red List 2022

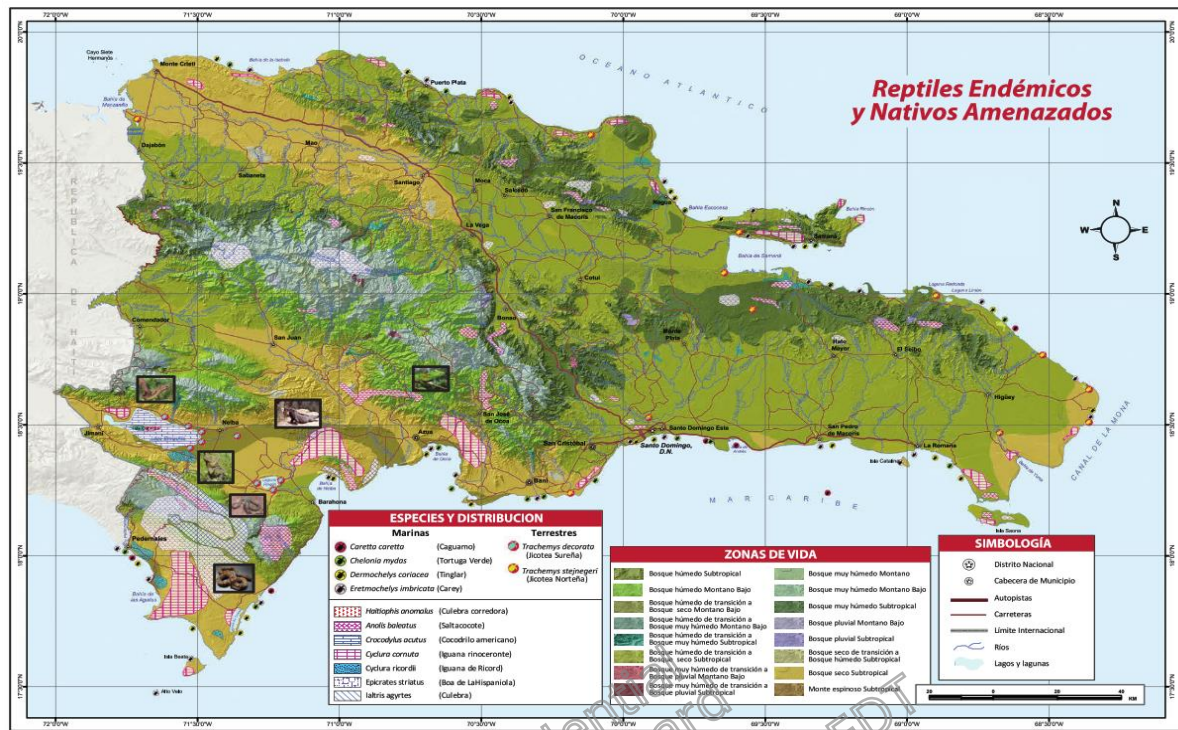
This is an abundant species and does not meet criterion 1, its presence in the project area does not correspond to a habitat that supports $\geq 10\%$ of its population.

Criteria 2: In the case of endemic species or species restricted to certain areas, 3 species of flora were identified in the area where the project will be developed, but as explained in Table 6-97 and in Annex 12.6; these species are widely distributed throughout the country and therefore do not meet the requirements of Criterion 2 for critical habitat, which states that this criterion will be applied when the habitat evaluated supports $\geq 95\%$ of the world population of an endemic species.

These three endemic species also have a wide distribution in the life zones of the subtropical dry forest and subtropical thorny forest, where several protected areas have been declared, including: El Morro National Park, Sierra de Bahoruco National Park, Parque Nacional del Este, Sierra Martín García National Park, Lago Enriquillo National Park and Cabritos Island; Jaragua, Luis Quinn, Villa Elisa, Anacaona National Park and Francisco Caamaño Deño National Park.

Also located in the project are 9 species of endemic reptiles which have a high distribution throughout the island, as all of them are usually generalist-opportunists tolerant to environmental changes, showing some "anthropophilia", so they are the first colonizers of disturbed environments.

In addition, as can be seen in Figure 6-228 the project area is isolated from the high endemism zones of the Dominican Republic.



Project location.

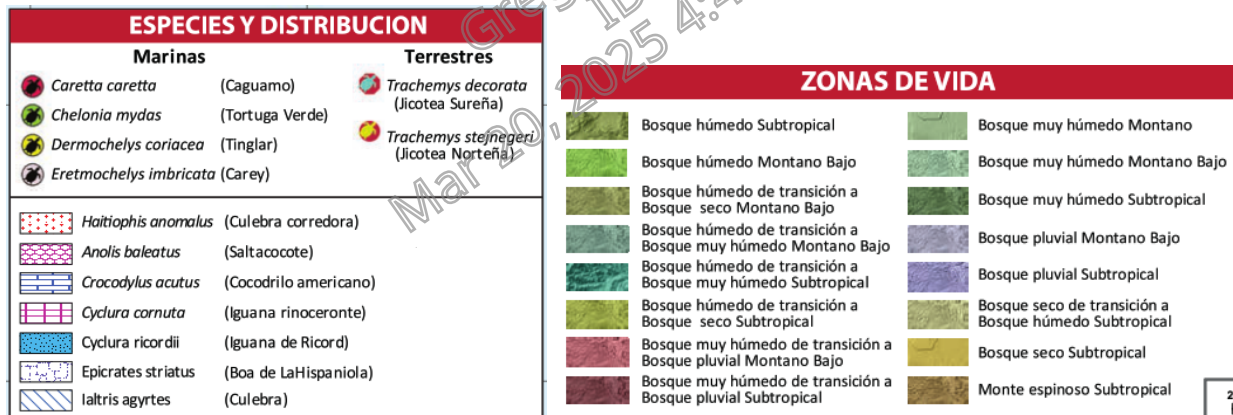


Figure 6-228. Areas where endemic and endangered native reptiles of the Dominican Republic are found.

Source: Atlas of Biodiversity and Natural Resources (MIMARENA, 2012).

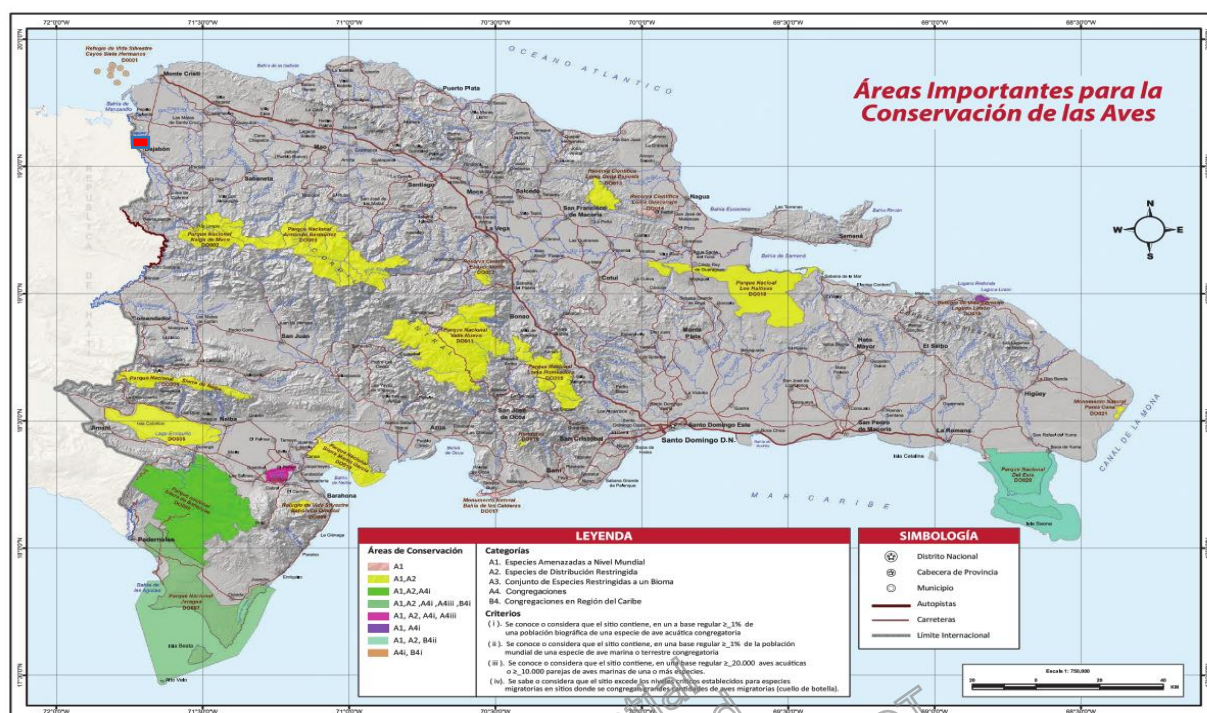
The rest of the terrestrial fauna has 8 endemic species for birds which are not restricted to the project area and are not sustained in the same, of any of the species, a $\geq 95\%$ of the world population; on the other hand, mammals do not have any endemic species in the area.

Criteria 3: Twenty-seven species of migratory birds were located in the project area (See Annex 12.3: List of bird species located in the project area, with scientific and common names, biogeographic status, and trophic guilds present in the project area), none of which meet the requirements evaluated in the different levels of criterion 3 for critical habitat, which states that the project area must support $\geq 95\%$ of the world population of a migratory species, either cyclically or regularly.

Of the 27 migratory species sampled in the project we found 3 species of worldwide range (Annex 12.7: Figures 1, 2 and 3) species are widely distributed in North America and Central America, even reaching northern areas of South America (Annex 12.7: Figures 4,5,6, 7 and 8); finally the rest of the 19 species move from northern Canada to the regions that bathe the Caribbean Sea, as well as the Atlantic and Pacific coasts of South America (Annex 12.7: Figures 9 to 27).

Also, if one consults the Map of the Important Bird Areas (IBA) there are no areas with category and criteria for migratory bird species for the Dominican Republic (Figure 6-229).

According to the above, the migratory bird species found in the project area have a wide distribution in North America, Central America, South America and the Caribbean, so it is not considered a critical habitat for criterion 3.



Project location.

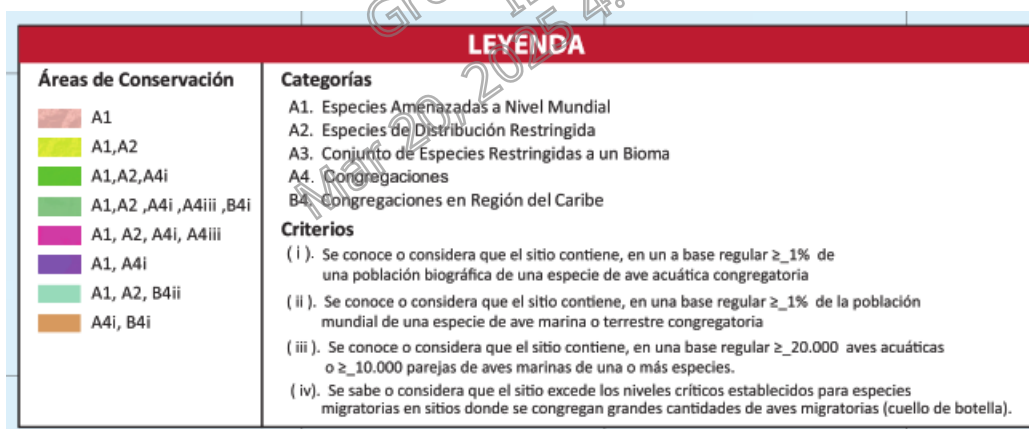


Figure 6-229. Important Bird Areas of the Dominican Republic.

Source: Atlas of Biodiversity and Natural Resources (MIMARENA, 2012).

Criteria 4: The area where the project is located does not represent a highly threatened or unique ecosystem for the Dominican Republic. The Map of ecological zones or life zones shows that the area occupied by the modified habitat in the project area is not significant for the 13,273 km² occupied by this life zone.

In the case of the natural habitat (xerophytic vegetation in transition to mangrove) affected by the Project, this is a small area located at the easternmost point of the transmission line, it is an area where there has been much anthropization, resulting in the loss of the original vegetation cover and suffering a slow process of recovery to a natural habitat represented by a mangrove ecosystem, If to the above we add the consideration that the Project borders the most extensive mangrove reserve in the Dominican Republic, we can summarize that, although we are faced with an important natural habitat such as a mangrove, there are not enough elements to consider it a highly threatened ecosystem and unique in the region.

Criteria 5: The area occupied by the Project is not associated with key evolutionary processes.

OTHER ASPECTS TO EVALUATE THE CRITERIA

- There are abundant protected areas near the project area where all the species found in the project are found: Estero Balsa Mangrove National Park, Laguna Saladilla Wildlife Refuge, and Siete Hermanos Key Wildlife Refuge (Unesco. 2002).
- One of the protected areas where most of the species present in the project area live and which is important for the regional flora is El Morro National Park on the northwest side, whose management objectives are to preserve and protect specific natural elements that are important for their biotic, aesthetic and cultural components and for their function as habitats for the reproduction of species. Permitted uses in this category include: scientific research, education, recreation, nature tourism or ecotourism, infrastructure for recreation, protection and research, infrastructure for public use and ecotourism with the specific characteristics defined by its management plan and authorized by the Secretary of State for the Environment and Natural Resources, as well as traditional uses and activities, according to the management plan and zoning.
- The Project is located in a modified habitat composed mainly of secondary xerophytic vegetation and grassland and a natural habitat of secondary xerophytic vegetation with transition to mangrove, which is heavily impacted by human activities.
- There is no area of high conservation value (HCV) that meets HCV 1, 2 and 3 criteria.

HCV 1: Areas containing globally, regionally or nationally significant concentrations of biodiversity values.

HCV 2: Large areas located in or containing threatened or endangered ecosystems.

HCV 3: Areas located in or containing threatened or endangered ecosystems.

6.2.5 Assessment of net loss of biodiversity and the need for a biodiversity action plan

In the area of the LNG Storage and Regasification Terminal and Power Plant with a capacity of approximately 420 MW, there will be no net loss of biodiversity, based on the results of the studies conducted. A bibliographic review of local biodiversity attributes was conducted, including

information from the 2016 Red List of Vascular Flora in the Dominican Republic and the List of Endangered, Threatened or Protected Species of the Dominican Republic, Red List according to the Criteria (IUCN). Similarly, the results of the environmental impact study were analyzed and it is clear that there will be no significant impact on the natural habitat area, whose representation is found in the mangrove areas, nor on the modified habitat area that corresponds to the Secondary Xerophytic Vegetation and Pasture.

The no net loss of biodiversity in the project area is based on the fact that there are no sites in the project area that meet the conditions cited in notes 74 and 75 for critical habitat level 1 or 2 under criterion 1 (endangered and critically endangered species), since neither of the two habitats present in the project supports a global population greater than or equal to 10% of a CR or EN species. Similarly, the requirements specified in notes 82 and 83 for level 1 or 2 critical habitat under criterion 2 (endemic species and/or species restricted to certain areas) are not met, which establishes that for it to exist it must support a population greater than or equal to 95% of an endemic species or species restricted to certain areas. As for notes 88 and 89 that support the situations necessary to be considered a level 1 or 2 critical habitat for criterion 3, they are not observed, since none of the project's habitats support a population greater than or equal to 95% of a migratory species on a regular or cyclical basis. None of the criteria cited in NO90 (*i, ii, iii* and others) of Performance Standard No. 6 are met, nor that this site has the regional attributes that may influence the evolutionary processes that give rise to regional species configurations and ecological properties (NO94).

The species that could be impacted and that have some degree of threat and/or protection are not at risk of disappearing or falling into a critical state due to the development of the project, as they are widely distributed in the dry and semi-dry forest, thorny forest, and mangrove areas. They are also protected in the Estero Balsa National Park, Laguna Saladilla Wildlife Refuge, and Montecristi National Park. These three areas near the project area are home to most of the 16 protected flora species present, as well as the fauna species located in the project.

After analyzing the characteristics of the area and the attributes of the biodiversity present, we have concluded that it is not necessary to develop a biodiversity action plan to mitigate the impacts of the project on the local flora and fauna, it is recommended to save the protected plant species that can be moved due to their characteristics and state of development.

6.2.6 Ecosystem services

Ecosystem services in the project area include the large presence of goats throughout Manzanillo and especially in the project area, family activities on the beach, the importance of fishing in the area of influence of the project, and ecotourism activities in the area of direct influence of the project.

The social team identified the ecosystem services and land use by neighboring communities near the land where the Block 02 project will be installed, through surveys and interviews. The level of impact on the families was also determined, in economic terms, for which three levels of impact have been defined:

High: Significantly affects the household's economic income or economy.

Medium: It is a significant impact on the household's income or economy.

Low: It is not a significant impact on the household's income or economy.

Ecosystem services identified by the social team:

Ecosystem Service No. 1: Animal breeding and grazing.

Description and level of impact: The number of animals observed being raised in the area of direct influence of the project is considerable; in Photo 29 (Annex 13) a group of goats can be seen near the project site. These animals are raised by neighboring families. And given their large but manageable numbers, once the project begins, they can raise them and take them to graze on other land in the area, or that of relatives or friends; this is a traditional practice in the country.

The presence of cattle in the area of influence of the project is significant, as can be seen in Photo 30 (Annex 13), which are being raised near the project lands. When the project starts, the owners can raise them and take them to graze on other lands in the area.

The sale of these animals generates an income for the families, once they are already raised or are still small, which is occasional, since it is not a permanent or high income. It is a form of savings that helps families with household needs. For these reasons, its level of impact is low.

In the Table 6-98 shows that most of the respondents claimed that they carry out some ecosystem activity in the area of influence of the project, and goat or cattle grazing is the most practiced with 24.28% respectively, followed by crab catching. Almost half of the respondents confirmed that they do not carry out any ecosystem activity. Beekeeping has very low numerical values, but it is one of the activities whose importance is not questionable. Two areas with apiaries are located on the route of the 345 KV transmission line (Photos 31 and 32 in Annex 13).

Monte Cristi has a vast terrain that is fundamental for the breeding of bees. The exportation of honey is important and very profitable at the national level, but it is somewhat scarce. Beekeepers benefit economically from this ecotourism activity on a seasonal basis in order to survive for more than 3 months with the profits.

Table 6-98. Ecosystem activities in the area of influence of the project.

Values	Carbonera	Copey	Manzanillo	Villa Ray	Total
Capture of birds or other wild species.	0	2	4	9	15
Crab catch.	1	2	17	14	34
Extraction of medicinal plants	0	2	7	10	19
Agricultural work for subsistence crops or subsistence or for the local market.	1	2	1	2	6
Beekeeping (production of bee honey).	0	3	3	3	9
Goat or cattle grazing.	3	14	41	27	85
Another	2	0	21	14	37
No activities	37	55	48	5	145

Source: Prepared by EMPACA based on surveys conducted.

Ecosystem Service No. 2: Recreational activity on the beach in the project's area of influence.

Description and Level of Impact: The beach located in the project's area of influence is frequented by local residents, including Manzanillo, Copey and Carbonara, the latter two being the furthest away. With the availability of more aquatic recreational spaces in the area, the impact level of the project is reduced to low, since they have access to more beaches in the area.

In the different territorial districts it can be seen that the inhabitants visit the beaches of Manzanillo, with the difference that Villa Ray, being the closest community to the area of influence of the project, is the one with the highest percentages (77.78), that is, much more than half of the respondents said that they do visit it, with family or friends. (See Table 6-99).

Table 6-99. Ecosystem activities in the area of influence of the project, beach recreation.

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Total	
	C	%	C	%	C	%	C	%	C	%
Weekly	5	6.10	7	7.87	25	17.61	18	33.33	55	14.99
Biweekly	4	4.88	2	2.25	14	9.86	4	7.41	24	6.54
Monthly	22	26.83	36	40.45	41	28.87	20	37.04	119	32.43
Does not use	50	60.98	44	49.44	60	42.25	12	22.22	166	45.23
N/A	1	1.22	0	0.00	2	1.41	0	0.00	3	0.82
Total	82	100.00	89	100.00	142	100.00	54	100.00	367	100.00

Source: Prepared by EMPACA based on surveys conducted.

Ecosystem Service No. 3: Fishing in the area of influence of the project.

Description and level of impact: Many people living near the project site are fishermen who have lived off fishing for generations. It is common that many are not only from Manzanillo, a good group are from Copey and Carbonera, although smaller.

Eel is the fishery product that brings in the most income per season in Manzanillo, so much so that many merchants and owners of national and international restaurants want to add this species to their dishes. As can be seen in Photo 33 (Annex 13), the fishing technique for this species using nets as tools.

The level of importance is medium, although it has access to more areas to fish, but it decreases the range of fishing opportunities and that influences the concentration of more fishermen that are distributed.

In the Table 6-100 shows that in Carbonera 56.10% of those surveyed know someone who practices or lives from fishing, in Copey 62.92%, in Manzanillo 68.31% and the predominant percentage is in the area of direct influence of the Villa Ray project with 81.48% respectively.

Table 6-100. Do you know any practitioners or people who make a living from fishing on the coast of Pepillo Salcedo and/or Estero Balsa?

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Total	
	C	%	C	%	C	%	C	%	C	%
Yes	46	56.10	56	62.92	97	68.31	44	81.48	243	66.21
No	35	42.68	30	33.71	40	28.17	7	12.96	112	30.52
N/A	1	1.22	3	3.37	5	3.52	3	5.56	12	3.27
Total	82	100.00	89	100.00	142	100.00	54	100.00	367	100.00

Source: Prepared by EMPACA based on surveys conducted.

Ecosystem Service No. 4: Ecotourism activities in the project's area of influence

Description and level of impact: It is important to note that Pepillo Salcedo has mangroves both inside and outside of the project's area of influence, which are one of the most important tourist attractions in the area. There are also food and beverage businesses for visitors who settle on the beaches. As a result, the number of people who practice these activities is considerable, considering the level of importance as medium.

Villa Ray as an area of direct influence of the project, half of the respondents claimed to know people who benefit from some ecotourism activity on the coast of Pepillo Salcedo and this same pattern is seen in Manzanillo with 50.00%, Table 6-101.

Table 6-101 Do you or anyone you know benefit from any ecotourism activity on the Pepillo Salcedo coast?

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Total	
	C	%	C	%	C	%	C	%	C	%
Yes	11	13.41	18	20.22	71	50.00	27	50.00	127	34.60
No	67	81.71	68	76.40	66	46.48	25	46.30	226	61.58
N/A	4	4.88	3	3.37	5	3.52	2	3.70	14	3.81
Total	82	100.00	89	100.00	142	100.00	54	100.00	367	100.00

Source: Prepared by EMPACA based on surveys conducted.

In terms of the type of ecotourism activity, the table shows that in Manzanillo and Villa Ray tour guides predominate, followed by the sale of drinks and food, and finally boat rentals (Table 6-102).

Table 6-102. Type of ecotourism activity.

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Total	
	C	%	C	%	C	%	C	%	C	%
Boat rental	3	27.27	3	16.67	15	21.13	6	22.22	27	21.26
Tourist guide.	5	45.45	2	11.11	22	30.99	14	51.85	43	33.86
Another	0	0.00	0	0.00	0	0.00	1	3.70	1	0.79
Sale of beverages and food.	1	9.09	12	66.67	27	38.03	6	22.22	46	36.22
Sale of souvenirs.	2	18.18	1	5.56	7	9.86	0	0.00	10	7.87
Total	11	100.00	18	100.00	71	100.00	27	100.00	127	100.00

Source: Prepared by EMPACA based on surveys conducted 2022.

6.2.7 Areas legally protected by national legislation

The Dominican Republic has a National System of Protected Areas (SINAP) as part of the national biodiversity conservation policies, made up of 123 conservation units, classified into six categories and thirteen management subcategories.

Category II: National Parks and Category IV: Nature Reserve are located in the area of indirect influence of the project and are described below:

6.2.7.1 Category II. National Parks

Its management objectives are: to protect the ecological integrity of one or more ecosystems of great ecological relevance or scenic beauty, with or without forest cover, or with underwater life, for the benefit of present and future generations, to avoid intensive exploitation and occupation that alter their ecosystems, to provide the basis for creating opportunities for spiritual recreation, scientific, educational, recreational and tourism activities.

The following uses are allowed in this category: scientific research, education, recreation, nature tourism or ecotourism, infrastructure for protection and research, infrastructure for public use and ecotourism in the areas and with the specific characteristics defined by the management plan and authorized by the Secretary of State for the Environment and Natural Resources (Sectoral Law of Protected Areas 202-04).

Estero Balsa Mangroves: This protected area is located in the province of Montecristi and extends along 17 km of coastline in a north-south direction, covering an area of 81 km². The protected area includes an area of wetlands with lagoons and mangroves located in the bay of Manzanillo. The wetlands have great natural beauty and among them is the Estero Balsa beach, in the sector known as Punta Presidente. The protected area is visited mainly by sea, although it is also possible to observe part of the wetlands by land. The mangroves of Estero Balsa National Park are among the largest in the Dominican Republic and visitors can observe hundreds of aquatic birds, such as flamingos, spoonbills and herons (Unesco. 2002).

6.2.7.2 Category IV. Natural Reserve

The management objectives of the areas belonging to this category are to guarantee natural conditions to protect species, groups of species, biotic communities or physical characteristics

that require artificial manipulation for their perpetuation. They also guarantee the economic benefits derived from ecotourism activities and sustainable use of their resources, such as water generation, timber production and ecotourism.

This category includes the following permitted uses: controlled use of its resources, traditional uses and activities, education, recreation, nature tourism or ecotourism, infrastructure for sustainable use under a management plan.

Cayo Siete Hermanos Wildlife Refuge: It extends along 9 km of sea in a north-south direction, covering an area of 114 km². The wildlife refuge encompasses seven sandy cays located off the north coast of Montecristi; their names are: Tororu, Muertos, Ratas, Ratas, Terrero, Monte Chico, Monte Grande and Arenas. The cays have a spectacular beauty, marking the calm waters of the bay of Montecristi. The virgin beaches of the cays are composed of fine white sand and are ideal for swimming. The visit to the protected area is done by sea, usually departing from the marina of Montecristi.

The cays serve as refuge and nesting area for large populations of boobies (*Sula sula*) that can be observed by visitors. In the marine area there are wonderful coral reefs full of life and in some places, there are also sunken ships from the colonial era.

Laguna Saladilla Wildlife Refuge: It is located on the border between the Dominican Republic and Haiti, with the political-administrative division of the provinces of Monte Cristi and Dajabón, on the mouth of the Masacre River on its eastern bank, in a southeast direction. It has a current surface area of 5.7 km² of fresh water, although it originally occupied an area of 30.7 km². This lagoon is considered the most important body of fresh water on the island. Its ecological category is based on Law 202-04, which declares it a Wildlife Refuge Area (Unesco, 2002).

However, like most of the country's protected areas, this lagoon does not have adequate protection by the Ministry of Environment, leaving it at the mercy of predators, opportunists and politicians, although these wetlands are protected by the Ramsar Convention, of which the country is a signatory, signed in 1971 in Iran and the General Environmental Law 64-00, which is the general legal framework that protects this type of natural systems, and establishes their category and ecological importance. These wetlands are very important ecosystems, containing a great biodiversity of flora and fauna species that depend on their primary productivity where many species of resident and migratory birds use them as staging, resting, feeding and breeding areas (Unesco. 2002).

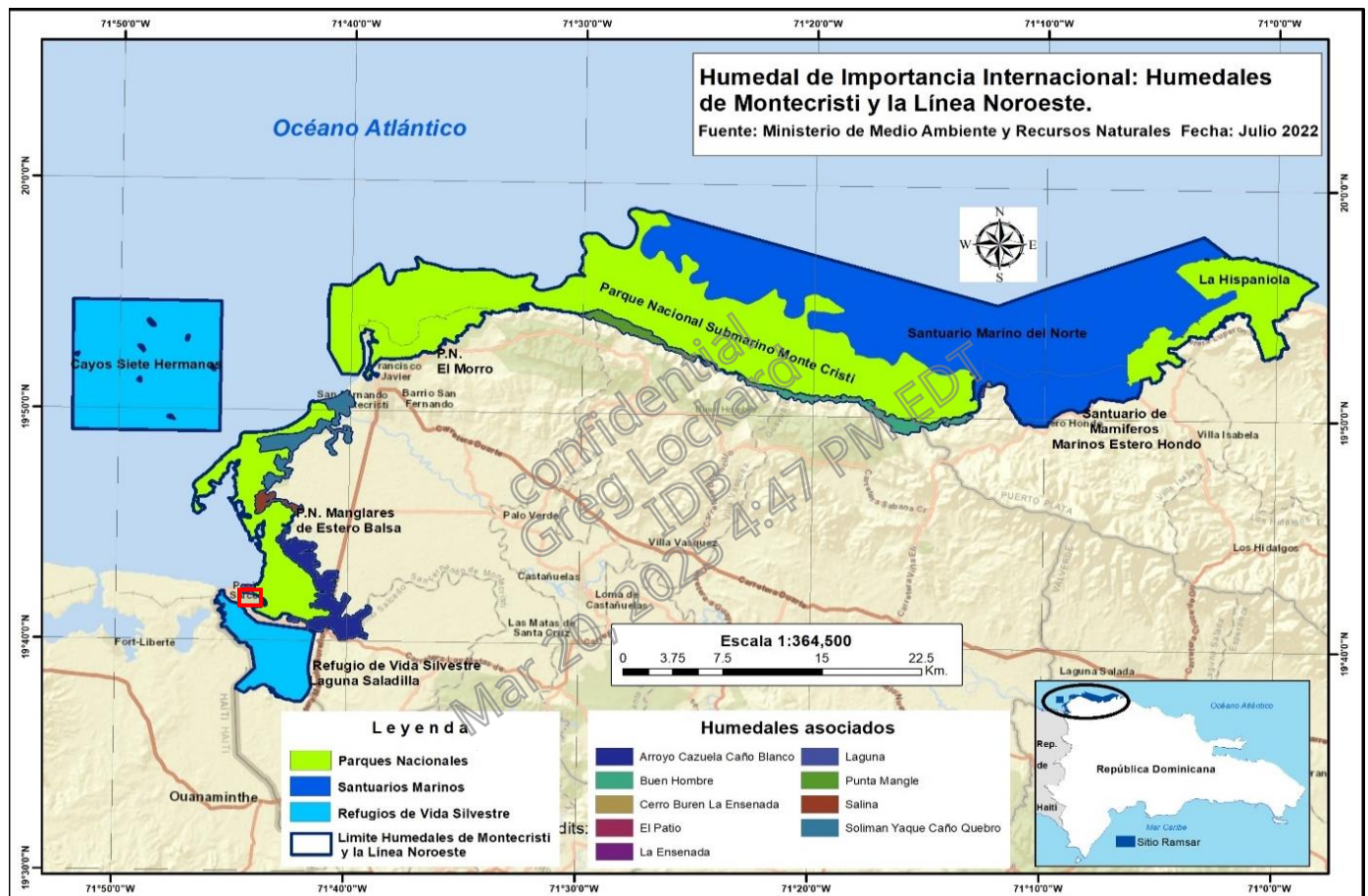
6.2.8 Areas legally protected by international law

Ramsar Site: On October 13, 2022, Ramsar Site No. 2497 was designated in the Dominican Republic, called Los Humedales de Montecristi y la Línea Noroeste, which is located at coordinates 19° 47'N 71° 37'W and covers 84,322.2 ha. Figure 6-230.

This site is composed of several protected areas and associated wetlands such as the Montecristi Underwater National Park, Buen Hombre Wetlands, Cayos Siete Hermanos Wildlife Refuge, Estero Balsa mangrove area, and Laguna de la Saladilla. They comprise a range of ecosystems including lagoons, mangroves, marshes, estuaries, swamps, dry shrub forests, and coral reefs. In addition, the site is home to a large proportion of the Dominican Republic's most representative coral reefs. It is home to a considerable population of endangered sea turtles such as

Eretmochelys imbricata and *Chelonia mydas*. Also, four important bird species use the site for breeding (*Anous stolidus*, *Onychoprion fuscatus*, *Thalasseus sandvicensis* and *Onychoprion anaethetus*).

The site supplies local communities with fresh water and food and supports flood control, groundwater recharge and climate change mitigation. Both the coral reefs and mangroves in the area support a local fishery that provides a livelihood for many of the local people. The main threats affecting the ecological character of the site are river channelization and regulation, proliferation of invasive species, lack of garbage and solid waste management, agricultural and forestry effluents, and droughts.



 Project area



Figure 6-230. Ramsar site containing protected areas near the project.
Source: Ramsar

6.3 Socioeconomic Baseline

6.3.1 Introduction

The municipalities of Pepillo Salcedo and Monte Cristi are the defined territorial demarcations that make up the project's area of influence. These two municipalities belong to the province of Monte Cristi, which is located in the northwestern region of the Dominican Republic (Map 5 in Annex 6: Map of areas of influence).

To establish the area of influence (AI) it is crucial to first understand what is meant by environmental impact. Conesa, 1995 describes it as any change, whether positive or negative, in the environment or in one of its elements, resulting from some activity or action. This conceptualization suggests that accurately calculating the extent of impacts is a considerable technical challenge, which varies according to the size and complexity of the project or activity in question. The area of influence refers to the geographic area affected by the potential environmental impacts of a project. Within this zone, the extent and severity of these impacts are analyzed in order to devise prevention or mitigation strategies, which are included in an Environmental Management Plan.

As part of the project's area of influence, the urban zone of the municipality of Pepillo Salcedo and the Copey and Carbonera sections are identified as the population centers closest to the project and, therefore, where the impacts will have a more direct and permanent materialization during the project's life cycle.

The urban area of the municipality of Pepillo Salcedo extends 2.2 kilometers west from where the gas-fired power plant will be built to the Haitian border, while the Copey and Carbonera sections are located 6.7 kilometers and 9.5 kilometers, respectively, south of the project area by road.

The inhabited area of the Copey section is located at a distance of 1.8 kilometers from where the last tower of the 345 kV transmission line, which is a component of this project, is planned to be installed and will connect to the 345 kV transmission line that extends from Santiago to Monte Cristi (Figure 6-231).

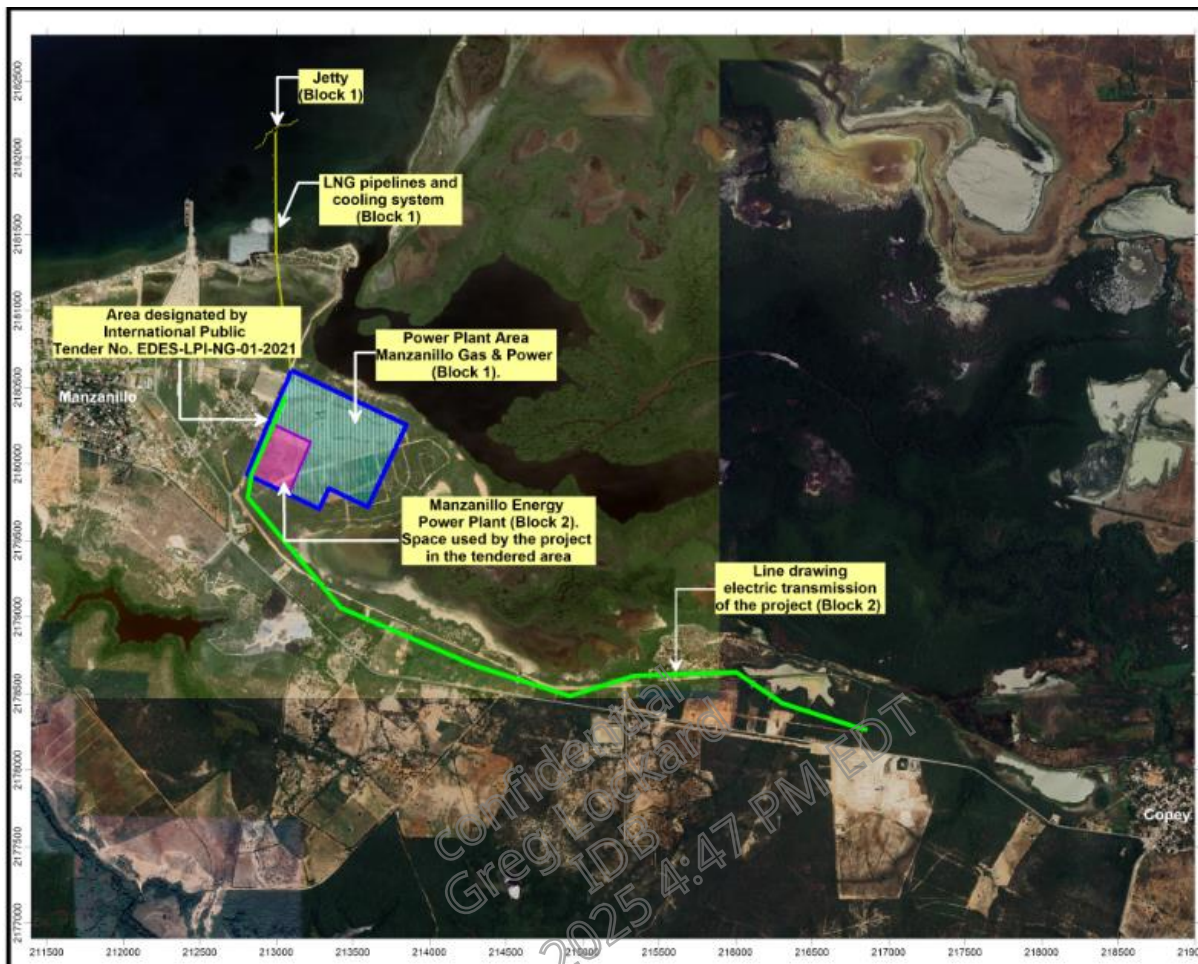


Figure 6-231. Google Earth image showing the transmission line route in green and the town of Copey at 1.8 km.

Source: EMPACA, 2024.

The land where the 345-kilowatt transmission line of the Manzanillo Energy Consortium Power Plant project will be installed is approximately 5 kilometers long, from the point where the plant will be built to an interconnection substation to the national electric system, at a geographical point near the town of Copey.

These lands, located northeast of the Copey-Pepillo Salcedo highway, are dominated by anthropized soils (scrublands, pastures, sparse vegetation) where a gas pipeline has been built in one section to supply the Manzanillo Power Land energy project of the Energía 2000 consortium.

Much of this land has been used by goat and sheep farmers through pastoral practices without being protected by land titles.

In addition, a portion of this land contains a small farm dedicated to raising cattle, goats and sheep, as well as growing transvalley-type pasture for sale to cattle ranchers in the region.

Also, adjacent to this land, an industrial building is being built for the installation of a steel industry company, Leskey Industries.

The closest inhabited territory of the municipality of Monte Cristi to the power plant to be built is the Los Conucos section, which is located at a distance of 13.8 kilometers, while the urban area of this municipality is located at a distance of 26 kilometers.

The municipality of Monte Cristi is included as part of the project's area of social and economic influence because it is home to the offices of the main public and private entities that affect the social and economic life of the entire province and because it is expected to have a significant impact on job creation and the dynamization of commerce.

The following topics and variables are addressed in this chapter:

- Demographic aspects.
- Housing.
- Economy.
- Services (education, sanitation, water, electricity, internet, health, energy, transportation, etc.).
- Relationship of the community with the environment (pollution factors, risk factors, environmental values, ecosystem services).
- Gender aspects.
- Situation of human rights.
- Cultural and archaeological heritage.

6.3.2 Methodology

The methodology used to define the area of socioeconomic influence of the project is described below.

6.3.3 Delimitation of the study area

The delimitation of the study area was based on the political-administrative demarcations of the Dominican Republic established by the Vice-Ministry of Territorial Planning and Development (VODT), attached to the Ministry of Economy, Planning and Development.

The territorial division of the Dominican Republic defines eight (8) basic units, which are from largest to smallest as follows: Region, Province, Municipality, Municipal District, neighborhood and sub-neighborhood for the urban area and Section and Paraje for the rural area. The following were considered for the project:

Region : Cibao Northwest
Province : Monte Cristi
Municipality : Pepillo Salcedo and San Fernando de Monte Cristi
Neighborhood : Villa Ray and other neighborhoods of the urban area
Section : Copey, Carbonera and Los Conucos²⁸ (rural area)

Considering the above and based on the description of the area of influence according to the identified impacts, it is determined that the analyses developed in this study consider the province of Monte Cristi as an indirect recipient of the identified impacts, while the municipalities of Pepillo Salcedo and Monte Cristi are identified as the territorial units where these impacts could be materialized more directly.

Although the municipality of San Fernando de Monte Cristi was considered as part of the project's area of influence, only the Los Conucos section belonging to this municipality, as well as the urban area of Pepillo Salcedo (Photo 1 in Annex 14) and the sections of Copey and Carbonera were where the field work for the collection of primary information (survey, interviews, focus groups) was concentrated to a greater extent, since these four territorial demarcations will be where the greatest social, economic and cultural impacts of this project will be felt, focus groups), since the greatest social, economic and cultural impacts of this project will be manifested in the radius of these four territorial demarcations, which is why, from the beginning of the study, it was established to prioritize the characterization of its population and the consultation of its social, economic and political actors (local authorities, community groups, commercial sector, etc.), as indeed it was done.), as indeed was done.

The fact that the urban area of the municipality of Pepillo Salcedo was chosen as a priority for the application of the survey, interviews and focus groups was justified by the fact that, as previously mentioned, it is the area closest to the land where the project will be built, with a significant part of its territory within the space of one (1) kilometer included in its area of environmental influence.

The Copey section is located at only 6.5 kilometers, at the intersection of the Monte Cristi-Dajabón highway with the road that leads to the urban area of Pepillo Salcedo, while the Colonia Carbonera section is located three (3) kilometers from this intersection in the direction of Dajabón and the Los Conucos section is approximately 6 kilometers from the Copey intersection in the direction of Monte Cristi.

It should be noted that, although in the municipality of Monte Cristi only surveys were applied to the population of the Los Conucos section, relevant information (primary and secondary) was collected through interviews and characterization sheets, especially on variables related to service structures (education, health, sanitation, etc.), as well as economic activities, the latter mainly from secondary sources. Among the secondary sources used are: recent surveys of the National Statistics Office, bulletins of the Central Bank of the Dominican Republic, documents containing municipal development plans of Pepillo Salcedo and Monte Cristi, reports of the Ministry of Education of the Dominican Republic, UNDP Human Development Report, interviews with officials of the health, education and sanitation sectors, among others.

²⁸ In the data of the IX National Population and Housing Census, 2010 Los Conucos appears as a place belonging to the Las Peñas section; however, community leaders consulted claim that this demarcation has the category of section.

6.3.4 Identification and analysis of the socioeconomic conditions of the area.

The general methodology for the social baseline included the collection of information from primary and secondary sources.

Primary data was collected through the application of:

- **Survey** of the population of the urban area of Pepillo Salcedo and the Copey, Carbonera and Los Conucos sections.
- **Interviews** with thirty-six (36) key stakeholders (local authorities, service entities, community leaders, merchants, churches, NGOs, etc.).
- A total of five (5) **focus groups** were conducted: two (2) with women belonging to community groups, one (1) with residents of the Villa Ray neighborhood, which is the neighborhood closest to the project area, one (1) with fishermen and one (1) with different economic actors affected by the project (beekeepers, fishermen, goat and sheep farmers, tourism entrepreneurs).
- Unstructured **interviews** with eleven (11) fishermen.
- **Survey of service structures:** by means of unstructured interviews and the filling out of forms.
- **Photographic survey** of sites, economic activities, infrastructure, surveys and focus groups, among others.
- **Survey of UTM coordinates** of field activities and variables addressed in the study.

All fieldwork was documented by means of photographic images, both the application of the survey, interviews and focus groups, as well as the survey of service structures and the reference to different variables of the study (housing, economic activities, etc.).

6.3.4.1 Research tools used

The tools used are presented in Table 6-103.

Table 6-103. Research tools used.

Research tool	Subjects under investigation	Stakeholders consulted
1. Survey of existing services	1. Education Service 2. Attention to emergencies 3. Health service 4. Transportation service	a) Citizens b) Community leaders c) Managers of service entities. d) Statisticians of service entities
2. Survey	1. Demographic data 2. Housing 3. Economy 4. Services 5. Relationship of the community with the environment 6. Perception of the project	Population over 18 years of age of households to be impacted in the study area.
3. In-depth interviews	1. Genre 2. Human rights 3. Vulnerable groups 4. Human development	a) Community, social or economic leaders b) Residents with social interests c) Local authorities d) NGO.

Research tool	Subjects under investigation	Stakeholders consulted
	5. Ecosystem services 6. Possible conflicts with the project. 7. Recommendations	e) Religious leaders
Focus groups	1. Genre 2. Human rights 3. Ecosystem services 4. Fears, expectations and recommendations.	a) Women residents in the area of influence of the project. b) Population of the Villa Ray neighborhood, located in the immediate vicinity of the project. c) Fishermen
5. Qualitative observation	1. Genre 2. Human rights 3. Potential conflicts with the project 4. Ecosystem services	a) All the reality of the community or communities to be impacted.

Source: Prepared by EMPACA.

6.3.4.2 Description and details of the tools

The tools used are described below.

a) Gathering of specific information (service structures and indicators related to these structures).

The information was collected through unstructured interviews and the application of data sheets that allowed us to obtain relevant information through interviews with people in charge of schools, health centers, city hall, the water and sanitation office, as well as other public service entities, which served to learn about the situation of the services in the study area and variables related to these services. Table 6-104 presents the topics and key questions asked.

Table 6-104. Themes and the key questions asked.

Topics	Key questions
Education service	a) Number of existing schools b) Number of classrooms c) Number of registered students d) Equipment e) Category: Primary, secondary, other f) Access to technical and university education
2. Attention to emergencies	a) Fire department b) Police service c) Ambulance service d) Civil Defense e) Red Cross f) 911
Health services	a) Number of health facilities b) Public and private centers c) Attention span d) Number of doctors, nurses, bioanalysts, dentists, promoters.

Topics	Key questions
	e) Number of beds available. f) Equipment g) Existence of popular apothecaries and availability of medicines h) Health insurance i) Main diseases
5. Transportation service	a) Most important routes b) Service providers c) Means (buses, cars, vans, motorcycles)

Source: Prepared by EMPACA.

b) Surveys.

A survey was applied (Annex 15.1: Survey form) to collect general information that made it possible to describe the socioeconomic characteristics of the population of the urban zone of the municipality of Pepillo Salcedo and its rural zone, made up of the Copey and Carbonera sections, as well as the Los Conucos section, belonging to the municipality of Monte Cristi.

A team of six (6) enumerators (Photo 2 in Annex 14), two supervisors, two remote coordinators and a driver were used to carry out the survey.

Despite the fact that the entire team of survey participants had extensive experience, two induction and training days were held for the team of surveyors who participated in the survey.

The first day was held via Zoom with members of AECOM's technical team, with the objective of introducing the survey participants, both surveyors and supervisors, to the performance standards of the International Finance Corporation (IFC), as well as to clarify the survey instrument that would be applied.

On the second day, in addition to rereading and explaining the meaning of each of the questions contained in the survey form, a test of this instrument was conducted to determine the average duration of its application and to detect potential difficulties in understanding the questions.

For the application of the survey were selected persons of legal age, prioritizing heads of households.

The methodology used to define the number of surveys was based on the number of inhabitants of the municipality of Pepillo Salcedo, registered in the 2010 National Population and Housing Census, excluding the population of the Santa María municipal district. This means that only the population of the urban area of Pepillo Salcedo and the Copey and Carbonera sections were considered, to which was added the population of the Los Conucos section of the Montecristi municipality.

The exclusion of the Santa María municipal district was justified by the fact that, as a municipal district, it enjoys autonomy from the municipality of Pepillo Salcedo and is located 16.7 kilometers from the project area, being closer to the municipality of Las Matas de Santa Cruz than to the urban area of Pepillo Salcedo municipality, so it can be expected that the social and economic influence of the project will be rather indirect (Table 6-105).

Table 6-105. Population of surveyed localities.

Demarcation	Quantity	Percentage
Urban area Pepillo Salcedo	3 679	48.9
Copey	1 703	22.6
Carbonera	1 505	20.00
Los Conucos	638	8.48
Total	7 525	100.00

Source: National Bureau of Statistics: National Population and Housing Census, 2010.

The sample was calculated using the Dyane version 4 program, for a confidence index of 95% and a margin of error of 5%, yielding a preliminary number of 392 surveys.

a) Gender. Methodologically, an attempt was made to balance the participation of men and women based on the gender distribution of the population, according to the 2010 Census, although, as will be seen in the section on difficulties, this could not be fully achieved.

b) Spatial distancing between the selected households in such a way that the selection of a surveyed dwelling implied skipping two dwellings after the last one. The Villa Ray neighborhood was excluded from this criterion. Likewise, this methodological criterion could not be fully met.

Once in the field, although the purpose was to census or apply surveys to all households located in the Villa Ray neighborhood, this purpose could not be fully accomplished because some of them were closed, and it was not possible to contact their residents despite new attempts to do so.

A total of 392 surveys were applied. 196 in the urban area of the municipality of Pepillo Salcedo, including Villa Ray; 89 in the Copey section, 82 in the Carbonera section and 25 in the Los Conucos section, as shown in Table 6-106. Annex 15.2: Survey results.

Table 6-106. Number of surveys applied per demarcation for the sample design.

Demarcation	Quantity
Urban area Pepillo Salcedo (except Villa Ray)	142
Villa Ray	54
Copey	89
Carbonera	82
Los Conucos	25
Total	392

Source: Prepared by EMPACA.

In principle, every effort was made to comply with the distribution by gender defined in the sample; however, this could not be fully achieved, since there was a predominance of cases in which women were the ones in the homes and insisting on achieving a greater participation of male heads of household complicated the schedule established for conducting the survey. The distribution by gender and locality was carried out as shown in Table 6-107.

Table 6-107. Distribution by gender and locality for the sample design.

Location	Distribution by gender	
	Men	Women
Urban area Pepillo Salcedo	69	73
Villa Ray	22	32
Copey	41	48
Carbonera	46	36
Los Conucos	13	12
Total	191	201

Source: Prepared by EMPACA.

Considering the need to give prior notice to the population that would be subject to the characterization process, before conducting the surveys, contact was made with representatives of the different neighborhood councils, so that they could inform the residents, through their community chats, about the survey and motivate them to collaborate with it. The general methodology of the field work to be carried out was socialized with these community leaders.

Survey supervision: Survey supervision was done both in the field and by telephone.

- Field supervision mainly verified that the surveyors were aligned with the established criteria on gender balance in the sample and on the spatial spacing between the selected households, to ensure that the surveyed population was plural.

- In the following days after the surveys were administered, 10% of the respondents were contacted by telephone and asked five control questions to determine the veracity of the information collected. The surveyors were informed of this form of supervision, so that they would strive to be rigorous in administering each survey.

c) In-depth interviews.

At the same time, interviews were conducted with different relevant stakeholders, including municipal officials, leaders of the Municipal Development Commission, the fishermen's association, directors of hospitals and school districts, leaders of community organizations, churches, among others (Photo 3 in Annex 14).

These interviews were used to deepen the study's different variables, especially those related to the perception and valuation of the project. Human rights, vulnerable groups, ecosystem services and gender issues were also addressed.

These results, as well as those obtained through the focus groups, have also been useful as an instrument for triangulating the data obtained through the survey.

d) Focus groups.

Five (5) focus groups were held with relevant stakeholders (fishermen, neighbors of Villa Ray, women of Pepillo Salcedo, beekeepers, goat and sheep farmers, ecotourism entrepreneurs) with

whom aspects related to the stakeholders to which they belong and their relationship with project implementation were discussed (Photos 4 and 5 in Annex 14).

6.3.4.3 Qualitative observation

The qualitative observation was developed mainly on three topics, they are:

- a) Gender.
- b) Human rights.
- c) Existing conflicts with the project (Block 01).

This was done throughout the fieldwork through observation notes and unstructured interviews with people living in the project's surroundings, obtaining information on various relevant topics such as the perception of the project and ecosystem services, among others.

6.3.4.4 Secondary source information

On the other hand, information was obtained from various secondary sources, making sure, as far as possible, that the date was not more than one year old, except for those data used to evaluate periods or those used to make comparisons between different years and comparisons with those of the country as a whole, by contrasting them with the data obtained through the survey.

In this order, in addition to online consultations of different portals of entities such as the Central Bank of the Dominican Republic, the Social Security Treasury, among others, and various publications with information relevant to the study, we were able to interview officials from school district offices to address education factors; officials from hospitals and Primary Health Care Units; provincial and/or municipal water and sanitation offices, among others.

6.3.4.5 Information processing

The surveys were worked with the KoboToolBox software, a free and open tool, which is an initiative for humanitarian and research institutions of Harvard University. With this tool, the survey form was designed (Annex 15.1: Survey form) and then placed in cell phones to be applied in the field without internet connection.

After the surveys were administered, each cell phone was connected to the Internet to transfer all the information collected in the field to the platform. The tabulation of the surveys was carried out in an automated way, following a previously prepared design. All the information collected by the surveyors was entered into an Excel database.

6.3.4.6 Difficulties

In the process of carrying out this social baseline, several difficulties were encountered, some of which are reflected in the presentation of the results, which is why it is pertinent to point them out.

Without the order in which they are presented being an indicator of greater or lesser importance, the difficulties encountered include the following:

1. In the application of the survey, when interviewees were asked about the gender and age of the other members of their households, especially minors, there was reluctance on the part of many of them, especially in the Copey and Carbonera sections. This explains why in the analysis of the results of these variables there were significant discrepancies between the total number of members and the distributions by gender and age.
2. In a very significant proportion, enumerators found that those in the dwellings were female.
3. Attempting to rigorously apply the methodological criterion of skipping two dwellings to survey a third often made it difficult to apply the criterion of parity in the gender distribution of the sample, since, as has been pointed out, it was mostly women who were found in the dwellings. It frequently happened that, while in the dwellings that were skipped there were male persons, in the third one selected there were female persons. This created delays that affected compliance with the survey schedule.
4. Households composed of Haitian nationals are under-represented in the total number of surveys applied because the date of application coincided with an increase in the deportation of Haitian nationals with an irregular migratory status, which caused many heads of household to decline to participate due to fears that are common among Haitian nationals.
5. The fact that the survey was still administered in the same week before the 10th National Population and Housing Census meant that it had to be made clear to respondents that it was not the census.
6. In the Villa Ray neighborhood, there was resistance to being surveyed by some heads of households due to the false belief that this survey was a census for purposes of displacement of the population of this neighborhood.
7. Although it is observed that the statistical databases at the national level have been published for more than a year, which hinders the feasibility of using secondary sources that meet the standards established by the International Finance Corporation (IFC), it is convenient to reference certain data sets exclusively for the purpose of carrying out comparative analyses of a historical nature. However, it is worth noting the incorporation of information from the Central Bank of the Dominican Republic and the findings of the ENHOGAR survey, 2021, released by the National Statistics Office, which have been incorporated into the study to enrich the analysis with more recent and detailed perspectives.
8. Data from secondary sources are limited by the fact that they are not available at the necessary level of disaggregation for the project's area of influence.
9. The fact that the country is in the midst of a pre-electoral process means that the spaces for consensus-building, both national and local, as well as within social organizations, are sometimes affected by disputes caused by the interest of each party to take advantage of each space to promote, openly or veiled, their candidates. This situation, which could be considered as an undesired side effect of the democratic exercise in the country, must be considered in order to understand the participation processes that take place around the project. Likewise, this fact may be a factor that influences some public entities (municipalities, educational, health and civil registry entities) to show reservations about fully collaborating in the collection of information relevant to this baseline.

6.3.4.7 Cartographic representation

The main results of the study are presented in cartographic form by EMPACA's Cartography Laboratory, which allows the main results of the study to be represented in graphic form.

6.3.5 Geographical location

The Dominican Republic is located in the Caribbean Sea, occupying the eastern part of the island of Santo Domingo, which it shares with the Republic of Haiti. Its geographical coordinates are: 17° 36' and 20° 05' north latitude; and between 68° 19' and 74° 29' west longitude. Its geographical limits are: to the north the Atlantic Ocean, to the east the Mona Channel, to the south the Caribbean Sea and to the west the Republic of Haiti. Its territory has an area of 48,448 km², where, according to the latest population census (2022), 10,760,028 people live.

For planning purposes, the country has been divided into ten (10) regions²⁹. These are: 1) Cibao Central, 2) Cibao Sur, 3) Cibao Nordeste, 4) Cibao Noroeste, 5) Valdesia, 6) Enriquillo, 7) El Valle, 8) Yuma, 9) Higuamo and 10) Ozama.

The Cibao Noroeste region is the region in which the province of Monte Cristi and the municipality of Pepillo Salcedo are located, which is where the Manzanillo Energy Consortium Power Plant project will be located, with an approximate capacity of 420 MW of combined cycle and a 345 KV transmission line. This region is integrated, in addition to Montecristi province, by the provinces of Dajabón, Santiago Rodríguez and Valverde.

In political-administrative terms, the country is divided into one (1) National District, where the central government is located, 31 provinces, 158 municipalities, 232 municipal districts, 1,182 sections, 9,965 districts, 2,621 neighborhoods and 4,954 sub-neighborhoods³⁰.

Montecristi is one of the 31 provinces that make up the Dominican Republic and one of the five (5) border provinces. Its geographical limits are: to the north the Atlantic Ocean; to the east the provinces of Valverde and Puerto Plata; to the south the provinces of Santiago Rodríguez and Dajabón, and to the west the Atlantic Ocean and the Republic of Haiti. Its geographic coordinates are located at 19°40' north latitude and 71° 25' west longitude, with a territorial extension of 1,875.64 km², where according to the 2022 Census there is a population of 123,519 inhabitants, which makes it one of the provinces with the lowest population density in the country: 66 inhabitants/km².

Monte Cristi province has six municipalities: San Fernando de Montecristi; Castañuelas; Guayubín; Las Matas de Santa Cruz; Villa Vásquez and Pepillo Salcedo.

The basic political-administrative entities of the territory are the municipalities and municipal districts. These constitute spaces in which the communities exercise their activities, represented by the city councils or mayor's offices and the district boards, respectively. These entities enjoy autonomy, and their functions, according to Law 176-07³¹, include land use planning, urban planning, use of green areas and parks, as well as managing the sanitation of the municipality, mainly the management and disposal of solid waste.

²⁹ Law 345-22: Law of Unique Regions of the Dominican Republic.

³⁰ National Statistics Office: Territorial Division of the Dominican Republic, 2020.

³¹ Law 176-07, on Municipal City Councils and the National District, of 2007.

The urban areas of the municipalities and municipal districts are divided into neighborhoods and sub-neighborhoods, while their rural areas are divided into sections and districts.

The municipality of Pepillo Salcedo, specifically its urban area, and the Copey and Colonia Carbonera sections, together with the Los Conucos section, belonging to the municipality of Monte Cristi, make up the territorial units that are characterized in this baseline, as they are the areas where the land of the project area and its environmental and social areas of influence are located.

As indicated, the urban area of the municipality of Pepillo Salcedo is the area closest to the area where the project will be built, with a significant part of its territory within one (1) kilometer of its area of environmental influence (see Figure 6-232), while the Copey section is only six and a half kilometers away, at the intersection of the Monte Cristi-Dajabón highway with the road leading to the urban area of Pepillo Salcedo, the Colonia Carbonera section is three (3) kilometers from this intersection in the direction of Dajabón, and the Los Conucos section is approximately six kilometers from this intersection in the direction of Montecristi.

Indeed, both during the construction and operation phases of the project, the inhabitants of these localities, especially in the urban area of the municipality, will be exposed to its influence, by economic dynamization (job creation, trade dynamization), immigration, possible polluting effects, among others.

Pepillo Salcedo was declared a municipality in 1949 by Law 2083 of that year. A significant part of the one (1) kilometer area of environmental influence of the Manzanillo Energy Power Plant project is located in its urban area.



Figure 6-232. Map of urban areas of Pepillo Salcedo, Copey and Carbonera.

Source: EMPACA 2022 elaboration

The urban area of Pepillo Salcedo, also called Manzanillo, is made up of 9 neighborhoods: Centro del Pueblo, Pueblo Nuevo, Pueblo Nuevo, Los Japoneses, Las Casitas, Los Barracones, Villa Ray, Villa Banack, El Cerro and Alto La Paloma or Manhattan. Of particular note among these neighborhoods is the Villa Ray neighborhood, which is completely within the area of environmental influence of the project, at a distance of no more than 100 meters from where the perimeter fence will eventually be erected.

As mentioned above, the Copey and Colonia Carbonera sections are located in the area of social and economic influence of the project, at a distance of 6.7 kilometers and 9.5 kilometers, respectively, to the south of the urban zone of the municipality, and the Los Conucos section is approximately 13 kilometers away.

San Fernando de Monte Cristi is the main municipality of the province of Monte Cristi. It is home to the offices of public and private entities that operate in the entire provincial territory, which is why this municipality has an impact on all the others, including Pepillo Salcedo (see Figure 6-233).



Figure 6-233. Map identifying the urban areas of the municipalities of San Fernando de Montecristi and Pepillo Salcedo.

Source: EMPACA 2022.

As established in the Pepillo Salcedo Municipal Development Plan 2020-2024, in terms of its functional context, the municipality of Pepillo Salcedo constitutes a municipality that is dependent on the municipality of Monte Cristi, since the latter concentrates "government and management agencies, administrative procedures, resource management and/or decision making, exchange of goods and services, cargo transportation flows, movement of people for labor, educational, health and recreational reasons, infrastructure coverage and basic services, higher level of access to water sources, and greater provision of electricity"³².

³² Pepillo Salcedo Municipal Development Plan 2020-2024.

In functional terms, the municipality of Pepillo Salcedo is linked to the rest of the province, including the municipality of San Fernando de Monte Cristi, and part of the Western Cibao region, because the port of Manzanillo is located in this municipality, from where the region's main agricultural products are exported, especially bananas.

6.3.6 Political context and background of the project

6.3.6.1 National and regional political context

The Dominican Constitution of 2010³³, amended in 2015, defines the Dominican State as a Social and Democratic State of Rights, declaring among its attributes the respect for human dignity and the fundamental rights of individuals.

This Constitution establishes a system of checks and balances through the independence of powers (executive, legislative and judicial) and the autonomy of municipalities.

The executive branch is made up of the central government, which exercises functions aimed at the provision of different public services (health, education, security, water and sanitation, cultural, environmental, etc.) as well as tax collection and regulatory functions. The governor is the representative of the executive branch at the provincial level.

The legislative branch is divided into the Upper House (Senate) and Lower House (Deputies). The Senate is made up of one representative for each of the 31 provinces and the National District, while the Chamber of Deputies is made up of electoral districts, the number of representatives for each province depending on the size of its population.

The main political forces are represented in the legislative branch, which means that decisions on public policies have a high level of consensus among the different parties and is a factor that influences the political stability of the country and the strength of its party system. Currently, both the executive and legislative powers are exercised by political actors democratically elected in 2020 for a period of four (4) years.

At the time of updating the data and information of this social baseline, December 2023, the country is immersed in a pre-electoral process, just two months before the 2024 municipal elections and five months before the presidential and congressional elections.

This situation, as the country is in the midst of a pre-electoral process, influences the spaces for consensus-building, both national and local, as well as within social organizations, which are sometimes affected by disputes caused by the interest of each party to take advantage of each space to promote, openly or in a veiled manner, their candidates. This situation, which could be considered as an undesired side effect of the democratic exercise in the country, must be considered in order to understand the participation processes that take place around the project.

The Judicial Branch is made up of the courts, which are appointed by the National Council of the Magistracy, and the public prosecutors or Public Ministry, whose head is appointed by the executive branch.

³³ Constitution of the Dominican Republic.

In the case of the municipality of Pepillo Salcedo and the province of Monte Cristi, as they are territorial units located in the border region, the Coordinating Council for Border Development is a relevant actor dependent on the executive branch.

Next, in Table 6-108 below shows the national, regional and provincial stakeholders relevant to the project.

Table 6-108. National, regional and provincial stakeholders relevant to the project.

Actors	Name	Phone	Location	Function
Coordinating Council of the Special Border Development Zone (CCDF)	Erodis Díaz	809 475-3932	Santo Domingo West	Governmental institution whose function is to promote private investment in the border area.
Border Zone Development Policies Directorate	Erick Dorrejo	809 258-3859	Santo Domingo D.N.	Department of the Ministry of Economy, Planning and Development in charge of coordinating development policies in the border area.
Ministry of Energy and Mines	Antonio Almonte	809 373-1800	Santo Domingo D.N.	Law 100-13, which creates the Ministry of Energy and Mines, empowers it to formulate and administer the country's energy policy.
Ministry of Environment and Natural Resources	Miguel Ceara Hatton	809 567-4300	Santo Domingo D.N.	Law 64-00, which creates the Ministry of the Environment and Natural Resources, empowers it to formulate environmental protection policies and to ensure the environmental sustainability of projects.
Provincial Directorate Ministry of the Environment and Natural Resources	Kevin Olivo	809-579-3177	Monte Cristi	Executes environmental protection policies in the province of Montecristi.
Provincial Senator's Office	Ramón Pimentel Gómez	809 533-5513 809 532-5561 ext. 5200	Monte Cristi	Senator of the Republic until August 16, 2024.
Provincial Governor	Milagros Cruz Martínez	809 733-0014	Monte Cristi	Representative of the central government in the province.
Universidad Central del Este (Monte Cristi campus)	--	809 579-3726	Monte Cristi	The only higher education entity with presence in the province.
Autonomous University of Santo Domingo	Juan Miguel Liriano	809 572-3918	Mao	Public university in the northwest region.

Actors	Name	Phone	Location	Function
(northwestern region)				
Technical Vocational Training Institute (INFOTEP) (Cibao Norte region)	--	809) 570-4125	Santiago	Public entity oriented to technical training for the labor market.

Source: Prepared by EMPACA.

6.3.6.2 Local political context

The municipal councils and boards of municipal districts constitute autonomous local powers, whose authorities are made up of the mayors, vice-mayors and councilmen or aldermen in the case of municipalities, and the directors of boards and members in the case of municipal districts. They are elected every four (4) years.

Another relevant actor related to the municipalities is constituted by what is called the Municipal Development Council or Economic and Social Council, which is a coordinating body, under Law 176-07 on the National District and Municipalities, which brings together the local elected political leadership, together with representatives of the social and community organizations of the municipalities.

Among the social and community organizations in the municipalities are the neighborhood councils, which play an important role in terms of support and social consensus for the management of the territory and are therefore important community social actors for the implementation of economic projects that may impact the environment and the quality of life of the communities.

Other relevant community organizations in the municipality of Pepillo Salcedo are the NGO Consejo para el Desarrollo de Manzanillo (COPADEMA), women's groups called mothers' centers, sports clubs, which bring together young people, the Asociación de Estudiantes Universitarios de Pepillo Salcedo, as well as school parents' associations.

Associations related to productive activities are also relevant in this municipality, such as associations of fishermen, livestock breeders, beekeepers and ecotourism entrepreneurs, among others (Table 6-109).

Table 6-109. Actors with incidence in the Pepillo Salcedo locality.

Name	Entity/reason	Location	Phone
Community organizations			
Antonia Perdomo	N.C. Union y Esperanza,	Villa Ray Neighborhood	829 641-6502
Digna Chavez	Santana Neighborhood Council	Carbonera	849 209-2887
Jorge Jimenez	Vecinos Unidos Podemos Council	Pueblo Nuevo	809 972-3277
Luz Divina Taveras	Marcelina Batista Neighborhood Council	Alto La Paloma	809 620-0898
Ramón Eduardo Ureña	Good Living Neighborhood Council	Manhattan	--

Name	Entity/reason	Location	Phone
Raquel Brito	Good Living Neighborhood Council	Manhattan	829 601-5286
Rosario Cabrera	Federation of Neighborhood Councils	Manhattan	829 934-2221
Mercedes Cabrera	Los Barracones II Neighborhood Council	Pepillo Salcedo	829 289-6727
Juan José Sosa Espinal	Neighborhood Council Los Barracones I	Pepillo Salcedo	809 768-8730
Yesenia Perdomo	Ray of Light Mothers' Center	Copey	809 383-3296
Paula Disla	Mothers' Center	Carbonera	809 779-0833
Moraima Marcelina Ogando	Nuestro Esfuerzo Mothers' Center	Alto La Paloma	809 912-0657
Rafael Guzman	Asociación Padres, Madres y Amigos de la Escuela (APMAE) (Parents, Mothers and Friends of the School Association)	Pepillo Salcedo	809 860-6881
Manny Almonte	Copey Softball and Basketball League	Copey	809 352-5291
Victor Mora	Juan Pablo Duarte Sports and Cultural Club	Carbonera	809-467-6447
Public entities			
Ignacio Rosa	Mayor municipality	Pepillo Salcedo	809 467-6444
Yojawi Sosa	Deputy Mayor	Pepillo Salcedo	--
Eneroliza Martinez	Municipal council	Pepillo Salcedo	829 758-5148
Roberto Espinal	Municipal council	Pepillo Salcedo	809 356-2209
Leudys Tineo	Municipal council	Pepillo Salcedo	829 701-3017
Frank Valenzuela	Municipal council	Pepillo Salcedo	8099 504-1982
Helvio Bejarán	Economic and Social Council of the Municipality	Pepillo Salcedo	829 356-4765
Maria Liberato	National Institute of Potable Water and Sewerage (INAPA)	Pepillo Salcedo	829 801-4823
Luis Rodolfo Fabian	Fire Department	Pepillo Salcedo	829 601-7696
Arturo Mena Disla	Civil Defense	Pepillo Salcedo	829 471-1608
Lenín Inoa	Municipal Development Council	Pepillo Salcedo	849 409-5827
July Sagatune	Customs Officer Port Manzanillo	Pepillo Salcedo	829 396-8080
Aristides Cabrera	Port Authority	Pepillo Salcedo	849 247-2213
Fernando Araujo	Pepillo Salcedo Municipal Hospital	Pepillo Salcedo	809 973-7796
Raysa López Ulloa	Pepillo Salcedo Municipal Hospital	Pepillo Salcedo	849 457-2422
Gerardo Justo	Ministry of Education	Pepillo Salcedo	829 286-1396
Manuel Alberto Almonte	Chamber of Commerce and Production Manzanillo	Pepillo Salcedo	849 629-5525
Edwin Castro	La Cruz de Manzanillo Project	Pepillo Salcedo	809 493-9110
César Fañas	La Cruz de Manzanillo Project	Pepillo Salcedo	829 860-8471
Zenaida Núñez	Civil Registry Office	Pepillo Salcedo	829 319-1555

Name	Entity/reason	Location	Phone
Private entities/NGOs			
Milagros Mieses	Council for the Development of Manzanillo (COPADEMA)	Pepillo Salcedo	849 433-7863
Giovanny Felipe	Copey Development Union	Copey	809 383-2028
Roque Taveras	Marine Guardian Fishermen's Association	Pepillo Salcedo	829 572-6338
Nelson Blanco	Eco-Adventure Manzanillo	Pepillo Salcedo	809 973-1880
White Doing	Eco-Adventure Manzanillo	Pepillo Salcedo	849 244-7396
Rafael Luis Torres	Tropical Seas	Pepillo Salcedo	849 925-6167
Juan Guzman	Communicator	Pepillo Salcedo	849 785-3303
Miguel Alejandro Bejarán	Atlantic Cooperative	Copey	829 760-4959
Wisnell Vargas Pimentel	Beekeepers Association	Pepillo Salcedo	849 272-5198
Ramón Arístides López	Manzanillo Cattlemen's Association	Pepillo Salcedo	809 858-8444
German Tavárez	Camioneros Pepillo Salcedo Association (affiliated to Fenatrado)	Pepillo Salcedo	829 639-4929
Guillermina Perez	Demimin Confectionery	Pepillo Salcedo	809 912-8604
Juan Batista	Shipping agent	Pepillo Salcedo	809 914-8559
Guarionex Luperon	Social and economic consultant	Pepillo Salcedo	829 602-4214
Radhames Tatis	Manzanillo Golf Club	Pepillo Salcedo	809 817-1719
Juan Pablo Terrero	Monte Cristi Park Ecological Society	Los Conucos	809 606 9931
Churches			
Pastor José Guillermo Sosa	Missionary Church	Pepillo Salcedo	809 978-4464
Pastor Remigio Báez Cuevas	Evangelical Assembly of God Church	Pepillo Salcedo	829 890-4776
Orlando Barajas	Catholic Church	Pepillo Salcedo	849 878-7838
Community			
Luis Peña Sosa	Environmentalist/lawyer	Pepillo Salcedo	809 799-7086
Arsenia Meran	Health sector activist	Pepillo Salcedo	809 713-1989
Economic actors on land adjacent to the transmission line			
Hugo Carías	Property owner		809 776-0164
Carlos Espinoza	"		809 722-4881
Kildre Taveras	"		809 545-0330
Roberto Gonzalez	"		809 543-7980
Joaquin Curiel	Beekeeper		809 481-7895

Source: Prepared by EMPACA, 2023.

6.3.6.3 Project background

On the other hand, one of the problems with political implications faced by nations such as the Dominican Republic is to find ways to harmonize environmental protection with economic growth, which is a prerequisite for its citizens to have access to goods and services in sufficient quantity and quality to overcome poverty levels and achieve a higher level of human development.

Contemporary history teaches that the economic development of any country goes hand in hand with the development of its energy sector. That is why investment in this sector is a priority, while it is recognized as necessary to take measures to avoid or mitigate the polluting effects of its use, especially those whose matrix are fossil fuels.

In this context, the Dominican State, through a process of consultation of all its political and social actors, has defined and implemented policies aimed at promoting the development of its energy sector³⁴, without neglecting the environmental sustainability of this development, in line with global trends aimed at guaranteeing the right of its citizens to enjoy a healthy environment and the protection of this³⁵, including the adherence of the Dominican State to the Paris Agreement against climate change.

In this regard, the country's public policies aimed at protecting the environment are governed by the Ministry of the Environment and Natural Resources³⁶, which, together with other public entities such as the Ministry of Economy, Planning and Development and the Ministry of Energy and Mines, among others, constitute institutional actors dependent on the Executive Power or central government, which align their objectives to guarantee the environmental sustainability of economic activities, the respect of the environmental rights of Dominicans and the diversification of the country's energy matrix, encouraging less polluting energy sources.

As a background of the Manzanillo Energy Thermoelectric Power Plant project, in 2007 the Dominican government issued Decree No. 264-07 dated May 22, 2007, which declares the use of Natural Gas to be of national interest, due to its social, economic and environmental interest; the State must promote its massive use, encouraging it as an alternative to petroleum derivatives.

Natural gas is currently considered the main energy source for the transition to the use of renewable sources. Among its benefits is that it is an environmentally friendly alternative, since it produces less CO₂ than other fuels, such as petroleum derivatives.

It is also cited that this fuel represents a less expensive alternative to petroleum derivatives, which contributes to the country's foreign exchange savings.

The use of natural gas as a source of electricity generation has been advancing in the country. In 2013 it was used in three plants that generated 600 megawatts, then representing 27% of the total overall capacity of the Dominican electricity system. Already in 2017, this fuel had become the main source of electricity generation, with 34.68%, surpassing petroleum-derived liquid fuels, according to a report by the Dominican Association of the Electricity Industry (ADIE).

³⁴ National Pact for the Reform of the Electricity Sector, 2021-2030.

³⁵ National Development Strategy of the Dominican Republic, 2010-2030.

³⁶ Law 64-00 on the Environment of the year 2000.

However, in 2020, with the entry into the energy system of the coal-fired Punta Catalina Plant, natural gas was displaced to second place as the main source of the Dominican electricity system, representing 30% compared to the 37% represented by the coal source.

However, in the year 2021, natural gas regained its top place as a source of electricity generation, as can be seen in Table 6-110.

Table 6-110. Generation sources of the Dominican electricity system.

Generation source	Installed capacity (MW)	Proportion (%)
Fuel	1,092.75	22.21
Coal	1,093.90	22.23
Natural gas	1,523.30	30.95
Hydroelectric	623.28	12.67
Wind	370.30	7.52
Solar	187.50	3.81
Biomass	30,000	0.61
Total	4,921.03	100.00

Source: EDESUR, Dominican electricity system and distributed generation, March 2021.

At this time (end of 2023), apart from the uncertainties derived from the Russia-Ukraine war and the war in the Middle East between Israel and the militias of the Palestinian organization Hamas, it seems that natural gas will consolidate in the coming years as the main source of electricity generation in the country, since the current tenders with the largest generation capacity are from this source.

The Manzanillo Energy Consortium Power Plant project, together with other similar projects in the municipality, such as the LNG Import Terminal with Storage and Regasification and Power Plant with a capacity of approximately 420 MW Manzanillo Gas & Power and the Manzanillo Powerland Thermal Power Plant, of the company Energía 2000, are consolidating this trend.

This project, which is part of the development initiatives included in all the alternatives that were considered in the Pepillo Salcedo Master Development Plan³⁷, is the expression of a will in which national political actors (central government), local political actors (municipal authorities), community actors, and economic actors (project promoters) converge.

6.3.7 Demographics

At present and until the data from the 10th National Population and Housing Census are fully published, relevant information such as population quantity and density in the area of influence of the project can only be estimated from a population projection based on data updated to the year 2022 for the provinces contained in the first bulletin of the 10th National Population and Housing Census of that year.

The population of the province of Montecristi in the year 2022 is 123,519 inhabitants, having had an average accumulated growth rate of 12.7, resulting in an increase of 13,912 inhabitants in a period of twelve (12) years from 109,607 in 2010.

³⁷ This master development plan is still in draft form, which is why, although it is referred to, it cannot be officially cited.

The population of the head municipality (San Fernando de Montecristi) in 2010 was 24,644 people and that of the municipality of Pepillo Salcedo was 9,136 inhabitants. If the same accumulated growth rate of 12.7 that the province, as a whole, experienced in the 12-year period between 2010 and 2022 is applied, the population of the municipality of San Fernando de Monte Cristi can be projected to grow by 3,129 to reach 27,773 inhabitants and that of Pepillo Salcedo by 1,160 to reach 10,296 inhabitants.

Following the same procedure, the urban area of Pepillo Salcedo would reach 4,146 inhabitants in 2022, the Copey section would grow to 1,919 inhabitants, the Carbonera section would reach 1,696 and Los Conucos would reach 719.

Table 6-111. Population projection of the localities in the area of influence of the project.

Location	Population in 2010	Projection to the year 2022
Province of Montecristi	109,607	123,519 (*) ³⁸
Municipality of San Fernando de Montecristi	24,604	27,773
Pepillo Salcedo Municipality	9,136	10,296
Urban area Pepillo Salcedo	3,679	4,146
Copey Section	1703	1,919
Coal Section	1505	1,696
Los Conucos	638	719

Source: Projection elaborated by EMPACA based on the census bulletin #26 that collects the first preliminary data at the provincial level of the X National Population and Housing Census, 2022, of the National Statistics Office of the Dominican Republic.

Regarding population density in the municipalities of San Fernando de Monte Cristi and Pepillo Salcedo, considering that the surface area of the former is 517.4 km² and that the projected population in 2022 would be 27,773 inhabitants, it would have a population density of 53.7 inhabitants/ km². The municipality of Pepillo Salcedo, which has a surface area of 151.2 km² and a projected population of 10,296, would have a population density of 68.1 inhabitants/ km².

Table 6-112. Projected population density of the localities in the area of influence of the project.

Demarcation	Area	Population projected 2022	Projected population density
Monte Cristi Province	1,885.81 km ²	123,519 ³⁹	65.5 inhab/ km2
San Fernando Municipality of Monte Cristi	517.4	27,773	53.7 inhab/ km2
Pepillo Salcedo Municipality	151.2	10,296	68.1 inhabitant/ km2

Source: Projection elaborated by EMPACA based on the census bulletin #26 that collects the first preliminary data at the provincial level of the X National Population and Housing Census, 2022, of the National Statistics Office of the Dominican Republic.

³⁸ Data on the population of the province of Monte Cristi based on the X National Population and Housing Census, 2022.

³⁹ Idem.

6.3.8 Gender

According to data from the X National Population and Housing Census, 2022, the female population in Monte Cristi province represents 48.3% of the total population, while the male population reaches 51.7%.

The survey data indicate that the gender distribution of the 1,139 members of the 392 households surveyed in the project's area of influence is 48.28% female and 51.72% male. This data is similar to that of the 2022 census for the province as a whole, which, as seen, also records a higher percentage of male (51.7%) than female (48.3%) population.

Table 6-113. Percentage distribution by gender of the population in the direct area of influence of the project

Gender	Quantity	%
Female	550	48.28
Male	589	51.72
Total	1139	100.00

Source: Survey applied in the urban area of Pepillo Salcedo and the Copey, Carbonera and Los Conucos sections (EMPACA, SRL, October and November 2022).

Although, as can be seen in Table 6-113 among the members of the households in the area where the survey was applied, the male population is higher than the female population, this trend is not uniform in all localities, since in some localities the female population is in the majority.

This is the case in the urban area of Pepillo Salcedo or Manzanillo, where 51.02% of the members of the surveyed households are female, as is the population of the Villa Ray neighborhood, where the female population represents 53.03%.

The case of the Carbonera section is different, where 55.33% of the members of the surveyed households are male, which is consistent with the 2010 census data, where the male population represents 52.62%.

Table 6-114. Distribution by gender and location of the population in the project's direct area of influence

Location	Female		Male		Another		Total	
Carbonera	109	44.67	135	55.33	-	-	244	22.22
Copey	95	47.73	99	52.27	-	-	199	18.12
Manzanillo	199	51.02	190	48.98	1	100.00	390	35.52
Villa Ray	105	53.03	93	46.97	-	-	198	18.03
Los Conucos	31	46.27	36	53.73	-	-	67	6.10
Total	539	--	553	--	1	100.00	1098	100.00

Source: Survey applied in the urban area of Pepillo Salcedo and the Copey, Carbonera and Los Conucos sections (EMPACA, SRL, October and November 2022).

6.3.9 Age

The survey data indicate that, of the 1,139 members of the 392 households surveyed, 25.37% are in the 0-17 age group, being the group with the highest representation. This group is followed by the 18-30 age group, which reached 19.05%, followed by the group of people over 60 years of age, which reached 18.17%.

The three groups in the middle of those already mentioned, that is, the groups between 31-40 years (12.46%); 41-50 years (11.59%) and 51-60 years (13.34%) are the least represented, which may be an indicator of the manifestation of migratory phenomena of the generations represented in these age groups.

Table 6-115. Percentage distribution by age group

Age range	Female	Male	Female	Male	Total	Total
	Quantity	Quantity	%	%	Quantity	%
0 a 17	141	148	25.64	25.13	289	25.37
18 a 30	104	113	18.91	19.19	217	19.05
31 a 40	67	75	12.18	12.73	142	12.46
41 a 50	59	73	10.73	12.39	132	11.59
51 a 60	74	78	13.45	13.24	152	13.34
More than 60	105	102	19.09	17.32	207	18.17
Total	550	589	100.00	100.00	1 139	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

With regard to the distribution by gender and age groups, the survey results show that there is no significant variation by gender among the different age groups, with only the age groups over 60 and 41-50 years of age showing a difference by gender of slightly more than one percentage point (Figure 6-234).

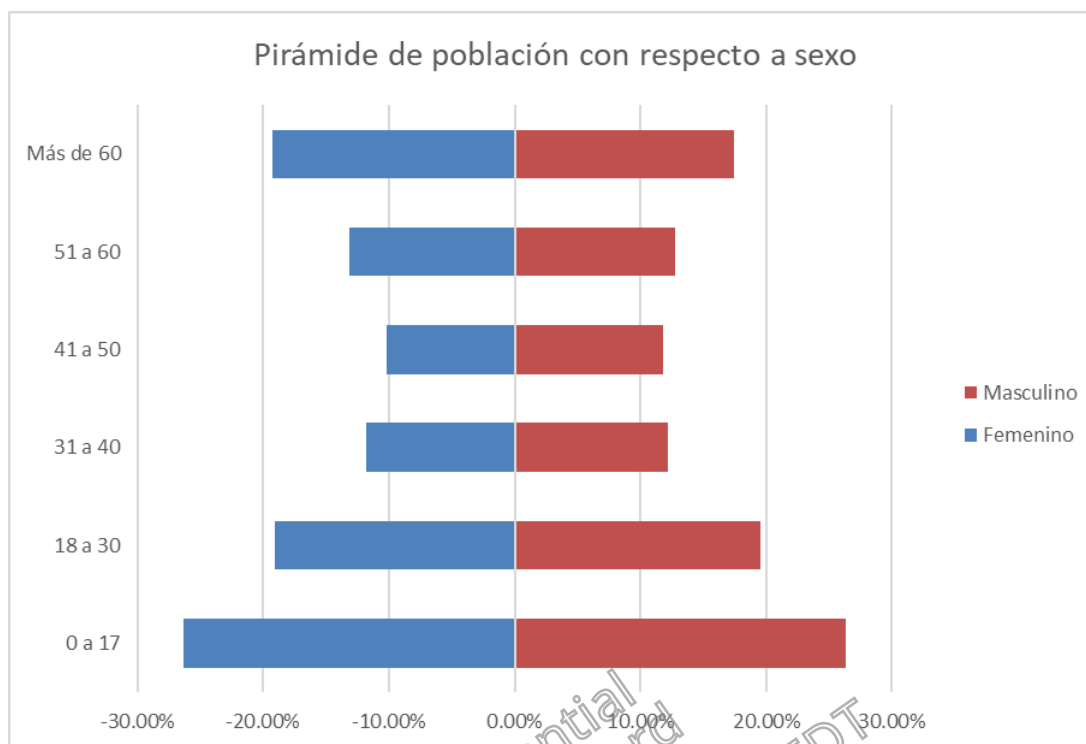


Figure 6-234. Distribution by gender and age group.

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

6.3.10 Marital or conjugal status

36.22% of the heads of household surveyed in the months of October and November 2022 have the marital status of unmarried (a), being this the predominant one in the area of influence of the project.

The marital status of unmarried is followed by the marital status of single, which represents 34.95%; the marital status of married, which reaches 18.88%; the marital status of widowed, with 6.12% and the status of separated, with 2.55%, while the marital status of divorced from a marriage only represents a little more than 1%.

It can be seen in the Table 6-116 that the married marital status has a greater representation in the urban zone of Pepillo Salcedo, including the Villa Ray neighborhood, compared to the Copey, Carbonera and Los Conucos sections. Conversely, in Carbonera and Copey there is a greater representation of the population whose marital status is unmarried than in the urban zone of the municipality and in the Villa Ray neighborhood, while a high proportion of people whose marital status is single (64%) is notable in the Los Conucos section.

Table 6-116. Marital status

Marital status	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Married	12	14.63	16	17.98	31	21.83	12	22.22	3	12.00	74	18.88
Divorced	1	1.22	1	1.12	1	0.70	1	1.85		0.00	4	1.02
Separated	4	4.88	2	2.25	2	1.41	2	3.70		0.00	10	2.55
Single	24	29.27	32	35.96	49	34.51	16	29.63	16	64.00	137	34.95
United	36	43.90	35	39.33	47	33.10	18	33.33	6	24.00	142	36.22
Widowed	5	6.10	2	2.25	12	8.45	5	9.26		0.00	24	6.12
N/A		0.00	1	1.12		0.00		0.00		0.00	1	0.26
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

6.3.11 Nationality

96.68% of the respondents declared to be of Dominican nationality and only 3.32% declared to be of Haitian nationality. (Table 6-117)

Table 6-117. Nationality of respondents.

Nationality	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Dominican	81	98.78	88	98.88	136	95.77	51	94.44	23	92.00	379	96.68
Foreigner	1	1.22	1	1.12	6	4.23	3	5.56	2	8.00	13	3.32
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

In relation to these data, it should be noted that when applying the criterion defined in the survey methodology of skipping two dwellings and applying the survey in the third, it was found that dwellings where Haitian nationals lived declined to be surveyed, and the next dwelling where Dominican nationals lived was chosen. This is one of the reasons why the survey data shows such a low percentage of Haitian nationals in these localities, which, because they are located in the border area, are expected to have a higher percentage of Haitian nationals, as reflected in the 2010 census data, in which 15.3% of the census population that year was identified as Haitian (Photo 6 in Annex 14).

As has already been pointed out, several causes seem to explain why many Haitian nationals declined to participate in the survey. One of them is linked to the fact that the date of application of the survey coincided with an increase in deportations of Haitian nationals in an irregular condition, together with the fact that the national population and housing census corresponding to the decade 2020-2030 would soon be carried out, about which there is a fear among this population that it would be an instrument that would facilitate taking measures to enforce eventual deportations.

6.3.12 Place of residence and migration

The results of the survey conducted by EMPACA in October and November 2022 (Table 6-118) indicate little immigration movement in the urban area of Pepillo Salcedo and the Copey, Carbonera and Los Conucos sections in the last five years, since, according to these data, only 8.93% of the households surveyed have resided in another municipality and only 1.28% in another country during this period.

Probably for the same or similar reasons as in the case of the determination of the nationality variable, it seems very likely that the population that has resided abroad in the last five years is underestimated in these data.

Table 6-118. Place of residence in the last five years.

Place of residence	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Here in this municipality	73	89.02	86	96.63	128	90.14	49	90.74	16	64.00	352	89.80
In another municipality	8	9.76	3	3.37	13	9.15	2	3.70	9	36.00	35	8.93
In another country	1	1.22		0.00	1	0.70	3	5.56		0.00	5	1.28
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

On the other hand, when asked if any member of the household is currently residing in another province, it was found that 66.84% of the households surveyed stated that a member of the household resides in another province, which is an indicator that a high percentage have emigrated (Table 6-119).

This data confirms multiple references obtained in interviews with leaders of community organizations that show the high emigration of the young population of this municipality, caused by the lack of employment opportunities and access to higher education.

Table 6-119. Households with household member residing in another province.

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Yes	54	65.85	48	53.93	109	76.76	39	72.22	12	48.00	262	66.84
No	28	34.15	41	46.07	32	22.54	15	27.78	13	52.00	129	32.91
N/A		0.00		0.00	1	0.70		0.00		0.00	1	0.26
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

Similarly, we asked if any member of the household resides in a foreign country, obtaining as a result that in 52.30% of these households, some member currently resides outside the country (Table 6-120).

Table 6-120. Household member currently residing abroad.

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Yes	40	48.78	23	25.84	93	65.49	40	74.07	9	36.00	205	52.30
No	42	51.22	66	74.16	47	33.10	14	25.93	16	64.00	185	47.19
N/A		0.00		0.00	2	1.41		0.00		0.00	2	0.51
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022, January 2024).

It should be noted that this figure, according to which 53.4% of the households surveyed have a member currently residing abroad, seems extraordinary, given that the latest data recorded on the level of migration abroad in the Dominican Republic estimate a percentage of 14.5% of the Dominican population.⁴⁰

6.3.13 Home and housing

The Manzanillo Energy Consortium Power Plant and 345 KV transmission line project does not include resettlement. However, it is pertinent to address this aspect in this baseline given its relevance for a more complete understanding of the social indicators of the populations.

In this study, a household is understood as a group of people who occupy a dwelling or part of it and consume and/or share food or other goods or services.

On the other hand, a dwelling is understood to be any structure made or not made for living, but used for that purpose. It consists of one or more rooms and their outbuildings, which constitute a building or are part of it, and its characteristics include:

- They have at least a bedroom, kitchen and bathroom (either inside or outside the house).
- It has one or more entrances.
- Non-conventional structures such as "multi-purpose" rooms with or without separating spaces (bedroom, kitchen, bathroom, etc.) are also considered as housing.

6.3.13.1 Average household size

According to the data obtained through the survey applied by EMPACA in the urban area of Pepillo Salcedo (Photo 7 in Annex 14) and the Copey, Carbonera and Los Conucos sections, the average household size is 3.31, which results from a population of 1,298 people residing in the 392 households surveyed (Table 6-121).

It is worth noting that this total of 1,298 persons in the 392 households surveyed differs significantly from the total counted by gender and age group, which is explained, as indicated in the section on difficulties encountered, by the fact that many households declined to provide information on the gender and age of underage members.

⁴⁰ Instituto Nacional de Migración de la República Dominicana, Población Dominicana en el exterior: Características Demográficas y Socioeconómicas.

The average household size in Villa Ray is the highest in the area studied, with an average of 4.07 persons per household. It is followed by Carbonera (3.28), the urban zone of the municipality (3.20), Copey (3.17) and Los Conucos (2.92).

Table 6-121. Average household size in the study area.

Demarcation	Households surveyed	Household members	Average household size
Urban area	142	454	3.20
Villa Ray	54	220	4.07
Copey	89	282	3.17
Carbonera	82	269	3.28
Los Conucos	25	73	2.92
Total	392	1 298	3.31

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

This average household size of 3.31 indicates that the average household size in the project's area of influence has increased compared to the 2010 average household size of 3.03, which is higher than the 2010 national average of 3.16, as recorded in that year's census data.

6.3.13.2 Housing tenure status

The data from the survey applied by EMPACA in the urban area of Pepillo Salcedo and the Copey, Carbonera and Los Conucos sections (Table 6-122) indicate that the predominant housing tenure condition in these localities is owned, already fully paid for, representing 81.63% of the households surveyed; this is followed by rented tenure (13.01%) and ceded or borrowed (4.59%).

It should be noted that in the Villa Ray neighborhood, belonging to the urban zone of Pepillo Salcedo, 92.59% of the households own their homes and have paid for them in full, while in the rest of the urban zone of Pepillo Salcedo the percentage is lower (73.94%), when compared to the rest of the territorial demarcations considered in this baseline.

Table 6-122. Housing tenure status.

Condition	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Rented	7	8.54	11	12.36	28	19.72	3	5.56	2	8.00	51	13.01
Loaned or Borrowed	1	1.22	7	7.87	8	5.63		0.00	2	8.00	18	4.59
Own already paid in full	73	89.02	71	79.78	105	73.94	50	92.59	21	84.00	320	81.63
Own still paying	1	1.22		0.00	1	0.70		0.00		0.00	2	0.51
Another		0.00		0.00		0.00	1	1.85		0.00	1	0.26
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

6.3.13.3 Housing materials

Data from the Encuesta Nacional de Hogares de Propósitos Múltiples (ENHOGAR), 2021 indicate that in the Dominican Republic 85.4% of the dwellings have block or concrete as the predominant wall material. Zinc is the predominant roofing material in 75.2% of the dwellings in rural areas, while cement is the predominant flooring material in 48.4% of the dwellings in the country.⁴¹

The survey data applied by EMPACA indicate the predominance of the same materials (block, zinc and cement), although there are significant differences in some percentages, such as exterior walls and floors.

Thus, it can be observed that the exterior walls of 70.66% of the houses in the area of influence of the project are built of block or concrete, while 27.55% of them are built of wood. This means that more than 98% of the dwellings in these localities are built of these two materials (Table 6-123).

The urban area of Pepillo Salcedo or Manzanillo is the locality with the highest percentage of houses built with block or concrete, with 86.62% of the houses built with this material on their exterior walls (Photo 8 in Annex 14).

It is worth noting that in the urban area of Pepillo Salcedo there are numerous constructions, both for housing and other uses, whose material is a combination of stone and cement (Photo 9 in Annex 14).

The Copey section is the territorial demarcation in the area of influence of the project where the lowest percentage of the exterior walls of the houses are built with block or concrete.

Table 6-123. Exterior wall materials

Materials	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Block or concrete	57	69.51	44	49.44	123	86.62	37	68.52	16	64.00	277	70.66
Wood	25	30.49	43	48.31	17	11.97	14	25.93	9	36.00	108	27.55
Half Block and Wood		0.00	1	1.12		0.00		0.00		0.00	1	0.26
Palm board		0.00		0.00	1	0.70	1	1.85		0.00	2	0.51
Zinc		0.00	1	1.12		0.00		0.00		0.00	1	0.26
N/A		0.00		0.00	1	0.70	2	3.70		0.00	3	0.77
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

On the other hand, the roofs of 73.72% of the houses in the area of influence of the project are built of zinc, which is similar to the national percentage reported in the ENHOGAR survey, while 24.74% of them are built of block or concrete (Table 6-124).

⁴¹ NSO: Encuesta Nacional de Hogares de Propósitos Múltiples (ENHOGAR), 2022.

Table 6-124. Roof materials

Materials	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Asbestos cement		0.00		0.00	2	1.41		0.00		0.00	2	0.51
Concrete	25	30.49	17	19.10	43	30.28	9	16.67	3	12.00	97	24.74
Another		0.00		0.00	1	0.70		0.00		0.00	1	0.26
Zinc	57	69.51	72	80.90	95	66.90	43	79.63	22	88.00	289	73.72
N/A		0.00		0.00	1	0.70	2	3.70		0.00	3	0.77
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

In relation to housing floors, the survey data indicate that the predominant material is cement (82.65%), which is significantly higher than the national average, followed by ceramic (13.78%), as can be seen in Table 6-125.

Table 6-125. Floor materials

Materials	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Cement	70	85.37	81	91.01	112	78.87	38	70.37	23	92.00	324	82.65
Ceramics	9	10.98	6	6.74	24	16.90	14	25.93	1	4.00	54	13.78
Granite	1	1.22		0.00	1	0.70		0.00		0.00	2	0.51
Mosaic	2	2.44	1	1.12	3	2.11		0.00		0.00	6	1.53
Another		0.00		0.00	1	0.70		0.00		0.00	1	0.26
Earth		0.00		0.00		0.00		0.00	1	4.00	1	0.26
N/A		0.00	1	1.12	1	0.70	2	3.70		0.00	4	1.02
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

6.3.13.4 Structural quality of housing

In the Dominican Republic, the use of block or concrete on the exterior walls, concrete on the roofs and ceramic or other materials such as granite, mosaic or marble on the floors, regularly correspond to high structural quality of the house, which is an indicator of belonging to the middle or upper-middle social strata.

The survey data (Table 6-126) indicate that, in the area of influence of the project, 62.76% of the dwellings are of medium structural quality, followed by those of low structural quality (22.70%) and those of high structural quality (13.27%).

Table 6-126. Structural quality of housing

Quality	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
High	17	20.73	5	5.62	19	13.38	9	16.67	2	8.00	52	13.27
Low	17	20.73	31	34.83	18	12.68	13	24.07	10	40.00	89	22.70
Medium	47	57.32	52	58.43	104	73.24	30	55.56	13	52.00	246	62.76
NC	1	1.22	1	1.12	1	0.70	2	3.70		0.00	5	1.28
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

The results of this survey, when compared to the 2010 census data, show a higher percentage of high structural quality housing, 13.27% compared to 6.69% in the census; lower percentage of medium structural quality housing 62.76% compared to 89.79% in the census data and higher percentage of low structural quality housing (22.70%), compared to 3.52%.

6.3.14 Economy

Throughout the present century, the Dominican economy has experienced sustained growth, with the exception of the period between 2003 and 2004, when due to bank frauds there was a recession in the economy⁴², as well as the period between 2019-2020 when there was an economic contraction caused by the Covid-19 pandemic.

In general, the Dominican economy has maintained a permanent rhythm of expansion, which has made it a privileged destination for the reception of foreign investment⁴³.

This characteristic of constant growth and expansion of the Dominican economy led organizations such as the World Bank in its reports prior to the occurrence of the Covid-19 pandemic to predict that, if it maintained its growth rate, the country could become a high-income economy in the next decade.

Although, due to the effects of the pandemic, it would be wise to moderate the optimism of the aforementioned forecast, it is not unreasonable, however, to state that the country has now recovered its growth rate and that, in effect, it is moving towards meeting that forecast of becoming a high-income country, with a minimum delay.

Thus, it can be observed that the Dominican economy has shown signs of strong macroeconomic fundamentals, a recovered labor market⁴⁴ and high levels of reserves, which has allowed it to recover its pre-pandemic growth level⁴⁵.

⁴² Central Bank of the Dominican Republic: Report of the panel of international experts: Dominican banking crisis, revised version March 2005.

⁴³ American Chamber of Commerce of the Dominican Republic: Understanding foreign investment in the Dominican Republic.

⁴⁴ Central Bank of the Dominican Republic: Quarterly Labor Market Bulletin, July-September 2022.

⁴⁵ Ministry of Economy, Planning and Development: Informe de Situación Macroeconómica: Seguimiento de Coyuntura, January 2023.

All these positive elements that characterize the Dominican economy are manifested against the gravitation of negative factors derived from the conflicts that are developing in the international scenario generated by the war in Ukraine and in the Middle East.

At present, although there is room for improvement in the execution of public spending, which would further impact the economy's growth rate, it can be said that the economy is increasingly increasing its demand for energy resources.

It is in light of this reality that the economic factors addressed in this baseline for the area of influence of this project make sense.

Among the topics addressed in this section are:

- Economic activities.
- Employment level.
- Type of occupation.
- Level of income and expenses.
- Sources of income.

6.3.14.1 Economic activities

6.3.14.1.1 Primary sector

The primary sector activities that predominate in both the municipality of Pepillo Salcedo and Monte Cristi are agriculture, livestock and fishing⁴⁶. In the case of the municipality of Monte Cristi, salt mining is also important.

Agricultural activities: The main economic activity not only in the municipalities of Pepillo Salcedo and Montecristi, but in the entire province, is agriculture and livestock production, especially banana production (Photo 10 in Annex 14), which is marketed nationally and for export.

In 2021, the province of Montecristi, as a whole, recorded exports worth US\$89.5 million, with banana exports worth US\$83 million, representing 92.7% of the total products exported by the province⁴⁷.

The United Kingdom and the Netherlands are the main export destinations for agricultural products from this province, together accounting for 76% of total exports in 2021⁴⁸.

The main agricultural crops grown in the municipality of Pepillo Salcedo are bananas and rice. Banana production is mainly concentrated in the municipal district of Santa María and rice production is significant in the Copey section, while other crops, such as chili, eggplant, beans, papaya and corn, among others, are grown in the Carbonera section.

Linked to banana production, in the municipality of Pepillo Salcedo there is a collection, classification and packaging center of a foreign company dedicated to the export of organic

⁴⁶ Pro Dominicana: Provincial Production Profiles, June 2022.

⁴⁷ Ibid.

⁴⁸ Ibid.

bananas. The company is called Plantaciones del Norte S.A. This collection and packing center is located on the road between Copey and the urban area of the municipality, taking advantage of its proximity to the port of Manzanillo for export activities. The employees working in this collection center, forty-four (44) in total, come from this municipality, although the company's offices are located in the city of Mao, Valverde province⁴⁹.

Pepillo Salcedo has a strategic advantage in having the port of Manzanillo, from which the banana production of the northwestern region of the country is exported. This explains why the offices of the largest banana producer for export in the country, the La Cruz de Manzanillo project, are also located there, despite the fact that it is in another municipality of the province where the land for the cultivation of this project is located and not in the municipality of Pepillo Salcedo as could be inferred from its name.

La Cruz de Manzanillo is an important agricultural project dedicated to the cultivation of bananas, plantains, corn, cassava, yucca, auyama and other minor crops, state-owned and operated by the banana plantation formerly owned by the Grenada Company.

The La Cruz de Manzanillo project offices are staffed by 52 employees, who come from the different localities of this municipality⁵⁰.

In Pepillo Salcedo, goat, sheep (Photo 11) and cattle raising are also important, particularly in the Carbonera section (Photo 12) (See Annex 14).

According to the president of the Manzanillo Cattlemen's Association⁵¹, there are more than 60 farmers in the municipality, 42 of whom belong to this association. Of these, 11 are raising cattle, goats and sheep, while the rest only raise goats and sheep.

Also, as in the municipality of Montecristi, beekeepers were identified in Pepillo Salcedo (Photo 13 in Annex 14). They are organized in the Association of Beekeepers of Pepillo Salcedo, to which ten (10) beekeepers belong and whose main source of income is beekeeping.

Each of these beekeepers generates temporary jobs, particularly during the harvesting phase. The number of jobs generated by these beekeepers is related to the number of hives they have, the average being between five⁵² (5) and six (6) per beekeeper.

On the land where the project will be installed there was one of the apiaries, which, according to the president of the organization that groups the beekeepers of this municipality, was important because it was used for the genetic improvement of queen bees. In addition, according to the same person, "these hives are important because they are used as bio-indicators of contamination, a sort of "canary in the mine", because when there is contamination, the bees die".

Fishing: Fishing is an important economic activity in the municipalities of Pepillo Salcedo and Monte Cristi. According to data from the 2019 National Fishing Census, in the municipalities of Monte Cristi and Pepillo Salcedo there are 8 ports of embarkation and disembarkation, of which six (6) are located in Monte Cristi and two (2) in Pepillo Salcedo. In the municipality of Montecristi 553 people are engaged in fishing activities and 130 in the municipality of Pepillo Salcedo.

⁴⁹ Interview with Giovanni Felipe, executive director of the Copey Development Council.

⁵⁰ Interview with Edwin Castro, La Cruz de Manzanillo project.

⁵¹ Interview with Ramón Aristides López, president of the Manzanillo Cattlemen's Association.

⁵² Interview with Wisner Pimentel, president of the Manzanillo Beekeepers Association.

Table 6-127. Ports of embarkation and fishing population in the area of influence of the project

Variable	Montecristi Municipality	Pepillo Salcedo Municipality	Total country
Ports of embarkation/disembarkation	6	2	205
Fishing population	553	130	14.929

Source: National Statistics Office: I National Fishing Census, 2019.

In the municipality of Monte Cristi, an important part of the fishermen are affiliated to a cooperative called Bienvenido Espinal⁵³, which has a store where the products of this activity are marketed. In addition to the cooperative, more than 40 fishmongers can be found in this municipality, distributed in all the neighborhoods and the center of the city.

This activity, both fishing and its commercialization, plays an important role in the local economy of the municipality of Monte Cristi, due to the fact that in this city a significant part of the working age population is dedicated to it, although these may appear under-registered because frequently people who have this occupation are registered under other categories, such as self-employed, merchants in cases where they also own fishmongers, etc.

Fishing is also an important activity in the municipality of Pepillo Salcedo, both in the urban and rural areas, specifically in the Carbonera section, where part of the population is engaged in fishing in the Saladilla Lagoon.

Given the importance of the fishing activity in the municipality of Pepillo Salcedo, its significance in terms of the relationship of this community with the environment and given the type of project, it was considered appropriate to apply unstructured interviews and conduct a focus group with fishermen of this municipality.

Eleven (11) fishermen from this municipality were interviewed, obtaining qualitative information on different aspects, such as: embarkation and disembarkation points, predominant fishing gear, most abundant species, the most profitable species or types of fish, their income levels, associativity, among others.

On the other hand, as indicated, according to the 2019 National Fishing Census conducted by the National Statistics Office (ONE), 130 fishermen were identified in the municipality of Pepillo Salcedo⁵⁴. Of these, about 80 are organized in the Fishermen's Association "Guardians of the Bay", of which about 50 are active⁵⁵. These data on associativity were confirmed in the interview with the president of this organization and by the Census data.

Although the I National Fishing Census, 2019, indicates that there are two (2) ports of embarkation and disembarkation in the municipality of Pepillo Salcedo, in the unstructured interviews applied to fishermen of this municipality it was determined that the embarkation and disembarkation points of the fishermen in this municipality are three: Los Japoneses, the Muelle and Estero Balsa in the Figure 6-235.

⁵³ Data from the I National Fishing Census (page 218) indicate that 28% of fishermen in the municipality of Monte Cristi and 48% in the municipality of Pepillo Salcedo are affiliated with a fishermen's organization.

⁵⁴ ONE: National Fisheries Census, 2019, page 59.

⁵⁵ Inter-American Development Bank: Rehabilitation and Expansion of the Port of Manzanillo (Environmental and Social Impact Study - ESIA), January 2021.



Figure 6-235. Map of fishermen's embarkation points in Pepillo Salcedo de Manzanillo.

Source: EMPACA, 2024.

The fishing sites are related to the embarkation and disembarkation points, so that those who use the pier as an embarkation and disembarkation point have the pier area as a fishing site, mainly to the northeast of the port breakwater, a maritime area that coincides with the area where the anchorage of the project's gas tankers is planned.

The other fishing sites are the Estero Balsa area, the Tapión channel that flows into Manzanillo Bay and the area that extends from the mouth of the Masacre River to the beach in front of the Los Japoneses neighborhood in the urban area. The latter for seasonal eel fishing.

The vessels used by these fishermen are boats and dinghies⁵⁶, most of which have outboard motors of 15 horsepower, which is why very few of them venture into maritime areas far from the bay, preventing them from having a greater volume of fish.

The predominant fishing gear among Manzanillo fishers are: fishing line reel with hook; mesh net made of fishing line (Photos 14 and 15 in Annex 14); underwater fishing using compressor, which is illegal and dangerous for human health; free diving, free diving; traps for mollusks and crustaceans, especially lobsters; very few fishermen use fish concentration devices in the high seas, known as balsa, due to the precariousness of their boats; beach seine using meshes⁵⁷.

In other words, it can be stated that fishing in the area of influence of the project is essentially artisanal, with the main fishing techniques practiced in the area being: line, nets, traps and diving (Table 6-128).

⁵⁶ ONE: National Fisheries Census, 2019, p. 166.

⁵⁷ Inter-American Development Bank: Rehabilitation and Expansion of the Port of Manzanillo (Environmental and Social Impact Study - ESIA), January 2021.

Table 6-128. Fishing techniques in the project's area of influence

Fishing technique	Montecristi Municipality	Pepillo Salcedo Municipality
Lanyards	121	17
Networks	165	45
Traps	29	4
Diving	198	57
Others	86	23

Source: National Statistics Office: I National Fishing Census, 2019.

The interviews also determined that the coastal waters of Manzanillo Bay are rich in marine species, including: first-class fish (snapper, snapper), second-class fish (bonito, cojinúa, marlin), third-class fish (bocayate, mullet), as well as different crustaceans (lobsters, shrimp, crabs) and mollusks (octopus and squid).

This information, some of it obtained through unstructured interviews, was confirmed with data about the province of Montecristi from the I National Fishing Census of 2019 and from the Dominican Council of Fishing and Aquaculture (CODOPESCA) updated to the year 2021, as can be seen in Table 6-129 y Table 6-130.

Table 6-129. Types of fish and seafood, according to the way in which the fishing activity is carried out in Montecristi province.

Type of fish	Swimming	On foot	With boat	Total
Dorado	16	5	89	110
Carite	33	12	190	235
Tuna	11	6	85	102
Needle	18	4	83	105
Chillo and other snappers	57	29	344	430
Mero	62	23	252	337
Parrotfish	64	30	261	355
Cojinúa	37	39	254	330
Bocayate	53	41	297	391
Horse mackerel	20	31	178	229
Shark and ray	2	1	13	16
Sardines	0	0	6	6
Shrimp	3	1	12	16
Lambí	52	7	126	185
Lobster	85	16	220	321
Octopus	59	11	95	165
Squid	2	2	9	13
Sea Cucumber	1	1	2	4
Clam	2	2	2	6
Mussels	1	1	0	2
Crab	2	7	96	87
Others	8	50	57	115

Source: National Statistics Office: I National Fishing Census, 2019.

There is consensus among the fishermen interviewed that the most profitable species are the snapper and different varieties of snappers, including red snapper and redbtail, as well as lobsters and shrimp.

From the statements obtained in unstructured interviews, it can be inferred that the income levels of most of the fishermen in this municipality are not very high. In addition, one of the characteristics of artisanal fishing is that the employment generated is informal, so the income of fishermen is irregular, estimating that the income of many of them is less than the cost of the basic food basket, which as we will see, in the month of November 2022 was RD\$25,307 pesos (equivalent to 428 dollars) per month for the lowest income quintile⁵⁸.

However, data obtained from the Dominican Council of Fisheries and Aquaculture (CODOPESCA) indicate that during the year 2021 the income of fishermen in the municipality of Pepillo Salcedo amounted to RD\$421,643,154.00 Dominican pesos, equivalent to approximately 7 million five hundred and twenty-nine thousand dollars. These CODOPESCA data allow us to estimate an average annual income per fishermen of RD\$324,331 Dominican pesos.

Table 6-130. Production by type of fish in the municipality of Pepillo Salcedo (year 2021)

Class	Weight (kg.)	Price (RD\$/Kg)	Value (RD\$)
First	201,837	300	60,551,100
Second	398,864	240	95,727,360
Second	213,600	171	36,525,600
Third	180,701	180	32,526,180
Fourth	113,555	96	10,901,280
Lobster	186,723	380	70,954,740
Spider crab	655	251	164,405
Syrian crab	49	323	15,587
Lambí	12,731	323	4,112,113
Octopus	5,524	250	1,381,000
Other fish	379,107	225	85,299,075
Total	1,693,346	249	421,643,154

Source: CODOPESCA: Statistical data on fishing in the Dominican Republic, 2021.

Accordingly, there is an income inequality among fishermen, which results from the difference between a simple fisherman and the fisherman who at the same time owns the fishing equipment. The latter, by owning the equipment, such as outboard motor boats, resources for fuel and the financing of the fishing trips, become what are called "owners" (Table 6-131), who have higher income levels than simple fishermen. In addition, these "shipowners" often also own the fish markets to which the fishermen sell their catch.

⁵⁸ As a reference, the minimum wage in the Dominican Republic for 2024 is RD\$14,161.

Table 6-131. Number of fishermen according to their ownership of fishing equipment (owners) in the municipalities of Montecristi and Pepillo Salcedo.

Demarcation territorial	Fisherman	Shipowner	Shipowner and fisherman
Montecristi	514	18	21
Pepillo Salcedo	117	3	10
Total	631	21	31

Source: National Statistics Office: I National Fishing Census, 2019.

On the other hand, as in other coastal towns of the Dominican Republic, in recent years, in the municipality of Pepillo Salcedo eel fishing has become more important (Photos 16 and 17 in Annex 14), an activity that has involved an important part of the fishermen of this municipality⁵⁹, being exported the product of this activity to Asian countries, mainly China, Taiwan and Japan, where it enjoys very good prices⁶⁰.

Eel fishing by Manzanillo fishermen is carried out by placing nets along the coastline eastward from the mouth of the Masacre River to the seawall of the urban zone, distant from the area where the gas terminal project will be installed.

This fishery is carried out during the period from October to March, involving a large part of the municipality's fishermen during this time due to its high profitability.

The income of these fishermen varies greatly depending on the prices obtained in the markets of Asian countries to which they are destined for export. For example, according to statements made by the president of the Marine Guardians Fishermen's Association, during the last eel fishing season, this product obtained its lowest price in recent years, since the kilogram oscillated between 100,000 and 110,000 Dominican pesos, while in the previous year the price per kilogram reached 250,000 pesos.

Another factor that, according to eel fishermen interviewed, influences the recent reduction in the income of these fishermen is that due to the overexploitation by Haitian fishermen located west of the Masacre River, they incursion into Dominican territorial waters, causing an increasing reduction in the volume of fishing⁶¹.

In the EMPACA survey, respondents were asked if anyone in the family or someone they know is a fisherman, and 64.29% of those interviewed responded positively.

⁵⁹ Interview with Roque Tavera, president of the Marine Guardians Fishermen's Association.

⁶⁰ Europa Azul: The lucrative business of eel fishing in the Dominican Republic.

⁶¹ In fact, on April 22, 2022, the Dominican Fisheries Council (CODOPESCA) issued resolution 02-22, which establishes the eel fishing period between October 15 and March 31, establishing a closed period between April 1 and October 14.

Table 6-132. Level of knowledge about people engaged in fishing.

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Yes	46	56.10	56	62.92	97	68.31	44	81.48	9	36.00	252	64.29
No	35	42.68	30	33.71	40	28.17	7	12.96	16	64.00	128	32.65
N/A	1	1.22	3	3.37	5	3.52	3	5.56		0.00	12	3.06
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

Extractive activity (mining): Monte Cristi, standing out as the country's main salt production center, plays a crucial role in the local economy, with salt extraction being the main source of income for its municipal government. The salt is widely distributed throughout the Cibao region, encompassing the northwest, central-north and northeast zones. Information provided by the municipality indicates that approximately 400,000 quintals of salt are currently extracted from these mines, which constitutes 60% of the country's total production. There is also a vast network of more than 300 salt mines operated by independent artisanal producers, who operate under quotas established by the municipal authority. However, it has been identified that, despite the economic importance of this sector for Monte Cristi, there are several structural weaknesses that limit its development potential, including conflicts between producers, the artisanal nature of production, limitations in storage capacity and the absence of a refinery⁶².

These mines are located at the exit of the urban area of the municipality of Monte Cristi, at a linear distance of 19.5 kilometers from the project, crossing the Monte Cristi National Park and 27 kilometers by road.

6.3.14.1.2 Secondary sector

Industrial activities: Similar to the other border provinces, Monte Cristi is one of the Dominican provinces that historically has been characterized by little development.

It is precisely to overcome this deficient condition of the entire region, especially its industrial sector, that through Law 27-01 of 2001 and extended by Law 12-21 of 2021, which creates the special border development zone, that the Dominican State established tax exemptions for certain companies, especially industrial, agro-industrial, agricultural, livestock, metal-mechanical and metallurgical companies.

To date, this law has mainly favored in the province of Monte Cristi the installation of companies in the agricultural sector linked to the export of bananas and aloe vera, with very few companies in the industrial sector.

In the province of Monte Cristi there are two special free trade zones⁶³, one in the municipality of Monte Cristi and the other in the municipality of Guayubín. These are maquiladoras that benefit from tax incentives under law 12-21 of border development. Only two (2) companies operate in these free trade zones,⁶⁴ one for each park.

⁶² Monte Cristi Municipal Development Plan, 2020-2024.

⁶³ Consejo Nacional de Zonas Francas: Map of free zones in the Dominican Republic.

⁶⁴ National Free Zone Council: Statistical Report 2021.

Among the companies belonging to the secondary sector are those located in the industrial free zone located on the Duarte highway, in the Monte Cristi-Villa Vásquez section. Of these companies, one dedicated to the manufacture of polymetallic doors stands out for the number of jobs it generates.

Currently, in the municipality of Pepillo Salcedo, industrial activity is practically nonexistent. Only recently are the facilities of companies dedicated to energy production and a free trade zone or maquiladora under construction, on the road that goes from the urban area of the municipality to the Copey section and on the road from this section to the Carbonera section, near the border control post.

In addition, the master development plan to extend the activities of the port of Manzanillo has as one of its components the establishment of an industrial complex and free trade zones, taking advantage of the advantages of this port as the closest point to the two most important export destinations for Dominican products.

This industrial complex would include a shipyard, natural gas storage and natural gas energy production, as well as free trade zone light industries to take advantage of the border zone investment incentive law.

One of the gas-fired power plants is currently under construction, the Manzanillo Powerland Energía 2000 plant, with a capacity to generate 414 megawatts, generating a total of 2,700 direct jobs during the construction phase. Although there is no data available to indicate the precise origin of the workers in this project, it should be noted that many of these jobs, especially those requiring higher technical qualifications, do not come from this municipality. Nevertheless, the impact of the construction of this project on the dynamization of commerce, especially food, and transportation is notorious.

In addition to the above, the preparation of land for the construction of two zones for industrial warehouses has been initiated, in order to take advantage of the investment incentive law in the border area. One of them is located on the road between the Copey crossroads and the urban area of Pepillo Salcedo and the other on the outskirts of the town of Copey on the road leading to the Carbonera section, near the military border control post.

6.3.14.1.3 Tertiary or service sector

Commercial and banking activities: In the Dominican Republic, commercial activities are the branch of economic activity that generates the highest levels of employment. In fact, the 2010 census reported that 22.79% of the country's economically active population was employed in the commercial sector, and in the municipalities of Monte Cristi and Pepillo Salcedo, these activities accounted for close to a quarter of the total employed population.

In the municipalities of Pepillo Salcedo and Monte Cristi, the central axis of commercial activity is oriented towards supplying a wide range of basic and leisure needs of the population, including food, clothing, residential maintenance and entertainment. This commercial spectrum ranges from grocery stores and supermarkets to clothing stores, hardware stores, leisure establishments such as discotheques and bars, as well as service outlets such as betting shops, restaurants, barbershops and beauty salons, thus configuring a diverse environment of commerce and

services aimed at satisfying the daily demands of the inhabitants of both municipalities. (Photo 18 in Annex 14).

The financial sector is present in the municipality of Pepillo Salcedo through two cooperatives: COOPATLANTICA and Cooperativa Momón Bueno, Inc. (Photo 19 in Annex 14).

The municipality of Monte Cristi has offices of two commercial banks: the Banco de Reservas de la República Dominicana (Banco de Reservas de la República Dominicana) and the Asociación Nacional de Ahorros y Préstamos (Asociación La Nacional de Ahorros y Préstamos). Other banks, such as Banco Popular Dominicano and Banco Hipotecario Dominicano (BHD), only have ATMs located in supermarkets.

Port activity: In the municipality of Pepillo Salcedo is the port of Manzanillo (Photo 20 in Annex 14), which is of great strategic and economic importance due to its location in the northwesternmost point of the country, which is the closest point to the United States and the Republic of Haiti, the Dominican Republic's main trading partners.

This port is of great importance in the history of the municipality, since it brought with it a dynamization of its economic life that, then, differentiated it from the rest of the towns located in the border area, which were characterized by having few economic activities.

At present, it is through this port that all banana production is exported from the northwest region of the country, which is the main producer of bananas. It is also used for the export of smaller fruits produced in this region.

Data from the customs office of this municipality cited in the Municipal Development Plan 2020-2024, indicate that 589,000 boxes of bananas are exported through this port, which represents 60% of the total exports of bananas in the country⁶⁵.

Imports are mainly of bulk cargoes of clinker and coal. Clinker is the material used in the manufacture of Portland cement by one of the main manufacturers of this product in the country: Cemento Cibao (Photo 21 in Annex 14).

The number of people employed at the port in different activities (cargo, stevedoring, surveillance, etc.) amounts to 404⁶⁶, in addition to a total of 19 employees linked to different administrative tasks⁶⁷. This makes the port of Manzanillo the main generator of direct jobs in the municipality, making it the main driving factor of its economy, impacting the generation of indirect jobs, such as transportation and commerce.

On the other hand, according to the website of the Dominican Port Authority, the length of the docks of this port is 227.70 linear meters; the depth of the port is 48 feet; the berthing depth is 36-30-25 feet; the entrance channel is 600 linear meters wide and the type of dock is of breakwater form (Figure 6-236).

⁶⁵ Pepillo Salcedo Municipal Development Plan, 2020-2024.

⁶⁶ Interview with Giovanni Felipe, executive director of the Copey Development Council.

⁶⁷ Interview with Rafael Torres, executive director of Tropical Seas.



Figure 6-236. Google Earth image of the port of Manzanillo.

Source: Prepared by EMPACA.

The port of Manzanillo is operated by the Corporación Portuaria del Atlántico, which states on its website that currently this port "operates in precarious conditions, being used only to export bananas and import klinker, natural coal, grease, gypsum and packing material. It does not meet the required safety and environmental standards. It lacks adequate services and has no facilities for dry cargo"⁶⁸.

As a result of the identification of this deficient condition in the operation of this port, the project for its remodeling has been defined as an essential part of the Master Development Plan of the Municipality, a project whose objective is to ensure that this port operates with the necessary technologies and infrastructure that will allow it to carry out competitive commercial transactions with the main international markets, especially the North American and European markets.

Tourist activity: Although the province of Monte Cristi was declared the 5th Tourism Development Pole in 1993, it is only recently that this province has begun a process of development in this sector, mainly oriented at present to the domestic market.

It is precisely in the municipalities of San Fernando de Monte Cristi and Pepillo Salcedo where the main tourist attractions of this province are concentrated. Among these are: El Morro (Photo 22), the Old Clock (Photo 23), Victorian style houses (Photo 24), Victorian style house in Monte Cristi, Cayos Los Siete Hermanos, the boardwalk (Photo 25), yacht club (Photo 26), among others (See Annex 14).

⁶⁸ Portal of the Corporación Portuaria del Atlántico.

In the case of the municipality of Pepillo Salcedo, Los Coquitos beach, the de Estero Balsa Mangroves National Park (Photo 27 in Annex 14) and the Saladilla Lagoon are tourist attractions.

Recently, in December 2022, the Super 8 Manzanillo Hotel, part of the international Wyndham chain, was inaugurated. This hotel is located in the Copey section of the municipality of Pepillo Salcedo. It has four levels and has 54 rooms, a swimming pool, restaurant and gym, generating direct employment for 24 people.

The data from the survey applied by EMPACA indicate that 34.95% of the people surveyed or a person known to them benefits from some ecotourism activity (Table 6-133).

Table 6-133. Level of knowledge about people benefiting from ecotourism activities in the area.

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Yes	11	13.41	18	20.22	71	50.00	27	50.00	10	40.00	137	34.95
No	67	81.71	68	76.40	66	46.48	25	46.30	15	60.00	241	61.48
N/A	4	4.88	3	3.37	5	3.52	2	3.70		0.00	14	3.57
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

The sale of beverages and food is the tourism activity most identified as a source of economic benefit by respondents (34.31%), followed by tour guide (33.58%) and boat rental (21.90%), as shown in Table 6-134.

Table 6-134. Activities linked to tourism identified from which economic benefits are obtained.

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Boat rental	3	27.27	3	16.67	15	21.13	6	22.22	3	30.00	30	21.90
Tourist guide	5	45.45	2	11.11	22	30.99	14	51.85	3	30.00	46	33.58
Sale of beverages and food	1	9.09	12	66.67	27	38.03	6	22.22	1	10.00	47	34.31
Souvenir sales	2	18.18	1	5.56	7	9.86		0.00	3	30.00	13	9.49
Another		0.00		0.00		0.00	1	3.70		0.00	1	0.73
Total	11	100.00	18	100.00	71	100.00	27	100.00	10	100.00	137	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

6.3.14.2 Level of employment in the study area

Previously, it has been pointed out that the Dominican economy has experienced a constant growth during the course of the present 21st century, which has had as one of its effects a growth in the level of employment of its population⁶⁹.

However, this growth has not been uniform for all provinces and areas of the country, with significant differences between employment levels in large urban concentrations, such as those around Greater Santo Domingo and Santiago, and many other provinces, especially those in the border region, which are characterized by lower levels of economic activity.

In addressing the country's current level of employment, it should be considered that in the last two years the country was significantly affected by the impact of the Covid-19 pandemic on the national economy, since, as in most countries, the authorities had to take a series of measures aimed at containing its spread.

Among these measures was the confinement and social distancing, which had an impact on the level of economic activity. To this was added the paralysis of tourism activities worldwide, which in the country had multiplied effects due to its importance in the Dominican economy and the characteristic of this industry as a locomotive of other economic activities.

These measures, together with others taken by the national authorities, proved to be successful, as the country was one of the first in the region to return to the path of economic growth, with an impact on the recovery of the employment level.

The labor market indicators for the Dominican Republic for the period between 2020 and 2022 indicate this (Table 6-135), showing that the country had a working age population (WAP) of 7,797,490 in 2020, which increased to 7,854,612 in the second quarter of 2022. The labor force or economically active population increased during the same period from 4 765 320 to 4 958 268 and the employed population went from 4 414 601 to 4 702 017, which translated into an increase in the employment rate from 56.6 to 59.9.

Table 6-135. Labor market indicators RD 2020-first quarter 2022.

Variable	2020	2021	2022
Working age population (WAP)	7 797 490	7 855 604	7 854 612
Economically Active Population (EAP)	4 765 320	5 039 973	4 958 268
Employed population	4 414 601	4 682 079	4 702 017
Unemployed open	350 719	197 156	277 410
Occupancy rate	56.6	59.6	59.9

Source: Central Bank of the Dominican Republic: Quarterly Bulletin April-October and November 2022.

These are the most updated data available at the moment, which are based on the National Labor Force Survey (ENCFT) conducted by the Central Bank of the Dominican Republic. However, data disaggregated by territorial demarcations are not available to the public, not even at the province level.

⁶⁹ Central Bank of the Dominican Republic: Quarterly Labor Market Bulletin, July-September 2022.

The survey applied by EMPACA addresses the issue of the level of occupation of heads of households in the area of influence of the project (Table 6-136), which shows that 55.61% of the population interviewed stated that they are employed, while 43.62% are not⁷⁰. It is interesting to note that between the years 2022 and 2021 there is a slight decrease in the working age population; if this is a trend, it could reflect a decrease in the labor force due to lower birth rates or migration.

It is noteworthy that the urban area of Pepillo Salcedo has the lowest level of employment (52.82%), being lower than average by 2.5 percentage points, while Los Conucos (60.00%) and Copey (59.55%) have the highest levels of employment, being higher than average by about 4 percentage points.

Table 6-136. Level of labor occupation in the urban zone of Pepillo Salcedo, Carbonera and Copey.

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Yes	44	53.66	53	59.55	75	52.82	31	57.41	15	60.00	218	55.61
No	37	45.12	36	40.45	65	45.77	23	42.59	10	40.00	171	43.62
N/A	1	1.22		0.00	2	1.41		0.00		0.00	3	0.77
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

On the other hand, one of the cross-cutting themes of this baseline refers to gender aspects, particularly those related to the economic vulnerability of women, which derives from their lower level of employment compared to men.

In that order, when relating the gender variable with the level of occupation in the data of this survey, it was determined that in the entire area of influence of the project, the level of occupation of women is significantly lower than the level of occupation of men, so that while only 45.27% of women are employed, 66.49% of men are (Table 6-137).

Table 6-137. Occupancy level by gender in the area of influence of the project.

Occupation level by gender	Grand total	
	Female	Male
Employed	45.27	66.49
Unemployed	54.23	32.46
N/A	0.50	1.05
Total	100.00	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

⁷⁰ It should be noted that these data refer to heads of households and not to the working age population in general, which is why it is not completely relevant to compare the data from this survey with the data from the National Labor Force Survey of the Central Bank of the Dominican Republic.

In the Copey section is where the gap between the level of labor participation between the male and female population is the greatest, since while 78.05% of the male population reported being employed, only 43.75% of the female population has this condition, which means that there is a difference of almost 35 percentage points.

Villa Ray is the demarcation that follows Copey in terms of the widest gap in labor participation levels between men and women, with a difference of 26 percentage points.

With a difference of about 16 percentage points, the urban area of the municipality of Pepillo Salcedo is where the gap in the level of labor participation between men and women is the smallest, followed by the Los Conucos section, with a difference in labor participation of 19% (Table 6-138).

Table 6-138. Occupation level according to gender by community

Condition	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	F	M	F	M	F	M	F	M	F	M	F	M
Employed	44.44	60.87	43.75	78.05	45.21	60.87	46.88	72.73	50.00	69.23	45.27	66.49
Unemployed	55.56	36.96	56.25	21.95	53.42	37.68	53.13	27.27	50.00	30.77	54.23	32.46
N/A	0.00	2.17	0.00	0.00	1.37	1.45	0.00	0.00	0.00	0.00	0.50	1.05
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

6.3.14.2.1 Type of occupation

According to the survey data (Table 6-139), the main occupation is that of public sector employee, which represents a quarter (25.69%) of the heads of households surveyed; this occupation is followed by private sector employee (18.35%); self-employed (17.89%); micro-entrepreneur or trader (9.63%), self-employed professional (4.13%) and fisherman (3.57%).

Other occupations identified were farmer (2.75%), day laborer (2.29%), beekeeper (1.38%), livestock farmer (1%) and domestic service (1%). Under the category of other occupation, 11.93% were identified.

Table 6-139. Type of occupation

Occupation	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Farmer	2	4.55	2	3.77		0.00	1	3.23	1	6.67	6	2.75
Beekeeper	1	2.27		0.00	2	2.67		0.00		0.00	3	1.38
Private employee	5	11.36	14	26.42	15	20.00	4	12.90	2	13.33	40	18.35
Public employee	9	20.45	13	24.53	24	32.00	5	16.13	5	33.33	56	25.69
Livestock (cattle, goats)	2	4.55		0.00		0.00		0.00		0.00	2	0.92
Laborer	2	4.55		0.00	2	2.67	1	3.23		0.00	5	2.29

Occupation	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Microentrepreneur and/or trader	7	15.91	6	11.32	6	8.00	2	6.45		0.00	21	9.63
Fisherman	1	2.27	2	3.77	4	5.33	1	3.23		0.00	8	3.67
Self-employed professional		0.00	3	5.66	2	2.67	2	6.45	2	13.33	9	4.13
Domestic service	1	2.27	1	1.89		0.00		0.00		0.00	2	0.92
Self-employed	9	20.45	8	15.09	10	13.33	7	22.58	5	33.33	39	17.89
Another	5	11.36	3	5.66	10	13.33	8	25.81		0.00	26	11.93
N/A		0.00	1	1.89		0.00		0.00		0.00	1	0.46
Total	44	100.00	53	100.00	75	100.00	31	100.00	15	100.00	218	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

It is notable that, among heads of household, only a significant fraction in Carbonera, amounting to 11.37%, claim to have occupations closely linked to the agricultural sector, including roles such as farmer, cattle rancher and beekeeper. In contrast, in Copey, this figure decreases to 3.77%, despite the fact that both localities are in rural areas. One possible explanation for this discrepancy lies in the bias introduced by the small percentage of Haitian migrants surveyed, an aspect already discussed in the methodological section of the study.

In the Dominican Republic, the contribution of Haitian labor to the agricultural sector is increasingly prominent, constituting 29.5% of the total number of workers in this sector. This presence is even more marked in certain crops, exceeding 90% according to estimates of the Dominican Agribusiness Board, especially in crops prevalent in the municipality of Pepillo Salcedo, such as bananas and rice.

The survey results also reveal a notable gender disparity in the workplace. While 39.56% of the women surveyed are employed in the public sector, significantly above the 16.10% of men, the male presence in the private sector (23.62%) and in fishing (5.93%) considerably exceeds that of women, which reaches 10.99% and 1.18% respectively in these sectors. Additionally, it should be noted that the occupation of farmer is exercised exclusively by men among those surveyed.

As for the gender distribution of the other occupations, there are no significant differences, as shown in Table 6-140.

Table 6-140. Type of occupation by gender

Occupation	Total					
	F		M		Total	
	C	%	C	%	C	%
Farmer	0	0.00	6	4.72	6	2.75
Beekeeper	1	1.10	2	1.57	3	1.38
Private employee	10	10.99	30	23.62	40	18.35
Public employee	36	39.56	20	15.75	56	25.69

Occupation	Total					
	F		M		Total	
	C	%	C	%	C	%
Livestock (cattle, goats)	0	0.00	2	1.57	2	0.92
Laborer	1	1.10	4	3.15	5	2.29
Microentrepreneur and/or trader	9	9.89	12	9.45	21	9.63
Fisherman	1	1.10	7	5.51	8	3.67
Self-employed professional	5	5.49	4	3.15	9	4.13
Domestic service	1	1.10	1	0.79	2	0.92
Self-employed	17	18.68	22	17.32	39	17.89
N/A	0	0.00	1	0.79	1	0.46
Another	10	10.99	16	12.60	26	11.93
Total	91	100.00	127	100.00	218	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022),

In the cases in which the head of household interviewed was not employed, we asked about the occupation of the person who contributed most of the resources to cover household expenses, finding, with slight variations, similar percentages in the occupations as those identified in the respondents who were employed. A notable exception is that in the case of the occupation of the partner, a higher percentage was found in which the occupation of the partner was that of private employee (22.22%) compared to that of public employee (17.28%).

Table 6-141. Type of occupation of respondent's partner.

Responses	Carbonera		Copey		Urban area Pepillo Salcedo		Villa Ray		Total	
	C	%	C	%	C	%	C	%	C	%
Farmer	1	3.70	2	4.08	2	3.17	1	4.35	6	3.70
Beekeeper	1	3.70	1	2.04	1	1.59		0.00	3	1.85
Private employee	3	11.11	10	20.41	18	28.57	5	21.74	36	22.22
Public employee	7	25.93	7	14.29	11	17.46	3	13.04	28	17.28
Livestock (cattle, goats)	1	3.70	0	0.00	0	0.00	0	0.00	1	0.62
Laborer	1	3.70	2	4.08	0	0.00	2	8.70	5	3.09
Microentrepreneur and/or trader	1	3.70	4	8.16	2	3.17	0	0.00	7	4.32
Fisherman	0	0.00	1	2.04	1	1.59	2	8.70	4	2.47
Self-employed	0	0.00	0	0.00	2	3.17	0	0.00	2	1.23
Domestic service	0	0.00	2	4.08	8	12.70	0	0.00	10	6.17
Self-employed	4	14.81	1	2.04	3	4.76	1	4.35	9	5.56
N/A	2	7.41	9	18.37	5	7.94	0	0.00	16	9.88

Responses	Carbonera		Copey		Urban area Pepillo Salcedo		Villa Ray		Total	
	C	%	C	%	C	%	C	%	C	%
Another	6	22.22	10	20.41	10	15.87	9	39.13	35	21.60
Total	27	100.00	49	100.00	63	100.00	23	100.00	162	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

On the other hand, those who indicated that they were not employed were asked in which category they were located, determining that 56% of them were engaged in home care, 29.65% identified themselves as retired from working life, 3.49% identified themselves as students, 3.49% as income earners and 6.40% in the category of other (Table 6-142).

Table 6-142. Category of persons not in the labor force

Occupation	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Home care.	20	54.05	24	66.67	34	52.31	15	65.22	4	36.36	97	56.40
Student	2	5.41	2	5.56	1	1.54		0.00	1	9.09	6	3.49
Withdrawn		0.00		0.00		0.00		0.00	1	9.09	1	0.58
Withdrawn.	12	32.43	10	27.78	22	33.85	7	30.43		0.00	51	29.65
Renter		0.00		0.00	2	3.08		0.00	4	36.36	6	3.49
Another	3	8.11		0.00	6	9.23	1	4.35	1	9.09	11	6.40
Total	37	100.00	36	100.00	65	100.00	23	100.00	11	100.00	172	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

Given that in the Dominican Republic there is a predominant gender pattern whereby domestic tasks are performed by women, there seems to be no need to cross-reference gender with the category of persons not in the labor force to determine to what extent the number of women who dedicate themselves to household care is predominant.

However, in the Table 6-143 it can be seen that in the households surveyed it is women, in a proportion close to 90%, who take care of the household.

Table 6-143. Percentage of females in non-working conditions in relation to males (%).

Condition	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	F	M	F	M	F	M	F	M	F	M	F	M
Home care.	85.00	15.00	95.83	4.17	82.35	17.65	100.00	0.00	75.00	25.00	88.66	11.34
Student	50.00	50.00	0.00	100.00	100.00	0.00	--	--	100.00	0.00	50.00	50.00
Renter					50.00	50.00	--	--	25.00	75.00	33.33	66.67
Withdrawn	16.67	83.33	40.00	60.00	31.82	68.18	28.57	71.43	100.00	0.00	30.77	69.23
Another	0.00	100.00			33.33	66.67	0.00	100.00	0.00	100.00	18.18	81.82

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

This illustrates that a considerable group of women are engaged in unpaid work as housewives or housekeepers, which reveals their greater economic vulnerability in the project's area of influence.

All this confirms what is reported in the Dominican Republic's Gender Parity Initiatives portal, which indicates that the country has one of the lowest rates of economic participation of women in Latin America, with domestic and unpaid care work being one of the main reasons for women's absence from the labor market, which is evidenced by the fact that the unemployment rate for women is 21.7%, while the unemployment rate for men is only 8.5%⁷¹.

6.3.14.2.2 Household expenditure in the project's area of influence

The average cost of the basic food basket in the northern region of the Dominican Republic, as of November 2022, is RD\$40,957 pesos, equivalent to 750 U.S. dollars calculated at the current rate of 54.57 pesos⁷².

Now, the Central Bank of the Dominican Republic determines the prices of the basic food basket according to quintiles by income level. In this way, five (5) quintiles are established, ranging from lower to higher income.

The price of the basic food basket for quintile 1, which has the lowest income, is RD\$25,307 pesos, while quintile 5, which has the highest income, is RD\$70,009 pesos, according to data from the Central Bank of the Dominican Republic updated as of October 2022⁷³ (Table 6-144).

Table 6-144. Cost of the basic food basket in the Dominican Republic.

Quintiles	Price (RD\$)
1	25,307
2	33,054
3	39,117
4	45,384
5	70,009

Source: Central Bank of the Dominican Republic Bulletin, November 2022.

In the EMPACA survey, respondents were asked about the level of household spending because, due to the informal nature of the occupations of a significant percentage of respondents, it was difficult to determine their income levels.

This survey yields results that show that 70.65% of the households' level of spending corresponds to the lowest income quintile. Of these, 41% have household expenditures of RD\$16,900 pesos or less and 18.62% have expenditures of less than RD\$11,900, which corresponds to the minimum wage established by the National Wage Committee for microenterprises (Table 6-145).

⁷¹ Portal Gender Parity Initiative, Dominican Republic.

⁷² Central Bank of the Dominican Republic: Cost of the basic family basket by region, 2020-2023.

⁷³ Central Bank of the Dominican Republic: Cost of the basic family basket by quintiles, 2018-2023.

Table 6-145. Level of household expenditure in the area of influence of the project.

Range of expenses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Less than \$11,900	13	15.85	18	20.22	21	14.79	13	24.07	8	32.00	73	18.62
\$11,901 - \$16,900	12	14.63	23	25.84	38	26.76	9	16.67	7	28.00	89	22.70
\$16,901 - \$21,900	22	26.83	12	13.48	30	21.13	10	18.52	7	28.00	81	20.66
\$21,901 - \$26,900	9	10.98	5	5.62	16	11.27	4	7.41		0.00	34	8.67
\$26,901 - \$31,900	3	3.66	5	5.62	8	5.63	6	11.11	1	4.00	23	5.87
\$31,901 - \$36,900	3	3.66	2	2.25	7	4.93	4	7.41	1	4.00	17	4.34
\$36,901 - \$41,900	1	1.22		0.00	3	2.11	4	7.41	1	4.00	9	2.30
More than \$41,900		0.00	2	2.25	8	5.63	1	1.85		0.00	11	2.81
N/A	19	23.17	22	24.72	11	7.75	3	5.56		0.00	55	14.03
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

Except for the Los Conucos section, where 88% of households have incomes below the basic food basket, there are no marked differences among the localities studied. Of these, the urban area of Pepillo Salcedo has the highest proportion of households where the level of expenditure barely reaches that of the basic food basket corresponding to the lowest income quintile. This is followed by the Carbonera section and the Villa Ray neighborhood. The Copey section is where the lowest proportion of households have expenditures corresponding to the lowest income quintile.

These survey data, which indicate a higher proportion of households in the urban area of Pepillo Salcedo having expenditures that correspond to the lowest income quintile, seem to contradict the commonsense perception that families in urban areas have higher levels of expenditures.

Although the existence of precarious settlements in the urban area of this municipality, such as the Los Barracones neighborhood (Photo 28) and the sector of the Alto de la Paloma neighborhood known as Manhattan (Photo 29) could indicate the existence of households that do not have resources and income that make higher levels of spending possible, the data from this survey do not allow us to determine the causes that determine this phenomenon (See Annex 14).

6.3.14.3 Income level

As mentioned above, the survey was applied to determine first of all the level of household spending, since it provides more reliable information given the informal nature of a considerable part of the households surveyed, in addition to the fact that, when compared with the cost of the basic food basket in the Dominican Republic, it allowed a better understanding of the level of access to the consumption of basic goods.

However, respondents were also asked about their income, finding, although the difference is not considerable, that, when compared to the level of expenditure, a lower percentage of the surveyed households reported having income below the cost of the basic food basket for the lowest income quintile, about 57%, while, as already noted 70.65% of households reported that their expenditures were lower than those of the poorest quintile.

Table 6-146. Income level of households in the area of influence of the project.

Income range	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Less than \$11,900	11	13.41	7	7.87	21	14.79	9	16.67	8	32.00	56	14.29
\$11,901 - \$16,900	12	14.63	9	10.11	26	18.31	10	18.52	10	40.00	67	17.09
\$16,901 - \$21,900	10	12.20	14	15.73	26	18.31	6	11.11	4	16.00	60	15.31
\$21,901 - \$26,900	9	10.98	10	11.24	19	13.38	3	5.56	1	4.00	42	10.71
\$26,901 - \$31,900	11	13.41	7	7.87	9	6.34	7	12.96	1	4.00	35	8.93
\$31,901 - \$36,900	2	2.44		0.00	11	7.75	6	11.11	1	4.00	20	5.10
\$36,901 - \$41,900	4	4.88	3	3.37	7	4.93	3	5.56		0.00	17	4.34
More than \$41,900	2	2.44	7	7.87	12	8.45	6	11.11		0.00	27	6.89
N/A	21	25.61	32	35.96	11	7.75	4	7.41		0.00	68	17.35
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

The survey data confirms for the area of influence of the project the manifestation of gender disparity in relation to income level. Thus, it can be observed that while 61.2% of the female population surveyed only has an income of RD\$26,900 or less, i.e., most of them have incomes that do not allow them to cover the cost of the basic food basket for the poorest quintile, on the other hand, only 53.4% of the male population surveyed falls into this category (Table 6-147).

Table 6-147. Income level according to gender of household heads in the area of influence of the project.

Income	Total					
	F		M		Total	
	C	%	C	%	C	%
Less than \$11,900	33	16.42	23	12.04	56	14.29
\$11,901 - \$16,900	34	16.92	33	17.28	67	17.09
\$16,901 - \$21,900	35	17.41	25	13.09	60	15.31
\$21,901 - \$26,900	21	10.45	21	10.99	42	10.71
\$26,901 - \$31,900	17	8.46	18	9.42	35	8.93
\$31,901 - \$36,900	9	4.48	11	5.76	20	5.10
\$36,901 - \$41,900	7	3.48	10	5.24	17	4.34

Income	Total					
	F		M		Total	
	C	%	C	%	C	%
More than \$41,900	8	3.98	19	9.95	27	6.89
N/A	37	18.41	31	16.23	68	17.35
Total	201	100.00	191	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

6.3.14.3.1 Revenue sources

Another aspect addressed in this baseline consisted of determining who contributes income to the household, which also made it possible to establish secondary sources of income, determining that in 64 of the households, representing 16.32% of the households surveyed, one of the sources of income comes from children (Table 6-148).

Table 6-148. Sources of income of households in the project's area of influence.

Responses	Carbonera	Copey	Manzanillo	Villa Ray	Los Conucos	Total
Interviewee	41	47	50	13	20	171
Son or daughter	13	9	27	13	2	64
Another	11	5	25	10	3	54
Couple	10	24	32	14	--	80
N/A	4	3	3	2	--	23
Total	79	88	137	52	25	392

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

Similarly, it was established that in the area of influence of the project, a quarter of the households (23.98%) receive income from remittances from family members living abroad (Table 6-149).

Table 6-149. Households receiving remittances

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Yes	21	25.61	10	11.24	44	30.99	17	31.48	2	8.00	94	23.98
No	48	58.54	77	86.52	87	61.27	33	61.11	23	92.00	268	68.37
N/A	13	15.85	2	2.25	11	7.75	4	7.41		0.00	30	7.65
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

6.3.15 Planning and land use

6.3.16 Land Cover and Land Use

According to data from the last study conducted in the Dominican Republic on land use and land cover⁷⁴ (Table 6-150), the predominant land cover in Monte Cristi province in 2012 was forest (610.19 km²), mainly dry forest, which covers an area of 520.62 km² and represents 27.40% of the total area of the province, this type of forest is followed by mangrove forest, with an area of 84.47 km², representing 4.47% of the area.

The predominant productive use is agriculture, which covers a total of 896.43 km², representing 47.18% of the province's total land area. The main crops are rice, musaceae (bananas and plantains), tobacco, aloe vera and mixed subsistence crops, such as cassava, pigeon peas, pumpkins (auyamas), sweet potatoes (batatas), among others.

A relevant factor in agricultural land use in the province of Monte Cristi is that it is located in the lower basin of the Yaque del Norte River, which crosses the province after its waters are used indiscriminately in irrigation canals for rice production. This determines that these soils, both alluvial and residual, are highly saline.⁷⁵

Table 6-150. Predominant land cover and land use in the Dominican Republic and Monte Cristi province.

Uses	Dominican Republic		Monte Cristi	
	Surface area km ²	%	Surface area km ²	%
Dry forest	4,835.31	10.03	520.62	27.40
Wetland forest	311.11	0.65	84.47	4.45
Other forest type	13,777	28.56	5.10	0.27
Total Forest	18,923.45	39.24	610.19	32.12
Thickets	2,859.76	5.93	323.30	17.02
Wetland vegetation	23.01	0.05	12.80	0.67
Sparse vegetation	536.28	1.11	26.16	1.38
High altitude savannah	5.0	0.01	--	--
Agricultural uses	24,200.23	50.18	896.43	47.18
Inland water bodies (dams, riverbeds, etc.)	522.47	1.08	5.83	0.36
Sand	18.23	0.04	0.68	0.04
Mines	8.71	0.02	--	--
Urban area	1,133.30	2.35	23.48	1.24
Total	48,230	100.00	1,899.9	100.00

Source: MIMARENA: Land use and land cover study, 2012.

⁷⁴ MIMARENA: Land Use and Land Cover Study, 2012.

⁷⁵ Food and Agriculture Organization (FAO): The Soils of the Dominican Republic, Santo Domingo, 2003.

In the project's area of influence, which includes the municipalities of Pepillo Salcedo and Monte Cristi, the predominant land cover is scrub and dry forest, although there is also extensive coverage of wetland forest (mangroves) and wetland vegetation (mangroves, guinea). It is worth noting that the area of wetland forest in the province is the largest in the country, representing more than 27% of the total forest in this category.

In the municipality of Monte Cristi, only 31.58% of the land is suitable for cultivation, 33.64% is only suitable for pasture and with certain conditions for rice cultivation, and 33.64% is considered non-cultivable land⁷⁶. Meanwhile, in the municipality of Pepillo Salcedo about 70% of its territory is occupied by dry forest, 10% is occupied by mangroves and 20% by agricultural and livestock uses⁷⁷.

A large part of the province's wetland forest area belongs to the Dominican Republic's protected area system, which, under the name of Estero Balsa National Park, covers an area of 81 km², including a wetland area with lagoons and mangroves that extends from the mouth of the Yaque de Norte River to the urban area of Pepillo Salcedo. (See photo 27 in Annex 14)

This protected area status of the mangrove forest, the existence of extensive areas dominated by dry forest and scrub, and the low rainfall that characterizes the entire region, mean that a large part of the area belonging to the municipality of Pepillo Salcedo is not used for agricultural activities.

As a consequence, the area occupied by the dry forest is used for raising goats for grazing, although in some areas, such as in the Santa María municipal district, there are numerous productive units dedicated to banana cultivation and in the Copey and Carbonera sections, agricultural activities are developed, particularly rice cultivation and various crops, such as peppers, eggplant, pumpkins (ayama), pigeon peas, among others⁷⁸.

On the other hand, in terms of urban land use, only 23.48 km² of the province of Monte Cristi is occupied by urban land use, which represents only 1.24% of the total surface area of the province. This urban land use in the province of Monte Cristi is distributed among the urban areas of its six municipalities and five municipal districts. In the municipality of Monte Cristi, the predominant urban land use is residential, followed by commercial, salt mines and tourism.

Residential use extends throughout the entire geography of the urban area, with the expansion of this use being limited to the south by the Yaque del Norte River. On the other hand, the expansion of residential use towards the northeast is notable, especially in precarious settlements located on a hill, north of the Duarte highway, observable to the right at the entrance of the city. This residential growth can also be seen towards the southeast of the city.

The commercial use of urban land is mainly concentrated on the main roads, such as Duarte Street, which is the Duarte Highway itself (route #1) as it passes through the city, and Mella Avenue, which connects with the Monte Cristi-Copey-Dajabón highway (route #45).

Land use oriented to salt mining and tourism activities is concentrated to the north, on the way to El Morro National Park, where salt mines are located and beyond a boardwalk, where there are

⁷⁶ Monte Cristi Municipal Development Plan, 2020-2024.

⁷⁷ Pepillo Salcedo Municipal Development Plan, 2020-2024.

⁷⁸ Ibidem, p. 65.

several hotels, restaurants, discotheques, municipal kiosks for the sale of drinks and food, a nautical club, among others.

On the other hand, the urban land of Pepillo Salcedo can be considered to be about 1% of the municipality's surface, considering that the percentage of urban land in the entire province is only 1.24% and that the urban area of Pepillo Salcedo is smaller than that of the other municipalities of the province.

Currently, in the year 2023, the construction of the border fence has caused changes in the urban territory. Thus, part of the population of the Pueblo Nuevo and Alto de la Paloma neighborhoods, located in the western part of the municipality, is in the process of being resettled, and plots of land have been handed over at the entrance to the urban area, in the southeastern part, for housing construction. This has an impact on land use in the municipality due to the reduced availability of urban area, and influences the need to create planning and control mechanisms for urban development.

On the other hand, it must be specified that the Copey and Carbonera sections, although they are defined as rural demarcations, because they conserve many characteristics of this type, nevertheless, these progressively acquire urban characteristics, among them the cross layout of their streets, and the increase and the concentration of their population. This is due to the fact that, with the exception of Gozuela, which belongs to the Copey section, both localities have practically no towns, since their populations are concentrated in the same geographic point, which facilitates the provision of services (health, education, water, solid waste collection, electricity, etc.).

6.3.17 Territorial planning

As of December 22, 2022, Law No. 368-22 on Land Use, Land Management and Human Settlements came into force in the Dominican Republic, which aims to regulate the use of land and occupation of the territory.

In addition, land use and land management are among the competencies of municipal councils⁷⁹, with almost all municipalities having designated officials for these functions. However, in practice, few of them perform these functions, which is due, among other reasons, to deficits in technical performance, but above all to the fact that only very recently has there been a precise mandate for a land use planning law.

The municipal development plan indicates that the municipality of Pepillo Salcedo does not have a land use plan, nor does it have urban planning regulations, construction regulations, or regulations on the use of green areas, among other deficits.

It should be noted, however, that in the year (2022), the municipality initiated a process of dialogue and discussion based on the project to expand the port of Manzanillo to develop a master plan for the development of the municipality. This plan has implications for land use planning (residential, industrial, commercial) in the urban area. That is why some of the main actors involved in this process point out that the municipality already has a land use plan, ahead of other municipalities in the country.

⁷⁹ Law 176-07, of 2007, on Municipalities and the National District.

Different stakeholders have participated in the process of preparing the Municipal Development Master Plan, including the Ministry of the Presidency, the Ministry of Economy, Planning and Development, local authorities, international cooperation agencies such as USAID, the U.S. Army Corps of Engineers and the main community organizations, among others.

This process has resulted in a draft of what would be a Master Plan for the development of the municipality, with great implications for its territorial planning. This first draft is dated September 2022.

It is worth noting that, in addition to this document being a draft subject to change, it is only a tool to facilitate collaboration among the different stakeholders. That the projects identified may be changed, and that this plan may be modified to adapt to changing conditions.

In relation to this whole process, it should be noted that the community of Manzanillo has participated with a mixture of enthusiasm and apprehension, because while, on the one hand, the population is interested in the development of the municipality, on the other hand, they fear a development that leaves the current inhabitants of the municipality out of the benefits that development brings.

In the community leaders' own words, they fear industrial development such as that which has taken place in the municipality of Haina, in the south of the country. A development which benefited the country, which benefited investors and attracted migrants from other parts of the country, but which displaced or generated poverty for its original inhabitants. This is what one municipal official identified as the need to overcome the dilemma between the community district and the investment opportunity district when defining the criteria for land use planning⁸⁰.

The document containing the aforementioned draft master plan presents the analysis of four (4) alternatives with land use and land use planning implications. Each of these are summarized in the draft document as follows:

- **Alternative 1:** balances industrial development with environmental preservation and enhancement of Manzanillo's community assets.
- **Alternative 2:** Minimizes relocation of residents, preserving Villa Ray at the expense of industrial development and environmental assets.
- **Alternative 3:** Prioritizes the preservation of community assets by locating the maritime infrastructure to the east of the existing pier.
- **Alternative 4:** proposes the shipyard within the land lease to the west of the existing pier, preserving environmental assets.

Of these four alternatives, the one that received the most support in the workshops was alternative number one (1), which would combine the development of an industrial circuit southeast of the port of Manzanillo with the preservation of the areas that are part of the protected areas system. This means that the Villa Ray neighborhood would be relocated. In addition, a mixed-use commercial center would be established around 27 de febrero street, including what the document

⁸⁰ Interview with Frank Valenzuela, Planning Director of the Pepillo Salcedo City Council.

refers to as the redevelopment of the Los Barracones neighborhood, which may involve improving the housing of residents in this neighborhood, but may also mean relocating them.

It should be noted that although in the workshops that resulted in the draft of the Master Plan for the development of Manzanillo, alternative number 2 was one of the least voted, on the other hand, this alternative had the support of different community actors and members of the local authorities interviewed by EMPACA as part of this social baseline, in the urban area of Pepillo Salcedo.

This support for alternative number 2, which implies no displacement of the inhabitants of Villa Ray, was reaffirmed by the participants in the focus group with inhabitants of this neighborhood, among whose participants were the president of the neighborhood's Neighborhood Council and a councilor of the municipality's City Hall.

6.3.18 Access to basic services

6.3.18.1 Water and sanitation

6.3.18.1.1 Drinking water service

The water service in the entire province of Monte Cristi is provided by the National Institute of Potable Water (INAPA), although the connection between the different local aqueducts is made through the Multiple Aqueduct of the Northwest Line (ALINO), which provides this water service from the Monción dam to all the provinces of the Western Cibao region, made up of the provinces of Valverde, Montecristi, Santiago Rodríguez and Dajabón.

The water service in Monte Cristi province is one of the best compared to the rest of the country, since, while the average number of hours of water received at the national level is 8.6⁸¹, in Monte Cristi province the average is 12.8 hours, which is the second highest in the country, after Valverde province (14.5%).

In the municipality of Monte Cristi, the distribution of drinking water is in charge of the National Institute of Drinking Water and Sewerage (INAPA). This distribution is carried out through a 38-inch pipe from the treatment plant of the Acueducto Múltiple de la Línea Noroeste (ALINO), located in Valverde province.

The Development Plan for the municipality of Monte Cristi for the period 2020-2024 states that the water service received by the municipalities is deficient, due to its irregular nature and that the supply lacks sufficient pressure, making it necessary to use pumps for water supply and water tanks as reservoirs for its accumulation⁸².

The Pepillo Salcedo municipal development plan states that the municipality's drinking water is supplied by INAPA (Photo 31 in Annex 14), which distributes it for twelve (12) hours a day.

The distribution of water limited to 12 hours per day by the aqueduct is confirmed by the fact that 60% of the respondents have a cistern or water tank (Photo 32 in Annex 14) for water storage.

⁸¹ NSO: Encuesta Nacional de Hogares de Propósitos Múltiples (ENHOGAR), 2022.

⁸² Monte Cristi Municipal Development Plan, 2020-2024

The data from the survey applied in the communities in the area of direct influence of the project show that almost 81% of the households in the area of influence of the project have water service from the aqueduct, either inside the house or in the yard, while 10.48% of the households have a public tap as a source of water and 5.64% have a tap from another house. Some households, in insignificant proportions, obtain water from sources such as rivers and streams, their own wells and rain (Table 6-151).

Table 6-151. Access to water sources.

Water source	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%			C	%
Key in the house	62	83.78	85	82.52	97	74.61	32	80.00	25		301	80.91
Key to another house	5	6.75	2	1.94	10	7.69	4	10.00	--		21	5.64
Public key	5	6.75	13	12.62	17	13.07	4	10.00	--		39	10.48
River or stream	2	2.70	--	--	--	--	--		--		2	0.53
Own well	0	0.00	1	0.97	--	--	--		--		1	0.27
Public well	0	0.00	0	--	--	--	--		--		--	--
Rain	0	0.00	0	--	2	1.53	--		--		2	0.53
Another	0	0.00	2	1.94	4	3.07	--		--		6	1.61

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

These survey data, which indicate that in the area of influence of the project almost 80% have an aqueduct tap, compare favorably with the data from the ENHOGAR survey, 2021, according to which only 53.0% of the households in the country receive water for domestic use from the aqueduct, inside the home.0% of the households in the country receive water for domestic use from the aqueduct, inside the dwelling, although it should be pointed out that this difference is probably largely explained by the fact that the survey applied by EMPACA does not differentiate between having water from the aqueduct inside the dwelling and in the dwelling, since the latter can be included in the patio of the dwelling.

It is worth mentioning that for some time (more than two decades), a large part of the Dominican population, in its different localities, both urban and rural, only uses water from the aqueduct for personal hygiene and cleaning household items, since there is a perception that it is not appropriate for drinking and cooking food, which is why the purchase of industrially bottled water has become widespread.

Data from the survey applied in the urban area of Pepillo Salcedo and the Copey and Carbonera sections indicate that 140 of the households surveyed use water bottles for drinking and cooking, which represents 38% of the households surveyed.

The need to buy water for drinking and cooking food translates into an additional expense that negatively impacts the family budget. Currently, the average cost of a bottle of water is RD\$75 Dominican pesos. The extent of this impact is influenced by the size of the household. The average consumption of a 4-person household is two bottles per week, so the average monthly

cost is RD\$600.00. This expenditure would represent at least 3.5% of the 40% of the surveyed population that indicated having a monthly expenditure of less than RD\$16,900 pesos; 2.7% of the population that indicated having an expenditure of less than RD\$21,900 pesos and 2.2% of the total that is in the lowest income quintile, that is, RD\$26,900 pesos or less.

6.3.18.1.2 Sanitation

In the Dominican Republic, storm and sanitary sewage systems exist only in some urban areas; they are less common, if not nonexistent, in rural areas⁸³.

According to the data contained in the basic report of the ENHOGAR survey, 2021, Monte Cristi province is the province with the second lowest percentage of households with private toilet service (58%), only surpassed by another border province, Elías Piña (44.1%).

However, this trend is not evident with respect to the connection of toilets to the sewerage system, since the data from the above-mentioned survey indicate that, in Monte Cristi province, the level of connection to the sewerage system represents 24.2%, a proportion that is higher than that of most other provinces, since only five of them (Santiago, Duarte, San Juan, La Vega and Puerto Plata) have levels of connection to the sewerage system higher than Monte Cristi.

According to the Monte Cristi Municipal Development Plan, in 2020 this municipality had a wastewater collection system that covered 60% of the urban territory. In the year 2022, the municipality has continued to advance in the coverage of its urban territory with a wastewater sewerage system, including a treatment plant⁸⁴.

However, the municipality of San Fernando de Monte Cristi does not have a rainwater collection system, with the exception of street gutters and curbs.

On the other hand, the Development Plan of the municipality of Pepillo Salcedo identifies as one of its shortcomings the fact that it does not have a wastewater collection network or treatment plant, which determines that the municipalities are forced to use septic and filtering wells.⁸⁵

Through the survey applied, it was determined that in the area of influence of the project, 83.67% of homes have toilet service, highlighting the Carbonera section (91.46%), as the demarcation where the highest percentage of households have this type of toilet service, followed by Los Conucos (88%) Villa Ray (85.19%), the urban area of Pepillo Salcedo (80.99%) and finally Copey (78.65%), as shown in the table below. (Table 6-152).

The other type of sanitary service used in the surveyed localities is the latrine, which represents 13.78% of the households, with the Copey section (21.35%) being the locality with the highest percentage of households with this type of service.

⁸³ Foro Centroamericano y República Dominicana de Agua Potable y Saneamiento: Gestión de las excretas y aguas residuales, 2013, pp. 8 and 9.

⁸⁴ Interview with Engineer Dalton Gómez, director of INAPA, Monte Cristi province.

⁸⁵ Pepillo Salcedo Municipal Development Plan.

Table 6-152. Type of sanitary service that the respondents' dwelling has.

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Toilet	75	91.46	70	78.65	115	80.99	46	85.19	22	88.00	328	83.67
Latrine	7	8.54	19	21.35	21	14.79	5	9.26	2	8.00	54	13.78
N/A		0.00		0.00	4	2.82	2	3.70		0.00	6	1.53
It does not have		0.00		0.00	2	1.41	1	1.85	1	4.00	4	1.02
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

On the other hand, through the survey data, it was also possible to establish that 87.76% of the homes that have a toilet are connected to a septic tank, 4.59% stated that they are connected to a sewer system, and 0.51% also discharge into neighboring land or into a river or stream (Table 6-153).

Table 6-153. Place where sanitary sewage ends up

Solid waste	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Sewers	5	6.10	3	3.37	3	2.11	7	12.96		0.00	18	4.59
On adjoining land	1	1.22		0.00		0.00	1	1.85		0.00	2	0.51
They do not have		0.00	1	1.12	2	1.41	1	1.85		0.00	4	1.02
Septic tank	75	91.46	77	86.52	130	91.55	42	77.78	20	80.00	344	87.76
Rivers or streams		0.00	1	1.12		0.00	1	1.85	2	8.00	4	1.02
N/A	1	1.22	7	7.87	7	4.93	2	3.70	3	12.00	20	5.10
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied by EMPACA, S.R.L. in Galeón, Pepillo Salcedo, Pepillo Salcedo and Pepillo Salcedo, October and November, 2022.

It should be noted, as established in the development plan of this municipality mentioned above, that in these localities there is no sewer system, which is why it can be interpreted that those who identified sewers may be referring to open channels, such as those visible in the Los Barracones neighborhood, in the urban area of Pepillo Salcedo (Photo 33 in Annex 14).

It is important to point out that the use of septic tanks for wastewater disposal is regularly linked to the construction of filters, which have polluting effects on groundwater.

6.3.18.2 Solid waste management

Solid waste collection in Pepillo Salcedo is the responsibility of its Municipal Council (Photo 34 in Annex 14), which, in accordance with the provisions of Municipal Law No. 176-07 of the National District and Municipalities, is an entity with political, fiscal and administrative autonomy.

Solid waste from the Los Conucos section is collected by the municipality of Monte Cristi.

In the Carbonera and Copey sections, under Article 25 of Law 176-07 on delegations, the Pepillo Salcedo City Council has created municipal delegations, which carry out in these districts some of the functions corresponding to the city council, among them the collection and disposal of solid waste.

For the collection and disposal of solid waste, the municipality of Pepillo Salcedo has three trucks and three adapted motorcycle vehicles with beds where the garbage is deposited.

Residents and municipal officials consulted agree that the frequency of solid waste collection varies depending on the areas and streets. For example, on 27 de febrero street, which is the main street in the urban area of Pepillo Salcedo, collection is daily, while in some neighborhoods such as Los Barracones and Alto de la Paloma and in the sections of Copey and Carbonera, solid waste is collected only twice during the week.

According to the survey data, the municipality provides collection services in 95.92% of the households in these localities, while currently only about 3% of them burn it, percentages that indicate an advance of great significance when compared to the data collected in the 2010 census in this municipality, according to which only 63% of households had their solid waste collected by the municipality and 33.5% burned it.

It is noteworthy that the level of solid waste collection by the municipality in the Carbonera section (100%) is higher than the average for the municipality, including the urban area, while a neighborhood like Villa Ray, which belongs to the urban area, although it is the most remote from its center, is where the lowest percentage of households have their solid waste collected by the municipality, as revealed by the survey data, as shown in Table 6-154.

Table 6-154. Form of solid waste disposal

Provision	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
They burn		0.00	4	4.49	3	2.11	4	7.41		0.00	11	2.81
Collect City Hall	82	100.00	83	93.26	138	97.18	48	88.89	25	100.00	376	95.92
They shoot in their own backyard		0.00	1	1.12		0.00		0.00		0.00	1	0.26
N/A		0.00	1	1.12	1	0.70	2	3.70		0.00	4	1.02
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

Currently, the main problem faced by the municipality of this municipality in relation to solid waste management, as in other municipalities in the country, is not so much the collection of solid waste as its final disposal.

Currently, solid waste from the urban area of the municipality is deposited in an open dump located at the entrance of the town, in front of the municipal cemetery (Photo 35 in Annex 14). This condition, located at the entrance of the urban area, is perceived as problematic, both visually

and in terms of sanitation⁸⁶, which is why the municipal authorities, in coordination with the Ministry of the Environment and Natural Resources, have explored alternatives to move it to another location.

The Carbonera and Copey sections have their own landfill, which is located approximately one kilometer away on the road that leads from Copey to Santa María (Photo 36 in Annex 14).

Solid waste from the Los Conucos section and the entire municipality of Monte Cristi is deposited in an open dump located approximately two kilometers from the city near the road that connects it with the Los Conucos section, on its way to Pepillo Salcedo.

6.3.18.3 Electric Service

The electricity system in the Dominican Republic is comprised of three sectors: Generation, Transmission and Distribution.

Currently, the public and private sectors are involved in power generation projects, some under construction, others in operation, from various sources (thermoelectric, hydroelectric, photovoltaic, wind, biomass, etc.).

The electricity transmission component is the responsibility of the Empresa de Transmisión Eléctrica (ETED), a public sector company that connects the electricity generating plants and parks with the distribution networks (Photo 37 in Annex 14).

Electricity distribution is mainly provided by companies belonging to the public sector. These are EDENORTE, EDESUR and EDEESTE. Several private companies provide distribution services in some areas of the country, such as the Consorcio Energético Punta Cana-Macao (CEPM), which provides electric service to corporate clients, mainly linked to the tourism sector.

The electricity issue has been one of the issues that has demanded the most attention from the governments of the Dominican Republic since the second half of the last century, and it can be said that at the date of writing this baseline report, December 2022, it is still a multi-faceted problem whose solution, although there has been undeniable progress, is still unfinished.

Currently, the Ministry of Energy and Mines of the Dominican Republic is working on the electricity sector by addressing its different components:

1. Increase in the supply of electric energy through the expansion and diversification of the generation park.
2. Expansion and modernization of the transmission system.
3. Improvement of the management and operation of the distribution companies, which implies an improvement in the quality and stability of service through the improvement of operational infrastructures.

An essential aspect related to the operation of the electricity system in the Dominican Republic is what has been called the National Pact for the Reform of the Electricity Sector. This is an agreement, which will be in force until the year 2030, between the different actors involved in the

⁸⁶ Interview with Frank Valenzuela, Planning Director of the Municipal Council of Pepillo Salcedo.

electricity sector of the Dominican Republic, with the declared purpose of guaranteeing a reliable supply of electricity at a competitive price and in conditions of financial and environmental sustainability, which implies encouraging the investment climate and the responsible and sustainable performance of public finances.

Through this pact, the Dominican State maintains its monopoly on the transmission of the interconnected National Electric System (SENI), while promoting the participation of the private and solidarity sector in generation and distribution.

In the case of distribution, this pact establishes that the State, through the Superintendency of Electricity, will promote the participation of the private sector and cooperatives in the commercialization of electricity through subcontracting.

A relevant aspect agreed in this pact is that, in point 9.5, one of the goals of the electricity generation plan is to deepen the diversification of the energy matrix by promoting the construction of new fuel terminals and the conversion to natural gas and other technologies and fuels, in order to optimize costs and reduce the environmental impact⁸⁷.

Regarding the level of coverage of the electricity system in the Dominican Republic, it is worth noting that for several decades the country has made progress in extending electricity service networks throughout its territory, including the most remote rural areas. Data from the 2010 census indicated that 96% of Dominican households had electricity service, and it can be affirmed that, in the period between 2010 and the present, the gap has been closed to achieve that this service reaches almost all households, although there is probably still a very small percentage, especially in rural areas, which still do not have access to this service.

In fact, data from the ENHOGAR survey, 2021, indicate that currently the percentage of households receiving electricity is 98.10%, 98.76% in urban areas and 94.54% in rural areas (Photo 38 in Annex 14).

However, it should be noted that although in recent years there has been a significant improvement in the quality and frequency of electric service, in some areas of the country there are still periodic interruptions of this service, which is due to the fact that the level of generation in the system is still not sufficient for the market demand, since every time certain plants go out of service for scheduled maintenance, there are significant supply deficits that cause the aforementioned interruptions.

The company in charge of electricity supply in the project's area of influence is Empresa Distribuidora de Electricidad del Norte (EDENORTE), one of the country's three public electricity distribution companies.

The EMPACA survey (Table 6-155) yielded data indicating progress in the level of connection to the electricity system (93.11%) of the population in the area of influence of the project, when compared to the 2010 census data, according to which only 63% of these households had this service in that year.

The Copey section stands out among the districts in the project's area of influence in terms of the level of connection to the electrical system, reaching almost 99%. The Copey section is followed

⁸⁷ National Pact for the Reform of the Electricity Sector in the Dominican Republic. 2021-2030.

by the urban area of the municipality, where 96.48% is connected to the electrical system, with the connection level in the Villa Ray neighborhood being lower than the urban area average (92.59%), but significantly higher than in the Carbonera section, where the connection level is only 80.49%.

Table 6-155. Level of electric service connection

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Yes	66	80.49	88	98.88	137	96.48	50	92.59	24	96.00	365	93.11
No	16	19.51	1	1.12	4	2.82	1	1.85	1	4.00	23	5.87
N/A		0.00		0.00	1	0.70	3	5.56		0.00	4	1.02
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

Regarding the number of hours that the households surveyed receive electricity 24 hours a day, it was determined that 73.47% of them receive electricity 24 hours a day, highlighting that in the rural area, that is, in the Copey, Carbonera and Los Conucos sections, they receive this service more continuously, since while 96% of Los Conucos, 76.40% of Copey and 75.61% of Carbonera receive electricity 24 hours a day, this only occurs in 67.6% of the households in the urban area of this municipality, being slightly higher, within this, in the neighborhood of Carbonera.40% of Copey and 75.61% of Carbonera receive electricity 24 hours a day, this only occurs in 67.6% of the homes in the urban zone of this municipality, being slightly higher in the Villa Ray neighborhood.

Table 6-156. Number of hours that households receive electricity

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Less than 6 hours		0.00		0.00	1	0.70	1	1.85		0.00	2	0.51
6-12 hours	1	1.22	2	2.25	5	3.52		0.00		0.00	8	2.04
More than 12 hours	18	21.95	19	21.35	37	26.06	12	22.22	1	4.00	87	22.19
24 hours	62	75.61	68	76.40	96	67.61	38	70.37	24	96.00	288	73.47
N/A	1	1.22		0.00	3	2.11	3	5.56		0.00	7	1.79
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

These data from the survey applied by EMPACA in the area of influence of the project are consistent with those of the ENHOGAR survey, 2021, according to which 79.2% of Dominican households receive electricity between 20 and 24 hours, with an average of 21.4 hours per day.

6.3.19 Access to household goods

Access to household goods, together with access to basic services such as health, education, water and sanitation, and recreation, are linked to the satisfaction of basic human needs, forming a set of elements that influence the determination of a community's human development index, the level of expansion of its middle class and, conversely, its poverty levels.

Not necessarily the lack of certain goods corresponds to the unsatisfaction of a need, since in some cases certain goods only fulfill the function of supplying a deficit of a public service.

For example, in the Dominican Republic, the electricity service deficit created the need for households to have power plants and/or inverters. However, as the country has improved this service, it has become less and less necessary to have these goods.

Another example is access to cisterns and/or water tanks, which are assets that respond to the need to supply and conserve drinking water when the public water supply service is deficient.

The reference to goods whose function is to make up for deficits in water and electricity services is relevant, based on the data obtained from the survey conducted by EMPACA in the urban area of Pepillo Salcedo and the Los Conucos, Copey and Carbonera sections.

According to the data from this survey, 48 households have a cistern and 180 have a water storage tank, out of 392 households considered in the study. This means that 56% of the households have access to a good that responds to a need originated from the deficit in water service, which is characterized by not being permanent, so it is necessary to accumulate this liquid in goods designed for this purpose (Table 6-157).

Table 6-157. Access to household goods

Articles	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Air conditioning	4	76	8	61	23	98	10	38	1	24	46	297
Fan	70	11	87	2	133	5	50	2	24	1	364	21
Cistern	3	78	13	69	18	116	14	38	0	25	48	326
Computer	18	63	19	63	32	99	18	34	9	16	96	275
Stove	74	8	87	2	132	6	51	1	24	1	368	18
Internet	38	43	39	45	77	56	32	19	12	13	198	176
Inverter	7	75	11	73	9	118	4	46	3	22	34	334
Clothes washer	71	11	86	3	130	9	48	4	20	5	355	32
Engine	46	34	43	40	79	51	36	16	14	11	218	152
Refrigerator	69	12	85	1	127	11	46	6	19	6	346	36
Power plant	1	81	1	79	5	127	1	50	2	23	10	360
Radio/music equipment	43	38	41	42	79	51	30	20	11	14	204	165
Telecable	33	48	26	49	62	65	19	32	5	20	145	214
Cell phone	73	9	77	10	115	19	47	5	23	2	335	45
Home Phone/Fixed Phone	3	78	1	79	20	108	3	48	1	24	28	337

Articles	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Television	62	20	69	18	114	24	48	4	17	8	310	74
Waste container	29	52	18	64	84	43	41	10	8	17	180	186
Automobile for private use	9	67	10	63	17	102	11	40	0	25	47	297

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

On the other hand, the survey data indicate that only 10 households have an electric plant and 34 have inverters, which means that only 11.22% of households have assets whose function is to satisfy the need for electric energy in the event of service outages or blackouts. However, as can be seen in the section on electricity service, 73.47% of households state that they have electricity service 24 hours a day, which means that it is not necessary for these households to have access to goods such as power plants or inverters.

Among the goods most accessed by the surveyed households are: stove (94%), clothes washer (90.56%), refrigerator (88.26%), cell phone (85.45%) and television (79%).

Also widely available to households in the project's area of influence are those goods aimed at controlling environmental temperature, such as fans and air conditioners, which together exceed the total number of households surveyed, so it must be assumed that some households have both fans and air conditioners.

The availability of their own means of transportation, including motorcycles (55.61%) and automobiles (12%), is relevant because it facilitates travel for 67% of households. Access to a private car can also be an indicator of belonging to the middle class.

The fact that more than half of the surveyed households have access to the Internet is also relevant, as it represents a great leap in terms of closing the digital divide in the period between the present and the 2010 census, when less than 4% of households had this service⁸⁸.

6.3.20 Education Service

6.3.20.1 Education services in Dominican Republic

The Dominican educational system is governed by the Ministry of Education of the Dominican Republic, which, according to the General Education Law 66-97 of 1997, is in charge of regulating the national educational service. To this end, the Ministry has several bodies, among which are the National Education Council, a higher decision-making body, a management body under the authority of the Minister and, by delegation, the Vice Ministers, and executive bodies made up of the regional, district and educational centers.

As of 2013, the Dominican Republic began to allocate 4% of the Gross Domestic Product to the education sector which has had an impact on significant advances in the level of school enrollment, especially due to the universalization of school breakfast, the construction of new

⁸⁸ NSO: IX National Population and Housing Census, 2010.

facilities, the introduction of the extended school day system and the provision of digital equipment (laptops, tablets) to students.

Various sectors question, however, that this increased allocation of resources has not translated into significant advances in the quality of education, since the country continues to perform poorly in international tests that, like the PISA tests, measure educational variables such as reading, mathematics and science of 15-year-old students, although the latest report of this test indicates that the country's students perform efficiently when it comes to analyzing cultural issues and global problems.

There is a consensus among the various actors in the education system that the low student performance in language, mathematics and science is related to the low level of training in these areas of most teachers, so it is necessary to address this deficit in order to make progress in achieving a higher quality of teaching.

Apart from adult education, the Dominican pre-university education system comprises three levels of education that extend over 15 years: an initial level (3 years), a primary level (6 years) and a secondary level (6 years).

The secondary level consists of two cycles: a first cycle that extends from the first to the third year and a second cycle that extends from the fourth to the sixth grade.

6.3.20.2 Education service in the project's area of influence

The province of Monte Cristi and the province of Dajabón are part of Region 13 of the Ministry of Education. The schools in the municipalities of Monte Cristi and Pepillo Salcedo are part of school district 13-01.

School District 13-01 has 43 educational centers operating in an equal number of schools, in which 447 teachers teach⁸⁹. Of these educational centers, 41 are public and two (2) are private, providing education in the 2022-2023 school period to 7,689 students distributed in different grades at the pre-school, primary, secondary and adult education levels⁹⁰ (Table 6-158).

Table 6-158. Students enrolled by level and grade in educational district 13-01, in the period 2022-2023.

Level/grade	Number of students registered	(%)
Initial	726	9.4
Pre-kinder	68	
Kinder	173	
Pre-primary	485	
Primary	3,992	51.9
First	655	
Second	668	
Third	703	

⁸⁹ Ministry of Education of the Dominican Republic: List of Active Centers 2020-2021.

⁹⁰ Dirección General de Gestión y Descentralización del Ministerio de Educación de la República Dominicana: Comparativo de matrícula, updated as of November 9, 2022.

Level/grade	Number of students registered	(%)
Fourth	658	
Fifth	696	
Sixth	612	
Secondary	2.555	33.2
First	533	
Second	537	
Third	490	
Fourth	425	
Fifth	352	
Sixth	216	
Adults	418	5.4
Total	7,689	100.00

Source: General Directorate of Management and Decentralization of the Ministry of Education of the Dominican Republic: Comparative enrollment, updated as of November 9, 2022.

On the other hand, in Table 6-159 which shows the distribution by gender of student enrollment in school district 13-01, in the municipalities of Monte Cristi and Pepillo Salcedo, a higher percentage of male population (51.62%) can be observed in the total school enrollment, although at the secondary level the proportion by gender is similar.

Table 6-159. Distribution by gender of students registered in educational district 13-01, municipalities Monte Cristi and Pepillo Salcedo period 2022-2023.⁹¹

Gender	Female		Male		Total
Level	Quantity	%	Quantity	%	Quantity
Initial	293	46.95	331	53.05	624
Primary	1 893	47.30	2 109	52.70	4 002
Secondary	1 277	50.00	1 276	50.00	2 553
Adult education	165	51.72	154	48.28	319
Total	3 628	48.38	3 870	51.62	7 498

Source: School Management Information System of the Ministry of Education of the Dominican Republic: Enrollment by district according to level, grade and gender, period 2022-2023.

⁹¹ In the Table 6-158, Table 6-159 y Table 6-160 are notable differences in the total and number of students registered at the different levels. Although not justified, these differences can be explained by the fact that the source of these reports comes from different instances within the Ministry of Education of the Dominican Republic. It could also find explanation in what was pointed out by the technician of educational district 13-01 Gerardo Justo, in the interview conducted on November 18, 2022, in which he indicated that many students of Haitian nationality, although enrolled in the educational system, often because they do not have identity documents, their enrollment is provisional, which creates disparity in the registration processes.

Of the total number of students registered in school district 13-01, 76.81% are of Dominican nationality, 12.35% are of Haitian nationality, and 0.6% are of another nationality (Table 6-160).

Table 6-160. Students registered by nationality in educational district 13-01, in period 2022-2023.

Nationality	Number of students registered	(%)
Dominicans	6000	76.81
Haitians	965	12,35
Another	46	0.59
Total	7,811	100.00

Source: Ministry of Education of the Dominican Republic: Comparative enrollment, updated as of November 9, 2022.

In the urban area of the municipality of Pepillo Salcedo there are two educational centers, one for basic and primary education and the other for secondary education, which covers both cycles of this level.

In the Copey and Carbonera sections there are two educational centers (Photos 39 and 40 in Annex 14), which only provide education up to the first cycle of secondary level, so students who wish to complete their education must move to the urban area of the municipality of Pepillo Salcedo, although some, especially those in Carbonera, move to the municipality of Dajabón.

In the educational centers of the urban zone of Pepillo Salcedo and the Copey and Carbonera sections, a total of 1,073 students are registered, distributed by locality as follows: Carbonera 272 students, Copey 156 students and the urban zone of Pepillo Salcedo 645 students (Table 6-161).

Table 6-161. Students registered in the urban zone of Pepillo Salcedo and the Carbonera and Copey sections, period 2022-2023.

Location	Quantity	Percentage
Urban area of Pepillo Salcedo	645	60.11
Carbonera	272	25.34
Copey	156	14.53
Total	1073	100.00

Source: Ministry of Education of the Dominican Republic: students registered by school in educational district 13-01, period 2022-2023.

In the educational district 13-01, which serves the school population of the municipalities of Monte Cristi and Pepillo Salcedo, data are available that indicate the existence of 3,900 seats in good condition, 2,268 in need of repair and 350 repaired (Table 6-162).

Adding the data of seats in good condition plus those repaired and relating this data to the registered school population for the period 2022-2023, which is 7,811 students, we can calculate a deficit in the availability of seats suitable for teaching of 45%, while, including seats in need of repair, the deficit in absolute terms is 16%.

Table 6-162. Status of seating needs in educational district 13-01, municipalities Monte Cristi and Pepillo Salcedo.

Status of seating requirements	Quantity
Number of seats in good condition	3,900
Number of seats in need of repair	2,268
Number of seats repaired	350
Number of missing seats	2,850

Source: Ministry of Education of the Dominican Republic: Survey of seating needs of educational centers, 2022.

6.3.20.3 Reading and writing level

According to data from the 2010 National Population and Housing Census, 18.34% of the Dominican population did not know how to read or write at that time. However, through the implementation of the "Quisqueya Aprende Contigo" program, these illiteracy levels have been considerably reduced, since by 2019 the percentage of illiterate people in the whole country was around 5.4%, as indicated by data from the 2019 National Literacy Survey (Encuesta Nacional de Alfabetismo, ENA) (Table 6-163).

Table 6-163. Illiteracy rate in Dominican Republic, 2019.

Can read and write	Quantity	%
Yes	74 522	92.97
No	4 323	5.39
Do not know	1 277	1.59
No information	36	0.04
Total	80 158	100.00

Source: NSQ: National Literacy Survey (ENA) 2019.

The data of the 2019 National Literacy Survey coincide with those of the survey applied by EMPACA, S.R.L., in October and November 2022 in the studied area, since in these localities only 6.89% declared not to know how to read or write (Table 6-164).

Table 6-164. Level of literacy in the area of direct influence of the project

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Yes	76	92.68	80	89.89	132	92.96	50	92.59	20	80.00	358	91.33
No	5	6.10	6	6.74	7	4.93	4	7.41	5	20.00	27	6.89
N/A	1	1.22	3	3.37	3	2.11		0.00		0.00	7	1.79
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

When asked whether the spouse can read and write, lower levels of literacy were found in spouses, as shown in Table 6-165.

Table 6-165. Literacy level of the spouse of the interviewee in the urban area of Pepillo Salcedo and the Copey and Carbonera sections.

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Yes	37	77.08	45	88.24	72	92.31	28	93.33	9	100.00	191	88.43
No	8	16.67	4	7.84	2	2.56	2	6.67		0.00	16	7.41
N/A	3	6.25	2	3.92	4	5.13		0.00		0.00	9	4.17
Total	48	100.00	51	100.00	78	100.00	30	100.00	9	100.00	216	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

Regarding the educational level attained by the respondents, the data indicate a higher percentage of people who attained incomplete secondary level (22.96%) over incomplete primary level (22.19%) and over complete secondary level (19.013%), as shown in the Table 6-166.

It is noteworthy that in the urban area of Pepillo Salcedo, the highest percentage of people surveyed reached the complete high school level (24.65%), which is consistent with the fact that this is the only educational center where both cycles of this level of study are offered, while in the towns of Carbonera and Copey only the first cycle is offered.

Table 6-166. Educational level attained by respondents

Level	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
None	8	9.76	4	4.49	6	4.23	3	5.56	2	8.00	23	5.87
Technical course		0.00	3	3.37		0.00		0.00		0.00	3	0.77
Incomplete elementary school	20	24.39	18	20.22	32	22.54	15	27.78	2	8.00	87	22.19
Completed primary school	6	7.32	11	12.36	19	13.38	5	9.26	2	8.00	43	10.97
Intermediate incomplete		0.00		0.00		0.00		0.00	5	20.00	5	1.28
Full intermediate		0.00		0.00		0.00		0.00	2	8.00	2	0.51
Incomplete high school	24	29.27	21	23.60	30	21.13	14	25.93	1	4.00	90	22.96
Completed High School	15	18.29	13	14.61	35	24.65	7	12.96	5	20.00	75	19.13
University incomplete	6	7.32	10	11.24	11	7.75	4	7.41		0.00	31	7.91
Full university	2	2.44	6	6.74	8	5.63	5	9.26	6	24.00	27	6.89
Postgraduate degree, (master's, doctorate)	1	1.22		0.00	1	0.70	1	1.85		0.00	3	0.77
NS/NC		0.00	3	3.37		0.00		0.00		0.00	3	0.77
Grand total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in the urban area of Pepillo Salcedo and the Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

It can be seen that in the Los Conucos section 44% of the spouses of the respondents completed secondary education, while in the other districts the data regarding the spouses are similar to those of the respondents, noting that also in the urban area of Pepillo Salcedo 25.64% of them completed their secondary education and 14% had completed university studies, which is higher than in the other localities (Table 6-167).

Table 6-167. Educational level attained by respondents' spouses.

Level	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
None	6	12.50	4	7.84		0.00	1	3.33		0.00	11	5.09
Incomplete elementary school	9	18.75	5	9.80	12	15.38	4	13.33		0.00	30	13.89
Completed primary school	1	2.08	4	7.84	7	8.97	2	6.67	2	22.22	16	7.41
Incomplete high school	14	29.17	6	11.76	16	20.51	7	23.33	3	33.33	46	21.30
Completed High School	6	12.50	13	25.49	20	25.64	8	26.67	4	44.44	51	23.61
Technical course		0.00	2	3.92	1	1.28	2	6.67		0.00	5	2.31
Incomplete University	1	2.08	5	9.80	2	2.56	3	10.00		0.00	11	5.09
Full university	2	4.17	3	5.88	11	14.10	1	3.33		0.00	17	7.87
Postgraduate degree, (master's, doctorate)		0.00		0.00		0.00	1	3.33		0.00	1	0.46
NS/NC	9	18.75	9	17.65	9	11.54	1	3.33		0.00	28	12.96
Total	48	100.00	51	100.00	78	100.00	30	100.00	9	100.00	216	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

6.3.20.4 Technical and university education

In terms of technical education, there is a Community Technology Center in the municipality, which used to offer Internet courses, digital literacy training, Office packages, cell phone repair, among others, but it is not currently operating.

Currently in Pepillo Salcedo there is a branch of the Instituto de Formación Técnico Profesional (INFOTEP), which operates provisionally in a van (Photo 41 in Annex 14) and is in the process of defining a curriculum in line with the market demands that the municipality's economic development initiatives will eventually generate.

In addition, efforts are being made to convert the secondary school located in the urban area into a technical or polytechnic training center, where high school graduates will be trained in a trade that will enable them to enter the job market.

Similarly, in the city of Dajabón, near the project's area of influence, there is a polytechnic institute belonging to the Jesuit religious congregation. This is the San Ignacio de Loyola Technological Institute, which offers a training curriculum in computer science, food processing, agricultural technology, nursing, furniture and wood structures, and electrical installations.

In terms of opportunities for people to access university education, particularly for young people finishing high school, these are offered in the closest centers of the public university, that is, the Autonomous University of Santo Domingo. The closest center of this university is located in the city of Mao, Valverde province.

In the municipality of Monte Cristi there is a campus of the Universidad Central del Este (UCE), which offers careers in accounting, law, education, business administration and marketing.

Some students, especially from the municipality of Pepillo Salcedo, due to its proximity, also attend a campus of the Universidad Tecnológica de Santiago (UTESA) located in the city of Dajabón. The academic offerings of this university in its Dajabón campus are: business administration, tourism and hotel business administration, public accounting, marketing, computer systems engineering, education, modern languages and psychology.

6.3.21 Security and emergency response

In the Dominican Republic, public security is the responsibility of the national police, which is a State body subordinate to the executive branch, attached to the Ministry of the Interior and Police and whose field of action is the entire national territory. Its functions include maintaining peace, order and public safety, serving as an auxiliary to the Public Prosecutor's Office and judges in investigative processes and the enforcement of laws, as well as carrying out surveillance work for the prevention of criminal acts.

At the national level, the Dominican National Police has personnel of 36,917 agents distributed in a hierarchical structure similar to the military structure, as follows: One (1) major general, 35 generals, 549 colonels, 686 lieutenant colonels, 886 majors, 1,447 captains, 6,247 lieutenants, 302 cadets, 9,685 sergeants, 7,067 corporals, 9,344 privates and 668 conscripts⁹².

Data for the year 2021 indicate that the Dominican Republic ranks **fifth among the countries with the lowest homicide levels in Latin America, with** a rate of **11.1** per 100,000 inhabitants, placing it in a position below the average for the region, which is 20.4 homicides per 100,000 inhabitants.

It should be noted that most homicides in the Dominican Republic have their origin in coexistence problems. According to official statistics from the Dominican government, of 1,349 homicides registered in 2021, 761 were due to this cause⁹³.

The police force operating in Monte Cristi province is part of the Northwest Regional Directorate, which is based in the city of Mao, Valverde province.

According to the document that contains the Municipal Development Plan of San Fernando de Monte Cristi, this municipality has a police station equipped with one (1) van, (1) motor for patrolling and a staff of only six (6) law enforcement officers.

⁹² Portal of the Dominican National Police.

⁹³ National Bureau of Statistics: Yearbook of Accidental and Violent Deaths, 2021, p. 66.

In the year 2021, 16 homicides were reported in the province of Monte Cristi, of which 12 were caused by coexistence problems⁹⁴.

In terms of emergency assistance, the municipality of San Fernando de Monte Cristi has a Fire Department, a Civil Defense office and the Red Cross.

The Fire Department reports to the municipal council. It has a building and a truck and is supported by a board of trustees to manage funds and equipment for its operation. Among the needs of this entity are: an ambulance, rescue equipment, and a permanent supply of fuel for the operation of the truck.

The Civil Defense is a public entity formed mostly by a body of volunteers that is activated in the event of emergencies caused by natural phenomena (cyclones, floods, earthquakes, droughts) or events created by human beings, such as fires, accidents. In Monte Cristi, at the provincial level, this entity does not have its own premises, so it operates in the building of the provincial governor's office. At the municipal level, it operates in a small building.

At the time this report was prepared, Monte Cristi was one of the seven (7) provinces in the country that was not yet connected to the 9-1-1 emergency system, despite the fact that buildings and fire department vehicles in some of its municipalities have 9-1-1 identification signs and that, by the end of 2020, it was announced that, along with the other border provinces, it would be connected to this system. There is information that in the first months of the year 2023 the connection to this system will be made.

The urban area of the municipality of Pepillo Salcedo has a police station where three (3) police officers currently work, one in each eight-hour shift (Photo 42 in Annex 14). There is also a police station in the Carbonera section.

There is a perception that the current number of police officers in the municipality is insufficient to guarantee a higher level of security. Recently, the Pepillo Salcedo police station was equipped with an all-terrain vehicle and a motorcycle, which may indicate the beginning of a process to strengthen security in the municipality.

As in all border provinces, in the province of Monte Cristi and in particular, in the municipality of Pepillo Salcedo, there are posts of the Specialized Border Security Corps (CESFRONT), both in the urban area of Pepillo Salcedo and in the Copey section (Photo 43 in Annex 14). The function of CESFRONT is to permanently control the points along the border with the Republic of Haiti. For this reason, control and checkpoints can be observed at different road points and at the mouth of the Dajabón River in Manzanillo Bay.

The Fire Department (Photo 44 in Annex 14) and the Civil Defense are the two entities present in the municipality of Pepillo Salcedo that are in charge of dealing with emergency situations.

The fire department has 10 permanent firefighters and 22 volunteers. It has two trucks, one of which is not in good condition, which is why it is constantly being repaired. It has 3 ambulances and a motorcycle ambulance. The fire department's personnel are trained in first aid.

⁹⁴ Ibidem

6.3.22 Road infrastructure and vehicular traffic

The Duarte Highway (route #1), which is the longest highway in the country, ends in the city of Monte Cristi, becoming Duarte Street in the interior of this city. Another important road in the municipality of Monte Cristi is Mella Avenue, which connects with the Monte Cristi-Copey highway (route #45).

Manolo Tavarez Justo Avenue (Photo 1 in Annex 14) is the main access road to the urban area of Pepillo Salcedo, which connects with the Monte Cristi-Copey-Dajabón highway (Route 45).

Another important road in the municipality of Pepillo Salcedo is the road that connects with the municipal district of Santa María (Photo 45 in Annex 14) and with the municipalities of La Mata de Santa Cruz and Guayubín.

Among the main streets in the urban area of Pepillo Salcedo are:

1. 27 de febrero Street, which is the street where the main commercial establishments and some public offices of the municipality are located, such as the municipal town hall, Empresa Distribuidora de Electricidad del Norte (EDENORTE), Instituto Nacional de Agua Potable y Alcantarillado (INAPA), among others.
2. Duarte Street, which is the street where the city's malecon and the Juan Pablo Duarte patriotic plaza are located.
3. Sanchez Street.
4. Port Street.
5. Estero Balsa Street. Also called Villa Ray Street, whose relevance comes from being the access road to the two energy generation projects in the urban area of the municipality.

Pepillo Salcedo's Municipal Development Plan document states that 70% of its streets are paved⁹⁵. However, it should be noted that some of the new residential areas, particularly in the Manhattan sector of the El Alto de la Paloma neighborhood (Photo 46 in Annex 14), have completely unpaved streets. The same can be said of some sectors of the Villa Ray and Villa Banack neighborhoods (Photo 47 in Annex 14).

As indicated in the Municipal Development Plan of Pepillo Salcedo, apart from the transit of heavy vehicles that transport agricultural production for export through the port and clinker from the port to the Cementos Cibao storage center on the Manzanillo-Copey highway, the transit of vehicles in this municipality is reduced, since only the transport known as Margarita, which is used to transport people within the urban area, has a continuous movement (Photos 48 and 49 in Annex 14).

This type of transportation is also used in Carbonera and Copey. At the Copey crossroads there is a dispatch point (stop) for these means of transportation, which provide transportation to the urban area of the municipality as well as to Carbonera and sometimes to other communities, such as Gozuela and Cañongo.

Transportation to other urban centers, including the closest (Dajabón, Monte Cristi, Mao) and more distant ones such as Santiago and Santo Domingo, is by bus.

⁹⁵ Pepillo Salcedo Municipal Development Plan, 2020-2024.

The Caribe Tours passenger transportation company has a dispatch point on 27 de Febrero Street in the urban area (Manzanillo), near the Los Barracones neighborhood, the departure point of a daily bus to the city of Santo Domingo.

The buses of this transportation company that leave from Dajabón also stop at the intersection of the Monte Cristi-Dajabón and Manolo Tavárez Justo highways, which is located in the Copey section.

6.3.23 Recreation infrastructure

One of the main public recreational infrastructures of the municipality of Pepillo Salcedo is its boardwalk, which is located where Duarte Street ends in its east-west course. In addition to being used as a meeting point, the people of Pepillo Salcedo flock to it, especially on weekends, especially during the day, to sit on its benches, talk and contemplate the marine landscape of the Manzanillo Bay. From this boardwalk you can clearly see a fishing village belonging to the Republic of Haiti, which is also located on the coast of this bay (Photo 50 in Annex 14).

Other important public infrastructure in the municipality consists of sports facilities: four (4) stadiums or "pley", one (1) baseball stadium and three (3) softball stadiums, two of which are located in each section of the municipality.

In addition, the urban zone and each of the sections have sports courts for basketball and/or volleyball. There is a sports center in the urban zone, but it is in deteriorated condition.

Currently, the municipal park, which is located in front of the town hall building, is in the process of being remodeled. In addition to other parks in the urban zone and in the Carbonera section (Photo 51 in Annex 14), the municipality of Pepillo Salcedo has two playgrounds, one in the urban zone and the other in Copey.

An important place for recreation, not only for the inhabitants of Pepillo Salcedo, but also for the inhabitants of the province of Dajabón, is Los Coquitos beach (Photo 52 in Annex 14).

In addition to the above, as in the rest of the Dominican Republic, alcohol outlets such as "drinks" (Photo 53 in Annex 14) and "car washes" are used, especially by young adults, as recreational places.

6.3.24 Human Development Index

According to the United Nations Development Program (UNDP), the Human Development Index (HDI) is the result of measuring certain indicators that are expressed in terms of a long and healthy life, which, in turn, refers to life expectancy at birth; access to education, which considers the average number of years of schooling, as well as a decent standard of living, which is measured by the gross domestic product per capita (GDPpc) adjusted for purchasing power parity.

The measurement of indicators for the determination of the human development index partially coincides with similar indicators that, in the negative sense or their deficit, also allow determining the level of poverty, both monetary poverty and multidimensional poverty.

However, the consideration of the gross domestic product per capita (GDPpc) is not sufficient to determine the indicators that refer to a decent standard of living, since the GDPpc does not weight

the income inequality factor, so the GINI coefficient, which measures the level of inequality in a country on a scale from 0 to 1, is used to determine this.

It has already been noted that, in terms of per capita income of the population, the Dominican economy is considered a middle-income economy. For its part, World Bank data updated to 2020 indicate that the Dominican Republic's Gini coefficient was 39.6, which places it in second place in Latin America, behind El Salvador (38.8) and ahead of Uruguay (40.2), among the countries with the lowest level of inequality.⁹⁶

The level of inequality is expressed negatively in the unequal degrees of satisfaction of material and cultural needs, that is, in the possibility of having a dignified life.

The measurement of indicators related to public investment in health, education, water and sanitation, among others, also affects the determination of the human development index.

Consistent with the data indicating progress in overcoming its levels of inequality, the Dominican Republic has also made notable progress in its Human Development Index (HDI) since 2009, when it was ranked number 100 on the world scale, with an HDI of 0.700, to move to position number 80 in 2021, with an HDI of 0.767⁹⁷, improving twenty positions in that period.

However, similar to what occurs in relation to several variables considered in this baseline, the human development index in the Dominican Republic shows differences between localities located in rural and urban areas, as well as between different regions and provinces.

The year 2016 is the latest year for which disaggregated data is available at the regional and provincial level on human development indicators in the country⁹⁸. In that year, the Western Cibao region, to which Monte Cristi province corresponds, had a human development index (HDI) of 0.475, ranking sixth among the country's ten regions.

In that same year, this index, at the Monte Cristi province level, was 0.456, which is lower than the average for the region, occupying the 20th position among the 32 provinces of the country, which allowed qualifying this index as medium-low.

In that year, the income index of the province of Monte Cristi was 0.510, its health index was 0.477, with an infant mortality rate of 18.4, an insurance index of 0.541, 15.2 doctors per 10,000 inhabitants and 21.6 beds per 10,000 inhabitants. The education index was 0.391, with a literacy rate of 0.859, an average net educational coverage, which includes pre-school, elementary and middle school, of 0.405 and an average completion rate of 24.1.

Information and data obtained through the field work carried out by EMPACA during the months of October and November 2022, as part of this socioeconomic baseline, although they do not allow us to directly measure the human development index of these localities, they do allow us to approach an understanding of how much their indicators have changed with respect to the 2016 data and to what extent they resemble or differ from those of the country at present.

⁹⁶ World Bank Portal.

⁹⁷ UNDP: Human Development Report 2021-22: "Uncertain times, unstable lives: shaping our future in a changing world".

⁹⁸ Interactive map Provincial Human Development, Dominican Republic, 2016.

Thus, the indicators referring to a dignified, healthy and healthy standard of living, as well as access to education, refer to different variables addressed in the sections on the economy, the structure of services, access to household goods and the health situation in the community, developed in this baseline.

Thus, the survey applied and the collection of information on the existing infrastructure allow us to know that in some cases there have been significant advances with respect to the 2016 human development indicators and in other cases there have not.

For example, survey data show that lower levels of employment and higher levels of monetary poverty persist in the project's area of influence than the national average.

Thus, the level of employment reported in the survey is 55.31%, while the national average is 59.9%. Data referring to the level of household expenditures refer to higher levels of monetary poverty in these localities than the national average, since the average cost of the basic food basket in the northern region, to which Monte Cristi province belongs, as of November was 40,957 pesos, while, as can be seen in Table 6-167, the average cost of the basic food basket in the northern region was 40,957 pesos, while the average cost of the basic food basket in the northern region, to which Monte Cristi province belongs, as of November was 40,957 pesos. Table 6-168 shows that only in about 5% of households the level of expenditure is close to the average cost of the basic food basket. This means that households in the project's area of influence have a significantly lower purchasing power than the average for the country.

Table 6-168. Approximate monthly household expenditure RD\$

Range of expenses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Less than \$11,900	13	15.85	18	20.22	21	14.79	13	24.07	8	32.00	73	18.62
\$11,901 - \$16,900	12	14.63	23	25.84	38	26.76	9	16.67	7	28.00	89	22.70
\$16,901 - \$21,900	22	26.83	12	13.48	30	21.13	10	18.52	7	28.00	81	20.66
\$21,901 - \$26,900	9	10.98	5	5.62	16	11.27	4	7.41		0.00	34	8.67
\$26,901 - \$31,900	3	3.66	5	5.62	8	5.63	6	11.11	1	4.00	23	5.87
\$31,901 - \$36,900	3	3.66	2	2.25	7	4.93	4	7.41	1	4.00	17	4.34
\$36,901 - \$41,900	1	1.22		0.00	3	2.11	4	7.41	1	4.00	9	2.30
More than \$41,900		0.00	2	2.25	8	5.63	1	1.85		0.00	11	2.81
N/A	19	23.17	22	24.72	11	7.75	3	5.56		0.00	55	14.03
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

Nevertheless, the survey data on access to goods (stoves, washing machines, cellular phones, etc.) and services (electricity connection, internet, etc.) in the home show important advances with respect to previous years, which express progress in indicators related to a dignified life.

On the other hand, this survey yields data that show progress in the education and health indicators, which is confirmed by the survey of the structure of services.

Also, information from secondary sources on access to education services at different levels (pre-school, primary and secondary) and adult education allows us to know important advances in education in these localities.

On the other hand, the existence of modern hospitals, both in the municipality of Monte Cristi, inaugurated in 2018, and in Pepillo Salcedo, inaugurated in 2017, and the existence of primary care centers in the Copey and Carbonera sections, influence the fact that health indicators in the project's area of influence have improved when compared to the data cited for 2016.

In summary, based on the survey data on literacy, educational level and access to household goods, as well as the survey of the structure of services (education, health, water and sanitation), it can be stated that the HDI in the municipalities of Pepillo Salcedo and Monte Cristi has approached the country's average, since in the last six years between the present and the last year in which data on the Human Development Index (HDI) is available for the province of Monte Cristi, the area of influence of the project has improved in its health and education indicators, although there are no conclusive data that can be compared to support the improvement in income and expenditure levels, as an indicator of a decent standard of living.

6.3.25 Gender aspects

This baseline addresses different variables on gender aspects with implications in different spheres of social, economic, labor, political, educational, health, and couple relationships, among others, that are manifested in the project's area of influence.

In this order, it is useful to analyze gender inequality by measuring it in three dimensions: reproductive health, empowerment and economic activity.

Maternal mortality and teenage pregnancy rates are indicators of reproductive health; the proportion of parliamentary seats held by women and their educational attainment are indicators of the level of women's empowerment; while the rate of female participation in the labor market and income levels are the indicators measured to establish the level of economic inequality.

The gender aspects addressed in this baseline are:

- Economic vulnerability.
- Gender gap in education.
- Teenage pregnancy.
- Gender violence.
- Social and political participation.

6.3.26 Economic vulnerability

The Gender Parity Index (GPI) is the instrument used to determine the level of inequality and the gender gap with respect to different social, economic and political variables.

In the Dominican Republic, female economic participation is among the lowest in Latin America, as reflected in the 2019 DR Gender Parity Index data. This phenomenon is largely due to the high proportion of women engaged in unpaid domestic and care work. These responsibilities significantly limit their wage mobility and professional training opportunities. The time and energy invested in these activities reduce women's availability to participate in the formal labor market, access better-paying jobs or engage in training and skills development programs. This situation perpetuates the gender gap in the workplace and hinders progress towards equal opportunities, as the commitment to caregiving prevents many women from improving their economic and professional situation through paid employment or the acquisition of new skills.

Data from the National Labor Force Survey (ENCFT) conducted by the Central Bank of the Dominican Republic, corresponding to the third quarter of the year 2021, indicate that the gender gap in labor participation is almost 20 percentage points, 59.57% men, 40.42% women.⁹⁹ This low rate of economic participation of women translates into a larger gender gap in monetary poverty.

This trend shown by the data from the National Labor Force Survey is confirmed by the data from the survey conducted by EMPACA in the project's area of influence in October and November 2022, where it was determined that 54.8% of the women surveyed are not employed, while only 32.9% of the men are unemployed.

Data from this same survey indicate a lower level of income among women, since while 74.35% of women reported incomes below the cost of the basic food basket for the lowest income quintile, only 60.56% of men reported having this income.

The same survey also shows that of the 97 people surveyed who indicated that they were engaged in unpaid work, 89% of them were women.

Interviews with women's leaders, neighborhood councils and mothers' centers, as well as focus groups with women in the urban area of Pepillo Salcedo, highlighted the scarcity of job opportunities currently available to women. This challenge is even more acute for those who face the reality of being single mothers. This context reflects and amplifies the obstacles previously mentioned, where domestic and unpaid care responsibilities significantly limit women's ability to access jobs and professional development opportunities. Being a single mother, in particular, imposes additional challenges, given that the total responsibility for family care falls on a single person, further reducing their possibilities to fully participate in the labor market and seek salary improvements or professional training.

The survey data show a total of 26 single mothers among the 189 women surveyed, which represents a percentage of 13.7% of households with single mothers (Table 6-169).

Table 6-169. Number of single mothers surveyed.

Marital status	Separated	Single	Total
Number of children	C	C	C
One child/children	1	11	12
Two children	0	10	10

⁹⁹ Central Bank of the Dominican Republic: National Labor Force Survey, third quarter 2021.

Marital status	Separated	Single	Total
Number of children	C	C	C
Three children	0	2	2
Four children	0	1	1
Five children	0	1	1
Total	1	25	26

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

Regarding the few employment opportunities, the focus groups referred to the expectations that the development initiatives being implemented have aroused in women to obtain jobs.

6.3.27 Gender gap in education

The approach to the gender gap in education is established by measuring indicators that make it possible to establish to what extent there is equity of participation between population groups of both sexes at the different educational levels.

Data from 140 school districts in 2020 indicate that, in the Dominican Republic, females (2,731,678 enrolled) and males (2,790,658 enrolled) have similar access to the educational system, with females representing 49.5% and males 50.5%¹⁰⁰. This difference in the percentages of men and women enrolled is not significant, especially if we take into consideration that the population of men (50.2%) is also slightly higher than that of women (49.8%).

It is worth noting that, in the same year, the net perseverance rate of women (87%) at the basic level was higher than that of men (84%).

Data from the same source indicate that in the province of Monte Cristi, 51.3% of the students enrolled were male, while 48.7% were female¹⁰¹. These data show a greater gender disparity in relation to access to education in the province of Monte Cristi when compared to the national average.

This trend is maintained in the municipalities of Pepillo Salcedo and Monte Cristi, as reflected in the 2022 data on the gender distribution of registered students in school district 13-01, according to which 51.6% of registered students are male and 48.38% are female.

However, and this is relevant to evaluate gender parity in education, these data from school district 13-01 show that at the secondary level the level of participation is even between males and females (see Table 6-159).

The survey applied by EMPACA in October and November 2022 in the urban area of Pepillo Salcedo and the Copey and Carbonera sections, shows a trend in which women achieve more in

¹⁰⁰ Ministry of Education of the Dominican Republic: Enrollment statistics, 2021.

¹⁰¹ Ibid.

education, since while 21.16% of the women in the surveyed households complete secondary school, only 17.14% of the men do so. Likewise, 6.35% of women complete university studies, while only 5.14% of men do so.

In view of the above, it can be affirmed that the gender gap in education is tending to close in the Dominican Republic in general and in the project's area of influence in particular.

6.3.28 Teenage pregnancy

It can be affirmed that one of the rights in relation to which the Dominican Republic currently shows a serious deficit is the sexual and reproductive rights of girls and adolescents, since their non-compliance has a negative impact on the development of their personality, on their access to educational and economic opportunities, on the high incidence of single mothers and, consequently, on the perpetuation of poverty of a high proportion of them.

As an effect of this deficit in the fulfillment of sexual and reproductive rights, the Dominican Republic has been one of the countries with the highest rate of teenage pregnancy, reaching 22.3% of births between the years 2010-2015 (Table 6-170).

Data from 2017 indicate that in the Dominican Republic, the adolescent fertility rate was 97 births per 1000 women between 15 and 19 years old. This means that in that year the teenage pregnancy rate was still the highest in Latin America and the Caribbean, reaching 34% higher than the average in the region.¹⁰²

Table 6-170. Comparison of total births to teenage mothers, major regions of the world and the Dominican Republic.

Location	(%)
Dominican Republic	22.3
World	9.6
Sub-Saharan Africa	15.2
Africa	14.1
Europa	4.0
Latin America and the Caribbean	16.5
Caribbean	14.4
North America	16.7
Oceania	7.4
Asia	6.3
Central America	16.6

Source: United Nations, Department of Economic and Social Affairs, Population Division (2017).

In rural areas there is a greater trend in teenage pregnancy, reaching 21.1%, while in urban areas it reaches 19.6%. These percentages are higher in the poorest municipalities, establishing a

¹⁰² Pan American Health Organization: Closing the Adolescent Pregnancy Gap in the Dominican Republic

correlation between the incidence of teenage pregnancy and the level of income and multidimensional poverty, such that in the poorest quintile, more than one in three households had teenagers who had been pregnant, while this was found in only 8.6% of households in the richest quintile.

This problem of teenage pregnancy was identified by 17.7% of the people surveyed in the project's area of influence. It was also addressed by community leaders interviewed and emerged in the focus group conducted with women in the urban area of Pepillo Salcedo.

6.3.29 Gender violence

The Dominican Republic is one of the countries in the Latin American subcontinent with the highest level of gender violence. In fact, in 2014 the country ranked fourth out of 16 countries in the region in terms of femicide, with a rate of 2.7 per 100 000 women, which was higher than the average for the region (2.4). However, it should be noted that, although the trend is not constant, as in some years it goes down and in others it goes up, the general trend is downward.

Data from the study "Feminicides in Dominican Republic during 2019-2020", by the Dominican Political Observatory¹⁰³, indicate the occurrence of 486 femicides in the period 2016-2020.

The age group most affected by femicides is young women of reproductive age, which represents 85%, and 13% of these femicides correspond to adolescents 17 years of age or younger.

Here it is also worth noting that there is a correlation between levels of gender-based violence on the one hand and levels of poverty and education on the other. The poorest and least educated tend to experience higher levels of gender-based violence.

According to the Gender Atlas of the Dominican Republic, 2020, the percentage of women aged 15 years and older who have experienced some type of violence by their intimate partner is 41.8%, being higher in rural areas, where it reaches 44.8%.¹⁰⁴

The issue of gender-based violence was addressed both in the interviews with community leaders and in one of the focus groups conducted with women in the project's area of influence. In general, the people interviewed and the participants in the focus group with women agreed that, due to the social cohesion existing in these communities, there are very few cases in which women suffer gender-based violence, especially among women of Dominican nationality. In the case of women of Haitian nationality, there was reference, in some interviews and in the women's focus group, to frequent cases of domestic violence suffered by women of this nationality.

Notwithstanding the above, it should be noted that during the time the fieldwork was being conducted, information was obtained about the occurrence of a femicide in the Copey section.

6.3.30 Social and political participation

Regarding the elective functions of the Dominican State, Law 12-00 of the year 2000 established that a minimum of 33% of the elective positions of the parties must be held by women. Also, in

¹⁰³ Dominican Political Observatory: Feminicides in the Dominican Republic during 2019-2020".

¹⁰⁴ ONE: Dominican Republic Gender Atlas, 2020.

the Municipalities Law 176-07 it is established that whenever a man is the candidate for mayor, a woman must be chosen for the function of vice-mayor.

However, this law is applied in such a way that participation is negatively affected, if not avoided altogether.

For example, in the case of the National Congress, out of a total of 224 congressmen, between senators and deputies, only 56 are women, which represents exactly 25% of the total. This is without considering the representation of women in the Senate, where only four (4) out of 32 senators are women, which represents only 12.5%.

On the other hand, very few women play the main role in the municipal councils, since it is overwhelmingly men who are nominated by the parties to run for the post of mayor, leaving women in the consolation position of deputy mayor. This pattern is evident in the project's area of influence, where the mayor's office is headed by a man and the deputy mayor's office by a woman.

The above confirms the conclusions of different studies that indicate that, although women have similar levels of participation to men within social and political organizations, the exercise of the main leadership functions is normally lower.

This lower level of exercising managerial functions within social and political organizations is reflected in the proportion of women exercising managerial functions within the State apparatus (Table 6-171).

Table 6-171. Management functions in the public administration of women in the Dominican Republic and Latin America.

Functions in the public administration	Republic Dominican	Latin America
Heads of ministries	18.2	26.0
Senators	9.4	24.5
Deputies	26.8	28.7
Supreme Court of Justice	29.4	29.1

Source: Luana Marques-Garcia Ozemela : Gender Inequality in Dominican Republic 2018-2020 editions Inter-American Development Bank, October 2019.

A relevant finding in the area of direct influence of the project was that most of the community organizations, particularly the neighborhood councils, are presided over by women (see mapping of community organizations), although this trend is not expressed in political organizations, where management functions are predominantly exercised by men.

Another example of the disparity in the level of political participation is expressed in the level of representation of women in the Municipal Council of Pepillo Salcedo, where out of five councilors or councilwomen only one is female, although it should be noted that she is the president of the Council.

6.3.31 Vulnerable groups

Although these are not necessarily the result of the project's operation, they have been identified among the vulnerable groups in the area of direct influence:

- Women.
- Fishermen.
- Residents of Villa Ray neighborhood.
- Seniors.
- Beekeepers.
- Haitian migrants.

6.3.31.1 Women

The vulnerability of women derives from the same condition of inequality addressed in the section on gender aspects. This condition of vulnerability is not linked to project implementation.

6.3.31.2 Fishermen

Fishermen are one of the vulnerable groups in relation to the development initiatives of the municipality of Pepillo Salcedo. This vulnerability will be caused mainly by the expansion of the port, since, as the president of the fishermen's association Guardianes de la Bahía warns, the fishermen will be "deprived of fishing activity zones, we will be deprived of aquatic routes, we will be deprived of land routes, because our main route to the 'anchorage' or where our boats are, you know that they will be diverted"¹⁰⁵.

6.3.31.3 Residents in the Villa Ray neighborhood

The proximity of the Villa Ray community to the epicenter of the project significantly increases its vulnerability, especially to exposure to contaminants derived mainly from the construction phase of the project. This vulnerability is not limited to environmental contamination alone, but encompasses a wide range of social and economic risks. The construction phase, characterized by intense activities, could lead not only to environmental degradation through the emission of dust and waste, but also to the disruption of the social and economic fabric of the community.

Altered air quality and increased noise could affect the well-being of residents, putting at risk particularly sensitive groups such as children, the elderly, and people with pre-existing conditions. In addition, the transformation of the landscape and the introduction of unusual vehicular and human flows could alter the dynamics of local life, affecting everything from mobility to public safety.

These concerns have not gone unnoticed and have been a recurring theme in all public consultations conducted in relation to the project, underscoring the critical need to incorporate mitigation and compensation strategies that protect the Villa Ray community and ensure that negative impacts are minimized while maximizing potential benefits.

¹⁰⁵ Interview with Roque Tavera, president of the Fishermen's Association Guardians of the Bay.

6.3.31.4 Beekeepers

The implementation of the project has a significant impact on the biodiversity of the surrounding areas, affecting not only the vegetation due to land clearing, but also local beekeeping. Bees, which depend on the region's flowers for food, play a crucial role in pollination, which is essential for the propagation of various floral species.

In the mangrove area adjacent to the land where the project will be built, there is an apiary with special characteristics, since, according to the president of the Manzanillo beekeepers association, it is an apiary for genetic improvement in which queen bees are produced¹⁰⁶. This apiary is used by all beekeepers in the area and some beekeepers from neighboring areas. In addition, another apiary has been identified in proximity to the last interconnection tower of the project's transmission line, highlighting the presence of beekeeping activities in areas close to the project's infrastructure.

The Manzanillo beekeepers' association has 10 members. Each beekeeper generates a minimum of temporary employment for three people. All of them could be negatively impacted by the implementation of the project.

6.3.31.5 Seniors

It is foreseeable that the dynamization of the economy of the municipality of Pepillo Salcedo, as well as the increase in immigration, will bring with it an increase in the cost of goods and services necessary for a decent life.

The elderly, because their income comes mainly from being retired from working life, often do not see their income indexed to the increase in the cost of living, which translates into less access to these goods and services and will lead to a deterioration in the quality of their lives.

In addition to the above, the particular case of the elderly people of the Villa Ray neighborhood is of special interest as a vulnerable group, due to the uncertainty created around a possible resettlement of the inhabitants of this neighborhood, which, although it is not part of the Regasification Terminal and Thermal Power Generation Plant Urban Zone project, in the imagination of these people is associated with its implementation.

6.3.31.6 Haitian migrants

Haitian migrants, upon relocating to a new nation, often face obstacles and reticence on the part of the local community, stemming from cultural differences or economic tensions. This situation is further complicated by the lack of social support networks they had in their country of origin, a situation that is exacerbated if their migratory status is irregular, making them more susceptible to abuses and violations of their rights.

Within the context of the Dominican Republic, which has become a destination point for migrants of various nationalities, the population from Haiti represents the largest group, due to the geographic proximity and land border that both countries share.

In particular, in the border municipality of Pepillo Salcedo, Haitian immigration takes on special significance. Haitian migrants in this locality, including both those who enter irregularly and those

¹⁰⁶ Interview with Wisnel Vargas Pimentel, president of the Pepillo Salcedo Beekeepers Association.

who follow legal channels, represent a particularly vulnerable group. This issue will be explored in greater detail in the subsequent section.

6.3.32 Analysis of the human rights situation in the DR and the project's area of influence

The Dominican Republic is an original signatory of the Universal Declaration of Human Rights of December 10, 1948¹⁰⁷, although for many years this original signatory status did not translate in practice into the Dominican State respecting the human rights of its citizens, since until 1961 the country was subjected to a dictatorship that permanently violated civil and political liberties, as well as the physical integrity of opponents.

The existence of this dictatorial government was followed by a period of political instability that ended in 1966 when a formally democratic government was installed, but in which there were still strong restrictions on freedoms and the existence of numerous political prisoners and exiles, until 1978, when a new government began a process of progress in the respect of these rights that has been constant until today.

Today, the Dominican Constitution defines the Dominican State as a "Social and Democratic State of Law", which means that, in addition to being based on respect for human rights, the separation and independence of powers and popular sovereignty, it also seeks respect for human dignity through the recognition of social rights (health, education, housing) and environmental rights, such as the right of people to live in a pollution-free environment, among others.

At the same time and as an effect of this process of consolidation of democratic institutions that has been going on for more than five decades, the Dominican State has signed different international agreements and covenants, such as the Inter-American Convention on Human Rights or Pact of San José, of November 22, 1969¹⁰⁸; the International Covenant on Economic, Social and Cultural Rights of December 16, 1966, ratified by the country on January 4, 1978¹⁰⁹; the Convention against all forms of discrimination against women of December 8, 1979 and ratification of its protocol in 2001¹¹⁰; the fundamental international conventions of the International Labor Organization, including the Worst Forms of Child Labor Convention of 1999¹¹¹; as well as various international agreements aimed at protecting the rights of vulnerable persons (children, the disabled, the elderly).

It can be said that the country has made progress in the respect for civil and political rights, achieved during a process that spans several decades, from the end of the dictatorship of Rafael Trujillo in the early 60's of the last century, through the release of political prisoners in 1978 to the present in which there are guarantees of respect for civil liberties by the State.

In accordance with the above, it can also be affirmed that, although there are still situations in the Dominican Republic that violate fundamental human rights, such as arbitrary detentions and

¹⁰⁷ United Nations General Assembly Resolution 217 A, 1948.

¹⁰⁸ Inter-American Commission on Human Rights (IACHR): Ratification of Inter-American human rights instruments by the Dominican Republic.

¹⁰⁹ United Nations: Treaty Collection.

¹¹⁰ United Nations Gender Equality Observatory: Countries that have signed and ratified the Optional Protocol to the Convention on the Elimination of All Forms of Discrimination against Women.

¹¹¹ International Labor Organization: Worst Forms of Child Labor Convention.

physical abuses by the security forces¹¹² , in recent years the country has made significant progress in the respect of these rights.

In this regard, an element that merits observation is the fact that, given the increase in the frequency of criminal acts in the country, a current of opinion has been installed that postulates the use of a "hard hand" to deal with crime, instead of proposing crime prevention policies based on improving the relationship with the community.

This practice that favors the use of the "iron fist" to confront crime by the public force has gained renewed validity, due to the gravitation of actions carried out in other countries of the region that has increased the popularity of the political actors that have implemented them. That is why in the Dominican Republic today it is not strange to observe journalists and communicators defending actions to put an end to crime, regardless of whether these actions are within or outside the law and whether they are framed within the framework of respect for human rights.

It seems that this trend is unfortunately imposed, despite the fact that in 2016 through Law 590-16 or Organic Law of the National Police, the Dominican State initiated a process of adaptation of the police force with the norms and principles defined in the agreements on human rights to which the country is a signatory, which, from all points of view, are contradictory to the "iron fist" policy.

The delays in the effective application of this Organic Law of the National Police is what has allowed the current advocating for the application of a "hard hand" to gain ground, delays that have been justified by the non-approval of the regulations and protocols that allow for its enforcement. However, in April 2021, the Executive Branch issued Decree 211-21 which provides for the formation of a working team, in order to overcome these delays and these regulations and protocols can be developed, allowing a better relationship between law enforcement and citizens, effectively combat crime and avoid excessive use of force. As of December 2022, when this report is being written, it is not yet known that the work of these commissioners has been concluded.

The area of influence of the project, made up of the Province of Monte Cristi, in particular the municipalities of Pepillo Salcedo and San Fernando de Monte Cristi, as members of the Dominican Republic, is exposed to the occurrence of events that reflect the general human rights situation in the country, although it should be noted that during the collection of information through field work, the occurrence of events involving the excessive use of public force was not verified. It was determined, in the case of the municipality of Pepillo Salcedo, through interviews with different leaders of community organizations, that, in general, very few cases of violation of the human rights of Dominican citizens were reported.

Although identified in a negative sense by the inhabitants of the urban area of the municipality of Pepillo Salcedo, an example that illustrates this is the fact that in this locality the body in charge of public security, the national police, only has a staff of three policemen, one for each shift.

In the Dominican Republic, regarding the environmental rights of citizens, Law 64-00, on the Environment, addresses the rights of communities to an environment free of contamination and to be subject to social compensation when the implementation of projects of different natures affects their interests and the normal development of their activities.

¹¹². U.S. Department of State Annual Report on Human Rights in the DR, 2020.

Although an in-depth evaluation has not been made, according to reports from individuals and community leaders, the import of clinker¹¹³ through the port of Manzanillo by a company dedicated to the manufacture of cement for the construction of civil works, affects the quality of the environment, particularly air quality, which affects, according to the perception of the generality of the inhabitants of this municipality in a high incidence of diseases, including respiratory diseases.

This negative experience of the population of the municipality of Pepillo Salcedo, particularly in its urban area, in relation to the environmental pollution associated with the import of clinker, has created an attitude of suspicion towards any project that could impact the quality of the municipality's environment.

For this reason, in view of the development initiatives that are currently being promoted, the different social and political actors, as well as the population in general, condition their support for these initiatives on the guarantee of resorting to the least contaminating options and the execution of mitigation actions when environmental impact is inevitable, so that the right of the inhabitants of this municipality, established in Law 64-00, to enjoy a pollution-free environment, is not violated.

Of particular relevance for the inhabitants of the project's area of influence are the existence of two protected areas: Estero Balsa National Park and Laguna Saladilla Wildlife Refuge.

Another aspect related to the human rights situation that is relevant to address is the human rights situation derived from the condition of the municipality of Pepillo Salcedo, which is located on the border of the Dominican Republic with the Republic of Haiti.

This status as a border town has an impact on the human rights situation in two ways:

1. The first is derived from human trafficking from Haiti to the Dominican Republic, which results in a high presence of undocumented economic migrants.
2. Linked to the above, in this year (2022) the Dominican government has initiated a resettlement process along the entire border line for the construction of a wall in order to have greater control of Haitian migration¹¹⁴.

Regarding human trafficking from the Republic of Haiti, this has implications in different areas (political, economic, health, security, diplomatic, etc.).

In the political sphere, Haitian migration has encouraged nationalist discourses, some of which have xenophobic overtones, fortunately a minority, with minimal political influence¹¹⁵.

In general, the Dominican population and most of the social and political actors adopt a moderate discourse, which emphasizes the rights inherent to the sovereignty of the Dominican State, which empowers it, as any State anywhere in the world, to deport any migrant in an irregular condition.

This discourse and the position adopted by the Dominican State has come into conflict with positions, especially those of international organizations such as the United Nations High

¹¹³ Clinker is a granular product composed of limestone and clay that when mixed with gypsum and other additives is used to manufacture cement.

¹¹⁴ Listín Diario, 19-10-2023: Dominican Republic inaugurates first section of its border wall with Haiti.

¹¹⁵ Manuel Núñez: El Ocaso de la Nación Dominicana, Editorial Letra Gráfica (virtual), 2001.

Commissioner for Refugees (UNHCR) and some NGOs, which prioritize the defense of the human rights of migrants and refugees¹¹⁶.

Obviously, this conflict results from the fact that each of these entities play their respective roles. The role of international entities and NGOs is to seek the protection of migrants and refugees, while the role of the Dominican State, like any other State, is to defend its sovereignty, respect for its immigration laws and its right to decide which and how many migrants it accepts in its territory.

It is worth noting that, although it is a sign of the times that the issue of migration has a polarizing impact on the internal politics of many states, in the case of Haitian migration to the Dominican Republic the issue has particular implications that make it difficult to take a simplistic approach that postulates that the right of sovereignty should be subordinated to other rights. This is mainly due to the fact that the Dominican Republic is the only country that shares a land border with the Republic of Haiti, which facilitates excessive migration from the latter, as opposed to other countries in the region, where the sea border and distance make such migration difficult.

All of the above influences the existence of a consensus among the main political and social forces of the Dominican Republic to uphold the rights of sovereignty in the face of international pressures that seek to make the country relax its migratory policy, without this meaning the promotion of xenophobic attitudes.

Among the arguments put forward by the Dominican State is the claim that the Dominican Republic is a country that is making efforts to overcome the poverty of a significant part of its population, but that the constant migration of a very poor Haitian population makes this effort much more difficult.

Some sectors that oppose excessive Haitian migration also argue that the installation in the country of a different ethnic group, such as Haitians, tends to form a minority that would not integrate into Dominican society, which in the future would create conflictive situations that could eventually lead to massive acts of violence, as has occurred in other countries (Kosovo, Ukraine, Sudan, Congo).

For the above reasons, among others no less important, the Dominican State has insisted that the Haitian humanitarian drama is a problem that must be faced by the international community. That the country cannot do more than what it is currently doing and that international organizations should not question the application of its migratory laws¹¹⁷.

On the other hand, excessive use of force in law enforcement is not unique to the Dominican Republic, although there are protocols in place to prevent such actions.

In the case of immigration control actions, similar to what happens with Dominican citizens who incur in actions against the law, situations of excessive use of force by the actors in charge of the enforcement of Dominican immigration laws may occur.

¹¹⁶ Z Digital, November 11, 2022: UNHCR reiterates that Haitians should not be deported in view of the DR position.

¹¹⁷ Portal Presidencia de la República Dominicana: Dominican Government responds to statements of human rights expert from UN Human Rights Office, September 18, 2023

This does not mean that excessive use of force is justified. It is imperative that, just as they are working on the development of protocols to guarantee human rights in the relationship of law enforcement with Dominican citizens, Dominican authorities should also work on the development and implementation of protocols to guarantee these rights in the application of their immigration laws.

Pepillo Salcedo is a municipality located in the border region, where, almost routinely, human trafficking situations occur, in which the public forces represented by the Specialized Border Security Corps (CESFRONT), act to prevent these actions. In fact, there are four checkpoints at different points in the area of direct influence of the project:

1. Crossing the bridge over the Yaque del Norte River, at kilometer 0 of the Monte Cristi-Copey highway.
2. At the intersection of the Copey-Dajabón, Copey-Las Matas de Santa Cruz and Copey-Pepillo Salcedo highways.
3. At the entrance-exit of the urban area of Pepillo Salcedo.
4. Along the border fence in the urban area of Pepillo Salcedo.

Although, due to security reasons, it could not be documented by photographic image, during the fieldwork in the Copey section, EMPACA's social team was able to observe actions of detention of Haitians attempting to enter the country, without observing excessive use of force in these acts.

Similarly, actions were observed in which Dominican citizens were involved in illegal trafficking of Haitian nationals. Also, for the same reasons, these actions could not be documented by photographic image.

In summary, during the fieldwork conducted in October and November 2022 in Pepillo Salcedo, no excessive use of force was observed.

In general, no such cases were cited by the Dominican community leaders interviewed, nor were references to them found in Pepillo Salcedo in the digital newspapers.

The testimony of a Haitian national, who is pastor of an evangelical church (Photo 54 in Annex 14), located in the municipality of Pepillo Salcedo, whose parish is made up of Haitian nationals, is particularly worth mentioning as it provides exceptional elements.

When interviewed, this Haitian religious leader acknowledged that, in general, his countrymen are not discriminated against in relation to the provision of different services such as health, education, school meals for children, and that, in general, relations between Dominicans and Haitians are harmonious, although he noted that he knows of cases of excessive use of force in the detention of Haitians when they have tried to enter the country.

This same person, in the interview, revealed information, subject to confirmation, that may be relevant to address the situation of Haitian nationals residing in the Dominican Republic who are seeking to regularize their migratory status.

According to this person, a problem faced by Haitians residing in the Dominican Republic in order to regularize their migratory status is that they must pay US\$600 every year to renew the visa that allows them to stay in the country legally. In addition, to keep this visa valid every month they

must pay 20 dollars and in cases where they are late in this payment for up to one day they must pay a fine of 2,500 Dominican pesos (equivalent today to 47 dollars).

He adds that this is part of a business in which both Haitian and Dominican nationals participate and benefit.

It is a testimony about a situation that there is no evidence available as to whether it is tolerated or beyond the control of the Dominican national authorities, but that needs to be addressed, as it coincides with reports in the national press about the conduct of business with visas to Haitian nationals¹¹⁸.

In relation to the construction of the border fence in the urban area of Pepillo Salcedo, more than two dozen families in the Pueblo Nuevo and Alto de la Paloma neighborhoods have been displaced.

They have been given plots of land located at the entrance of the urban area of the municipality and a certain amount of money for the purchase of construction materials for their new homes, currently the construction of some of these homes has been initiated.

6.3.33 Community health assessment

6.3.33.1 Health service structure in the Dominican Republic

The Dominican Republic's health system is a mixed system, involving both the public and private sectors.

In the public sector, the following actors are involved: the Ministry of Public Health (MSP), the National Health Service (SNS), the National Social Security Council (CNSS), the Superintendence of Health and Labor Risks (SISALRIL), the Social Security Treasury (TSS) and the National Health Insurance (SENASA).

The private sector includes health risk managers (Administradoras de Riesgos de Salud, ARS), private health service providers, and nongovernmental organizations working in the area of health.

The Ministry of Public Health is the governing body for health services in the Dominican Republic, so that, although it is a public actor to which all public actors in the health sector are attached, its sphere of influence extends to the private sector, regulating the interventions of actors in this sector involved in health, such as private medical centers, independent professionals, private health risk administrators, the drug trade, etc.

The National Health Service was created by Law 123-15 of 2015 and is attached to the Ministry of Public Health and Social Assistance, with the purpose of coordinating the services provided by public hospitals and Primary Care Units or First Level Center.

¹¹⁸ Carolina Pichardo (2022, 12 December) Visa business continues in Haiti with closed offices, Listín Diario newspaper.

The National Social Security Council is the governing body of the social security system of the Dominican Republic. It is a decentralized public entity, in which the health guilds, unions and employers' organizations are represented.

The Social Security Treasury (TSS) is an autonomous and decentralized entity attached to the Ministry of Labor whose function is to manage the collection and payments of the social security system.

The Superintendencia de Salud y Riesgos Laborales (SISALRIL) is an autonomous public entity that is responsible for guaranteeing the provision of services to ARS affiliates, as well as supervising payment to ARSs and health service providers.

The National Health Insurance (SENASA) is a public health risk manager (ARS). It provides the poor population with subsidized insurance with funds of fiscal origin that is mainly used by the National Health Service (SNS) network and private non-profit providers. SENASA also affiliates a portion of Dominican government employees and private sector contributory workers who select it as their ARS.

Private Health Risk Managers (ARS) may enroll the contributory population of employees of private sector companies, non-profit organizations and some decentralized public entities, as well as sell private health insurance plans. For the delivery of services to their affiliates, they contract private and non-profit providers.

Private health care providers consist of private clinics or medical centers, laboratories and independent health care professionals who provide their services to ARSs and to patients who do not have health insurance and, consequently, must pay out-of-pocket for the different services (consultation, laboratory, hospitalization).

6.3.33.2 General health situation in the Dominican Republic

In 2020, life expectancy at birth was 74.26 years, 77.5 for women and 71.17 for men; moving from 95th place in 2019 to 90th place in the following year.

In 2019, public spending on health accounted for 2.7% of gross domestic product (GDP) and 16.3% of total public spending, while it is estimated that out-of-pocket spending on health accounted for 42.9% of total health spending¹¹⁹.

In the period between 2000 and 2019, the country saw a reduction in the infant mortality rate from 39.1 to 21.5 per 1000 live births, i.e. a decrease of 45% in that period.

In 2019, the overall age-adjusted mortality rate was 7 per 1,000 population.

When classified according to communicable diseases, non-communicable diseases and external causes (accidents, homicides, suicides), the country's health statistics for 2019 indicate that the mortality rate for communicable diseases was 85.4 per 100,000 inhabitants (92.1 per 100,000 in men and 78.6 per 100,000 in women); while the mortality rate for non-communicable diseases

¹¹⁹ Pan American Health Office: Country Profile: Dominican Republic.

was 512.7 per 100 000 inhabitants (583.4 per 100 000 in men and 448.3 per 100 000 in women) and the mortality rate adjusted for external causes was 108.4 per 100 000 inhabitants.

The country continues to be one of the countries in Latin America with the highest incidence of tuberculosis. In 2020, 24 new cases of tuberculosis were registered per 100,000 inhabitants.

On the other hand, in 2020, the rate of new diagnoses of the human immunodeficiency virus (HIV) reached 45.6 per 100,000 inhabitants, with a mortality rate of 18.9 per 100,000 inhabitants in the previous year. It is estimated that in the period from 2000 to 2019, the mortality rate for this disease decreased by 75%, thanks to the implementation of a subsidized drug program donated by the Global Health Fund.

Similar to the rest of the world, in recent years, the health factor with the greatest impact has been the Covid-19 pandemic. Official statistics, up to the first week of December 2022, indicate that 651,000 cases have been detected in the Dominican Republic, with a daily average of 87 cases per day, and 4,384 people have died from this disease, with only one death reported since July 15, 2022.

Although the country has not yet officially declared the end of this pandemic, it has practically overcome it, with fewer and fewer cases every day, which is why the authorities have eliminated all restrictions taken to combat it, being the first country in Latin America to do so.

Recently, in October 2022, a case of cholera imported from the Republic of Haiti was reported.

The country has a prenatal care coverage of 98.9%, institutional delivery care coverage of 97.5% and professional delivery care coverage of 97.8%, values that are much higher than most Latin American countries.

However, although the most recent statistics indicate that both the infant mortality rate¹²⁰ and the maternal mortality rate have declined in recent years, they are still higher than in Latin American and Caribbean countries with similar economic conditions.

Similarly, although the adolescent fertility rate shows a decreasing trend, it is still higher than the average for Latin America, since data for the year 2022 indicate that this is 63.2 per 1000 women aged between 15 and 19 years, while already in the lustrum between 2015-2020 this had been reduced to 60.7 in Latin America.¹²¹

6.3.33.3 Health situation in the localities of the area of influence of the project

Public health services in the province of Monte Cristi are under the responsibility of the Health Network Area Management III, based in the urban area of San Fernando de Monte Cristi, which is attached to the Western Cibao Regional Health Service.

The health infrastructure in the localities of the project's area of influence includes two hospitals: one (1) hospital that serves patients from all the municipalities of the Monte Cristi province, located in the urban area of the municipality of San Fernando de Monte Cristi (Photo 55) and one (1) municipal hospital located in the urban area of the municipality of Pepillo Salcedo (Photo 56) (See Annex 14).

¹²⁰ Ibidem

¹²¹ Pan American Health Organization: Adolescent Pregnancy in Latin America and the Caribbean, August 2020.

The Padre Fantino Provincial Hospital, located in San Fernando de Monte Cristi, is a specialized center with:

- 77 beds, most of which are located in two-bed rooms.
- Emergency Care Unit.
- 10 consultation rooms.
- A surgical block with two operating rooms.
- Intensive care unit with capacity for two beds.
- One (1) neonatal intensive care unit.
- Two (2) delivery rooms.
- Pharmacy.

The health personnel or human resources working at the Padre Fantino Provincial Hospital consists of: 42 physicians, 17 nurses, 4 dentists together with 3 assistants, 7 laboratorians and 3 psychologists.

This medical staff has different specialists, including: 9 obstetrician-gynecologists, 3 internists, 1 gastroenterologist, 3 pediatricians, 3 internists, 2 surgeons, 4 anesthesiologists, 1 dermatologist, 1 orthopedist, 2 epidemiologists, 1 radiologist.

The municipality of Pepillo Salcedo has a municipal hospital and five Primary Health Care Units (UNAP) or First Level Centers.

The Pepillo Salcedo Municipal Hospital is located in the urban area. This same urban area has two Primary Care Units. One in the Los Barracones neighborhood and the other in the Alto de La Paloma neighborhood.

The other primary care units are located in the Copey (Photo 57) and Carbonera (Photo 58) sections, as well as in the Santa Maria municipal district (see Annex 14).

Table 6-172. Public sector health resources in the municipalities of Pepillo Salcedo and San Fernando de Monte Cristi.

Health resources	Pepillo Salcedo Municipality	San Fernando de Monte Cristi Municipality
Hospitals or specialized centers	1	1
Primary care centers	5	7
Beds	28	77
General practitioners	8	12
Medical specialists	3	30
Nurses	17	17
Laboratorians	3	7
Dentists	2	4
Psychologists	--	3

Source: Interviews with Dr. Domingo Guzmán and Dr. Leudys Tineo, hospital directors of San Fernando de Monte Cristi and Pepillo Salcedo and development plans of these two municipalities.

In addition to the aforementioned resources, the Pepillo Salcedo hospital has an adult observation room with six beds and a pediatric observation room with five beds, a delivery room and an emergency room.

However, although the population of Pepillo Salcedo is satisfied with the physical conditions of the hospital, and in general with the services offered, there is a perception that more medical personnel are needed, particularly specialists in pediatrics, surgery, gastroenterology, anesthesiology, internists and dermatologists.

The EMPACA survey determined that about 71% of the population attends mainly public hospitals, the rest being distributed among those who attend primary care centers and private clinics (Table 6-173).

Table 6-173. Place where they go to receive medical care

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Primary Care Center	3	3.66	21	23.60	8	5.63		0.00	2	8.00	34	8.67
Private clinic	28	34.15	22	24.72	6	4.23	7	12.96	1	4.00	64	16.33
Public hospital	49	59.76	45	50.56	118	83.10	44	81.48	22	88.00	278	70.92
Another	2	2.44		0.00	1	0.70		0.00		0.00	3	0.77
N/A		0.00	1	1.12	9	6.34	3	5.56		0.00	13	3.32
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

37.50% of the respondents indicated that the health care center they attend is located less than 1 kilometer from where they reside; 24% indicated that it is between one and five kilometers; 15% stated that it is located between six and ten kilometers and 21.68% stated that it is more than 10 kilometers (Table 6-174).

Table 6-174. Distance in relation to the medical care center

Distance	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Less than 1 KM	21	25.61	27	30.34	80	56.34	18	33.33	1	4.00	147	37.50
1 to 5 KM	12	14.63	4	4.49	50	35.21	23	42.59	5	20.00	94	23.98
6 to 10 KM	11	13.41	23	25.84	2	1.41	4	7.41	19	76.00	59	15.05
More than 10 KM.	37	45.12	35	39.33	7	4.93	6	11.11		0.00	85	21.68
N/A	1	1.22		0.00	3	2.11	3	5.56		0.00	7	1.79
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

The diseases with the highest incidence during the last year in the project's area of influence are: blood pressure, which is suffered by people belonging to 97 of the surveyed households, representing 26.42%. This disease is followed by Covid-19, with 87 households where someone suffered from this disease during the last year, which represents in percentage terms 22.61%; diabetes, with 62 households, which represents 17%. Other diseases with incidence in these localities are cardiovascular disease, chikungunya, acute respiratory diseases, cancer, dengue, scabies, parasitism and gastrointestinal diseases.

Table 6-175. Incidence of diseases in the urban area of Pepillo Salcedo and the Copey and Carbonera sections.

Diseases	Carbonera	Copey	Manzanillo	Villa Ray	Los Conucos	Total
Cholera	0	0	0	0	0	0
Dengue	1	3	2	1	0	7
Covid-19	19	14	38	12	0	83
Scabies or scabies	0	0	3	4	0	7
Leptospirosis	0	0	0	0	0	0
Chikungunya	9	2	7	2	0	20
Parasitism	0	0	4	2	0	6
Cardiovascular disease	8	3	13	2	4	30
High blood pressure	20	27	35	15	5	102
Acute respiratory disease	5	1	4	2	1	13
Skin disease	0	0	0	0	0	0
Gastrointestinal disease	0	3	1	1	0	5
Cancer	0	2	5	0	0	7
Diabetes	13	14	30	5	8	70
Another	11	3	25	11	1	51
Low blood pressure	1	1	8	3	0	13

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

Finally, it is pertinent to mention a factor that affects the general health situation in the municipalities of Monte Cristi and Pepillo Salcedo, which derives from the fact that they are located in the border region.

This factor consists of the high demand for medical care by Haitian nationals who cross the border for this purpose, which creates great pressure on their health resources.

In this regard, it is worth mentioning the statement made by Dr. Domingo Guzmán, director of the Padre Fantino Provincial Hospital, located in the municipality of Monte Cristi, who revealed that more than half of the women treated in the gynecology-obstetrics department of this hospital are of Haitian nationality¹²².

¹²² Interview with Dr. Domingo Guzmán, director of Padre Fantino Hospital, Monte Cristi.

6.3.33.4 Health insurance

According to data from the Social Security Treasury, in the Dominican Republic in October 2021, a total of 5,750,573 people were affiliated to the subsidized insurance system, of which women accounted for 50.35% and men for 49.65%.¹²³

The same source indicates that in the same month of October 2021, a total of 4,179,540 were affiliated to the contributory insurance scheme. This means that almost 58% of the population was affiliated to the subsidized insurance scheme, while slightly more than 42% was affiliated to the contributory insurance scheme.

Adding both types of insurance, a total of 9,930,113 people had health insurance in the Dominican Republic at that date. The population projection of the National Statistics Office for the year 2021 is 10,621,938 inhabitants, which means that by that date 93.5% of the Dominican population had health insurance, whether subsidized or contributory.

More recently, data cited by a Dominican newspaper, El Dinero, whose source is the Dominican Association of Health Risk Administrators (ADARS), indicate that by August 2022, subsidized and contributory health insurance coverage had reached 98% of the population¹²⁴.

The survey conducted by EMPACA in the project's area of influence shows that the level of health insurance coverage in these communities is significantly lower than the national average indicated by the above-mentioned sources.

Thus, in the Table 6-176 it can be seen that this coverage only reaches 83.67% of the total population surveyed, and even in the case of Villa Ray it represents only 70.37%.

The Copey section is the one where the highest level of insurance coverage was found, reaching 91%, which is close to the national average as of October 2021.

Table 6-176. Health insurance coverage

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Yes	69	84.15	81	91.01	118	83.10	38	70.37	22	88.00	328	83.67
No	12	14.63	7	7.87	22	15.49	13	24.07	3	12.00	57	14.54
N/A	1	1.22	1	1.12	2	1.41	3	5.56		0.00	7	1.79
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

Regarding the type or system of insurance to which the members of the households in the area of influence of the project have access, the survey applied by EMPACA included a question that

¹²³ Social Security Treasury: Statistical report on SDSS health coverage, October, 2021.

¹²⁴ Esteban Delgado (2022, August 17) 98% of the Dominican Population is affiliated to health insurance, El Dinero newspaper.

distinguishes between individual or private insurance and contributory insurance. However, this distinction is not present in the statistical report of the Social Security Treasury.

Table 6-177 shows that subsidized insurance is the type of insurance to which slightly more than half (51.22%) of the members of the surveyed households have access, while 25.91% reported having individual (private) insurance and 22.56% reported having contributory insurance. These data on subsidized insurance in the surveyed localities indicate that the level of affiliation to subsidized insurance is eight (8) percentage points lower than the average for the country.

Table 6-177. Type or scheme of health insurance

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Contributory	14	20.29	15	18.52	33	27.97	11	28.95	1	4.55	74	22.56
Individual (private)	10	14.49	27	33.33	33	27.97	10	26.32	5	22.73	85	25.91
Subsidized	45	65.22	38	46.91	52	44.07	17	44.74	16	72.73	168	51.22
N/A		0.00	1	1.23		0.00		0.00		0.00	1	0.30
Total	69	100.00	81	100.00	118	100.00	38	100.00	22	100.00	328	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

On the other hand, the Table 6-178 shows that in 40.12% of the cases the health insurance only covers the person interviewed; 27.66% covers between three and five household members, 25.53% covers two household members and 3.95% covers six or more members.

Table 6-178. Number of family members covered by health insurance.

Members	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Three to five household members	22	31.88	23	28.40	26	22.03	10	26.32	10	43.48	91	27.66
Two household members	15	21.74	18	22.22	32	27.12	15	39.47	4	17.39	84	25.53
Six or more household members		0.00	4	4.94	2	1.69	5	13.16	2	8.70	13	3.95
Only to the interviewee	27	39.13	34	41.98	56	47.46	8	21.05	7	30.43	132	40.12
N/A	5	7.25	2	2.47	2	1.69		0.00		0.00	9	2.74
Total	69	100.00	81	100.00	118	100.00	38	100.00	23	100.00	329	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

6.3.34 Relationship of the community with the environment

The concept of environment is commonly used to refer to a system in which the natural and artificial elements that make up the surroundings in which human beings develop their existence are related.

The subject of environmental pollution is one of the main and most current issues related to the interaction of human beings with the environment.

The survey conducted by EMPACA in the communities in the project's area of influence, as part of the social baseline, addressed the perception of the people surveyed on the issue of pollution factors in their communities.

The results of this survey (Table 6-179) show that the generation of dust due to the existence of unpaved streets (Photo 59 in Annex 14) is the first factor identified by the inhabitants of these localities, with 16.10%, with the Copey section standing out, where more than a quarter of those surveyed identified this factor, followed by the urban area of Pepillo Salcedo, where in particular some neighborhoods such as Alto de la Paloma, Villa Ray and Villa Banack have sectors with unpaved streets.

The second polluting factor is identified under the category Other, which when specified in the case of the urban area of Pepillo Salcedo refers to the pollution resulting from the unloading and transportation of clinker from the port of Manzanillo to the clinker storage center of the Cibao Cement Factory, located about two kilometers from the urban area on the road to Copey.

The third factor is identified under the category pigsty or farm with 14.33%. In relation to this factor, it should be noted that what is identified as pigsty or farm refers, in the particular case of these localities, to the raising of cattle in the Carbonera section and to the raising of goats and sheep, both in the urban zone of Pepillo Salcedo and in the Copey section.

Although it is not recorded in the survey, information obtained through interviews and observations of the team that participated in the field work, allows us to affirm that the identification of cattle and goat breeding as a polluting factor in these localities is due to the fact that the streets of these localities are used for cattle grazing and that in some cases where stables are used, they are located in areas very close to the houses.

During the field work, the presence of goats and sheep was also observed, not only grazing on the landfill grounds, but also rummaging through the piles of solid waste in search of food, a fact that could pose a health risk to the inhabitants of this municipality.

Other pollution factors identified are: stagnant water (13.30%), noise from vehicles and engines (9.51%), accumulation of garbage (7.87%) and music from bars and grocery stores (5.44%), among others.

Table 6-179. Perception of pollution factors affecting localities in the area of influence of the project.

Sources of contamination	Carbonera	Copey	Manzanillo	Villa Ray	Los Conucos	Total
Garbage accumulation	0	12.05	8.2	0	38.10	7.87
Stagnant water	4.88	22.62	12.7	2.08	38.10	13.30
Gasoline pump	0	3.85	0.85	6.25	0.00	2.02
Gully with garbage or contaminated water	0	10.26	0.84	0	4.76	2.87
Waste or residues from factories, workshops, hospitals, canteens, supermarkets, grocery stores, etc.	0	1.27	0.85	2.08	0.00	0.86
Gas filling machine	0	0	0	0	0.00	0.00
Chemical products factory	0	0	0	4.17	0.00	0.57
Smoke or factory fumes	0	2.53	0	0	0.00	0.58
Loud music from bars, grocery stores or neighbors	4.88	5.06	5.88	4.17	9.52	5.44
Pigsty or farm	13.41	16.46	10.92	27.08	0.00	14.33
Dust from unpaved road or street	6.1	25.61	12.61	16	38.10	16.10
Vehicle and engine noise	2.5	13.92	8.47	2.04	42.86	9.51
Factory or workshop noise	0	0	1.69	2.08	0.00	0.86
Noise and/or fumes from power plant	0	0	0.85	0	0.00	0.29
Landfill very close to the house	0	0	0.85	0	0.00	0.29
Another	6.56	0	27.71	24.24	0.00	15.15

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

This same survey also revealed the perception of the inhabitants of these localities in relation to the risk factors to their security caused by natural phenomena. Thus, it was established that the greatest risk factor perceived by the inhabitants of these localities is drought, which is identified by 46% of the people surveyed, which is consistent with the fact that this part of the country has low rainfall. Other factors identified are torrential rains (8.61%), floods (6.69%) and cyclones (7.37%), as shown in Table 6-180.

Table 6-180. Perception of risk factors to which localities are exposed in the area of influence of the project

Sources of risk	Carbonera	Copey	Manzanillo	Villa Ray	Los Conucos	Total
Cyclones	3.70	7.25	3.36	0.00	59.09	7.37
Landslides or landslides	0.00	0.00	0.00	0.00	4.55	0.00
Rockfall	0.00	0.00	0.00	0.00	0.00	0.00
Land subsidence	0.00	0.00	0.00	2.08	0.00	0.32
Forest fires	0.00	0.00	0.00	0.00	0.00	0.00
Floods	2.47	14.29	5.98	0.00	18.18	6.69
Torrential rains	0.00	17.72	8.66	11.76	0.00	8.61
Drought	48.15	50.75	39.32	60.00	27.27	45.99
Earthquakes	0.00	0.00	0.00	2.08	0.00	0.30
Tornado	0.00	0.00	0.00	0.00	9.09	0.60

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

In addition to some of the data obtained through the survey, interviews with selected stakeholders (fishermen, cattle ranchers, beekeepers, ecotourism entrepreneurs and other economic actors), as well as with community leaders and local authorities made it possible to obtain qualitative information on the relationship between the inhabitants and the ecosystems in the project's area of influence (wetlands, mangrove zones, marine zone), ecosystems that converge in the project's area of influence, made it possible to obtain qualitative information on the relationship of the inhabitants with the ecosystems in the project's area of influence (wetlands, mangrove zones, marine zone), ecosystems that converge in Manzanillo Bay and the main environmental value of the project's area of influence, which is the Estero Balsa National Park.

The Manglares de Estero Balsa National Park is a protected area that has an extension of 17 km of coastline in a north-south direction, from the mouth of the Yaque de Norte River to the municipality of Pepillo Salcedo, covering an area of 56.54 km².¹²⁵ It includes a wetland area with lagoons and mangroves around the bay of Manzanillo. Six (6) natural ecosystems can be differentiated in it. These are: Beaches, mangroves, water body, seagrass meadows, salt marshes/salters/salitrals and dry forest and scrub¹²⁶.

This national park, protected by the Ramsar Convention, provides important ecosystem services because it is home to one of the most developed mangrove forests in the Dominican Republic. Within this park there are 16 temporary or permanent lagoons. The mangroves as ecosystems have national protection and are a great attraction for recreation and ecotourism in the region, in addition to their importance for fishing activities¹²⁷.

Among the fishing spots cited by the fishermen interviewed, two of them are located within the park's marine area. These are the Estero Balsa beach area, which is at the same time one of the embarkation and disembarkation points, as well as the mouth of the Tapión Stream.¹²⁸

¹²⁵ MIMARENA: Management Plan for Estero Balsa Mangrove National Park, 2014-2019.

¹²⁶ Ibid.

¹²⁷ Ibid.

¹²⁸ Interview with Miguel Ballony, fisherman and member of the Marine Guardian Fishermen's Association.

In addition, the Laguna Saladilla Wildlife Refuge is a protected area covering an area of 31.18 km² to the southwest of the urban zone of Pepillo Salcedo. Within this protected area there is a lagoon with the same name, which is a fishing spot for some of the residents of the Carbonera section.

It is worth mentioning the results of the survey that show the proportion of the population of these localities that are involved in fishing or know someone who is. According to this survey, 66.21% of the population is involved in this activity or knows someone who is (Table 6-181).

Table 6-181. Level of knowledge about people linked to the fishing activity.

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Yes	46	56.10	56	62.92	97	68.31	44	81.48	9	36.00	252	64.29
No	35	42.68	30	33.71	40	28.17	7	12.96	16	64.00	128	32.65
N/A	1	1.22	3	3.37	5	3.52	3	5.56		0.00	12	3.06
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

It is also relevant to refer to the results of the survey that shows the number of people interviewed who were or know someone who carried out some activity on the land where the project will be installed. According to the survey, most of them were involved in livestock grazing (85), followed by crab trapping (34), extraction of medicinal plants (19), capture of birds or other wild species (15), beekeeping (10), and agricultural work (6). See Table 6-182.

It should be noted that three similar power generation projects are planned in the area, one of which is already under construction in the Copey section, so it is possible that in some cases respondents are referring to the latter, especially in the case of respondents from the Copey and Carbonera sections, which are closer.

Table 6-182. Level of knowledge about people who carry out activities on the project lands.

Values	Carbonera	Copey	Manzanillo	Villa Ray	Los Conucos	Total
Capture of birds or other wildlife species.	0	2	4	9	0	15
Crab catch.	1	2	17	14	0	34
Extraction of medicinal plants.	0	2	7	10	0	19
Agricultural work for subsistence crops or for the local market.	1	2	1	2	0	6
Beekeeping (honey production).	0	3	3	3	1	10
Goat or cattle grazing.	3	14	41	27	0	85
Another	2	0	21	14	0	37

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

The use of the beaches for recreational purposes in the area of influence of the project is another of the ecosystem services provided by Manzanillo Bay to these residents. The survey data indicate that 54% use the Estero Balsa beach for recreational purposes. They were not asked about the recreational use they make of Los Coquitos beach, which is the beach that is most used for these purposes not only by the population of Pepillo Salcedo, but also by nearby towns such as those in the province of Dajabón, according to some people who work in beverage and food establishments located on this beach, to whom unstructured interviews were carried out (Table 6-183).

Table 6-183. Use of the Estero Balsa beach for recreational purposes.

Usage	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Weekly	5	6.10	7	7.87	25	17.61	18	33.33	3	12.00	58	14.80
Fortnightly	4	4.88	2	2.25	14	9.86	4	7.41	5	20.00	29	7.40
Monthly	22	26.83	36	40.45	41	28.87	20	37.04	6	24.00	125	31.89
Does not use	50	60.98	44	49.44	60	42.25	12	22.22	11	44.00	177	45.15
N/A	1	1.22		0.00	2	1.41		0.00		0.00	3	0.77
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

One of the ecosystem services linked to the Manglares de Estero Balsa National Park is ecotourism activities that can be economically exploited by the population in the project's area of influence. The survey yields data indicating that 35% of the surveyed population benefits or knows someone who benefits from ecotourism activities, with the most frequent activity being the sale of beverages and food (34.31%), followed by tour guides (33.85%), as can be seen in Table 6-184 y Table 6-185.

There is a young population of tourist guides related to ecotourism activities in Manglares de Estero Balsa National Park. This population is organized in an organization called Eco-Aventura, which is made up of young people who are descendants of fishermen, a condition that helps them get to know the different tourist attractions in this park, as well as having the possibility of using their parents' boats for lucrative excursions¹²⁹.

Table 6-184. Economic exploitation of ecotourism activities

Responses	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Yes	11	13.41	18	20.22	71	50.00	27	50.00	10	40.00	137	34.95
No	67	81.71	68	76.40	66	46.48	25	46.30	15	60.00	241	61.48
N/A	4	4.88	3	3.37	5	3.52	2	3.70		0.00	14	3.57
Total	82	100.00	89	100.00	142	100.00	54	100.00	25	100.00	392	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

¹²⁹ Interview with Nelson Blanco, Executive Director of the Eco-Aventura organization.

Table 6-185. Source of profit linked to ecotourism activity.

Sources	Carbonera		Copey		Manzanillo		Villa Ray		Los Conucos		Total	
	C	%	C	%	C	%	C	%	C	%	C	%
Boat rental	3	27.27	3	16.67	15	21.13	6	22.22	3	30.00	30	21.90
Tourist guide	5	45.45	2	11.11	22	30.99	14	51.85	3	30.00	46	33.58
Sale of beverages and food	1	9.09	12	66.67	27	38.03	6	22.22	1	10.00	47	34.31
Souvenir sales	2	18.18	1	5.56	7	9.86		0.00	3	30.00	13	9.49
Another		0.00		0.00		0.00	1	3.70		0.00	1	0.73
Total	11	100.00	18	100.00	71	100.00	27	100.00	10	100.00	137	100.00

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

6.3.35 Problems and needs in the area of direct influence of the project

Other aspects addressed in this baseline refer to the perception of these localities on the main social problems that affect them (Table 6-186), as well as the main community needs (Table 6-187).

In this order, the survey determined that the main problem identified by the inhabitants of these localities is poverty, which was identified by almost half of the people surveyed (48.76%); this problem is followed by crime, which is identified by 35.52%; drug addiction (29.36%); teenage pregnancy (17.31%) and alcoholism (13.93%), among others.

Table 6-186. Perception of social problems in the localities in the area of influence of the project

Problems	Carbonera	Copey	Manzanillo	Villa Ray	Los Conucos	Total
Crime	58.02	21.18	32.03	5.88	100.00	35.52
Conflicting relations with neighbors	3.70	2.38	5.69	0.00	0.00	3.33
Drug addiction	46.91	14.46	29.60	15.69	52.38	29.36
Alcoholism	13.58	8.24	18.18	1.96	42.86	13.93
Teenage pregnancy	14.81	24.42	18.25	8.00	14.29	17.31
Domestic violence	0.00	0.00	2.46	0.00	0.00	0.84
Poverty	53.09	50.00	42.19	49.02	68.42	48.76

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

Employment opportunities is the felt need identified by the highest percentage of respondents (90.79%), while the need for more efficient water service is identified by 23.78% of respondents. These needs are followed by public infrastructure (streets, sidewalks, etc.), which is identified by 16.77%; educational services and technical training (16.28%) and access to hospital services (10.34%).

Table 6-187. Perception of needs felt in the localities in the area of influence of the project

Needs	Carbonera	Copey	Manzanillo	Villa Ray	Los Conucos	Total
Employment opportunities	87.65	89.29	92.70	88.68	100.00	90.79
Water service	7.41	3.13	35.71	52.83	8.00	23.78
Electric power	2.47	3.23	7.56	3.92	0.00	4.44
Access to hospital services	3.70	9.09	11.20	13.73	24.00	10.34
Educational services and technical training	7.41	32.10	15.15	8.00	8.00	16.28
Public infrastructure (sidewalks, streets, courts, street lighting)	14.81	24.36	14.52	13.73	0.00	16.77

Source: Survey applied in urban area of Pepillo Salcedo and Copey, Carbonera and Los Conucos sections (EMPACA, October and November 2022).

6.3.36 Landscape

Six landscape types were delimited in the study area, considering the characteristics of the relief, vegetation cover and degree of urbanization and anthropization (Map of Landscape Types), these are:

- Inland plain of medium height, cleared (identified with the letter A on the map).
- Inland plain of medium altitude, urbanized (identified with the letter B on the map).
- Inland plain terrace with coastal edge, little anthropized (identified with the letter C on the map).
- Low floodplain (marsh), (identified with the letter D on the map).
- Cumulative coastal beach strip (identified with the letter E on the map).
- Marshes with mangroves (Estero Balsa), (identified with the letter F on the map).

The landscape was evaluated through the following attributes:

- **Visibility:** All possible points of direct observation in situ were considered.
- **Fragility:** Set of characteristics of the territory related to its capacity to respond to changes in its landscape properties. Normally, the factors influencing fragility are biophysical, perceptual and historical-cultural. In addition to these factors, proximity and visual exposure can be considered.
- **Quality or beauty of the landscape:** The assessment is based on the contemplation of the entire landscape according to the resources it possesses.
- **Fragmentation:** Loss of continuity of the landscape that produces important changes in the structure of plant and animal populations and communities, both in the physical and ecological environment, which affects their functioning.
- **Anthropogenic changes:** Everything that comes from or results from the activities of human beings or is produced by them. Humans interact with the environment and modify it in multiple ways. Some are positive, others negative and others harmless to the environment.
- **Climate variations:** The consequences of climate change now include, among others, intense droughts, water shortages, severe fires, sea level rise, flooding, melting of the poles, catastrophic storms and declining biodiversity.

- **Sensitivity and value of the landscape:** Consist in the fact that through it we can identify ourselves with our environment, thus harboring a feeling of belonging, which is fundamental for human beings. Landscape is therefore recognized as having a heritage value, which may refer to our natural or cultural heritage.

Each of these attributes was given the categories summarized in Table 6-188.

Table 6-188. Categories of each of the attributes.

Attribute	Categories	Attribute	Categories	Attribute	Categories	Attribute	Categories
Visibility	High	Fragility	High	Quality	Excellent	Fragmentation	High
	Medium				Very good		
	Low		Good		Low		
	Null		Low				Regular
					Bad		

Attribute	Categories	Attribute	Categories	Attribute	Categories
Anthropogenic changes	High	Climatic variations	High	Sensitivity and value of the landscape	High
	Medium		Medium		Medium
	Low		Low		Low

Source: EMPACA, 2024.

6.3.36.1 Description of landscape types

6.3.36.1.1 Inland plains of medium height, cleared

This landscape unit is distributed in the easternmost sector of the interior plain, structural, coinciding with the area that will be occupied by Block 02, without urbanization (Figure 6-237). It has been identified as **A** in the Map of landscape types.



Figure 6-237. Inland plain landscape of medium elevation, cleared.

Source: EMPACA elaboration taken from drone flight October 2023.

This type of landscape does not show any element of vegetation cover on the flat surface, where Block 02 will be built, where silty clay sediments lie, with little thickness on limestone. In general, the vegetation cover was removed, and was represented by secondary xerophytic vegetation with trees that do not exceed 7 m in height.

This vegetation was modified by an urbanization project that was abandoned in the November 2021 Google Earth imagery (Figure 6-238) you can see the layout of the roads and a villa that was built. It is currently cleared and is destined by international public bidding for new generation No. EDES-LPI-NG-01-2021 in the plots owned by the Dominican Corporation of State Electrical Companies (CDEEE).



Figure 6-238. Google Earth image where you can see that the area where the project will be located.

Source: Image © 2023 Maxar Technologies.

6.3.36.1.2 Inland plains of medium altitude, urbanized

This landscape unit is represented by the western sector of the interior plain described above, with a flat surface, but with a high rate of urbanization. It has been identified as **B** in the Map of landscape types.

Similarly, there are superficial relicts of silty clay sediment layers, which overlie the organogenic limestones, with a predominance of anthropic coverage with low-level buildings, asphalted road networks and industrial facilities where the Port of Manzanillo's warehouse facilities stand out (Figure 6-239).



Figure 6-239. Inland mid-elevation plain, urbanized.

Source: EMPACA elaboration taken from drone flight October 2023.

This type of landscape is found in the neighborhoods adjacent to the project area, which due to their rural condition are dominated by patios and spaces with plants planted by the inhabitants, such as coconut palm (*Cocos nucifera*), mango (*Mangifera indica*), banana (*Musa sp*), among others (Photo 60 in Annex 14).

6.3.36.1.3 Inland plain terrace with coastal border, anthropized

This landscape unit is distributed throughout the northern edge of the interior plain, and is the structural element of the coastal edge towards the sea or the low marsh. It represents a rocky step, with a semi-vertical wall where pasture and secondary scrub vegetation predominates, although towards the eastern half there are narrow coastal mangroves (Photos 61 and 62 in Annex 14). It has been identified as **C** in the Map of Landscape Types.

The terrace section towards the western half of the study area is heavily transformed by the industrial facilities that were built on the upper surface, at the level of the plain, and which required leveling works, in addition to the other industrial structures related to the Port.

This landscape unit is also located north of the Copey-Pepillo Salcedo road where the 345 kV transmission line will be built. Figure 6-240. This section, approximately 5 km long and 330 m wide measured on both sides of the route, extends from the point where Block 02 will be built to the point where it connects with the 345 kV transmission line of the National Interconnected Electric System at UTM coordinates X: 216851 and Y: 2178265, in front of the Manzanillo Power Land energy project of the Energía 2000 consortium, currently under construction.

This section of this landscape unit is anthropized, with a predominance of secondary xerophytic vegetation at its ends (see Photo 4 in Annex 13), grasslands in the center (Photo 12 in Annex

13), and at the point where it connects with the 345 kV transmission line of the National Interconnected Electrical System there is secondary xerophytic vegetation in transition to mangrove (Photo 11 in Annex 13). See Annex 6: Maps).

In this section was built the gas pipeline to supply natural gas for the Manzanillo Power Land energy project, of the consortium Energía 2000 (Photo 63 in Annex 14).

Much of this land has been used by goat and sheep farmers through pastoral practices without being protected by land titles.

In addition, a portion of this land contains a small farm dedicated to raising cattle, goats and sheep, as well as growing transvalley-type pasture for sale to cattle ranchers in the region.

Also, adjacent to this land, an industrial building is being built for the installation of a steel industry company named Leskey Industries.



Figure 6-240. Inland plain terrace with coastal edge, anthropized.

Source: Prepared by EMPACA, based on information from Manzanillo Energy Consortium, Inc. 2024.

6.3.36.1.4 Low floodplain (marshland)

This landscape unit is distributed at the foot of the plain terrace, throughout the western half of the study area, and behind the coastal strip. It has been identified as D on the Landscape Type Map.

It represents a flat plain, with very low elevations, which remains flooded due to the tidal regime and regional rainfall. Muddy, sandy silts, even silty sands, lie along its entire length, and their distribution responds to the very low local hydrodynamics (Figure 6-241).



Figure 6-241. Low floodplain (salt marshes)

Source: EMPACA elaboration taken from drone flight October 2022.

In this low plain there is a sector to the west where all the mangrove vegetation is dead, with very little sign of recovery (Photo 64 in Annex 14). This very unfavorable situation is basically caused by the very low dynamics of the waters entering the plain and the high temperature.

In the eastern half of the plain, near the only point of exchange with marine waters, the quality of the vegetation is superior, with mangroves distributed in patches, and fauna typical of these wetlands (Photos 65 and 66 in Annex 14).

6.3.36.1.5 Cumulative coastal beach strip

This landscape unit is distributed throughout the northern edge of the low floodplain, as a sandy barrier of appreciable width and a shallow dune, with accretionary beach. It has been identified as **E** on the Landscape Type Map.

Throughout the entire strip, vegetation cover is represented by mangroves, which are not very dense, and salt marshes where visual perception is low (Photo 67 in Annex 14).

The entire coastal edge of this landscape unit, represented by a low, accumulative beach, is covered by gray sands and silty sands, with a shallow dune where mangrove grows on the beach sand, composed mostly of button mangrove, *Conocarpus erectus*. In the post-beach, the silty fraction and silt is predominant, with scattered vegetation. It is precisely in this post-beach sector where vehicular traffic and power lines can be observed, which deteriorate the view and establish compaction conditions that are not favorable to the stability of the sands (Photos 68, 69 and 70 in Annex 14).

Throughout the eastern sector of the coastal strip the level of anthropization is high, with this beach area being the site of several rustic fishermen's houses, an accumulation of boats anchored on the shore or on the dune, and isolated boat repair facilities (Photos 71 and 72 in Annex 14).

6.3.36.1.6 Mangrove swamps (Estero Balsa)

This landscape unit is distributed along the entire eastern sea front of the study area, where dense mangroves predominate over shallow accumulations of terrigenous material. In the entire strip bordering these mangroves, the predominant species are mangroves composed of *Rhizophora mangle*, *Avicennia germinans* and *Laguncularia racemosa* (Photo 73 in Annex 14). It has been identified as **F** on the Landscape Type Map.

These mangrove formations grow associated with accumulations of sediments dragged from land and accumulated in sites of balance between the dynamics of marine waters and surface waters, but where very low, scarcely emerged terrain predominates, without appreciable stretches of shore or beaches.

Very punctually, in the interior of these mangroves, some rustic forms of salt extraction have been observed.

6.3.36.2 Landscape evaluation

In the Table 6-189 presents the results of the landscape evaluation matrix. See Map 17 of Landscape Types in Annex 6.

Table 6-189. Valuation of landscape types.

Landscape type	Visibility	Fragility	Quality or beauty	Fragmentation	Changes antropogenic	Variations climatic	Sensitivity and value of the landscape
Inland plain of medium height, cleared (A).	High	Low	Regular	High	High	Low	Low
Inland plain of medium height, urbanized (B).	Medium	Medium	Good	High	High	Low	Low

Landscape type	Visibility	Fragility	Quality or beauty	Fragmentation	Changes antropogenic	Variations climatic	Sensitivity and value of the landscape
Inland plain terrace with coastal edge, anthropized. (C).	High	High	Regular	High	High	High	Low
Low floodplain (marshland) (D)	High	Medium	Regular	Medium	Medium	High	High
Cumulative coastal beach fringe (E)	High	Medium	Good	Medium	Medium	High	Medium
Mangrove marshes (Estero Balsa) (F)	High	High	Excellent	High	Few	High	High

Source: EMPACA, 2023.

6.3.37 Historical and cultural heritage

This section addresses the following aspects:

- Brief History of the Dominican Republic.
- History of the province of Monte Cristi and the municipality of Pepillo Salcedo.
- Dominican cultural identity.
- Cultural and architectural heritage of Monte Cristi and Pepillo Salcedo.
- Religiosity.
- Archaeological prospecting.

6.3.37.1 Brief History of the Dominican Republic

On December 5, 1492, Europeans arrived on the island of Santo Domingo, which was called Quisqueya or Haiti by its original inhabitants. It was then baptized by Admiral Christopher Columbus as La Hispaniola.

At that time, the Tainos, an ethnic group of the Arawak branch from the Atlantic coast of South America, extended their presence throughout the Greater Antilles, including the island of Santo Domingo.

At that time, the island was politically organized into five (5) chiefdoms: Marién, Maguá, Maguana, Jaragua and Higüey, which were governed by caciques, a word of Taino origin meaning chief.

After the conquest and subsequent colonization of the island of Santo Domingo, it remained under Spanish rule until 1625, when French filibusters and buccaneers began to settle in the western part of the island. In 1697, Spain officially ceded that part of the island to France through the Treaty of Ryswick, creating the colony of Saint Domingue, from which the Republic of Haiti would later emerge.

The eastern part of the island remained a Spanish colony until the first two decades of the 19th century. During this period, the Taino ethnic group gradually became extinct, due to different causes, among them contagious diseases, hard work and the mixture with other ethnic groups, such as those coming from the Atlantic coast of Africa and the Iberian Peninsula in the European continent.

This last cause gave rise to the predominant phenotype in the Dominican population, which gathers physical characteristics of the black African, the Spanish white and the aboriginal Taino, forming the Dominican mulatto, to which is associated a cultural identity resulting from a shared heritage and history.

The Dominican Republic was formed as an independent state in 1844, when it separated from the Republic of Haiti, whose government had occupied the eastern part of the island 22 years earlier.

Once the Dominican State was formed and survived over 178 years of numerous vicissitudes, including the loss of sovereignty on three occasions, civil wars and the establishment of authoritarian governments, the Dominican Republic has enjoyed more than five decades of political stability and progressive democratic advances that have made it, according to different international organizations, a model for the region, despite evident imperfections.

6.3.37.2 History of the province Monte Cristi and the municipality of Pepillo Salcedo

The territory now occupied by the province of Monte Cristi is located in what before the colonization of the island was the chiefdom of Marién. This cacicazgo was governed by the cacique Guacanagarix, a historical character around whom there is a black legend, identifying him as a surrendering and servile cacique to the European conquerors. From this legend derives that in the country, the Guacanagarix complex is attributed to Dominicans who have a preference for foreigners and subordinate national interests to those of other countries.

The name Monte Cristi dates back to the early days of the discovery of the island, since Christopher Columbus, on his first trip, baptized this place as Monte Cristo because the mountain now known as El Morro reminded him of Jesus Christ on the mountain of Golgotha.

It was in 1506, under the governorship of Nicolás de Ovando, that the first settlement of the colonizers was established in Monte Cristi, a fishing village, which was joined by a group of families from the Canary Islands, headed by Juan de Bolaños, a character whom history recognizes as the founder of this town. As early as 1588, documents of the time refer to Monte Cristi as one of the parishes that were part of the island.

A milestone in Dominican history linked to Monte Cristi is known as the "Devastaciones de Osorio", which consisted of the transfer of the inhabitants of Monte Cristi and Puerto Plata to the east of the island, by order of the Spanish crown in order to avoid the illegal trade that was then taking place in that region. As a result of these events, the town of Monte Plata was founded in an area near Santo Domingo.

Later, in 1751, the town of Monte Cristi was founded again by order of King Ferdinand VI, with the intention of taking advantage of its favorable conditions for maritime activities.

Once the Dominican Republic was created, by Decree No. 14 of July 24, 1884, Monte Cristi acquired the category of common belonging to the department of Santiago and, by Law # 4803 of September 9, 1907, it was converted into a province, of which San Fernando de Monte Cristi was the head common and the other commons were Sabaneta, Guayubín, Dajabón, Monción and Restauración.

In Law # 5220, on Territorial Division, of 1959, Monte Cristi maintained its status as a province, being made up of the municipalities of San Fernando de Monte Cristi, Guayubín, Pepillo Salcedo and Villa Isabel.

On the other hand, what is today the municipality of Pepillo Salcedo or Manzanillo had its origin in a fishing village that was established around the bay of the same name, located in the northwestern end of the country, in the place where the Masacre or Dajabón River flows into the sea. Already in 1907, when Monte Cristi acquired the category of province, what was then the area of Manzanillo belonged to the common of Dajabón.

6.3.37.3 The Grenada Company and the development of Monte Cristi

In 1943, the Grenada Company was established in Manzanillo (Photo 74 in Annex 14), after signing a contract with the Dominican government authorizing it to use a certain extension of land for banana exploitation for a period of 50 years. As part of this contract, the company was also authorized to build a seaport for the shipment of banana production.

This company, the Grenada Company, was a subsidiary, created under Dominican law, of the United Fruit Company, which was then the world's leading banana producer, with plantations in different countries in Central and South America.

The Grenada Company began the construction of small buildings in the lower part of the town of Manzanillo and a residential neighborhood in the upper part, where the main executives lived, which is what today is the El Cerro neighborhood.

At the same time, the Grenada Company began planting bananas in a plantation located on the banks of the Yaque del Norte River, in the Palo Verde section. The name of this plantation was "Plantación Berlanga", in honor of the Spanish religious man who introduced bananas to the American continent¹³⁰.

It was from then on, that Manzanillo became the most prosperous place on the border, so in 1950 it reached the category of common, which is the equivalent of what today is called a municipality, being formed at that time by the town of Manzanillo, plus the sections of Copey, Carbonera, Gozuela, Santa Maria and Sanita. A year later, in 1951, the name was changed to Pepillo Salcedo, in honor of the first constitutional president of the Dominican Republic after the Restoration, José Antonio Salcedo.

In 1966, due to, among other factors, the social and political instability that the country was experiencing, the Grenada Company ended its operations and withdrew, transferring its properties (port, administrative offices and agricultural plantation) to the Dominican State.

6.3.37.4 Dominican Culture

Dominican culture has its own characteristics, some of which have been present from the moment of the nation's conformation and are the ones that mainly define its cultural identity.

130 Gutiérrez Félix, Euclides (July 6, 2020): The Cross of Palo Verde, El Nacional newspaper.

However, like any culture, the Dominican culture is in constant change, due to its insertion in contemporary history and its interaction with other cultural traditions, especially with other Latin American and Caribbean cultures, as well as the influence it receives as a result of a significant movement of emigration to the United States and Europe and immigration, mainly of Haitian nationals, as well as from Spain, the Middle East, China and Venezuela.

Among the main cultural traits that today define the identity of Dominicans are:

Language	Spanish
Religion	Catholic mainly, since it has been established since colonial times, although since the last century various Protestant denominations have been growing. There are also diverse forms of popular religiosity.
Music	Merengue, bachata, palo, dembow.
Gastronomy	Dishes based on different combinations of rice, beans, beef, poultry, viands.
Hobbies	Dominoes, cock fights (Photo 75 in Annex 14), palo ensebado, among others.
Sports	Baseball, basketball, volleyball.
Traditions	Patron saint festivals or celebrations related to devotions of the Catholic Church, carnivals, etc.

Linked to the above, it can be stated that groups with diverse ethnic origins have been present in the Dominican Republic, a phenomenon whose explanation refers to immigration phenomena that have taken place since the end of the 19th century and have continued to the present day.

Since the end of the 19th century, waves of migration from the Middle East began to take place, mainly from Syria, Lebanon and Palestine, as well as from China. Today, descendants of these migrations can be found up to the sixth generation who have been integrated into the Dominican culture, which is why it should be pointed out that at present these are not culturally differentiated groups. Many of them have excelled in different business and professional fields¹³¹, with the current president of the country being a descendant of a family from the Middle East.

Other migratory waves are linked to the development of the sugar industry, having as sources at one time some of the so-called Lesser Antilles whose populations speak English. These groups, which in the past had cultural characteristics differentiated from the rest of the population, were progressively integrated into the Dominican culture. In the present and in the recent past, many of them play prominent roles in various fields such as literature and sports, among others.

Another group of migrants originally linked to the sugar industry is from the Republic of Haiti. This group, despite coming from a country that, like Haiti, shares the island of Santo Domingo with the Dominican Republic, has had a presence characterized by a lesser vocation to integrate into Dominican culture, a phenomenon that has several causes, among them historical conflicts¹³² linked to the origin of the Dominican Republic and the relative isolation of some of the vital spaces where they have developed their existences, such as the sugar plantations.

¹³¹ Moisés Álvarez (2018, November 15) Arab Migration to the Dominican Republic, País Dominicano newspaper.

¹³² Schwarz Coulange Méroné: Elementos sociohistóricos para entender la migración haitiana a República Dominicana, Papeles de Población, Toluca 2018.

6.3.37.5 Cultural and architectural heritage of Monte Cristi and Pepillo Salcedo

In general, the municipalities of San Fernando de Monte Cristi and Pepillo Salcedo share the cultural traits that characterize the Dominican nation, with the specificities that derive from their location in the border region and their historical development.

A crucial factor linked to the historical and cultural heritage of San Fernando de Monte de Cristi is what is known as the Monte Cristi Manifesto, which is a document that sets out the ideas on which the Cuban Revolutionary Party based itself to organize the Cuban War of Independence in 1895. It was signed by José Martí and Máximo Gómez on March 25, 1895 in this locality.

That is why the city of Monte Cristi has a museum in the house where Máximo Gómez lived, where objects and letters related to José Martí's two visits to this city are exhibited. There is also a small library. This museum depends on the Municipal City Hall and represents one of the main places of historical-cultural value of the city.

Among the architectural heritage of the city of San Fernando de Monte Cristi, the Victorian style buildings also stand out, although it is noteworthy that most of these buildings require recovery and restoration actions.

Another cultural heritage of this municipality is its municipal clock, an iron structure that is a symbol of the city. This clock was manufactured in France by the famous watchmaker Paul Garnier at a cost of 15,000 Mexican pesos and inaugurated in 1895. It is said that Máximo Gómez and José Martí were present at its inauguration, and that the latter pointed out that the clock would mark the hour of Cuba's independence.

On the other hand, San Fernando de Monte Cristi has a very specific carnival tradition, which consists of the duel between the bulls and the civilians, *with foetes (sisal or cabuya whips)*.

Other picturesque traditions that are present in the carnival in Monte Cristi are common to traditions in other areas of the country, such as the *Roba la Gallina* character, which is a grotesque character, with a rickety umbrella, who walks from one side to the other shouting: "Roba la Gallina", to which the rest of the comparsa responds "Palos con ella" (Sticks with her).

Also among the traditions of this municipality are the patron saint festivities of San Fernando, which are celebrated on May 30 with religious ceremonies.

The gastronomy of the entire province is of great variety, especially the food products that come from fishing, such as seafood stews and other dishes such as shrimp, lobsters, lambí, spider crabs, octopus, grouper, chillo, mullets, tilapia, crab and others.

Another representative dish of the province is made from goat, which consists of goats cooked in different ways: baked, salted (it is known as bacon), stewed, in locrio, sancocho, stewed, steamed, among others.

As for drinks, the following are worth mentioning: milky milkshake, oat juice with lemon, punch, ginger tea, "mabí de las inglesitas", among others.

The main architectural heritage of the municipality of Pepillo Salcedo is associated with the past presence of the Grenada Company, which introduced the construction of buildings with a mixture

of stone and cement that is very characteristic of this municipality, particularly in its urban area (Photo 76 in Annex 14).

It is also a historical and cultural heritage of this municipality the placement of the pyramid number 1 of the 311 that mark the border line between the Dominican Republic and the Republic of Haiti.

In terms of cultural traditions, the municipality of Pepillo Salcedo celebrates its patron saint festivities in honor of the Sacred Heart of Jesus, which is the name of its parish. These festivities begin on October 11 and last until November, celebrating different activities, among them, the election of the Queen of these festivities, the celebration of a mass in honor of the Sacred Heart of Jesus, popular games in the municipal park (palo ensebado) and athletic competitions.

In relation to music, the musicians and singers from Monte Cristo, among which we can mention:

Musicians

- **Manuel Rueda**, pianist.
- **Luis Rivera (1901-1986)**. Musician and composer. He was the first Dominican conductor to direct the National Choir. He composed the Dominican Rhapsody No. 1 for piano and orchestra. He conducted the music band of the National Police and for a time the orchestra of Cuban Ernesto Lecuona, the greatest figure of Cuban music. He published the *Antología Musical de la Era de Trujillo, 1930-1960*.
- **Gaspar Eugenio Isidor Silva (1918-1993)**. Gaspar Eugenio Isidor Silva was considered one of the greatest musicians of the Province of Montecristi and one of the promoters of music and choral singing in the Northwest Region during his lifetime.

From an early age he shared his time in school, music, tailoring, commerce and basketball, being a member of the team "Los Piratas de Montecristi". At the end of the 1930's he founded and directed the Selene Orchestra. Maestro Gaspar was a pendolista and because of his great musical ear he was able to write dictated music. This ability allowed him to play the hits of the moment because his repertoire was renewed by listening to the songs of Radio Habana Cuba and the Voice of the United States. La Selene remained active until 1952.

He participated in musical groups and distinguished himself for his outstanding ability with the clarinet and saxophone, earning the nickname 'Pico de oro'. In 1955 he was appointed director of the Municipal Band of Montecristi. In 1960 he founded the "Combo Sublime", a group that brought together young musicians of great value.

His contributions in the educational area were very significant; he was, for many years, Professor of Music at the Rosa Smester School, director of the Municipal Music Band, Professor of the Music Academy of the City Hall and Regional Director of School Singing of the Secretary of Education.

His legacy has left great traces in his hometown. Examples of that legacy are: Domingo Lora, Carlitos Castillo, Erasmo Vargas (Compay), Puro Vargas (Purito), Billo Sánchez, José Porfirio Báez (Achin), Julito Peña (El Flecu), Tian Rojas, Monchito Vargas (Bulu), Pancho Tejeda, Claudio Castillo, Veloy Castillo, José Rivera, José Virgil, Antonio Vargas (el cacato), Bolívar

de la Cruz (Poyoyo), Darío Peña (Paparín), Fredy Tavera, Ramón Marte, Víctor De La Cruz (Vitico), Geraldo Álvarez (Kaquito), Arturito Pelegrín, Manuel Virgil (Mañe), Jesús María Sosa, among others.

- **Nicanor Rivera.**
- **Chichi Sanchez.**
- **José Rivera,** Tulile's father.
- **Manuel - Manny - Rivera** (Tulile) (He grew up in Monte Cristi).

Singers:

- **Xiomara Fortuna** (native of the Santa Barbara neighborhood of Monte Cristi).
- **Fabio Sanabia.**
- **Aquiles de la Rosa.**
- **Alicia Paniagua.**
- **Eduard Domínguez.**
- **Arismendy Miguel.**
- **Julio Grisanty.**
- **Claudio Santiago.**

Typical merengueros:

- **Tato Martínez** (Villa Vásquez).
- **Héctor Jiménez Ortiz** (Villa Vásquez).
- **Narciso Francisco** (Villa Vásquez).
- **Pedro Lantigua.**
- **Gina Castillo.**

Bachateros:

The community of Santa María has the particularity of having given the country three renowned bachateros, who are the following:

- **Manni Yovanny.**
- **Félix Valoy Castillo** (El Gato de la Bachata).

Félix José (El Soberano de la Bachata)". (Province of Monte Cristi, 2022)

6.3.37.6 Churches

Although there are some evangelical churches throughout the project's area of influence, as in the rest of the country, the Catholic Church has the strongest presence, and its rituals and beliefs are the most deeply rooted.

The Sagrado Corazón de Jesús Church (Photo 77), located in the urban area of Pepillo Salcedo, was founded in the 1940s, while the Copey Church (Photo 78) was founded in 1923 and became a pilgrimage site for visitors from other parts of the country (See Annex 14).

6.3.38 Archaeological prospection

At the request of Manzanillo Energy, S.A., an archaeological survey was conducted at the Manzanillo Energy Consortium Power Plant Project, in the municipality of Pepillo Salcedo (Manzanillo), Monte Cristi province, Dominican Republic.

The objective of this research has been to determine the presence or not of archaeological sites within the area under study, and if there are any, to locate their geographic position and to propose, if considered pertinent, strategies for their evaluation and possible rescue.

No sites with pre-Hispanic or colonial archaeological material were located during this survey.

6.3.38.1 Methodology

The survey was conducted from Sunday, 20 and until Thursday, November 24, 2022, considering, as a fundamental criterion, the spatial location of the archaeological sites, since it allows to characterize, in a general way, the settlement patterns. In addition, this information was considered within a regional context that allows a level of analysis where interactions and relationships of these cultural groups with other groups or regions can be established.

Several stages were followed in the process of identification and evaluation of the archaeological sites:

Compilation of secondary information: In this activity the following aspects were worked on:

- ✓ *Bibliographic review.* In various publications, newspapers, magazines, books, as well as in the Bulletins of the Museo del Hombre Dominicano, information on archaeological works that have been carried out in this province was consulted in order to assess the archaeological problems and the characteristics of the sites.
- ✓ *Cartography review.* This was carried out based on the study of topographic and satellite photogrammetry maps from Google Earth, as well as maps developed by the National Statistics Office of the Dominican Republic, in order to identify, based on the relief, the characteristics of the area in addition to geomorphological aspects, as well as data on political divisions, etc. Relationships with water sources and the location with respect to specific areas for the exploitation of the environment and the obtaining of resources and raw materials were also observed. This allowed inferences to be made about places suitable for occupation.

Personal communication with area specialists and locals: During the research phase, both in the field¹³³ and in the office, direct contacts were established with other archaeologists, documentary researchers, speleologists and historians, who had worked on aspects related to their specialty in both the broad area of study (province of Montecristi) and in the strict zone (specific area planned for the survey).

Archaeological Prospecting in the area under study: A surface reconnaissance or archaeological prospecting was carried out in order to locate possible archaeological sites within the area under study.

133 Robinson Jiménez and Ramy Rodríguez Castillo served as local informants.

This area was previously selected by the developers of the Manzanillo Energy Consortium Power Plant project, so the search for sites with archaeological material was very specific and direct. In the Figures 1 to 8 of Annex 15.3: Figures of the archaeologically prospected sites by quadrants show the sectors into which the area occupied by the project was divided for prospecting.

The following indicators were also taken into consideration:

- ✓ *Relief.* Within the characteristics of the relief, terraces in flat areas and areas with possible caves, petroglyphs and pictographs were recorded.
- ✓ *Proximity to water sources.* Areas near rivers and bodies of water were taken into consideration.
- ✓ *Type of soils.* They are related to agricultural activities or other types of exploitation as sources of raw materials or other resources.
- ✓ *Proximity to natural resource areas.* These are related to the presence of ecological niches, forest areas, mangrove, etc.
- ✓ *Strategic position.* Places with visual domain of a wide territory, as well as those located in natural passage areas, or in limits between regions with different characteristics that allow access to a greater variety of resources.
- ✓ *Relationship with archaeological sites already identified and recorded.* The location of archaeological sites that have already been reported is an important indicator and serves as a reference for observing settlement patterns and as a guide for the potential location of other sites.

During this survey, the location of the sites was determined with respect to the studied area, their conservation status was also identified, and the expected impacts during the work were preliminarily identified.

The available cartographic information and the use of the GPS system (Georeferential Position System) provided georeferencing of each of the potential sites and identified deposits, which were carried out in the WGS84 datum system.

In addition, a photographic record of the research process was made and is presented in Annex 15.4: Photographic records of surveyed sites.

6.3.38.2 Historical background

The place where Monte Cristi is located was part of the Marién chiefdom, governed by the chief Guacanagarix.

Discovered by Christopher Columbus on his first voyage, when he sighted the mountain called El Morro, and remembering Jesus Christ on the mount of Golgotha, he called it Monte Cristo. Today it is one of the few towns that preserve the original name assigned by the Castilians upon their arrival.

Due to its convenient location (according to some), Columbus had the idea of founding his first settlement here, but when he found bodies of unburied corpses in the "Fuerte de la Navidad" (today Haiti), it was interpreted as a bad omen, so he decided that the first city of the New World should be founded further northeast (today in the area of Puerto Plata province), and called it "La Isabela", after the Queen of Castile Isabel La Católica.

The beginnings of Monte Cristi date back to 1506; it was a fishing village founded by Nicolás de Ovando. However, the date cited for its foundation is 1533, when it was repopulated by a group of sixty families from the Canary Islands, headed by Juan de Bolaños.

In 1545, thirty more families arrived.

In 1588 it is registered as one of the parishes that made up the island.

In 1606 Monte Cristi and Puerto Plata were destroyed by the so-called "Devastaciones de Osorio", ordered by the Spanish Crown to attack illegal trade on the north coast of the island. The populations, along with their material wealth, were moved to the east of the island and the town of Monte Plata was founded.

In 1751, after years of abandonment, the town of Monte Cristi was founded again by order of King Ferdinand VI of Bourbon, with the intention of taking advantage of its location with respect to maritime trade.

By decree No. 14 of July 24, 1884, which established its political-administrative territorial division into five departments and 29 commons, Monte Cristi was assigned as a common of the department of Santiago.

Law No. 4803 of September 9, 1907, published in Official Gazette No. 1821 of September 11, 1907, established that the Dominican territory was divided into provinces and these into common ones, among which was Monte Cristi with the common ones Monte Cristi, Sabaneta, Guayubín, Dajabón, Monción and Restauración.

Law No. 5220 on Territorial Division, enacted on September 21, 1959, maintained its status as a province, and constituted with the territories of the municipalities of Monte Cristi, Guayubín, Pepillo Salcedo and Villa Isabel, with the city of San Fernando de Monte Cristi as the provincial capital.

The territorial evolution of the province and its municipalities throughout its history is supported by the laws that gave rise to them, which are listed in the following table. (Table 6-190).

Table 6-190 Territorial evolution of the province and its municipalities throughout its history and legislation.

Date Created	No. Law	Territorial unit	Name
9-09-1907	4803c	Province	Monte Cristi
24-07-1844	14 +	Municipality	Monte Cristi
9-06-1845	40 c	Municipality	Monte Cristi
13-04-1974	647	Municipality	Castanets
16-12-2002	186-02	Municipal district	Palo Verde
9-05-1855	385	Municipality	Guayubín
17-07-1997	165-97	Municipal district	Villa Elisa
4-09-1997	189-97	Municipal district	Hatillo Palma
16-12-1999	115-99	Municipal district	Caná Chapeton

Date Created	No. Law	Territorial unit	Name
18-03-1985	268	Municipality	Las Matas de Santa Cruz
20-08-1949	2083	Municipality	Pepillo Salcedo
20-06-1938	1521	Municipality	Villa Vasquez
Note: The territorial units that have two allocations of laws, were created by decree or resolution, then this elevation was ratified by constitutional law. Symbolology: + Decree c Constitution of the Republic			

Source: Official Gazette of the Dominican Republic.

6.3.38.3 Archaeological background

In order to locate the different archaeological sites reported for the province of Monte Cristi a bibliographic review was carried out. Special interest was placed on each and every one of the archaeological sites reported and/or published.

We also consulted the "Registro de Sitios Arqueológicos" of the Museo del Hombre Dominicano, as well as the "Inventario de Materiales Arqueológicos en Depósito" (Inventory of Archaeological Materials in Deposit) (Polanco, 1981). (Polanco, 1981) of said museum, to verify if in the vicinity of the area, or in the province, there are any registered sites that had not yet been published. In this sense, contact was established with other archaeologists, as well as local informants, etc.

As a result of these documentary investigations,¹³⁴ presents the archaeological sites reported for the province of Monte Cristi. These sites were identified with the number that appears in parentheses, with 15 being the number that identifies the province and the other the number that identifies the site resulting from the research. In Annex 15.5: Archaeological Sites Reported for the province, a table and figures are presented with the list of archaeological sites registered by province, municipality, municipal district and "paraje".

Cristóbal Gómez, MC-1 (15.1)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 02 Villa Elisa, Section: 05 El Papayo. Coordinates: 264593E with 2192331N.

Reported by: (Ulloa Hung, Archaeology on the Northwest Line of Hispaniola. Landscapes, ceramics and interactions, 2014), (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

Humble Lopez (15.2)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 02 Villa Elisa, Section: 05 El Papayo. Coordinates: 265465E with 2190694N.

¹³⁴ Note: for more information on any of these archaeological sites, please refer directly to the sources (books, articles) listed in the bibliography at the end of this report.

Reported by: (Ulloa Hung, Archaeology on the Northwest Line of Hispaniola. Landscapes, ceramics and interactions, 2014), (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015)..

Tasajera (15.3)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 El Rincón, Paraje 002 Jaiquí. Coordinates: 234107E with 2195759N, approximate location.

Reported by: (Polanco, 1981, p. 1)., (Marichal B., 1994, p. 31), (Ortega E., 2005, pp. 410-411)..

Horse Saddle (15.4)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 El Rincón. Coordinates: 237795E with 2197220N, approximate location.

Reported by: (Krieger, The aborigines of the ancient island of Hispaniola, 1929)., (Krieger, Aboriginal indian pottery of the Dominican Republic, 1931), (Vega, 1973), (Perez Sanchez, 1978, p. 208), (Ortega E., 2005, p. 418)..

Rafo, MC-5 (15.5)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 02 Villa Elisa, Section: 05 El Papayo. Coordinates: 260811E with 2192784N.

Reported by: (Ulloa Hung, Archaeology on the Northwest Line of Hispaniola. Landscapes, ceramics and interactions, 2014), (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

Escalante (15.6)

Location: Province: 15 Monte Cristi, Municipality: 04 Las Matas de Santa Cruz, Municipal District: 01 Las Matas de Santa Cruz, Section: 02 Los Almaceyes. Coordinates: 237271E with 2169695N, approximate location.

Reported by: (Marichal B., 1994, p. 31)..

Don Julio, MC-7 (15.7)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 02 Villa Elisa, Section: 02 El Copey. Coordinates: 260071E with 2193739N.

Reported by: (Angeletti, Coppa, Genchi, & Petrucci, 2009), (Ulloa Hung, Archaeology on the Northwest Line of Hispaniola. Landscapes, Ceramics, and Interactions, 2014), (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

Sinencio's Path (15.8)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 El Rincón, Paraje 007 La Vereda de Sinencio. Coordinates: 237210E with 2200665N, approximate location.

Reported by: (Marichal B., 1994, p. 31)..

La Tina, MC-9 (15.9)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 02 Villa Elisa, Section: 02 El Copey. Coordinates: 260885E with 2194650N.

Reported by: (Ulloa Hung, Archaeology on the Northwest Line of Hispaniola. Landscapes, ceramics and interactions, 2014), (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

Papolo, MC-10 (15.10)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 02 Villa Elisa, Section: 05 El Papayo. Coordinates: 264287E with 2192340N.

Reported by: (Ulloa Hung, Archaeology on the Northwest Line of Hispaniola. Landscapes, ceramics and interactions, 2014), (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

Puerto Juanita, MC-11 (15.11)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 02 Villa Elisa, Section: 05 El Papayo, Paraje: 005 Puerto Juanita. Coordinates: 262405E with 2193238N.

Reported by: (Ulloa Hung, Archaeology on the Northwest Line of Hispaniola. Landscapes, ceramics and interactions, 2014), (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

Saladillo Lagoon (15.12)

Location: Province: 15 Monte Cristi, Municipality: 05 Pepillo Salcedo, Municipal District: 01 Pepillo Salcedo, Section: 02 Carbonera. Coordinates: 215372E with 2176525N, approximate location.

Reported by: (Marichal B., 1994, p. 31)..

José Enrique Quiñones, MC-13 (15.13)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 02 Villa Elisa, Section: 05 El Papayo. Coordinates: 264800E with 2191227N.

Reported by: (Ulloa Hung, Archaeology on the Northwest Line of Hispaniola. Landscapes, ceramics and interactions, 2014), (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

Jobo Corcobado (15.14)

Location: Province: 15 Monte Cristi, Municipality: 02 Castañuelas, Municipal District: 01 Castañuelas, Section: 03 Loma de Castañuelas. Coordinates: 238169E with 2181113N, approximate location.

Reported by: (Museum of Dominican Man, Survey, 1976)..

Las Cuevas de Rafo, MC-15 (15.15)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 02 Villa Elisa, Section: 05 El Papayo. Coordinates: 261666E with 2192784.

Reported by: (Ulloa Hung, Archaeology on the Northwest Line of Hispaniola. Landscapes, ceramics and interactions, 2014), (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

Rafael Quiñones, MC-16 (15.16)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 02 Villa Elisa, Section: 05 El Papayo. Coordinates: 264478E with 2191075N.

Reported by: (Ulloa Hung, Archaeology on the Northwest Line of Hispaniola. Landscapes, ceramics and interactions, 2014), (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-117 (15.17)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 Rincón. Coordinates: 235327E with 2198288N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-118 (15.18)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 Rincón. Coordinates: 231182E with 2201744N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-119 (15.19)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 Rincón. Coordinates: 231143E with 2201526N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-120 (15.20)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 Rincón. Coordinates: 232276E with 2201397N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

La Paloma I, MC-21 (15.21)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 03 Hatillo Palma, Section: 03 Los Derramaderos, Paraje: 009 Loma La Paloma. Coordinates: 268013E with 2188846N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-122 (15.22)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 Rincón. Coordinates: 237387E with 2202918N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-123 (15.23)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 Rincón. Coordinates: 236537E with 2203132N.

Reported by: (Herrera Malatesta, 2018).

Hatillo Palma, MC-24 (15.24)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 03 Hatillo Palma, Section: 02 Hatillo Palma. Coordinates: 271024E with 2173262N.

Reported by: (Boyrie Moya, Memoria de las actividades realizadas durante al año 1959, 1959), (Boyrie Moya, Five years of Dominican archaeology, 1960), (Ortega & Veloz Maggiolo, Excavación arqueológica en el vasto residuario indígena de Hatillo Palma, 1971-1972), (Ortega & Veloz Maggiolo, Excavación arqueológica en el vasto residuario indígena de Hatillo Palma, 1971-1972), (Veloz Maggiolo, 1972, pp. 301-308), (Ortega E. Emil de Boyrie Moya" Pioneer of

archaeology in the Northwest Region of the Dominican Republic, 1974, pp. 37-38, 144).. (Morbán Laucer, 1979), (Polanco, 1981, p. 6)., (Marichal B., 1994, pp. 24-27)., (Ortega E., 2005, pp. 382-394), (Ulloa Hung, Archaeology on the Northwest Line of Hispaniola. Landscapes, ceramics and interactions, 2014), (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015)., (Herrera Malatesta, 2018).

MC-125 (15.25)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 03 Los Conucos. Coordinates: 247065E with 2194805N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-126 (15.26)

Location: Province: 15 Monte Cristi, Municipality: 05 Pepillo Salcedo (Manzanillo), Municipal District: 01 Pepillo Salcedo (Manzanillo), Section: 01 Pepillo Salcedo (Manzanillo). Coordinates: 211809E with 2179253N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

Las Canas, MC-27 (15.27)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 03 Los Conucos. Coordinates: 246401E with 2194934N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

El Lechosal, MC-128 (15.28)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 Rincón. Coordinates: 235171E with 2200243N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

Lucrecio Gonzalez, MC-29 (15.29) Lucrecio Gonzalez, MC-29

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 Rincón. Coordinates: 239299E with 2200265N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

Rufino Martínez, MC-30 (15.30)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 Rincón. Coordinates: 239354E with 2199599N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

Pedrito Martinez, MC-31 (15.31)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 04 Villa García. Coordinates: 239960E with 2198849N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

Victorian, MC-32 (15.32)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 04 Villa García. Coordinates: 242123E with 2199624N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

Juan de Dios Rosario, MC-33 (15.33)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 03 Los Conucos. Coordinates: 248227E with 2195625N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

La Poza, MC-34 (15.34)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 03 Los Conucos. Coordinates: 245718E with 2199479N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

La Poza 2, MC-35 (15.35)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 03 Los Conucos. Coordinates: 245374E with 2199084N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

La Piedra, MC-36 (15.36)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 03 Los Conucos. Coordinates: 246265E with 2199429N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

El Peñon, MC-37 (15.37)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 01 Guayubín, Section: 04 Sabana Cruz. Coordinates: 256372E with 2192041N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018)

El Cayal I, MC-38 (15.38)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 01 Guayubín, Section: 04 Sabana Cruz, Paraje: 003 El Cayal. Coordinates: 254894E with 2194091N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

El Cayal II, MC-39 (15.39)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 01 Guayubín, Section: 04 Sabana Cruz, Paraje: 003 El Cayal. Coordinates: 255877E with 2192943N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

Cesar Gonzales, MC-40 (15.40)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 01 Guayubín, Section: 04 Sabana Cruz. Coordinates: 253874E with 2191517N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

Percio Cruz, MC-41 (15.41)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 01 Guayubín, Section: 04 Sabana Cruz. Coordinates: 255106E with 2190735N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

La Parcela, MC-42 (15.42)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 01 Guayubín, Section: 04 Sabana Cruz. Coordinates: 252890E with 2192150N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

Pablillo Key, MC-43 (15.43)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 04 Las Peñas. Coordinates: 220652E with 2201150NN.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-44 (15.44)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 04 Villa García. Coordinates: 242376E with 2197331N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC45 (15.45)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 04 Villa García. Coordinates: 240551E with 2201405N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-46 (15.46)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 04 Villa García. Coordinates: 239962E with 2202289N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-47 (15.47)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 04 Villa García. Coordinates: 241598E with 2200896N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-48 (15.48)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 04 Villa García. Coordinates: 241869E with 2201363NNN.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-49 (15.49)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 04 Villa García. Coordinates: 239666E with 2199479N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-50 (15.50)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 Rincón. Coordinates: 235236E with 2202913N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-51 (15.51)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 04 Villa García. Coordinates: 243490E with 2200726N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-52 (15.52)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 Rincón. Coordinates: 234399E with 2197969N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-53 (15.53)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 04 Villa García. Coordinates: 243002E with 2199074N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-54 (15.54)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 04 Villa García. Coordinates: 242895E with 2198958N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-116 (15.55)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 Rincón. Coordinates: 234989E with 2198336N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-56 (15.56)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 04 Villa García. Coordinates: 242181E with 2198415N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-57 (15.57)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 03 Los Conucos. Coordinates: 247102E with 2194782N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-58 (15.58)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 04 Villa García. Coordinates: 243250E with 2199367N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-59 (15.59)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 04 Villa García. Coordinates: 242977E with 2200644N.

Reported by: (Herrera Malatesta, 2018).

Maboa Hill, MC-60 (15.60)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 01 Guayubín, Section: 04 Sabana Cruz. Coordinates: 254633E with 2189407N.

Reported by: (Olsen Bogaert, 2011), (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-61 (15.61)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 01 Guayubín, Section: 04 Sabana Cruz. Coordinates: 256011E with 2188862N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-62 (15.62)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 01 Guayubín, Section: 04 Sabana Cruz. Coordinates: 252246E with 2194432N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-63 (15.63)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 01 Guayubín, Section: 04 Sabana Cruz. Coordinates: 252525E with 2191185N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-64 (15.64)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 01 Guayubín, Section: 04 Sabana Cruz. Coordinates: 253014E with 2191808N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-65 (15.65)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 04 Villa García. Coordinates: 244079E with 2198528N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-66 (15.66)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 03 Los Conucos. Coordinates: 246477E with 2198891N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-67 (15.67)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 03 Los Conucos. Coordinates: 250009E with 2195833N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-68 (15.68)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 03 Los Conucos. Coordinates: 249850E with 2195820N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-69 (15.69)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 Rincón. Coordinates: 235401E with 2203421N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-70 (15.70)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 03 Los Conucos. Coordinates: 250175E with 2195745N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-71 (15.71)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 02 Villa Elisa, Section: 05 El Papayo. Coordinates: 258631E with 2193696N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-72 (15.72)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 03 Los Conucos. Coordinates: 249947E with 2197764N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-73 (15.73)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 02 Villa Elisa, Section: 05 El Papayo. Coordinates: 261266E with 2191725N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-74 (15.74)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 04 Las Peñas. Coordinates: 223158E with 2187236.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-75 (15.75)

Location: Province: 15 Monte Cristi, Municipality: 05 Pepillo Salcedo (Manzanillo), Municipal District: 01 Pepillo Salcedo (Manzanillo), Section: 01 Pepillo Salcedo (Manzanillo). Coordinates: 211166E with 2180840N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-76 (15.76)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 04 Las Peñas. Coordinates: 221429E with 2191200N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-77 (15.77)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 Rincón. Coordinates: 227859E with 2200936N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-78 (15.78)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 04 Las Peñas. Coordinates: 221913E with 2194262N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-79 (15.79)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 04 Las Peñas. Coordinates: 223646E with 2201065N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-80 (15.80)

Location: Province: 15 Monte Cristi, Municipality: 05 Pepillo Salcedo (Manzanillo), Municipal District: 01 Pepillo Salcedo (Manzanillo), Section: 01 Pepillo Salcedo (Manzanillo). Coordinates: 211899E with 2179530N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-81 (15.81)

Location: Province: 15 Monte Cristi, Municipality: 05 Pepillo Salcedo (Manzanillo), Municipal District: 01 Pepillo Salcedo (Manzanillo), Section: 01 Pepillo Salcedo (Manzanillo). Coordinates: 211356E with 2179817N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-82 (15.82)

Location: Province: 15 Monte Cristi, Municipality: 05 Pepillo Salcedo (Manzanillo), Municipal District: 01 Pepillo Salcedo (Manzanillo), Section: 01 Pepillo Salcedo (Manzanillo). Coordinates: 211617E with 2181131N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-83 (15.83)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 03 Las Aguas. Coordinates: 226694E with 2186949N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-84 (15.84)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 03 Las Aguas. Coordinates: 223868E with 2187796N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-85 (15.85)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 01 Guayubín, Section: 04 Sabana Cruz. Coordinates: 253242E with 2190565N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-86 (15.86)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 El Rincón. Coordinates: 229238E with 2201229N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-87 (15.87)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 El Rincón. Coordinates: 229941E with 2202091N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-88 (15.88)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 04 Las Peñas. Coordinates: 222909E with 2201510N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-89 (15.89)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 04 Las Peñas. Coordinates: 223980E with 2192962.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-90 (15.90)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 El Rincón. Coordinates: 236910E with 2203001N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-91 (15.91)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 El Rincón. Coordinates: 231040E with 2202897N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018)

MC-92 (15.92)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 El Rincón. Coordinates: 229523E with 2201866N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-93 (15.93)

Location: Province: 15 Monte Cristi, Municipality: 05 Pepillo Salcedo (Manzanillo), Municipal District: 01 Pepillo Salcedo (Manzanillo), Section: 01 Pepillo Salcedo (Manzanillo). Coordinates: 222892E with 2175793N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-94 (15.94)

Location: Province: 15 Monte Cristi, Municipality: 05 Pepillo Salcedo (Manzanillo), Municipal District: 02 Santa María, Section: 01 Santa María. Coordinates: 227843E with 2174946N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-95 (15.95)

Location: Province: 15 Monte Cristi, Municipality: 05 Pepillo Salcedo (Manzanillo), Municipal District: 02 Santa María, Section: 01 Santa María. Coordinates: 232036E with 2172805N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-96 (15.96)

Location: Province: 15 Monte Cristi, Municipality: 05 Pepillo Salcedo (Manzanillo), Municipal District: 02 Santa María, Section: 01 Santa María. Coordinates: 227980E with 2174743N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-97 (15.97)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 01 Guayubín, Section: 04 Sabana Cruz. Coordinates: 248506E with 2171381N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-98 (15.98)

Location: Province: 15 Monte Cristi, Municipality: 05 Pepillo Salcedo (Manzanillo), Municipal District: 01 Pepillo Salcedo (Manzanillo), Section: 01 Pepillo Salcedo (Manzanillo). Coordinates: 211382E with 2178728N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-127 (15.99)

Location: Province: 15 Monte Cristi, Municipality: 05 Pepillo Salcedo (Manzanillo), Municipal District: 01 Pepillo Salcedo (Manzanillo), Section: 01 Pepillo Salcedo (Manzanillo). Coordinates: 211257E with 2178440N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-100 (15,100)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 01 Guayubín, Section: 04 Sabana Cruz. Coordinates: 252483E with 2190920N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-101 (15,101)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 04 Las Peñas. Coordinates: 217937E with 2188127N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-102 (15,102)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 04 Las Peñas. Coordinates: 217298E with 2188350N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-103 (15,103)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 04 Villa García. Coordinates: 240030E with 2199822N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-104 (15,104)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 04 Villa García. Coordinates: 241349E with 2199198N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-105 (15,105)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 04 Las Peñas. Coordinates: 216533E with 2193455N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-106 (15,106)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 El Rincón. Coordinates: 228235E with 2200386N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-107 (15,107)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 El Rincón. Coordinates: 237286E with 2198719N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-108 (15,108)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 El Rincón. Coordinates: 236788E with 2198783N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-109 (15,109)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 El Rincón. Coordinates: 238124E with 2198515N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-110 (15,110)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 El Rincón. Coordinates: 238071E with 2198262N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-111 (15,111)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 04 Villa García. Coordinates: 243663E with 2198735N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-112 (15,112)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vásquez, Municipal District: 01 Villa Vásquez, Section: 04 Villa García. Coordinates: 241947E with 2197651N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-113 (15,113)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 01 Guayubín, Section: 04 Sabana Cruz. Coordinates: 251586E with 2191424N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-114 (15,114)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 01 Guayubín, Section: 04 Sabana Cruz. Coordinates: 251208E with 2192670N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

MC-115 (15,115)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District: 01 Monte Cristi, Section: 02 El Rincón. Coordinates: 236253E with 2198131N.

Reported by: (Ulloa Hung & Herrera Malatesta, Investigaciones arqueológicas en el norte de La Española, entre viejos esquemas y nuevos datos, 2015), (Herrera Malatesta, 2018).

Reed Creek (15,116)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 03 Hatillo Palma, Section: 03 Los Derramaderos, Paraje 004 Arroyo Caña. Coordinates: 273486E with 21881822N, approximate location.

Reported by: (Hoy Newspaper, 1984), (El Sol, 1984), (Ultima Hora, La Tarde Alegre, 1984), (Ortega, Pierre, & Olsen Bogaert, New Archaeological Sites in Arroyo Caña, 1985), (Ortega, Denis, & Olsen Bogaert, Nuevos yacimientos arqueológicos en Arroyo Caña, 1990), (Ortega E., 2005, pp. 412-417)..

The Waters of Gualterio (Walterio) (15,117)

Location: Province: 15 Monte Cristi, Municipality: 01 Monte Cristi, Municipal District 01 Monte Cristi, Section: 03 Las Aguas, Paraje 008 Batey Walterio. Coordinates: 225595E with 2186759N, approximate location.

Reported by: (Boyrie Moya, Memoria de las actividades realizadas durante al año 1959, 1959).., (Boyrie Moya, Five years of Dominican archaeology, 1960), (Ortega E. Emil de Boyrie Moya, Pioneer of Archaeology in the Northwest Region of the Dominican Republic, 1974, pp. 38-44).., (Museo del Hombre Dominicano, Fragmento, 1976), (Ortega Álvarez, 1987, pp. 348-349, 413), (Ortega E., 2005, pp. 395-399)..

Good Man (15,118)

Location: Province: 15 Monte Cristi, Municipality: 06 Villa Vázquez, Municipal District: 01 Villa Vázquez, Section: 03 Los Conucos, Paraje 002 Buen Hombre. Coordinates: 248368E with 2197482N, approximate location.

Reported by: (Rimoli, Veloz, Ortega, & Marichal, 1974, pp. 14-33), (Polanco, 1981, p. 25), (Marichal B., 1994, pp. 27-31), (Ortega Álvarez, 1987, p. 414), (Ortega Álvarez, 1987, p. 414), (Ortega E., 2005, pp. 400-405)..

Cerro Gordo (15,119)

Location: Province: 15 Monte Cristi, Municipality: 03 Guayubín, Municipal District: 04 Cana Chapetón, Section: 03 Cerro Gordo. Coordinates: 25703E with 2171004N, approximate location.

Reported by: (Ortega E. , Localizan en Cerro Gordo un yacimiento mellacoide, 1972).., (Polanco, 1981, p. 20), (Ortega Álvarez, 1987, page 414), (Ortega E. , 2005, pp. 406-409)..

6.3.38.4 Results of the archaeological survey

An archaeological survey was conducted within the areas planned for the development of the "LNG Import Terminal with Storage and Regasification and Power Plant with a capacity of approximately 420 MW" project in the municipality of Pepillo Salcedo in the province of Montecristi, with the objective of locating possible archaeological sites within the same, georeferencing them, and proposing, if deemed appropriate, strategies for their study, conservation, and dissemination.

Table 6-191 presents the UTM coordinates of the surveyed sites and the results obtained during the surface reconnaissance and Figures 1 to 8 in Annex 15.6: Location of the archaeologically surveyed sites by quadrants, with the location of the surveyed sites by quadrants in the Google Earth image.

Table 6-191. Results of surveyed sites.

Site No.	Coordinates (WGS84)		Quadrants	Annex 15.4: Photographic records of surveyed sites	Location in Figure Annex 15.6: Location of archaeologically prospected sites by quadrants
	East	North			
1	212954	2180250	Negative	Photo No. 1	Figure 2 Detailed view, 1 of 7.
2	213006	2180240	Negative	Photo No. 2.	
3	213046	2180225	Negative	Photo No. 3.	
4	213112	2180155	Negative	Photo No. 4.	
5	213162	2180140	Negative	Photo No. 5.	
6	213209	2180118	Negative	Photo No. 6.	
7	213204	2180095	Negative	Photo No. 7.	
8	213160	2180078	Negative	Photo No. 8.	
9	213061	2180132	Negative	Photo No. 9.	
10	212978	2180161	Negative	Photo No. 10.	
11	212885	2180100	Negative	Photo No. 11.	
12	212868	2180053	Negative	Photo No. 12.	
13	212983	2180034	Negative	Photo No. 13.	
14	213086	2180034	Negative	Photo No. 14.	
15	213131	2179954	Negative	Photo No. 15.	
16	213100	2179857	Negative	Photo No. 16.	
17	213063	2179834	Negative	Photo No. 17.	
18	213080	2179957	Negative	Photo No. 18.	
19	212985	2179974	Negative	Photo No. 19.	
20	212922	2179886	Negative	Photo No. 20.	
21	212893	2179896	Negative	Photo No. 21.	
22	212834	2179922	Negative	Photo No. 22.	
23	212842	2179976	Negative	Photo No. 23.	

Site No.	Coordinates (WGS84)		Quadrants	Annex 15.4: Photographic records of surveyed sites	Location in Figure Annex 15.6: Location of archaeologically prospected sites by quadrants
	East	North			
24	212818	2179837	Negative	Photo No. 24.	
25	212833	2179822	Negative	Photo No. 25.	
26	212850	2179774	Negative	Photo No. 26.	Figure 3 Detailed view, 2 of 7.
27	212839	2179712	Negative	Photo No. 27.	
28	212895	2179673	Negative	Photo No. 28.	
29	212889	2179712	Negative	Photo No. 29.	
30	212920	2179693	Negative	Photo No. 30.	
31	212926	2179659	Negative	Photo No. 31.	
32	212945	2179646	Negative	Photo No. 32.	
33	212969	2179583	Negative	Photo No. 33.	
34	212985	2179530	Negative	Photo No. 34.	
35	213011	2179533	Negative	Photo No. 35.	
36	213033	2179559	Negative	Photo No. 36.	
37	213052	2179053	Negative	Photo No. 37.	
38	213081	2179459	Negative	Photo No. 38.	
39	213121	2179448	Negative	Photo No. 39.	
40	213099	2179430	Negative	Photo No. 40.	
41	213145	2179414	Negative	Photo No. 41.	
42	213144	2179386	Negative	Photo No. 42.	
43	213124	2179403	Negative	Photo No. 43.	
44	213188	2179354	Negative	Photo No. 44.	
45	213186	2179322	Negative	Photo No. 45.	
46	213187	2179927	Negative	Photo No. 46.	Figure 4 Detailed view, 3 of 7.
47	213234	2179254	Negative	Photo No. 47.	
48	213295	2179238	Negative	Photo No. 48.	
49	213297	2179263	Negative	Photo No. 49.	
50	213264	2179286	Negative	Photo No. 50.	
51	213253	2179298	Negative	Photo No. 51.	
52	213322	2179192	Negative	Photo No. 52.	
53	213292	2180524	Negative	Photo No. 53.	
54	213303	2179171	Negative	Photo No. 54.	
55	213347	2179185	Negative	Photo No. 55.	
56	213361	2179154	Negative	Photo No. 56.	
57	213347	2179129	Negative	Photo No. 57.	
58	213390	2179087	Negative	Photo No. 58.	
59	213384	2179114	Negative	Photo No. 59.	

Site No.	Coordinates (WGS84)		Quadrants	Annex 15.4: Photographic records of surveyed sites	Location in Figure Annex 15.6: Location of archaeologically prospected sites by quadrants
	East	North			
60	213470	2179065	Negative	Photo No. 60.	
61	213452	2179030	Negative	Photo No. 61.	
62	213591	2179014	Negative	Photo No. 62.	
63	213611	2179006	Negative	Photo No. 63.	
64	213558	2179020	Negative	Photo No. 64.	
65	213602	2178971	Negative	Photo No. 65.	
66	213588	2178974	Negative	Photo No. 66.	
67	213669	2178959	Negative	Photo No. 67.	
68	213655	2178895	Negative	Photo No. 68.	
69	213718	2178922	Negative	Photo No. 69.	
70	213737	2178943	Negative	Photo No. 70.	
71	213758	2178943	Negative	Photo No. 71.	
72	213823	2178874	Negative	Photo No. 72.	
73	213851	2178887	Negative	Photo No. 73.	
74	213911	2178866	Negative	Photo No. 74.	Figure 5 Detailed view, 4 of 7
75	213903	2178847	Negative	Photo No. 75.	
76	213960	2178818	Negative	Photo No. 76.	
77	213971	2178852	Negative	Photo No. 77.	
78	214051	2178814	Negative	Photo No. 78.	
79	214036	2178782	Negative	Photo No. 79.	
80	214147	2178739	Negative	Photo No. 80.	
81	214162	2178762	Negative	Photo No. 81.	
82	214253	2178717	Negative	Photo No. 82.	
83	214236	2178692	Negative	Photo No. 83.	
84	214343	2178668	Negative	Photo No. 84.	
85	214354	2178686	Negative	Photo No. 85.	
86	214440	2178654	Negative	Photo No. 86.	
87	214452	2178622	Negative	Photo No. 87.	
88	214545	2178618	Negative	Photo No. 88.	
89	214544	2178586	Negative	Photo No. 89.	
90	214628	2178572	Negative	Photo No. 90.	
91	214661	2178579	Negative	Photo No. 91.	
92	214743	2178547	Negative	Photo No. 92.	Figure 6 Detailed view, 5 of 7
93	214756	2178527	Negative	Photo No. 93.	
94	214829	2178493	Negative	Photo No. 94.	
95	214833	2178521	Negative	Photo No. 95.	

Site No.	Coordinates (WGS84)		Quadrants	Annex 15.4: Photographic records of surveyed sites	Location in Figure Annex 15.6: Location of archaeologically prospected sites by quadrants
	East	North			
96	214947	2178517	Negative	Photo No. 96.	
97	214949	2178484	Negative	Photo No. 97.	
98	215052	2178536	Negative	Photo No. 98.	
99	215091	2178514	Negative	Photo No. 99.	
100	215157	2178574	Negative	Photo No. 100.	
101	215157	2178574	Negative	Photo No. 101.	
102	215273	2178582	Negative	Photo No. 102.	
103	215263	2178610	Negative	Photo No. 103.	
104	215377	2178609	Negative	Photo No. 104.	
105	215374	2178644	Negative	Photo No. 105.	
106	215492	2178629	Negative	Photo No. 106.	
107	215450	2178640	Negative	Photo No. 107.	
108	215540	2178640	Negative	Photo No. 108.	Figure 7 Detailed view, 6 of 7
109	215512	2178614	Negative	Photo No. 109.	
110	215648	2178612	Negative	Photo No. 110.	
111	215667	2178646	Negative	Photo No. 111.	
112	215748	2178611	Negative	Photo No. 112.	
113	215763	2178641	Negative	Photo No. 113.	
114	215869	2178618	Negative	Photo No. 114.	
115	215864	2178638	Negative	Photo No. 115.	
116	215942	2178621	Negative	Photo No. 116.	
117	215954	2178649	Negative	Photo No. 117.	
118	216005	2178635	Negative	Photo No. 118.	
119	216043	2178611	Negative	Photo No. 119.	
120	216043	2178630	Negative	Photo No. 120.	
121	216034	2178594	Negative	Photo No. 121.	
122	216177	2178525	Negative	Photo No. 122.	
123	216195	2178545	Negative	Photo No. 123.	
124	216236	2178516	Negative	Photo No. 124.	
125	216234	2178478	Negative	Photo No. 125.	
126	216241	2178440	Negative	Photo No. 126.	
127	216306	2178469	Negative	Photo No. 127.	Figure 8 Detailed view, 7 of 7
128	216277	2178477	Negative	Photo No. 128.	
129	216332	2178449	Negative	Photo No. 129.	
130	216304	2178435	Negative	Photo No. 130.	
131	216395	2178406	Negative	Photo No. 131.	

Site No.	Coordinates (WGS84)		Quadrants	Annex 15.4: Photographic records of surveyed sites	Location in Figure Annex 15.6: Location of archaeologically prospected sites by quadrants
	East	North			
132	216386	2178395	Negative	Photo No. 132	
133	216414	2178383	Negative	Photo No. 133.	
134	216450	2178389	Negative	Photo No. 134.	
135	216447	2178411	Negative	Photo No. 135.	
136	216529	2178349	Negative	Photo No. 136	
137	216537	2178380	Negative	Photo No. 137.	
138	216633	2178338	Negative	Photo No. 138.	
139	216680	2178309	Negative	Photo No. 139.	
140	216712	2178295	Negative	Photo No. 140.	
141	216718	2178323	Negative	Photo No. 141	
142	216780	2178305	Negative	Photo No. 142.	
143	216790	2178288	Negative	Photo No. 143.	
144	216771	2178282	Negative	Photo No. 144.	
145	216815	2178268	Negative	Photo No. 145.	
146	216817	2178288	Negative	Photo No. 146.	
147	216831	2178274	Negative	Photo No. 147.	
148	216834	2178294	Negative	Photo No. 148.	
149	216849	2178283	Negative	Photo No. 149.	

Source: Prepared by EMPACA, 2023.

6.3.38.5 Conclusion

During the development of the archaeological survey conducted for Manzanillo Energy, S.A., in the area planned for the development of the Manzanillo Energy Consortium Power Plant project, no pre-Hispanic or colonial archaeological sites were located in the area related to the construction of the power plant and the electric transmission route, so the archaeological survey conducted in the area under study is considered to have negative results in this regard.

The survey conducted within the prospected area did not reveal the presence of archaeological artifacts or any evidence of rock art. Therefore, we recommend that this project, in accordance with the laws in force in the Dominican Republic on archaeological heritage, be approved for execution with the observation that no archaeological prospecting or survey can cover the surface and subsoil of an area one hundred percent.

If in the course of any soil removal any archaeological artifact is found, the action should be suspended in the specific area and the Museum of Dominican Man should be contacted so that one of its archaeologists can attend to the situation and proceed with systematic rescue excavations.

7. IDENTIFICATION AND ASSESSMENT OF ENVIRONMENTAL AND SOCIAL IMPACTS

This chapter quantifies and qualifies the risks and positive and negative impacts that will be caused by the actions of the construction and operation phases of the Manzanillo Energy Consortium Power Plant project.

The area of influence corresponds, according to the International Finance Corporation (IFC), to "the area likely to be affected by both on-site and off-site impacts from project activities, assets and facilities, including related facilities. It is in this territory where the potential impacts derived from the development of the project on any of its physical, biological, socioeconomic or historical-cultural components could manifest themselves.

The areas of influence of the project are defined below:

- ✓ The area of influence of the project on the physical-biotic elements includes the area of land where the thermoelectric plant will be built plus a perimeter strip of 1000 meters measured from its limits, as well as the space occupied by the transmission line to the National Interconnected Electric System and its easement strip, plus a strip of 300 meters measured on both sides of it.
- ✓ The area of influence on the socioeconomic elements includes the province of Monte Cristi as an indirect recipient of the identified impacts, while the municipalities of Pepillo Salcedo and Monte Cristi are identified as the territorial units where these impacts could be materialized more directly.

7.1 Methodologies used according to the nature of the action undertaken, the environmental and social variables affected and the environmental, social and health characteristics of the area of influence.

This section presents the methodologies used to identify and evaluate the potential environmental and social impacts associated with the project. The methodology used is intended to detect and identify potential negative and positive impacts that could be generated during the construction and operation phases of the project.

7.1.1 Identification of environmental and social risks and impacts

To identify the potential environmental impacts of the project, double-entry tables or interaction matrices (cause-effect) were prepared for the construction and operation phases, where the interrelationship between the project activities that generate impacts in each phase and the environmental elements were analyzed, without making value judgments. In these matrices, all the activities that are an integral part of the project were identified and placed on the columns.

Similarly, all the environmental elements were identified and placed on the row entries (interaction matrices 7.1 and 7.2, at the end of this chapter).

These matrices were made up of a total of twenty-two (22) main activities: ten (10) during the construction phase and twelve (12) during the operation phase; and thirteen (13) environmental elements affected (physical, biological and socioeconomic aspects) during the construction phase and fourteen (14) environmental elements affected during the operation phase. This arrangement originated a grid composed of cells, where each cell indicates a possible interaction between the activities and the elements. The existence of interactions was identified by placing a black dot (•) in the corresponding cell (matrices 7.1 and 7.2).

Subsequently, identification matrices were prepared (matrices 7.3 and 7.4 at the end of the chapter), where the impacts generated in each box where the presence of an interaction between environmental elements and project activities was identified.

7.1.2 Environmental and social risk and impact assessment.

The impact assessment was carried out by applying a modification, made by Lago Pérez (2004), of Conesa's (1995) methodology, based on the description of the Project's activities and the environmental baseline data, including the transformation of impact measurements that present incommensurable units, to commensurable values of environmental quality, where necessary. The evaluation of the impacts consisted of a matrix analysis, where their quantitative characterization was based on the analysis of a series of evaluation criteria (Table 7-1.)

Table 7-1. Summary of evaluation criteria

Impact Assessment Criteria				
	Valuation Criteria	Value	Classification	Impact
(CI)	Character of the Impact			
	Refers to the beneficial (+) or detrimental (-) effect of the different impacts that will have an effect on the environmental elements.	(+)	Positive	Generates benefits
		(-)	Negative	Produces affectations or alterations
		(+/-)	Neutral	Existing conditions are maintained
(I)	Impact intensity			
	(Degree of impact) Represents the amount or degree of incidence of the impact on the element in the specific area in which it acts.	(1)	Low	Minimal impact
		(2)	Medium	
		(4)	High	
		(8)	Very High	
		(12)	Total	Destruction of the element
(EX)	Extent of impact			
	Refers to the theoretical area of influence of the impact in relation to the project environment (% of the	(1)	Localized	Very localized effect on the AID
		(2)	Partial	Significant impact on DAI
		(4)	Extensive	Affects a large part of the IIA

Impact Assessment Criteria				
	Valuation Criteria	Value	Classification	Impact
	area with respect to the environment in which the effect is manifested).	(8)	Total	Generalized throughout the IIA
		(12)	Critical	The impact is manifested beyond the IIA.
(SI)	Synergy			
	This criterion considers the reinforcement of two or more single effects, which may generate successive and related effects that accentuate the consequences of the impact analyzed.	(1)	Non-synergistic	When an impact acting on one element does not affect other impacts acting on the same element.
		(2)	Synergistic	Moderate synergism
		(4)	Very Synergistic	Highly synergistic
(PE)	Persistence			
	Reflects the time the effect is supposed to last since its appearance	(1)	Temporary	Occurs during the construction phase and resources are recovered during or immediately after construction
		(2)	Medium persistence	Extends beyond the construction phase
		(4)	Permanent	Persists throughout the life of the project
(EF)	Effect			
	It is interpreted as the form of manifestation of the effect on an element as a consequence of an activity, in other words, it expresses the cause-effect relationship.	(D)	Direct	Its effect has an immediate and direct impact on some environmental element, being the representation of the activity a direct consequence of it.
		(I)	Indirect	Its manifestation is not direct from the activity, but takes place from a primary effect, acting as a second order activity.
(RO)	Risk of Occurrence			
	Characteristic that indicates the probability that an effect will be manifested in the environment.	(1)	Improbable	There are low expectations that the impact will be manifested.
		(2)	Likely	The forecasts of an impact are not clearly favorable or unfavorable.
		(4)	Very Likely	There are high expectations that the impact will be manifested

Impact Assessment Criteria				
	Valuation Criteria	Value	Classification	Impact
		(8)	Certain	Impact with 100% probability of occurrence
(AC)	Accumulation			
	This criterion or attribute gives an idea of the progressive increase in the manifestation of the effect when the action that generates it persists continuously or repeatedly.	(1)	Simple	It is the impact that is manifested on a single environmental element, or whose mode of action is individualized, without consequence in the induction of new effects, nor in that of synergy.
		(4)	Cumulative	It is the effect that, as the action of the inducing agent is prolonged in time, progressively increases its severity, since the medium lacks elimination mechanisms with a temporal effectiveness similar to that of the increase of the action causing the impact.
(RC)	Recoverability			
	Possibility of introducing corrective, protective and recovery measures. This refers to the possibility of total or partial reconstruction of the affected element as a result of the project, i.e. the possibility of returning to the initial conditions (prior to the action) by means of human intervention (introduction of corrective, protective or recovery measures).	(1)	Short Term Recoverable	Restoration of initial conditions in less than 1 year
		(2)	Recoverable in the medium term	Recovery of initial conditions between 1 and 10 years
		(4)	Mitigable	The effect can be partially recovered
		(8)	Irrecoverable	Alteration impossible to recover, both by natural and human action.
(RV)	Reversibility			
	Possibility of returning to initial conditions by natural means. Refers to the effect in which the alteration can be assimilated by the environment (measurably in the short, medium or long term) due to the functioning of natural processes, i.e. the possibility of returning to the initial conditions prior to the action by natural means.	(1)	Short Term	Return to baseline conditions in less than 1 year
		(2)	Medium Term	Return to baseline conditions between 1 and 10 years
		(4)	Irreversible	Impossibility or extreme difficulty to return by natural means to natural conditions, or to do so in a period longer than 10 years.
(IMP)	Importance			
	Quantity and quality of the resource affected	(1)	Low	The effect is manifested on a resource of small size and poor quality.

Impact Assessment Criteria				
	Valuation Criteria	Value	Classification	Impact
		(2)	Medium	The effect is manifested on a resource of regular extension and moderate quality.
		(4)	High	The effect is manifested on a resource of great extent and quality
Impact Assessment				
(SF)	• Significance of Effect			
	It is obtained from the quantitative evaluation of the criteria presented above.	$SF = \pm [3(I) + 2(EX) + SI + PE + EF + EF + RO + AC + RC + RV + IMP]$		
(CLI)	• Impact Rating			
	Based on the range analysis of the significance of effect (SO) rating	(L)	Low	If the value is less than or equal to 25
		(M)	Moderate	If the value is greater than 25 and less than or equal to 50
		(H)	High	If the value is greater than 50 and less than or equal to 75
		(VH)	Very High	If the value is greater than 75

Once the environmental impacts were evaluated, impact assessment matrices were prepared (see matrices 7-5 and 7-6 at the end of the chapter). The results obtained for each of the above criteria are used to determine the significance level (SF) for each of the impacts, using the following expression:

$$SF = \pm [3(I) + 2(EX) + SI + PE + EF + EF + RO + AC + RC + RV +$$

Finally, the level of significance was used to classify each of the impacts and to proceed to their hierarchical ranking, using the classification scale shown in the following table. (Table 7-2)

Table 7-2. Impact classification scale

Scale	Impact classification
≤25	Low (L)
>25 - ≤50	Moderate (M)
>50 - ≤75	High (H)
>75	Very High (VH)

7.2 Identification and assessment of project-specific environmental, social and health impacts and risks for construction and operation phases

7.2.1 Identification of project actions likely to have impacts

The following is an identification of the activities that will be carried out during the construction and operation phases of the project. Since the project does not contemplate an abandonment phase, no analysis has been made for this stage.

7.2.1.1 Actions for construction phases

The following are the activities identified for the Manzanillo Energy Consortium Power Plant project that will be carried out during the construction phase.

1. Mobilization of materials, equipment and machinery to the project site.
2. Installation of temporary construction facilities and demand for basic services during the construction phase.
 - Construction of roads and temporary perimeter fences.
 - Location of the temporary facilities camp.
 - Storage of construction materials.
 - Provision of parking spaces.
 - Water supply and consumption.
 - Generation and management of liquid waste.
 - Energy supply and consumption.
 - Fuel supply and consumption.
 - Generation and management of solid and oily waste.
 - Transportation of construction materials and other supplies.
3. Land conditioning.
 - Clearing and cleaning of vegetation and topsoil from the construction area.
 - Stripping or cutting of unusable material.
 - Stakeout.
 - Earth moving and excavations.
4. Construction of the thermoelectric power plant.
 - Construction of buildings.
 - Administration buildings.
 - Storage.
 - Maintenance/Control.
 - Installation of thermoelectric power plant equipment:
 - Gas turbine installation with generator.

- Steam turbine installation with generator.
- Installation of heat recovery steam generator (HRSG).
- Steam condenser.
- Desalination water plant.
- Saltwater cooling tower.
- Electricity transformer and elevator substation.

5. Construction of service infrastructure.

- Drinking water supply system.
- Wastewater treatment system.
- Surface drainage system.
- DC backup electrical system with battery bank and inverters.
- AC backup electrical system with emergency electrical generator.
- LNG supply system inside the thermoelectric power plant.
- Liquid fuel storage and distribution system.
- Compressed air system.
- Compressed gas system.
- Security system.
- Firefighting systems.
- Natural gas and other gas leak detection system.
- Telecommunications system.
- Road system and parking lots.

6. Construction of transmission line to the National Interconnected Electric System.

7. Connection to the National Grid.

8. Hiring of temporary labor force.

9. Withdrawal of temporary facilities.

10. Transportation of construction materials and waste.

7.2.1.2 Activities for the operation phase

The following are the activities identified for the Manzanillo Energy Consortium Power Plant project that will be carried out during the operation phase.

1. Start-up and operations of the thermoelectric power plant and the power transmission line.
2. Maintenance of facilities and equipment.
 - Thermoelectric power plant machinery.
 - Thermoelectric power plant facilities.
 - Electric transmission line.
3. Natural Gas management and consumption.
4. Liquid fuel handling and consumption.
5. Generation and management of hazardous and non-hazardous solid waste.
6. Generation and management of oily waste.

7. Water consumption and treatment.
8. Generation and treatment of industrial and domestic liquid waste generated.
9. Vector and rodent pest control.
10. Handling of chemical products.
11. Hiring of permanent labor force.

7.2.1.3 Activities for the closing phase

1. Dismantling of facilities and equipment.
2. Collection of solid (hazardous and non-hazardous), liquid and oily waste.
3. Transportation and final disposal of solid (mainly debris and scrap), liquid and oily waste collected, as well as dismantled equipment.

7.2.2 Identification of the environmental elements to be impacted

The environmental elements (physical-biotic, socioeconomic and perceptual) considered in the environmental impact assessment for the Manzanillo Energy Consortium Power Plant project are shown in Table 7-3.

Table 7-3. Elements of the environment.

Phase	Biophysical	Socioeconomic	Perceptual
Construction	Air. Weather. Soil. Vegetation. Fauna. Resources (water, energy resources and loan materials).	Population (workers and communities). Construction sector. Economy. Traffic and roads. Basic services infrastructure. Cultural heritage.	Landscape.
Operation	Air. Weather. Soil. Groundwater. Coastal waters. Terrestrial fauna. Marine biota. Resources (water and energy resources).	Land Use. Population (workers and communities). Economy. Energy System. Basic services infrastructure.	Landscape.

7.2.3 Identification of environmental impacts

The environmental impacts were identified considering the elements of the environment that will be affected by the activities of the construction and operation phases of the project.

Based on the preparation of the Interaction Matrices for the construction and operation phases (Matrices 7.1 and 7.2 at the end of this chapter), it was possible to define the list of potential

environmental impacts for the construction and operation phases and determine, through the preparation of the identification matrices for the construction and operation phases, the activities that would generate these impacts in each of the project phases (Identification Matrices 7.3 and 7.4 at the end of this chapter). See tables below.

Table 7-4. Identification of construction phase impacts

Element of the medium	Code	Impacts
Air	A-1	Increased concentration of particulate matter due to construction activities and transportation of materials.
	A-2	Increased noise and vibration levels due to construction activities and transportation of materials.
	A-3	Increased flue gas concentration from vehicle, heavy equipment and truck operations.
Weather	CL-1	Change or impact on climate due to greenhouse gas emissions from vehicle, heavy equipment and truck operations.
Soil	S-1	Possibility of soil contamination due to construction activities and deficiencies in the management of solid, liquid and oily waste.
	S-2	Risk of soil contamination from fuel and lubricant spills.
Vegetation	V-1	Disappearance of vegetation cover and loss of flora due to vegetation clearing for construction works, including individuals and populations of native, endemic and threatened species.
Terrestrial fauna	F-1	Loss of habitat for wildlife due to clearing.
	F-2	Impact on fauna due to construction activities that generate noise and dust and human presence.
Population (workers and communities)	PB-1	Improving the quality of life and purchasing power of the workers who will build the Project and their families.
	PB-2	Possibility of disturbance to residents due to increased noise and dust levels as a result of the Project's construction activities.
	PB-3	Possible exposure to diseases due to the influx of temporary or permanent labor.
	PB-4	Risk of physical injury or loss of life to residents arising from the use of force by Project physical security personnel.
	PB-5	Risk of accidents resulting in physical injury or loss of life to workers and residents as a consequence of the Project's construction activities.
	PB-6	Economic impact on beekeepers in the area due to land clearing.
	PB-7	Loss of area for goat grazing due to clearing of project lands.
Construction Sector	CT-1	Increased demand and use of construction materials and other inputs.
Economy	EC-1	Creation of temporary jobs.
	EC-2	Increase in the financial flow and commercial activity in the province of Montecristi due to the contracting of services.
	EC-3	Generation of income for the State and the Municipality of Pepillo Salcedo from the payment of taxes.
	EC-4	Temporary increase in demand for food services for Project workers.

Element of the medium	Code	Impacts
	EC-5	Temporary increase in demand for rooms in the municipality of Pepillo Salcedo for Project workers residing in distant areas.
	EC-6	Generate more income for the sector of the population employed in the motoconcho transport sector, which is the main means of transportation in the area.
Traffic and roads	TV-1	Increased truck and vehicle traffic on access roads.
	TV-2	Risk of traffic accidents resulting in physical injury or loss of life to workers and residents on access roads.
	TV-3	Possibility of deterioration of access roads due to the passage of trucks and equipment for the transport of construction materials and equipment.
Basic Services Infrastructure	IS-1	Increased demand for services provided by government entities during the construction phase of the project.
Cultural heritage	PC-1	Possibility of affecting unknown archaeological sites in the construction area.
Resources (water, energy resources, loanable materials)	RC-1	Temporary increase in water consumption during the construction phase of the project.
	RC-2	Temporary increase in electricity and fuel consumption during the construction phase of the project.
	RC-3	Increased consumption of loan materials.
Landscape	PS-1	Possibility of deterioration of the landscape due to construction activities.

Table 7-5. Identification of the impacts of the operation phase

Element of the medium	Code	Impacts
Air	A-4	Potential for air pollution due to emissions of combustion gases into the atmosphere and suspended particulate matter from the operation of turbines and emergency power generators.
	A-5	Increased noise and vibration levels due to thermoelectric plant operations.
	A-6	Possibility of air pollution from LNG leaks.
Weather	CL-2	Change or impact on the climate due to the emission of greenhouse gases resulting from the operations of electricity generators.
Soil	S-3	Possibility of soil contamination due to inadequate management of liquid, solid and oily wastes.
	S-4	Possibility of soil contamination from fuel and lubricant spills.
Groundwater	AS-1	Possibility of groundwater contamination due to poor management of liquid waste.
Surface water	ASP-1	Possibility of modification of marine water quality due to the discharge of cooling water and industrial wastewater.
Vegetation	V-2	Loss of vegetation and partial elimination of flora due to cutting and pruning for clearing the transmission line easement strip.

Element of the medium	Code	Impacts
Terrestrial fauna	F-3	Possibility of the spread of vector and rodent infestations due to poor solid waste management.
	F-4	Possibility of affecting fauna due to the use of chemical products to control vector pests, rodents and weeds.
	F-5	Decrease in fauna caused by collisions of birds and bats with the towers and power lines of the transmission line.
	F-6	Detriment to fauna due to the electrocution of birds and bats by the voltage of the transmission line.
Marine biota	BM-1	Possibility of affecting the marine biota due to the discharge of cooling water into the sea.
Population (workers and communities)	PB-9	Possibility of affecting the population (workers and communities) due to increased levels of gas emissions, suspended particles, noise and vibrations from the thermoelectric plant's operations.
	PB-10	Improving the quality of life and purchasing power of Project workers and their families.
	PB-11	Improvement in the public electric energy service due to an increase in the energy supply.
	PB-12	Possible exposure to diseases due to the influx of temporary or permanent labor.
	PB-13	Risk of physical injury or loss of life to residents arising from the use of force by Project physical security personnel.
	PB-14	Risk of accidents resulting in physical injury or loss of life for workers during the operation of the thermoelectric power plant and the power transmission line.
	PB-15	Risk of accidents resulting in physical injury or loss of life to residents and visitors during power plant and transmission line operations.
	PB-16	Generation of benefits for the population of Pepillo Salcedo due to the implementation of the Project's Community Relationship Plan.
	PB-17	Risk of health effects to workers and residents from exposure to electromagnetic fields.
Economy	EC-7	Creation of permanent jobs.
	EC-8	Increase in the financial circulation in the province of Montecristi.
	EC-9	Increase in the flow of capital around the country's economy and in tax collections by the Municipality of Pepillo Salcedo.
Land use	US-1	Change of land use from idle to industrial.
Energy System	SE-1	Increased capacity to deliver electric energy to the National Interconnected Electric System.
	SE-2	Increased efficiency of the country's energy system using cleaner and more efficient technology for electricity generation.
Basic services infrastructure	IS-2	Increased demand for services provided by government entities during project operations.

Element of the medium	Code	Impacts
Resources (water and energy resources)	RC-4	Increased fuel and electricity consumption.
	RC-5	Increased water consumption.
Landscape	PS-2	Introduction of anthropic elements in the rural landscape.

7.2.4 Assessment of environmental impacts

Next, the impacts for the construction and operation phases of the project will be assessed. At the end of the chapter, the impact assessment matrices that have been completed based on the analysis conducted in this section are presented.

7.2.4.1 Assessment of the impacts of the construction phase

This sub-item assesses the impacts for the construction phase.

Affected item	Air
Code	A-1
Increased concentration of particulate matter due to construction activities and transportation of materials.	
<p>Construction activities are characterized by vehicle and equipment traffic, earth moving, and material and waste handling. The dispersion of particles caused by the aeolian action during the execution of the described activities generates an increase in the concentration of particulate matter in the air, deteriorating its quality.</p>	
<p>The deterioration of air quality is a negative and direct impact because it reduces the quality of life of people in contact with airborne dust, primarily affecting those with respiratory and pulmonary problems, asthma, influenza, among other health conditions.</p>	
<p>The surrounding vegetation can also be affected by the accumulation of suspended particles on the surface of their leaves, causing a decrease in photosynthetic function.</p>	
<p>The environmental impact caused by suspended particles will be of medium intensity, partial extension, synergic and simple. It is reversible in the short term as soon as the actions that cause it cease and recoverable in the short term, since there is the possibility of returning to the initial conditions quickly by taking control actions. The persistence of the effect is temporary during the construction phase of the work.</p>	
<p>The risk of occurrence of the impact is very likely and the significance is high.</p>	
<p>The significance level obtained from the valuation of this impact was 24, therefore, the impact is classified as LOW.</p>	

Affected item	Air
Code	A-2
<p>Increased noise and vibration levels due to construction activities and transportation of materials.</p> <p>Construction activities involve the operation of construction machinery and equipment, vehicular traffic, and tool handling, which are a major source of noise and vibration.</p> <p>Noise is considered one of the most stressful factors that exist and prolonged exposure to noise levels above 70 dB(A) can cause, among others, disorders, heart rate variation, increased muscle activity and even hearing loss. The effect of noise and vibrations is also evident in wildlife, by altering mating patterns and causing species migration.</p> <p>This impact is negative and direct, of high intensity and extensive. It has a temporary persistence, reversible in the short term and recoverable in the short term. It is synergistic and simple.</p> <p>The risk of occurrence of the impact is certain and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 38, therefore, the impact is classified as MODERATE.</p>	

Affected item	Air
Code	A-3
<p>Increased flue gas concentration from vehicle, heavy equipment and truck operations.</p> <p>Construction activities require the use of vehicles, heavy construction machinery, compactors, low-capacity generators and other equipment operated with internal combustion engines that use diesel or gasoline as fuel.</p> <p>Emissions produced by the operation of heavy equipment can produce an increase in the concentration of combustion gases in the air, which are factors that contribute to the greenhouse effect and acid rain.</p> <p>The environmental impact is a low intensity negative impact due to the type of gas emission sources at the service of the Project and with punctual extension. It has a temporary persistence during construction work and emissions are made in open and unpopulated areas that have a good assimilation capacity, making it reversible in the short term. It is synergistic, recoverable in the short term, and simple, with a direct effect.</p> <p>The risk of occurrence of the impact is certain and the significance is high.</p> <p>The significance level obtained from the valuation of this impact was 23, therefore, the impact is classified as LOW.</p>	

Affected item	Weather
Code	CL-1
Change or impact on climate due to greenhouse gas emissions from vehicle, heavy equipment and truck operations.	
<p>The vehicles, heavy machinery and vehicles that will be used during the construction phase will be a source of greenhouse gas emissions, such as CO₂, CO, NO_x, SO₂, which cause climate change.</p> <p>The environmental impact is indirectly negative, of low intensity considering the potential for the project's vehicles, equipment and trucks to produce changes in the climate.</p> <p>Extensive, considering that the impacts related to greenhouse gas emissions are reflected worldwide.</p> <p>It has a permanent persistence and is irreversible. It is synergistic, cumulative and irreversible, but mitigable, with the application of measures.</p> <p>The risk of occurrence of the impact is probable and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 35, therefore, the impact is classified as MODERATE.</p>	

Affected item	Soil
Code	S-1
Possibility of soil contamination due to construction activities and deficiencies in the management of solid, liquid and oily waste.	
<p>This direct negative impact can be caused if hazardous solid waste (welding rods, diluent containers, paints and varnishes, etc.), non-hazardous waste (household garbage, debris from clearing and cutting trees, debris, etc.), liquid waste generated by site workers, and oily waste (used oil and oil-contaminated containers) are not handled properly. The intensity of the impact will be low, due to the characteristics of most of the waste that will be handled in this phase.</p> <p>Point spread, since its effects are very localized in the areas where the waste will be generated and temporarily stored; it is produced in the short term immediately after construction of the work objects begins; temporary, during the construction phase and reversible in the short term and recoverable in the short term when the areas where they were stored are cleaned up. Non-synergistic and simple.</p> <p>The risk of occurrence of the impact is probable and the significance is medium.</p> <p>The significance level obtained from the valuation of this impact was 14, therefore, the impact is classified as LOW.</p>	

Affected item	Soil
Code	S-2
<p>Risk of soil contamination from fuel and lubricant spills.</p> <p>This direct negative impact can be caused by accidental spills during fueling of equipment and vehicles used in the construction site or poor condition of fuel storage tanks, lubricant leaks from equipment and vehicles, maintenance of equipment and vehicles at the construction site, among others.</p> <p>The impact is of low intensity, since there are no plans to handle large quantities of fuels or lubricants during the construction phase of the project.</p> <p>Punctual extension, in the places of occurrence of spills within the Project lands. Its persistence is temporary and is reversible in the short term. The impact is recoverable in the short term, non-synergistic and simple.</p> <p>The risk of occurrence of the impact is probable and the significance is medium.</p> <p>The significance level obtained from the valuation of this impact was 14, therefore, the impact is classified as LOW.</p>	

Affected item	Terrestrial vegetation
Code	V-1
<p>Disappearance of vegetation cover and loss of flora due to vegetation clearing for construction works, including individuals and populations of native, endemic and threatened species.</p> <p>This negative impact was caused by the clearing of vegetation cover on the land where the thermoelectric plants will be built, in addition to the clearing of the area that will be occupied by the bases of the transmission line towers and their easement strip. The impact will have a direct impact on the vegetation, causing the disappearance of plant species.</p> <p>The intensity of the impact is high, since the clearing affected most of the area where the thermoelectric plants will be built and in the place there were individuals of several protected and endangered species such as: alpagata, <i>Consolea moniliformis</i>; pitajaya, <i>Harrisia divaricata</i>; Caguey, <i>Leptocereus paniculatus</i>, tuna brava; <i>Opuntia dillenii</i>; mulito de pollo, <i>Opuntia taylorii</i>; cayuco, <i>Pilosocereus polygonus</i>; chicharrón, <i>Casearia illicifolia</i>; quiebra hacha, <i>Krugiodendrum ferreum</i>, vera, <i>Guaiaacum sanctum</i>, bombillito, <i>Mammillaria prolifera subsp. Haitiensis</i> and guasábara, <i>Cylindropuntia caribaea</i>; . and for the 345 kV transmission line, the 30 m easement strip, plus a 300 m strip, for a total of 330 m measured on both sides of the route, where the following protected species were identified: <i>Avicennia germinans</i>, (mangle prieto); <i>Harrisia divaricata</i>, (pitajaya); <i>Opuntia taylorii</i>, (mulito de pollo); <i>Pilosocereus polygonus</i>, (cayuco); <i>Lemaireocereus histrix</i>, (cayuco); <i>Selenicereus pteranthus</i>; <i>Conocarpus erectus</i>, (button mangrove); <i>Laguncularia racemosa</i>, (white mangrove); <i>Casearia illicifolia</i>, chicharrón; <i>Guaiaacum officinale</i>, (guaiaacum) and <i>Guaiaacum sanctum</i>, (vera). The total area considered to be affected is the transmission line easement strip with an area of 300,000 m².</p> <p>Partial extension, in the plot where the Project and the transmission line and its easement strip will be built. Its persistence is permanent, since, once produced, its effects will remain with little variation on the flora and vegetation of the site. The clearing will affect the vegetation, although limited to the area where the work objects are located. These effects will be irreversible but mitigable with the application of measures such as the creation of live fences around the facilities and green areas such as native and endemic species in the area, in addition to protecting these protected species during the clearing of the transmission line route and easement passage, which due to their height will not be obstacles to the cabling. The impact on the area is cumulative, as it acts very synergistically with other impacts, such</p>	

as habitat fragmentation and alteration.

The risk of occurrence of the impact is **certain** and the significance is **high**.

The significance level obtained from the valuation of this impact was **60**, therefore, the impact is classified as **HIGH**.

Affected item	Terrestrial fauna
Code	F-1
Loss of wildlife habitat due to vegetation clearing. Direct negative impact caused mainly by the clearing of vegetation on the land where the thermal power plants will be built and will occur along the route of the transmission line, which caused and will cause species to migrate and migrate to surrounding areas seeking refuge and others, such as the blue crab, to change their travel route from the northern to the southern mangroves; however, the transplanting and compensation of the vegetation species present in the project will mitigate the impact to a large extent; However, the transplanting and compensation of the vegetation species present in the project will mitigate the impact to a large extent, since the affected species can make the plants used in the revegetation their new ecological niche. It is considered of high intensity, due to the number of species and individuals of the herpetofauna that were inventoried, of partial extension, its persistence is permanent, irreversible and irrecoverable . Highly synergistic and cumulative , as wildlife habitat is increasingly reduced as new projects are developed. The risk of impact occurrence is certain and the significance is high . The significance level obtained from the evaluation of this impact was 48 , therefore, the impact is classified as MODERATE .	

Affected item	Terrestrial fauna
Code	F-2
Impact on fauna due to construction activities that generate noise and dust and human presence. Direct negative impact caused by human presence and the generation of noise and dust from the activities to be carried out during the construction phase of the project. It is considered of medium intensity, due to the degree of impact that could be caused to the fauna, of punctual extension, temporary persistence, since it will occur during the construction phase of the project and reversible and recoverable in the medium term . Synergistic and cumulative , because the effects are aggravated as the action that produces the impact is prolonged. The risk of occurrence of the impact is very probable and the significance is high . The significance level obtained from the evaluation of this impact was 27 , therefore, the impact is classified as MODERATE .	

Affected item	Population
Code	PB-1
Improving the quality of life and purchasing power of the workers who will build the project and their families.	
<p>This is an indirect positive impact derived from the hiring of workers for the construction of the different works of the Project in the communities of the area of socioeconomic influence. This impact will extend to service providers (food, lodging, transportation) to direct project workers and their families.</p> <p>The impact will have a very high intensity, if the results of the socioeconomic characterization of the area of influence are evaluated with the situation of the poverty index.</p> <p>The extent of the impact is considered partial due to the repercussions for the communities in the Project's area of influence.</p> <p>It is very synergic and cumulative, an impact such as the improvement of purchasing power induces other positive impacts, such as an increase in the demand for goods and services, increase in circulating currency, among others. It is a temporary and irreversible impact.</p> <p>The risk of occurrence of the impact is very likely and the significance is high.</p> <p>The significance level obtained from the valuation of this impact was 53, therefore, the impact is classified as HIGH.</p>	

Affected item	Population
Code	PB-2
Possibility of disturbance to local residents due to increased noise and dust levels as a consequence of the Project's construction actions	
<p>This is a direct negative impact that can be caused by construction activities, considering that they involve the use of heavy machinery and tools that generate noise and suspended particles, as well as the transportation of construction materials and debris, if the pertinent preventive and mitigation measures are not taken.</p> <p>The intensity of the impact will be medium, considering the level of impact that could be caused by the construction of the Project. Partial extent for residents closest to the project facilities. Irreversible, as it is a socioeconomic impact, but mitigable, with the application of measures.</p> <p>It is synergistic and cumulative, since other negative effects can be caused, and the effects are aggravated as the actions that cause them are extended over time.</p> <p>The risk of occurrence of the impact is probable and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 31, therefore, the impact is classified as MODERATE.</p>	

Affected item	Population
Code	PB-3
<p>Possible exposure to diseases due to the influx of temporary or permanent labor.</p> <p>It is a negative impact that can be caused by the presence of workers at the construction site during the construction phase who may be carriers of communicable diseases (such as cholera, COVID-19, among others), non-compliance with basic hygiene measures, inadequate management of solid and liquid waste at the construction site, or lack of pest control that could lead to the spread of waterborne or water-related diseases (dengue, malaria).</p> <p>Low intensity, considering that the Project will not have a camp for housing workers during the construction phase, potable water will be provided for their consumption, and measures will be taken for the proper management of solid and liquid waste on site, thus reducing the possibility of spreading waterborne or water-related diseases.</p> <p>Partial extension, for construction workers and residents of the communities in the area of socioeconomic influence, especially the municipality of Pepillo Salcedo. Irreversible, but mitigable, with the application of measures such as the development of health and safety training programs that include topics related to the prevention of infectious diseases, aimed at both construction site workers and residents of nearby communities.</p> <p>It is synergistic and cumulative since other negative effects on the population may be caused. Its effect is direct.</p> <p>The risk of occurrence of the impact is probable and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 28, therefore, the impact is classified as MODERATE.</p>	

Affected item	Population
Code	PB-4
<p>Risk of physical injury or loss of life to residents arising from the use of force by Project physical security personnel.</p> <p>During the construction phase of the Project there will be a risk of accidents, physical injury or death for the local population, due to the inadequate use of force by security personnel who will guard the facilities if they are not properly trained.</p> <p>The impact can be considered of low intensity, considering the low probability of this occurring, since the physical security of the facilities will be provided by a company specialized in the security area, whose personnel will be duly trained in the proper use of force and firearms.</p> <p>The impact is of partial extension, for the residents of the communities in the area of socioeconomic influence, especially the municipality of Pepillo Salcedo. The impact is temporary and irreversible because it is a socioeconomic impact. It can be mitigated with adequate training of Project security personnel and the implementation of a social management plan that allows for the institutional channeling of all complaints and claims from the community in order to avoid conflicts that could lead to the use of force by security personnel.</p> <p>It is synergistic and cumulative since other negative effects on the population may be caused. Its effect is direct.</p> <p>The risk of impact occurrence is unlikely, and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 27, therefore, the impact is classified as MODERATE.</p>	

Affected item	Population
Code	PB-5
Risk of accidents resulting in physical injury or loss of life to workers and local residents as a consequence of the Project's construction activities.	
<p>During the construction phase of the Project there will be a risk of accidents resulting in physical injury or loss of life for workers, due to unsafe acts by workers or the existence of unsafe conditions within the facilities of the thermoelectric power plant and the layout of the power transmission line. There is also a risk of accidents for the residents of the communities in the area of influence, due to inadequate signage, lack of access control to the project site, and unsafe conditions during construction in areas where access is not restricted, as is the case with the route of the power transmission line.</p> <p>In general, the impact can be considered of medium intensity, due to the level of risk to which most of the workers will be subjected because of the characteristics of the Project, although this varies depending on the different positions and the functions performed by each one.</p> <p>The impact is of localized extension, for the workers of the Project. It is short-term, temporary but irreversible, as it is a socioeconomic impact. It is also synergistic and cumulative.</p> <p>It is mitigable, with the application of an adequate occupational health and safety plan. The risk of occurrence of the impact is probable and the significance is high. The significance level obtained from the assessment of this impact was 29, therefore, the impact is classified as MODERATE.</p>	

Affected item	Population
Code	PB-6
Economic impact on beekeepers in the area due to land clearing.	
<p>This direct negative impact is caused by the clearing of the land where the thermal power plants will be built because the area used to have apiaries for honey production, where beekeepers managed the genetic improvement of the queen bees due to the biological richness of the area.</p> <p>The impact is of low intensity considering the level of development of beekeeping in the area (according to the results of the survey conducted in October and November 2022, only 9 people were engaged in this activity). The extent of the impact is localized, and persistence is permanent considering that the effect will be maintained throughout the life of the project.</p> <p>The impact is synergistic and cumulative; in addition to income, the quality of life of affected beekeepers in the area and their families could be affected if measures are not taken.</p> <p>The risk of occurrence of the impact is certain and the significance is medium. The impact is mitigable.</p> <p>The significance level obtained from the evaluation of this impact was 33, therefore, the impact is classified as MODERATE.</p>	

Affected item	Population
Code	PB-7
Loss of area for goat grazing due to clearing of project lands. <p>This indirect negative impact is caused by the clearing of the land where the thermal power plants will be built. In the municipality of Pepillo Salcedo, it is a typical scene to observe herds of goats out in search of food. The project site, due to its proximity and biological diversity, was one of the favorite places for these herds to eat. This could have an economic impact on the people who keep goats in the area, mainly for subsistence purposes, considering that they will have to look for other places to feed their livestock.</p> <p>The impact is of low intensity considering the level of impact that could be caused, since there are other lands in the area that can be used for these purposes. The extent of the impact is localized and persistence is permanent considering that the effect will be maintained throughout the life of the project. The impact is synergistic and cumulative.</p> <p>The risk of occurrence of the impact is certain and the significance is low.</p> <p>The significance level obtained from the evaluation of this impact was 32, therefore, the impact is classified as MODERATE.</p>	

Affected item	Construction Sector
Code	CT-1
Increased demand and use of construction materials and other inputs. <p>Direct positive impact derived from the demand and use of construction materials and other inputs for the construction of the works.</p> <p>High intensity given the level of construction development that the Project will have. Extensive, given that the materials will be supplied from the northern region and other areas of the country and abroad. The impact is irreversible and temporary since it occurs during the construction stage.</p> <p>Synergic and cumulative, new positive impacts are induced, such as an increase in the demand for construction materials and other inputs, an increase in goods and services, and an increase in cash flow, among others. The risk of occurrence of the impact is certain and the importance is high.</p> <p>The significance level obtained from the evaluation of this impact was 47, therefore, the impact is classified as MODERATE.</p>	

Affected item	Economy
Code	EC-1
Creation of temporary jobs. <p>The social and economic characterization of the Project's area of influence reflected the poor employment situation in the municipality of Pepillo Salcedo and the province of Montecristi. According to the results of the survey conducted by EMPACA in October and November 2022, in the urban area of Pepillo Salcedo (Villa Ray neighborhood) and the Copey and Carbonara sections, 43.87% of the heads of households surveyed were unemployed.</p>	

The need for workers for the construction phase will have a **direct positive** impact on the communities located in the area of socioeconomic influence of the Project, if the inhabitants of these communities receive training and education in the areas required by the Project during this phase.

This impact is considered to be of **very high** intensity due to the number of jobs that will be created (approximately 1,512 in the peak period), of **partial** extension due to the social repercussion and the number of workers that will be employed, of **temporary** persistence, but **irreversible** because it is a socioeconomic impact.

It is **highly synergistic** and **cumulative**, since it has other positive impacts linked to increased demand for goods and services, improvement in the quality of life of hired workers and their families, among others.

The risk of occurrence of the impact is **certain** and the significance is **high**.

The significance level obtained from the evaluation of this impact was **57**, therefore, the impact is classified as **HIGH**.

Affected item	Economy
Code	EC-2
Increase in the financial flow and commercial activity in the province of Montecristi due to the contracting of services.	
<p>The generation of cash flow in the construction phase of the Project is a positive impact that develops from the moment the promoter begins to hire experts for the elaboration of topographic studies and design of the Project; continuing with the purchase of materials for the construction of the buildings and infrastructure and the hiring of workers; to which is added the economic dynamization that occurs due to the acquisition of services and goods provided by local enterprises throughout the construction cycle of the project. The impact can be evaluated with a medium intensity and partial extension.</p> <p>It has a medium persistence considering the time foreseen for the execution of the Project. The generation of cash flow is a synergistic impact with all the impacts linked to the economy and is cumulative. The risk of occurrence of the impact is certain and the importance is high.</p> <p>The significance level obtained from the evaluation of this impact was 42, therefore, the impact is classified as MODERATE.</p>	

Affected item	Economy
Code	EC-3
Generation of income for the State and the Municipality of Pepillo Salcedo from the payment of taxes.	
<p>The construction of works such as the project will result in an increase in tax revenues for the State and the Municipalities of Pepillo Salcedo and Montecristi. In addition, as a result of the demand for lodging, food, health and recreation services, among others, generated by the migration of people who go to work</p>	

at the project, new companies will emerge in the area with other infrastructure projects that will demand land and will have to be formalized and pay taxes to the state and the municipalities.

Although the project is located in Pepillo Salcedo, the Municipality of Montecristi is also impacted by investments such as new hotels, which will seek to respond to the new demands for services in the area.

For all of the above reasons, it is a **positive** impact, **direct** effect, of **very high** intensity and **partial** extension.

The impact is **temporary, synergistic and cumulative** because the municipalities and the State will have more resources to invest in social works (repair and cleaning of streets, garbage collection, creation of recreational and sports facilities, among others). The risk of occurrence of the impact is **very probable** and the importance is **high**.

The significance level obtained from the valuation of this impact was **51**, therefore, the impact is classified as **HIGH**.

Affected item	Economy
Code	EC-4
Temporary increase in demand for food services for Project workers. Among the services demanded by the workers participating in the project is food and beverages, most of which are supplied by individuals or small businesses in the area, which has an indirect positive impact on the local economy. The impact is of medium intensity considering the number of workers that demand these services and partial extension in the municipality of Pepillo Salcedo. It is temporary, for the duration of the construction phase of the Project. The risk of occurrence of the impact is very likely and the significance is high . The significance level obtained from the evaluation of this impact was 33 , therefore, the impact is classified as MODERATE .	

Affected item	Economy
Code	EC-5
Temporary increase in demand for rooms in the municipality of Pepillo Salcedo for Project workers residing in distant areas. This positive impact, which has an indirect effect, is caused by the demand for lodging (rooms or housing) by the specialized technicians working at the site, most of whom live in distant communities and cannot travel daily. This would benefit homeowners and hostels in the area, which would increase their rental income. It is of medium intensity, due to the number of workers that could require these services during the construction phase of the project. The impact will be temporary , considering the estimated duration of the construction work.	

Synergistic and **cumulative**, due to all the positive effects it brings to the economy and the population of the Project's area of influence. The risk of occurrence of the impact is **very probable** and the importance is **high**.

The significance level obtained from the evaluation of this impact was **33**, therefore, the impact is classified as **MODERATE**.

Affected item	Economy
Code	EC-6
<p>Generate higher income for the sector of the population employed in the motoconcho transportation sector (motorcycle transportation service), which is the main means of transportation in the area.</p> <p>This positive impact will be caused by the demand for transportation by construction workers, many of whom will have to commute daily to their place of residence. This would benefit the population employed in the transportation sector, especially those dedicated to "motoconcho", which is the main means of transportation in the area.</p> <p>It is of medium intensity, due to the number of workers that could require these services during the construction phase of the project. The impact will be temporary, considering the estimated duration of the construction work.</p> <p>Synergistic and cumulative, due to all the positive effects it brings to the economy and the population of the Project's area of influence. It is of indirect effect, with a very probable risk of occurrence and the importance is high.</p> <p>The significance level obtained from the evaluation of this impact was 33, therefore, the impact is classified as MODERATE.</p>	

Affected item	Traffic and roads
Code	TV-1
<p>Increased truck traffic on access roads.</p> <p>Direct negative impact that will cause an increase in the current traffic of trucks transporting construction materials, equipment and waste to and from the Project site along the El Copey-Manzanillo highway, the access road and other roads within the material transportation routes.</p> <p>The intensity is low in accordance with the number of vehicles that will transit and the frequency during the construction phases of the Project. Occasional, in the access road sections where materials will be transported and temporary during the construction phase of the project. Irreversible, but mitigable. Synergistic and cumulative, other negative impacts can be caused by deterioration of the roads, increased risk of accidents, among others.</p> <p>The risk of occurrence of the impact is certain and the significance is medium.</p> <p>The significance level obtained from the valuation of this impact was 30, therefore, the impact is classified as MODERATE.</p>	

Affected item	Traffic and roads
Code	TV-2
Risk of traffic accidents resulting in physical injury or loss of life to workers and local residents on access roads.	
<p>This negative impact may be caused by the transportation of construction materials, equipment, as well as debris and waste, to and from the project area, for which trucks and heavy equipment will be used, increasing the risk of traffic accidents on the El Copey-Manzanillo highway, the access road to the project and other roads located within the material transportation routes, which could affect construction workers and local residents.</p> <p>It is a direct impact, of medium intensity and of localized extension, on the sections of access roads where the materials will be transported. It will be temporary and irreversible because it is a socioeconomic impact. Mitigable, with the application of an adequate traffic management plan.</p> <p>The risk of occurrence of the impact is probable and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 29, therefore, the impact is classified as MODERATE.</p>	

Affected item	Traffic and roads
Code	TV-3
Possibility of deterioration of the access roads due to the passage of trucks and equipment for the transportation of construction materials and equipment.	
<p>The transport of materials and equipment for the Project may cause deterioration of the El Copey-Manzanillo Road, the access road and other roads along the material transport routes.</p> <p>This is a negative impact of low intensity and localized extension in the road sections that may be affected. It is reversible and recoverable in the short term, with the repair of the affected roads. Its effect is indirect.</p> <p>The risk of occurrence of the impact is probable and the significance is medium.</p> <p>The significance level obtained from the valuation of this impact was 14, therefore, the impact is classified as LOW.</p>	

Affected item	Basic services infrastructure
Code	IS-1
Increased demand for public services provided by government entities during the construction phase of the project.	
<p>The project's construction work will result in the temporary migration of workers to the Pepillo Salcedo municipality, whose presence will increase the demand for basic services provided by the State and the local municipality, including potable water, waste collection, medical services, security, and education for children, among others. This has an indirect negative impact, considering the deficiencies already</p>	

existing in many of these services, which could worsen if the State does not provide the necessary resources (material and human) to supply them.

This impact is of **high** intensity and **partial** extension for the municipality of Pepillo Salcedo. The impact is **permanent**, since many of the workers who migrate to the municipality during the construction phase of the project could remain permanently in the area demanding services.

Irreversible, as it is a socioeconomic impact. **Mitigable**, with proper coordination with the State institutions in charge of providing the different services, as well as with the local municipality.

It is **synergistic** and **cumulative**; the demand for basic services in the municipality will tend to increase over time as new constructions planned by the State and/or the private sector are developed, including the expansion of the port, construction of a shipyard, an industrial park, an ecotourism center, among others.

The risk of occurrence of the impact is **certain** and the significance is **high**.

The significance level obtained from the evaluation of this impact was **46**, therefore, the impact is classified as **MODERATE**.

Affected item	Cultural heritage
Code	PC-1
Possibility of affecting unknown archaeological sites in the construction area.	
Direct negative impact that may be caused by earthmoving activities that will be carried out for the construction of the different objects of the Project.	
<p>The intensity of the impact is low, considering that in the area where the project will be built, according to the results of the archaeological prospecting, no pre-Hispanic or colonial archaeological sites were located, nor was the presence of archaeological artifacts or evidence of rock art detected. However, taking into account that the archaeological prospecting or survey does not cover 100% of the surface and subsoil of the study area, the presence of this type of artifacts is not ruled out.</p>	
<p>If archaeological sites are affected, the impact will be permanent and irreversible; it is not possible to return to the initial conditions after the site has been disturbed. It is synergistic and cumulative. The impact is mitigable, following the recommendations regarding the "Fortuitous Finding of Archaeological Remains" of the Ministry of Culture.</p>	
<p>The risk of occurrence of the impact is unlikely and the significance is medium.</p>	
<p>The significance level obtained from the valuation of this impact was 26, therefore, the impact is classified as MODERATE.</p>	

Affected item	Resources
Code	RC-1
<p>Temporary increase in water consumption during the construction phase of the project.</p> <p>This direct negative impact will be caused by the demand for water during the construction phase of the project, both for workers' consumption and for construction work, including the preparation of mixtures, cleaning of areas, and wetting of roads, among other activities.</p> <p>The intensity of the impact is considered medium, due to the volume of water that the Project will require during the construction phase (approximately 89.4 m³/ per day during periods of maximum activity). Partial extent, for the aquifer from which the Project will be supplied.</p> <p>Temporary during the construction phase of the project. Reversible in the short term because it is a renewable resource, but mitigable, since measures can be applied such as water leakage controls in the temporary facilities of the construction site, use of spray nozzles in the hoses used for irrigation of green areas, training of workers on water saving measures, among others.</p> <p>Synergistic and cumulative, as the impact tends to increase over time. The risk of occurrence of the impact is certain and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 34, therefore, the impact is classified as MODERATE.</p>	

Affected item	Resources
Code	RC-2
<p>Temporary increase in electricity and fuel consumption during the construction phase of the project.</p> <p>This direct negative impact will be caused by the demand for electricity for the construction of the Project's structures, as well as fuel for the operation of heavy equipment, emergency power generators, vehicles and the trucks that will transport materials.</p> <p>Medium intensity, due to the demand for energy and fuels that the Project will have during the construction phase. Extensive, for the National Interconnected Electric System (SENI).</p> <p>Temporary persistence, during the construction phase of the Project. Irreversible, considering that fossil fuels are non-renewable resources.</p> <p>Mitigable, with the implementation of measures such as: keeping heavy equipment in good working condition, turning off equipment and trucks when not in use, driving equipment and trucks at moderate and constant speed, training workers in energy and fuel saving practices, among others.</p> <p>Synergistic and cumulative, as the impact tends to increase over time. The risk of occurrence of the impact is certain and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 41, therefore, the impact is classified as MODERATE.</p>	

Affected item	Resources
Code	RC-3
<p>Increased consumption of loan materials.</p> <p>Direct negative impact due to the fact that borrow materials will be used during the construction phase for backfilling the Project site, among other construction work, which will result in the depletion of these resources.</p> <p>Low intensity, considering the volumes of borrow materials (caliche, gravel) that the Project will require. The extension is localized, since the borrow materials will be extracted from quarries.</p> <p>It is temporary, during the construction phase of the work. It is synergistic and cumulative. Irreversible, since this resource is non-renewable. Mitigable, with the application of measures.</p> <p>The risk of occurrence of the impact is certain and the significance is medium.</p> <p>The significance level obtained from the valuation of this impact was 30, therefore, the impact is classified as MODERATE.</p>	

Affected item	Landscape
Code	PS-1
<p>Possibility of deterioration of the landscape due to construction activities.</p> <p>Direct negative impact caused by the presence of temporary facilities, storage of construction materials, generation of solid waste and debris, as well as the construction of the Project works. Medium intensity and partial extent, considering the quality of the landscape in the area and the visibility that the structures will have.</p> <p>Temporary, during construction work, reversible and irrecoverable. The impact is non-synergistic and simple.</p> <p>The risk of occurrence of the impact is certain and the significance is medium.</p> <p>The significance level obtained from the evaluation of this impact was 28, therefore, the impact is classified as MEDIUM.</p>	

Matrix 7-5 (at the end of the chapter) shows the evaluation criteria and the results of the application of the formula used to determine the significance of the environmental and social impacts generated during the construction phase.

7.2.4.2 Assessment of the impacts of the operation phase

This sub-item assesses the impacts for the operation phase of the project.

Affected item	Air
Code	A-4
Potential for air pollution due to emissions of combustion gases into the atmosphere and suspended particulate matter from the operation of turbines and emergency power generators.	
<p>This direct negative impact arises as a direct consequence of the thermoelectric plant's operations. The impact is of low intensity, since the thermoelectric plant will use Liquefied Natural Gas as its primary fuel, which is the least polluting of the fossil fuels.</p> <p>It is permanent and reversible in the short term, with proper equipment maintenance. However, it is recoverable in the short term. It is synergistic and cumulative, considering that other actions will be carried out that may affect air quality in the Project and that other negative consequences may arise, such as affecting people's health.</p> <p>The risk of occurrence of the impact is certain and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 29, therefore, the impact is classified as MODERATE.</p>	

Affected item	Air
Code	A-5
Increased noise and vibration levels due to thermoelectric plant operations.	
<p>Noise and vibration emissions from the thermoelectric power plant originate from the operation of the turbine units and auxiliary equipment, such as the cooling system, among others. The impact is direct negative, of medium intensity and localized extension, considering that, although the turbines and other equipment will produce high noise levels, measures will be taken to reduce the noise levels perceived outside.</p> <p>Permanent, but reversible in the short term. Recoverable in the short term, through the application of measures. It is synergistic and cumulative, considering that other negative impacts can be generated, such as effects on the local population.</p> <p>The risk of occurrence of the impact is certain and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 28, therefore, the impact is classified as MODERATE.</p>	

Affected item	Air
Code	A-6
<p>Possibility of air pollution from LNG leaks.</p> <p>This impact may be caused by accidental LNG leaks in the LNG distribution pipelines. The impact is direct negative, of high intensity considering that large volumes of this fuel will be handled at the project facilities (consumption will be 20 TBTU per year) and the extent is partial.</p> <p>Permanent, but reversible in the short term. Recoverable in the short term, by shutting down the LNG supply and correcting the leak detected. It is synergistic and cumulative, considering that other negative impacts can be generated, such as health effects on the population in the area and the possibility of fires and explosions.</p> <p>The risk of occurrence of the impact is probable and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 34, therefore, the impact is classified as MODERATE.</p>	

Affected item	Weather
Code	CL-2
<p>Change or impact on the climate due to the emission of greenhouse gases resulting from the operations of electricity generators.</p> <p>This indirect negative impact is caused by the operation of the power generation units of the thermoelectric plant, which will use Liquefied Natural Gas (LNG) as the primary fuel.</p> <p>The impact is of low intensity, considering that LNG is the least polluting of the fossil fuels. In fact, the use of this fuel will avoid the emission of 1,210,309.64 Tn CO₂ eq annually and 30,257,741 Tn CO₂ eq during the 25 years of the project's useful life. This is if the project is compared to the installation of a thermoelectric plant of equal capacity with the use of the Dominican Republic's electricity mix, which is the combination of the different energy sources that cover the country's electricity supply.</p> <p>The impact is extensive, as the impacts related to greenhouse gas emissions are reflected worldwide.</p> <p>The impact is permanent and irreversible. However, it is mitigable with the implementation of measures. It is highly synergistic and cumulative, due to all the negative effects related to climate change.</p> <p>The risk of occurrence of the impact is probable and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 37, therefore, the impact is classified as MODERATE.</p>	

Affected item	Soil
Code	S-3
<p>Possibility of soil contamination due to inadequate management of liquid, solid and oily wastes.</p> <p>This direct negative impact may occur due to inadequate management of hazardous and non-hazardous solid waste that will be generated during power plant operations.</p> <p>The impact is low because of the planned management of the waste. Hazardous waste includes rags contaminated with grease and oil, oil filters, fluorescent tubes, batteries, and batteries, among others, which will be given special handling to avoid contamination.</p> <p>It is of medium persistence and reversible in the short term, considering how quickly the impact can be reversed through earthmoving activities for the collection of contaminated soils and their proper final disposal. It is recoverable in the short term, through the application of measures such as soil remediation if necessary. It is a non-synergistic and simple impact, with a direct effect.</p> <p>The risk of impact is unlikely considering that most of the plant's facilities will be paved and the significance is medium.</p> <p>The significance level obtained from the valuation of this impact was 14, therefore, the impact is classified as LOW.</p>	

Affected item	Soil
Code	S-4
<p>Possibility of soil contamination from fuel and lubricant spills.</p> <p>This direct negative impact can be caused by fuel (diesel) and lubricant spills, or by poor management of solid waste contaminated with grease and oil.</p> <p>The impact is of low intensity and the extent of the impact is localized, as it will occur at the place where the spill occurs.</p> <p>It is of medium persistence and reversible in the short term, through soil remediation in the place where the spill occurred. It is a non-synergistic and simple impact, with direct effect.</p> <p>The risk of impact is unlikely, since the fuel tanks to be installed at the plant, as well as the oil tanks and transformers at the substation will have containment systems to prevent spills in case of rupture. The significance is medium.</p> <p>The significance level obtained from the valuation of this impact was 14, therefore, the impact is classified as LOW.</p>	

Affected item	Groundwater
Code	AS-1
<p>Possibility of groundwater contamination due to improper handling of liquid waste.</p> <p>Direct negative impact, which may be caused by the deficient treatment of domestic and industrial liquid waste generated by the thermoelectric plant, which will infiltrate into the subsoil after treatment.</p> <p>Low intensity, considering that the construction of an efficient wastewater treatment system is planned. Partial extension, for the aquifer where the water will infiltrate.</p> <p>It is of medium persistence and reversible in the short term, if the discharge of poorly treated liquid waste is stopped. It is recoverable in the short term, since measures such as maintenance of the wastewater treatment system and control of effluent water quality can be applied. Synergistic and cumulative, since the prolonged action of the inducing agent progressively increases its severity.</p> <p>The risk of impact occurrence is unlikely and the significance is high.</p> <p>The significance level obtained from the valuation of this impact was 22, therefore, the impact is classified as LOW.</p>	

Affected item	Surface water
Code	ASP-1
<p>Possibility of modification of marine water quality due to the discharge of cooling water and industrial wastewater.</p> <p>This is a negative impact that can be caused by the discharge of cooling water and industrial wastewater from the thermoelectric power plant into the sea if the appropriate preventive measures are not taken.</p> <p>The average intensity, localized extension, in the coastal sector near the Project. It is reversible and recoverable in the short term, with the application of measures.</p> <p>It is synergistic and cumulative, as other negative impacts on marine fauna may be caused. Its effect is direct.</p> <p>The risk of occurrence of the impact is probable and the significance is high.</p> <p>The significance level obtained from the valuation of this impact was 24, therefore, the impact is classified as LOW.</p>	

Affected item	Vegetation
Code	V-2
Loss of vegetation and partial elimination of flora due to cutting and pruning for clearing the transmission line easement strip.	
<p>The negative impact is of low intensity, considering that vegetation management should not eradicate all vegetation, but maintain the growth of plants and trees that could negatively affect the infrastructure below the threshold that is detrimental from an economic point of view. Excessive maintenance of vegetation could remove unnecessary amounts of vegetation, resulting in a constant replacement of species in succession and an increased likelihood of invasive species becoming established. Localized extension, in the transmission line easement strip.</p> <p>It occurs in the short term, when the vegetation is maintained. Persistence is permanent, during the useful life of the project.</p> <p>Irreversible, it will not return to the original conditions, however, it is mitigable, with the application of measures.</p> <p>Synergistic and cumulative, other impacts may be caused to fauna, mainly reptiles and amphibians. Its importance is LOW.</p> <p>The significance level obtained from the valuation of this impact was 25, therefore, the impact is classified as LOW.</p>	

Affected item	Terrestrial fauna
Code	F-3
Possibility of the spread of vector and rodent infestations due to poor solid waste management.	
<p>This negative impact may be generated by the poor management of domestic solid waste (mainly organic waste) during thermoelectric plant operations.</p> <p>The impact is of low intensity and localized extension, mainly in the areas closest to the garbage dumps. Reversible and recoverable in the short term, since the effect lasts less than one year if measures are taken.</p> <p>Synergistic, since new negative impacts are induced, such as possible effects on the health of workers and the population of nearby communities. Cumulative, since the negative effects tend to increase over time if no measures are taken.</p> <p>Its effect is direct, from the inadequate management of solid waste. The risk of occurrence of the impact is improbable and the importance is medium.</p> <p>The significance level obtained from the valuation of this impact was 18, therefore, the impact is classified as LOW.</p>	

Affected item	Terrestrial fauna
Code	F-4
<p>Possibility of affecting fauna due to the use of chemical products to control vector pests, rodents and weeds.</p> <p>Direct negative impact that may occur if chemicals are used inappropriately for vector and rodent pest control at the power plant facilities and the use of herbicides to control vegetation in the right-of-way, as these chemicals can be toxic to wildlife if not properly selected and applied.</p> <p>Low intensity and localized extension, considering that preference will be given to other methods of pest control, so the use of large volumes of chemical products is not foreseen. If their use is necessary, low toxicity products will be selected. Temporary, reversible in the medium term and recoverable in the short term.</p> <p>Synergistic and cumulative, due to the negative consequences for biodiversity.</p> <p>The risk of impact occurrence is unlikely and the significance is high.</p> <p>The significance level obtained from the valuation of this impact was 21, therefore, the impact is classified as LOW.</p>	

Affected item	Terrestrial fauna
Code	F-5
<p>Decrease in fauna caused by collisions of birds and bats with the towers and power lines of the transmission line.</p> <p>This direct negative impact can be caused by the collision of birds and bats with the towers and cables of the power transmission line.</p> <p>The intensity of the impact is high when considering the bird species that move from Estero Balsa to the Saladilla Lagoon and bats in the project area (only two protected bird species and one bat species were found in the project's area of influence).</p> <p>Specific, on the route of the project's power transmission line. The impact is permanent, during the life of the project.</p> <p>Irreversible, considering that the useful life of the project is 25 years. Mitigable, with the application of measures. Synergistic and cumulative, inducing new impacts.</p> <p>The risk of occurrence of the impact is probable and the significance is high.</p> <p>The significance level obtained from the valuation of this impact was 35, therefore, the impact is classified as MODERATE.</p>	

Affected item	Terrestrial fauna
Code	F-6
<p>Detriment to fauna due to the possible electrocution of birds and bats by the voltage of the transmission line.</p> <p>This direct negative impact is caused by the power transmission line, which will be operated by Empresa de Transmisión Eléctrica Dominicana (ETED). The intensity of the impact is medium, considering the diversity and characteristics of the existing avifauna in the project area (only two protected bird species and one bat species were found in the project's area of influence).</p> <p>Localized, in the path of the project's power transmission line. Permanent, the effect lasts for the entire useful life of the project. Irreversible, considering that the useful life of the project is 25 years.</p> <p>The impact is mitigable, with the application of measures. Synergistic and cumulative, new impacts are induced.</p> <p>The risk of occurrence of the impact is probable and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 32, therefore, the impact is classified as MODERATE.</p>	

Affected item	Marine biota
Code	BM-1
<p>Possibility of affecting marine biota due to the discharge of cooling water into the sea.</p> <p>The discharge of contaminated cooling water or water with temperatures higher than those permitted can cause this impact.</p> <p>It is a negative impact, of medium intensity and partial extension. It is permanent, irreversible and mitigable, with the application of measures to control the temperature of discharged water. It is a synergistic and cumulative impact, with a direct effect.</p> <p>The risk of occurrence of the impact is probable and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 27, therefore, the impact is classified as MODERATE.</p>	

Affected item	Population
Code	PB-9
<p>Possibility of affecting the population (workers and communities) due to increased levels of emissions of combustion gases, suspended particles, noise and vibrations from the thermoelectric plant's operations.</p> <p>It is a negative impact that can be caused by the operation of turbines and other equipment, if preventive or environmental mitigation measures are not taken.</p> <p>Medium intensity, because although workers at the thermoelectric plant will be exposed to high noise levels, they will have strict protocols regarding the use of ear protectors and measures will be taken to prevent noise levels from being perceived outside the facilities. In the case of combustion gas and particulate emissions, there is little chance of being affected, considering that the power plant will use liquefied natural gas as its main fuel.</p> <p>Partial extension, mainly for workers at the thermoelectric plant, although residents in the surrounding area may be affected. Irreversible, as it is a socioeconomic impact, but mitigable, with the implementation of measures.</p> <p>It is synergistic and cumulative, since another thermoelectric plant will be built adjacent to the project (block 01) with several electricity generation units and other equipment that generate noise that may affect the population. Its effect is direct.</p> <p>The risk of occurrence of the impact is probable and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 34, therefore, the impact is classified as MODERATE.</p>	

Affected item	Population
Code	PB-10
<p>Improving the quality of life and purchasing power of Project workers and their families.</p> <p>Indirect positive impact derived from the hiring of workers in the municipality of Pepillo Salcedo, Montecristi province. This will improve the purchasing power of the population and therefore their quality of life.</p> <p>The intensity of the impact is very high, considering the number of benefited workers and their families. The impact is partial, in the communities mentioned above.</p> <p>Permanent and irreversible, during its useful life.</p> <p>Highly synergistic and cumulative, other Project actions act on this element, inducing other positive impacts, such as the improvement of the economy in the communities of the Project's area of influence.</p> <p>The risk of occurrence of the impact is very likely and the significance is high.</p> <p>The significance level obtained from the valuation of this impact was 56, therefore, the impact is classified as HIGH.</p>	

Affected item	Population
Code	PB-11
Improvement in the public electric energy service due to an increase in the energy supply.	
<p>The main positive impact that the Project will have for the Dominican population is the improvement of the public electricity service through the incorporation of a 420 MW capacity power generation plant to the National Interconnected Electric System (SENI).</p> <p>The impact is of total and extensive intensity considering the influence that the Project will have in relation to the national demand.</p> <p>It is permanent, irreversible and mitigable according to the useful life of the Project. It is a synergistic and cumulative impact, with a direct effect.</p> <p>The risk of occurrence of the impact is very likely and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 70, therefore, the impact is classified as HIGH.</p>	

Affected item	Population
Code	PB-12
Possible exposure to diseases due to the influx of temporary or permanent labor.	
<p>It is a negative impact that can be caused by the presence of workers during the operations of the thermoelectric power plant who may be carriers of communicable diseases, as well as by the lack of compliance with hygiene measures, inadequate management of solid and liquid waste or by the lack of pest control in the facilities that could generate the spread of communicable diseases.</p> <p>The impact is considered to be of low intensity, considering that drinking water will be supplied for workers' consumption (cleaning and hygiene), preventive health campaigns will be carried out, measures will be taken for the proper management of solid and liquid waste at the thermoelectric plant, and a pest control plan will be implemented, thus reducing the possibility of the spread of communicable diseases.</p> <p>The extension is partial, for the workers of the thermoelectric plant and for the inhabitants of the communities in the area of socioeconomic influence, especially the municipality of Pepillo Salcedo. Irreversible, but mitigable, with the application of measures such as the development of health and safety training programs that include topics related to the prevention of infectious diseases aimed at both the workers at the worksite and the inhabitants of nearby communities.</p> <p>It is synergistic and cumulative, since other negative effects on the population may be caused. Its effect is direct.</p> <p>The risk of occurrence of the impact is probable and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 31, therefore, the impact is classified as MODERATE.</p>	

Affected item	Population
Code	PB-13
Risk of physical injury or loss of life to residents arising from the use of force by Project physical security personnel.	
<p>During operation of the thermoelectric power plant, there is still a risk of accidents, physical injury or death for the local population due to the inadequate use of force by security personnel guarding the facilities if they are not adequately trained.</p> <p>This negative impact can be considered of low intensity, considering the low probability of this occurring, since the physical security of the facilities will be provided by a company specialized in the area of security, whose personnel will be duly trained in the proper use of force and firearms.</p> <p>The impact is of partial extension, for the residents of the communities in the area of socioeconomic influence, especially in the municipality of Pepillo Salcedo.</p> <p>Irreversible, as it is a socioeconomic impact. The impact is mitigable, with adequate training of the Project's security personnel and the implementation of a social management plan that allows the institutional channeling of all complaints and claims from the community in order to avoid conflicts that may result in the use of force by security personnel.</p> <p>It is synergistic and cumulative, since other negative effects can be caused by increasing the population's distrust and rejection of the Project. Its effect is direct.</p> <p>The risk of impact occurrence is unlikely and the significance is high.</p> <p>The significance level obtained from the valuation of this impact was 30, therefore, the impact is classified as MODERATE.</p>	

Affected item	Population
Code	PB-14
Risk of accidents resulting in physical injury or loss of life for workers during the operation of the thermoelectric power plant and the power transmission line.	
<p>During the operation phase of the Project there will be a risk of accidents resulting in physical injury or loss of life to workers, due to unsafe acts by workers or the existence of unsafe conditions within the power plant facilities or the route of the power transmission line.</p> <p>In general, the impact can be considered of medium intensity, due to the level of risk to which most of the workers will be subjected because of the characteristics of the Project, although this varies depending on the different positions and the functions performed by each one.</p> <p>The impact is of localized extension, since the effect will be localized in the area of influence of the project. It is permanent and irreversible, as it is a socioeconomic impact.</p> <p>The impact is mitigable, with the application of an adequate occupational health and safety plan. The risk of occurrence of the impact is probable and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 32, therefore, the impact is classified as MODERATE.</p>	

Affected item	Population
Code	PB-15
Risk of accidents resulting in physical injury or loss of life to residents and visitors during power plant and transmission line operations.	
<p>During the operation phase of the Project there will be a risk of accidents causing physical injury or loss of life for residents of the municipality of Pepillo Salcedo and visitors due to unsafe conditions within the Project facilities or the route of the power transmission line, poor signage, lack of induction and lack of provision of personal protective equipment to visitors, among other situations that may arise. Risks to the population also include the possibility of vehicle accidents on access roads, the risk of fires, explosions, LNG leaks, and damage from contact with hazardous materials or waste generated at the project facilities, among others.</p>	
<p>At a general level, the impact can be assessed as low intensity, considering the effects that residents and visitors could have. The impact is of localized extension, for residents near the Project facilities in the municipality of Pepillo Salcedo and visitors to the Project facilities. It is permanent and irreversible, as it is a socioeconomic impact.</p>	
<p>The impact is mitigable, with the implementation of an adequate health and safety plan for the community. The risk of occurrence of the impact is unlikely and the significance is high.</p>	
<p>The significance level obtained from the evaluation of this impact was 28, therefore, the impact is classified as MODERATE.</p>	

Affected item	Population
Code	PB-16
Generation of social benefits for the population of Pepillo Salcedo through the implementation of the Project's Community Relationship Plan.	
<p>With the start-up of the thermoelectric plant, Manzanillo Energy Consortium, Inc., which will operate the project, will implement a Community Relations Plan for the communities in the area of socioeconomic influence of the project, especially in the municipality of Pepillo Salcedo. This plan may include projects in the areas of environment, community infrastructure, social development (education, health, sports, culture, income generation, strengthening of organizations, among others), which will benefit these communities.</p>	
<p>The impact is positive and of high intensity and partial extension for the communities in the area of socioeconomic influence of the project. It is synergistic and cumulative, due to all the positive effects that could be generated in the communities as a result of the implementation of the plan.</p>	
<p>The risk of occurrence of the impact is very likely and the significance is high.</p>	
<p>The significance level obtained from the evaluation of this impact was 42, therefore, the impact is classified as MODERATE.</p>	

Affected item	Population
Code	PB-17
Risk of health effects to workers and residents from exposure to electromagnetic fields. <p>This negative impact could be caused by power transmission line operations and other electrical equipment, which emit invisible lines of force produced by the voltage.</p> <p>At a general level, the impact can be assessed as low intensity, considering that the urbanized areas in the communities in the area of influence are located far from the transmission line (more than 100 m) and, according to the IFC, there is no empirical data demonstrating adverse health effects related to exposure to normal levels of electromagnetic fields generated by electricity transmission cables and equipment. Nevertheless, some caution is recommended (IFC, 2007).</p> <p>The impact is of localized extension, for workers and residents closest to the project's power transmission line, as electric and magnetic fields decrease rapidly with distance.</p> <p>It is permanent throughout the life of the project and irreversible, as it is a socioeconomic impact.</p> <p>The impact is mitigable, with the application of measures. The risk of occurrence of the impact is improbable, however, the importance is high because it concerns the health of the population.</p> <p>The significance level obtained from the evaluation of this impact was 28, therefore, the impact is classified as MODERATE.</p>	

Affected item	Economy
Code	EC-7
Creation of permanent jobs. <p>Direct positive impact caused by the hiring of labor for the operation phase of the Manzanillo Energy Consortium Power Plant project.</p> <p>The intensity of the impact is high, considering the number of workers (approximately 145 direct workers in addition to indirect workers) that will be hired for the operation and maintenance of the thermoelectric plant and the power transmission line. The effects of this impact are enhanced if the inhabitants of the communities in the area of influence are trained in the areas demanded by the project.</p> <p>It is of partial extension for the province of Montecristi, especially the municipality of Pepillo Salcedo. It is permanent and irreversible, during the useful life of the Project.</p> <p>It is very synergistic and cumulative; other Project actions act on this element, inducing positive impacts, such as the increase of goods and services and the improvement of the quality of life of the workers who will work in the Project and their families.</p> <p>The risk of occurrence of the impact is certain and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 60, therefore, the impact is classified as HIGH.</p>	

Affected item	Economy
Code	EC-8
Increase in the financial circulation in the province of Montecristi. <p>The impact is positive due to the demand for supplies and services for the operations of the thermoelectric plant and the hiring of employees. The products in demand include spare parts, lubricants, chemical and maintenance products, office supplies, among others. Services include food services, lodging, solid and oily waste collection, facility maintenance, and pest control, among others.</p> <p>The impact is of high and partial intensity, mainly for the province of Montecristi. It is permanent and irreversible, considering its useful life. As a positive impact, the measures are aimed at reinforcing its effects.</p> <p>The impact is synergistic and cumulative, due to the positive impacts it entails, including increased income for local businesses and self-employed workers, increased demand for goods and services, creation of new businesses, among others. It has a direct effect.</p> <p>The risk of occurrence of the impact is very likely and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 42, therefore, the impact is classified as MODERATE.</p>	

Affected item	Economy
Code	EC-9
Increase in the flow of capital around the country's economy and tax revenues by the Municipality of Pepillo Salcedo. <p>The Project's operations will result in the demand for fuels and other supplies, as well as services and the payment of taxes to the Pepillo Salcedo Municipality, which will boost the economy, all of which will have a positive impact.</p> <p>The intensity is medium and extensive, considering the capital flows and tax revenues that the Project will bring.</p> <p>It is permanent and irreversible, considering the useful life and the measures are aimed at reinforcing its effects.</p> <p>The impact is synergistic and cumulative, as it will be maintained over time, with a tendency to increase, and its effect is direct.</p> <p>The risk of occurrence of the impact is very likely and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 40, therefore, the impact is classified as MODERATE.</p>	

Affected item	Land Use
Code	US-1
Change of land use from idle to industrial. <p>With the start-up of the Project, there will be a change in the land use of the land where the Project will be located from idle to industrial.</p> <p>This is a positive impact considering that no productive activity is currently being carried out in them.</p> <p>The impact is of medium intensity and localized extension in the Project lands. It will be permanent and irreversible during its useful life. It is considered to be synergistic and cumulative, with a direct effect.</p> <p>The risk of occurrence of the impact is certain and the significance is medium.</p> <p>The significance level obtained from the evaluation of this impact was 36, therefore, the impact is classified as MODERATE.</p>	

Affected item	Energy System
Code	SE-1
Increased capacity to deliver electric energy to the National Interconnected Electric System. <p>By incorporating the generation of electricity produced by the thermoelectric plant into the National Interconnected Electric System (SENI), it will mean an increase of 420 MW in delivery capacity to the public service, with a more favorable balance between demand and generation capacity.</p> <p>It is a positive impact, of total and extensive intensity, for the whole country. It is a permanent and irreversible impact for the useful life of the Project. It is highly synergistic and cumulative, with a direct effect.</p> <p>The risk of occurrence of the impact is certain and the significance is high.</p> <p>The significance level obtained from the valuation of this impact was 76, therefore, the impact is classified as VERY HIGH.</p>	

Affected item	Energy System
Code	SE-2
Increased efficiency of the country's energy system through the use of cleaner and more efficient technology for electricity generation. <p>The use of liquefied natural gas (LNG) for electricity generation in the country instead of liquid fossil fuels or coal is a positive impact, considering that it generates less emissions of polluting gases into the atmosphere (CO, NO_x, NO₂, SO₂, suspended particles) and produces less solid and oily waste. Likewise, the use of this fuel allows a better use of combustion heat, since it has an efficiency of more than 50%, when other fossil fuels have an efficiency of no more than 35%.</p>	

The impact is of **high** intensity and is **extensive** for the Dominican Republic. It is a **permanent** and **irreversible** impact for the life of the Project. It is **highly synergistic and cumulative**, with a **direct effect**.

The risk of occurrence of the impact is **certain** and the significance is **high**.

The significance level obtained from the evaluation of this impact was **52**, therefore, the impact is classified as **HIGH**.

Affected item	Basic services infrastructure
Code	IS-2
Increased demand for services to state entities during project operations.	
<p>During the operations of the thermoelectric plant, approximately 145 direct jobs will be created in the municipality of Pepillo Salcedo, in addition to indirect jobs, whose presence will increase the demand for basic services provided by the State and the local municipality, including drinking water, waste collection, medical services, security, education for children, among others. This represents an indirect negative impact, considering the deficiencies already existing in many of these services, which could worsen if the State does not provide the necessary resources (material and human) to supply them.</p>	
<p>This impact is of high intensity and partial extension, for the municipality of Pepillo Salcedo. The impact is permanent throughout the life of the project.</p>	
<p>It is irreversible, as it is a socioeconomic impact. It is mitigable, with the appropriate coordination with the State institutions in charge of providing the different services, as well as with the local municipality.</p>	
<p>It is synergistic and cumulative; the demand for basic services in the municipality will tend to increase over time as new constructions projected by the State and/or the private sector are developed.</p>	
<p>The risk of occurrence of the impact is certain and the significance is high. The significance level obtained from the assessment of this impact was 46, therefore, the impact is classified as MODERATE.</p>	

Affected item	Resources
Code	RC-4
Increased fuel and electricity consumption.	
<p>This direct negative impact is due to the operation of the turbines that will be installed at the thermoelectric plant, which use Liquefied Natural Gas, Light Fuel Oil (Diesel) for starting and fuel used by vehicles. Electric power will also be consumed at the thermoelectric plant facilities; however, the amount of electric power that will be consumed is insignificant compared to the amount of electric power to be generated at the facilities.</p>	
<p>This impact is of high intensity, due to the amount of fuel that the thermoelectric power plant facilities will require (approximately 2 TBtu of LNG per month in addition to the liquid fuel).</p>	
<p>It is permanent during the useful life of the project and irreversible. It is synergic and cumulative, due to the country's high dependence on fossil fuels.</p>	

The risk of occurrence of the impact is **certain** and the significance is **high**.

The significance level obtained from the evaluation of this impact was **41**, therefore, the impact is classified as **MODERATE**.

Affected item	Resources
Code	RC-5
<p>Increased water consumption.</p> <p>This direct negative impact is due to the consumption of water for the thermoelectric plant's operations. The project will be supplied with seawater for both industrial and domestic use, and a desalination plant will be installed to treat this water.</p> <p>This impact is of medium intensity, since the activity that will demand the greatest amount of water in the project is derived from the cooling system and this will be extracted from the sea and returned to it. The extent of the impact is partial for the aquifer from which the project is supplied.</p> <p>It is mitigable, with the application of water saving measures. It is permanent during the useful life of the project and irreversible. It is synergistic and cumulative, as it can cause other impacts such as possible overexploitation of the aquifer.</p> <p>The risk of occurrence of the impact is certain and the significance is high.</p> <p>The significance level obtained from the evaluation of this impact was 44, therefore, the impact is classified as MODERATE.</p>	

Affected item	Landscape
Code	PS-2
<p>Introduction of anthropic elements in the rural landscape.</p> <p>In the rural environment a series of anthropic elements of an industrial nature will be inserted, which given their composition and characteristics are difficult to integrate into an environment without buildings and the reflection of this type of structures are often visible from great distances.</p> <p>The impact intensity is medium for this Project considering the landscape characteristics of the site.</p> <p>This is a negative impact, permanent during the useful life of the facilities, irreversible, but mitigable. It is non-synergistic and cumulative, with direct effect.</p> <p>The risk of occurrence of the impact is certain and the significance is low.</p> <p>The significance level obtained from the evaluation of this impact was 40, therefore, the impact is classified as MODERATE.</p>	

Matrix 7-6 (at the end of the chapter) shows the valuation given to all the impact assessment criteria and the results of the application of the formula from which the significance of the impact for the operation phase of the Project is obtained.

7.2.4.3 Summary of environmental impacts

The following tables present the impacts, type, effect and significance that were identified for the Project in the construction and operation phases, respectively.

Table 7-6. Summary of impact assessment during the construction phase.

Impact	Code	Type	Effect	Sig.	Classification
Increase in the concentration of particulate matter due to construction activities and transportation of materials.	A-1	(-)	D	24	LOW
Increased noise and vibration levels due to construction activities and transportation of materials.	A-2	(-)	D	38	MODERATE
Increased gas concentration from heavy equipment and truck operations.	A-3	(-)	D	23	LOW
Change or impact on climate due to greenhouse gas emissions from vehicle, heavy equipment and truck operations.	CL-1	(-)	I	35	MODERATE
Possibility of soil contamination due to construction activities and deficiencies in the management of solid, liquid and oily waste.	S-1	(-)	D	14	LOW
Risk of soil contamination from fuel and lubricant spills.	S-2	(-)	D	14	LOW
Disappearance of vegetation cover and loss of flora due to vegetation clearing for construction works.	V-1	(-)	D	60	HIGH
Loss of habitat for wildlife due to clearing.	F-1	(-)	D	48	MODERATE
Impact on fauna due to construction activities that generate noise and dust and human presence.	F-2	(-)	D	27	MODERATE
Improvement of the quality of life and purchasing power of the workers who will build the Project and their families.	PB-1	(+)	I	53	HIGH
Possibility of disturbance to local residents due to increased noise and dust levels as a consequence of the Project's construction actions	PB-2	(-)	D	31	MODERATE
Possible exposure to diseases due to the influx of temporary or permanent labor.	PB-3	(-)	D	28	MODERATE

Impact	Code	Type	Effect	Sig.	Classification
Risk of physical injury or loss of life to local residents arising from the use of force by Project physical security personnel.	PB-4	(-)	D	27	MODERATE
Risk of accidents resulting in physical injury or loss of life to workers and local residents as a consequence of the Project's construction activities.	PB-5	(-)	D	29	MODERATE
Economic impact on beekeepers in the area due to land clearing.	PB-6	(-)	D	33	MODERATE
Loss of area for goat grazing due to clearing of project lands.	PB-7	(-)	I	32	MODERATE
Increased demand and use of construction materials and other inputs.	CT-1	(+)	D	47	MODERATE
Creation of temporary jobs.	EC-1	(+)	D	57	HIGH
Increase in the financial flow and commercial activity in the province of Montecristi due to the contracting of services.	EC-2	(+)	D	42	MODERATE
Generation of income for the State and the Municipality of Pepillo Salcedo from the payment of taxes.	EC-3	(+)	D	51	HIGH
Temporary increase in demand for food services for Project workers.	EC-4	(+)	I	33	MODERATE
Temporary increase in demand for rooms in the municipality of Pepillo Salcedo for Project workers residing in distant areas.	EC-5	(+)	I	33	MODERATE
Generate more income for the sector of the population employed in the motoconcho transport sector, which is the main means of transportation in the area.	EC-6	(+)	I	33	MODERATE
Increased truck traffic on access roads.	TV-1	(-)	D	30	MODERATE
Risk of traffic accidents resulting in physical injury or loss of life to workers and local residents on access roads.	TV-2	(-)	D	29	MODERATE
Possibility of deterioration of the access roads due to the passage of trucks and equipment for the transportation of construction materials and equipment.	TV-3	(-)	I	14	LOW
Increased demand for services provided by government entities during the construction phase of the project.	IS-1	(-)	I	46	MODERATE
Possibility of affecting unknown archaeological sites in the construction area.	PC-1	(-)	D	26	MODERATE

Impact	Code	Type	Effect	Sig.	Classification
Temporary increase in water consumption during the construction phase of the project.	RC-1	(-)	D	34	MODERATE
Temporary increase in electricity and fuel consumption during the construction phase of the project.	RC-2	(-)	D	41	MODERATE
Increased consumption of loan materials.	RC-3	(-)	D	30	MODERATE
Possibility of deterioration of the landscape due to construction activities.	PS-1	(-)	D	28	MODERATE
Total impacts.	32	(-) =24 (+) =8 (+/-) =0	D=24 I=8		L=5 M=23 H=4 VH=0

Legend:

Type	Effect	Significance of the Impact (SF)
- Negative impact	D = Direct	L = Low
+ = Positive impact	I = Indirect	M = Moderate
+/- = neutral impact	NA = Not Applicable	H = High
		VH = Very High

Source: Prepared by EMPACA / AECOM.

During the construction phase, 32 impacts were identified, of which 24 are negative (75%) and 8 (25%) are positive.

For the operation phase, the following impacts were identified.

Table 7-7. Summary of impact assessment during the operation phase.

Impact	Code	Type	Effect	Sig.	Classification
Potential for air pollution due to emissions of combustion gases into the atmosphere and suspended particulate matter from the operation of turbines and emergency power generators.	A-4	(-)	D	29	MODERATE
Increased noise and vibration levels due to thermoelectric plant operations.	A-5	(-)	D	28	MODERATE
Possibility of air pollution from LNG leaks.	A-6	(-)	D	34	MODERATE
Change or impact on the climate due to the emission of greenhouse gases resulting from the operations of electricity generators.	CL-2	(-)	I	37	MODERATE

Impact	Code	Type	Effect	Sig.	Classification
Possibility of soil contamination due to inadequate management of liquid, solid and oily wastes.	S-3	(-)	D	14	LOW
Possibility of soil contamination from fuel and lubricant spills.	S-4	(-)	D	14	LOW
Possibility of groundwater contamination due to poor liquid waste management.	AS-1	(-)	D	22	LOW
Possibility of modification of marine water quality due to the discharge of cooling water and industrial wastewater.	ASP-1	(-)	D	24	LOW
Loss of vegetation and partial elimination of flora due to cutting and pruning for clearing the transmission line easement strip.	V-2	(-)	D	25	LOW
Possibility of the spread of vector and rodent infestations due to poor solid waste management.	F-3	(-)	D	18	LOW
Possibility of affecting fauna due to the use of chemical products for vector and rodent pest control.	F-4	(-)	D	21	LOW
Decrease in fauna caused by collisions of birds and bats with the towers and power lines of the transmission line.	F-5	(-)	D	32	MODERATE
Detriment to fauna due to the electrocution of birds and bats by the voltage of the transmission line.	F-6	(-)	D	32	MODERATE
Possibility of affecting marine biota due to the discharge of cooling water into the sea.	BM-1	(-)	D	27	MODERATE
Possibility of affecting the population (workers and communities) due to increased levels of gas emissions, suspended particles, noise and vibrations from the thermoelectric plant's operations.	PB-9	(-)	D	34	MODERATE
Improving the quality of life and purchasing power of Project workers and their families.	PB-10	(+)	I	56	HIGH
Improvement in the public electric energy service due to an increase in the energy supply.	PB-11	(+)	D	70	HIGH
Possible exposure to diseases due to the influx of temporary or permanent labor.	PB-12	(-)	D	31	MODERATE
Risk of physical injury or loss of life to residents arising from the use of force by Project physical security personnel.	PB-13	(-)	D	30	MODERATE
Risk of accidents resulting in physical injury or loss of life for workers during the operation of the thermoelectric power plant and the power transmission line.	PB-14	(-)	D	32	MODERATE

Impact	Code	Type	Effect	Sig.	Classification
Risk of accidents resulting in physical injury or loss of life to residents and visitors during power plant and transmission line operations.	PB-15	(-)	D	28	MODERATE
Generation of benefits for the population of Pepillo Salcedo due to the execution of the Project's Community Relationship Plan.	PB-16	(+)	D	42	MODERATE
Risk of health effects to workers and residents due to exposure to electromagnetic fields.	PB-17	(-)	D	28	MODERATE
Creation of permanent jobs.	EC-7	(+)	D	60	HIGH
Increase in the financial circulation in the province of Montecristi.	EC-8	(+)	D	42	MODERATE
Increase in the flow of capital around the country's economy and tax revenues by the Municipality of Pepillo Salcedo.	EC-9	(+)	D	40	MODERATE
Change of land use from idle to industrial.	US-1	(+)	D	36	MODERATE
Increased capacity to deliver electric energy to the National Interconnected Electric System.	SE-1	(+)	D	76	VERY HIGH
Increased efficiency of the country's energy system through the use of cleaner and more efficient technology for electricity generation.	SE-2	(+)	D	52	HIGH
Increased demand for services provided by government entities during project operations.	IS-2	(-)	I	46	MODERATE
Increased fuel and electricity consumption.	RC-4	(-)	D	41	MODERATE
Increased water consumption.	RC-5	(-)	D	44	MODERATE
Introduction of anthropic elements in the rural landscape.	PS-2	(-)	D	40	MODERATE
Total impacts.	33	(-) =24 (+) =9 (+/-) =0	D=30 I=3		L=7 M=21 H=4 VH= 1

Legend:

Type	Effect	Significance of Impact (SF)
- Negative impact	D = Direct	L = Low
+ = Positive impact	I = Indirect	M = Moderate
+/- = neutral impact	NA = Not Applicable	H = High
		VH = Very High

Source: Prepared by URS Holdings.

During the operation phase, 33 impacts were identified, of which 24 (73%) are negative and 9 (27%) are positive. Compared to the construction phase, the proportion of positive impacts increases.

It should be noted that the negative impacts in the operation phase are of low, medium or moderate significance. Impacts of high or very high significance are all positive.

7.3 Cumulative impact analysis

This section is developed with the purpose of identifying and analyzing the potential environmental and social risks and impacts of the Manzanillo Energy Consortium Power Plant project, in a context that incorporates over time and within its area of influence, possible cumulative effects that other human activities and/or natural factors and external social pressures could generate, on common valued environmental and social components (VEC), of social, scientific and professional interest.

An adequate assessment of the cumulative impacts that could be generated by a new activity to be developed is considered a relevant part of environmental assessments in various standards such as the International Finance Corporation (IFC) Performance Standard 1: Environmental and Social Risk and Impact Assessment and Management; the World Bank Safeguard Policy OP-4.01 World Bank Environmental Assessment; Annex II "Environmental and Social Impact Assessment Report (ESIA)" included in the Recommendation of the Council of the Organization for Economic Co-operation and Development (OECD) on Common Approaches for Officially Supported Export Credits and Environmental and Social Due Diligence (the "Common Approaches"), April 6, 2016, PR-2 of the Equator Principles.

In addition, they are mentioned in the Equator Principles (July 2020), in particular in the description of supporting information shown in Annex II: Illustrative List of Potential Environmental and Social Issues to be Addressed in Environmental and Social Assessment Documentation.

Hegmann et al. (1999) define cumulative effects as "changes in the environment that are caused by an action in combination with other past, present and future actions".

The Good Practice Handbook on Cumulative Impacts Assessment and Management: Guidance for the Private Sector in Emerging Markets (IFC, 2015), states that "Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity (collectively referred to as "undertakings" in this handbook) when added to the effects of other existing, planned, and/or reasonably foreseeable undertakings. For practical reasons, the identification and management of cumulative impacts is limited to effects that are generally recognized as significant based on concerns of the scientific community and/or affected communities."

The document also states that "What is important is that during the process of identifying environmental and social impacts and risks, developers/operators (a) recognize that their actions, activities and projects - their undertakings - may contribute to cumulative impacts on *Valued Environmental and Social Components* (VECs) on which other existing or future undertakings could also have negative effects, and (b) to the extent possible, avoid and/or minimize their contribution to these cumulative impacts. Likewise, project developers should understand that their developments could be at risk if cumulative effects significantly affect those ecosystem services upon which the viability of their project depends." In addition, it proposes to carry out a rapid cumulative impact assessment and management (rapid CIA), which involves a review of

relevant documentation and some consultation with affected communities and other stakeholders to determine whether a project's activities could significantly affect environmental and social aspects of concern.

Based on what is described in the manual and the information available on the design of the Manzanillo Energy Consortium Power Plant project, this cumulative impact analysis was developed, considering the area of influence of the project.

7.3.1 Objectives

The main objective of this section is to identify and evaluate the potential environmental and social risks and impacts of the Manzanillo Energy Consortium Power Plant project, from the perspective of the International Finance Corporation (IFC) and the Equator Principles, over time and in the context of the potential effects that other projects, actions and activities and/or external environmental and social factors may have on the same VEC.

In this context, the specific objectives of this analysis are as follows:

- Identify all valued environmental and social components (VEC), which could be directly or indirectly affected by the potential impacts of the project.
- Identify and select existing, planned and anticipated projects and activities and external environmental and social factors that could potentially have an effect on the identified and selected VECs.
- Identify how the potential impacts of the project on the identified VECs could be combined, cumulatively, with existing and potential impacts associated with other local human activities, as well as natural stressors such as droughts or extreme weather events.
- If it is verified that some environmental impacts of the project act cumulatively with the effects of other projects or activities, describe the type of impact on the environmental and social components assessed (VEC).
- Identify and analyze mitigation, reduction and prevention measures for potential risks that could arise as a result of the cumulative impacts identified.

7.3.2 Methodology

For the development of this analysis, the methodology based on the guidelines included in the Cumulative Impacts Assessment and Management Good Practice Manual (CFI, June 2015) was applied, which proposes the performance of a rapid cumulative impact assessment and management (rapid CIA), which considers the review of existing and available relevant information such as: previous environmental impact studies, planning documents, updated baseline information, stakeholder opinions, among others.

The methodology used considered the six steps defined in the IFC Manual, the scope of which is shown in Figure 7-1. The methodology used considered the six steps defined in the IFC Manual, the scope of which is shown in Figure 71, the development of which is presented in the following sections.

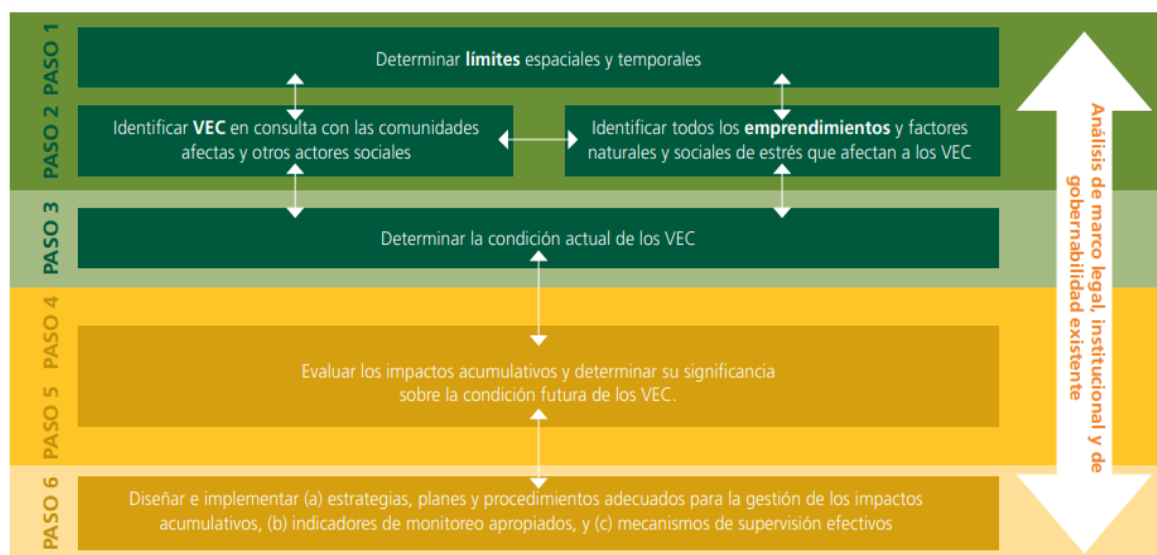


Figure 7-1. Schematic of "Cumulative impact assessment and management".

Source: Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (IFC, 2015).

7.3.3 Determination of spatial limits

To define the spatial boundaries or geographic scope for the cumulative impact analysis, the area that will be directly affected (direct footprint) by the Manzanillo Energy Consortium Power Plant project, as a result of the activities to be carried out during the construction and operation stages, was considered. Additionally, the important resources or VECs existing within the area of direct influence were identified, evaluating whether they occupy a wider area that exceeds the area of direct influence, and the distance that the effects and impacts to which these VECs may be exposed beyond the area of direct influence were estimated.

Considering the above, for the cumulative impact analysis, the area of direct influence defined by the Municipality of Pepillo Salcedo with the communities of Copey and Carbonere, including the outlet of the Chacuey River and the Masacre River, and the community of Manzanillo Rural, and the area of indirect influence formed by the municipality of Monte Cristi and the community of Los Conucos as defined in Chapter 4 on Project Description, of this document, were defined as the spatial or geographic limit. Additionally, considering the relationship of this project (Block 2) with the energy project to be built in Block 01 and Block 03, the components that make up the latter are considered related facilities and therefore the area occupied by these blocks is included in the area of indirect influence.

7.3.4 Determination of time limits

The definition of the time scale for the cumulative impact analysis, i.e., the time period within which the activities with which the project could interact and the cumulative impacts to occur are identified, takes into account the degree of uncertainty associated with the low level of information available on short-, medium- and long-term development plans for the study area.

Under this consideration, the time limit of the cumulative impact analysis corresponds, in the first term, to the construction period of the project, which has been estimated at a total of approximately 42 months (see Chapter 4 - Project Description). Once the construction stage is completed, the operation period would begin, in which there would be other types of interaction with nearby projects. For the purposes of this analysis, the first ten (10) years of operation (December 2025 to December 2035) were considered, considering that after this period, the degree of uncertainty regarding the development of new works or the continuity of planned activities increases significantly.

7.3.5 Identification of valued environmental and social components (VEC)

IFC's methodological guide defines as VECs those "environmental and social attributes that are considered important in the assessment of impacts and risks", because they are considered relevant or of concern from a social, scientific or professional point of view. They may also be directly or indirectly affected by the cumulative impacts generated by the development of the Manzanillo Energy Consortium Power Plant project, as well as by the projects and activities developed in the surrounding area (area of influence), extreme natural events and social stress factors.

The sources of information for the selection of the SCVs considered in this cumulative impact analysis include the following:

- Chapter 6 - Environmental and Social Baseline (physical, biological and socioeconomic baseline) of this Environmental and Social Assessment Study of the project.
- Chapter 7 - Identification of environmental and socioeconomic impacts of this Environmental and Social Assessment Study of the project.
- Significant environmental and social conditions for communities potentially affected by the project, based on consultations with stakeholders.
- Social and environmental conditions identified as relevant during the baseline survey of the area of influence.
- Available information on significant natural processes and events that could affect the area of analysis for cumulative impacts.

In addition, the VECs subject to this cumulative impact analysis were selected based on the following criteria:

- Impacts identified as part of this impact study and whose evaluation indicated a moderate, high or very high level of significance.
- There is the possibility of a cumulative effect on the VEC with other projects or activities.

Given the nature of the potential interactions, the VECs under analysis are as follows:

- Environmental quality.
- Habitats, vegetation and terrestrial flora.
- Habitats and terrestrial fauna.
- Habitats and aquatic fauna.

- Economy, employment, and livelihoods.
- Quality of life, health, and safety of the community.

Table 7-8. Environmental and social components assessed

VEC of the physical environment	
Environmental quality	Physicochemical properties of air.
	Noise level characteristics.
	Physicochemical characteristics and structure of soils, sensitivity to erosion, change in runoff regime.
	Physicochemical properties of surface and coastal marine waters.
VEC of the biological environment	
Habitats, vegetation, and terrestrial flora	Associations of terrestrial and riparian vegetation that form natural habitats. Includes species with a particular conservation status.
Habitats and terrestrial fauna	Reptiles, amphibians, birds, and mammals that inhabit the project area, either permanently or seasonally.
Habitats and aquatic fauna	Includes fish and zooplankton species that take advantage of the area of influence.
VEC of the socio-economic and historical-cultural environment	
Economy, employment, and livelihoods	Local and regional economic development, workforce employability, income and livelihoods of communities that could be affected by cumulative impacts.
Quality of life, health, and safety of the community	The well-being of the population related to their environment, their physical safety and their perception of situations that may constitute a risk to the environment and/or health, considering the following elements: water and air quality, exposure to noise and vibrations, economic security, risk perception and services offered to the community, vehicular flow.

7.3.6 Identification of actions, activities, projects, and social and natural stressors affecting the VECs

SCVs are immersed in a constantly changing natural environment, which affects their condition and resilience. SCVs function as integrators and receptors of a number of stressful situations that affect them.

According to IFC's Good Practice Manual "The purpose of this step is to identify the totality of stressors that may determine or affect the condition of the VECs selected for the EGIA". The important thing is to identify all sources of stress that may affect the condition or end state of a VEC considering past undertakings whose impacts persist, existing undertakings and foreseeable future undertakings, as well as any other relevant external social and/or environmental factors."

The determination of the potential sources of cumulative impacts existing in the area of influence of the project was carried out considering projects and/or activities (existing or planned) located in the area of analysis and with available information. To obtain the basic information for the analysis of projects and activities, the sources used were:

- Information available on local development plans of governmental entities related to the development of the main activities in the area.
- Public information available in digital media on the development of private and public projects at the local level.

Regarding projects being planned and implemented in the area of influence of the project under study, it was identified that the Dominican government is planning key projects for the development of Manzanillo Bay and the Cibao Noroeste region. In addition to modernizing the port, there are plans for a shipyard, power generation plants, sanitation, road interventions, beach improvements, and accession to the 9-1-1 emergency system.

Most of the works are in the planning process, with the exception of the Manzanillo Power Plant, whose developer is executing the civil works, and the construction of two hotels of the foreign chain Super 8 in Pepillo Salcedo and Montecristi began in November 2021. The Master Plan for all these works is in the design process.

In addition to the identification of projects in the study area, economic activities in the area of influence of the project were identified.

The projects and activities in the area of influence that could generate cumulative impacts with the Manzanillo Energy Consortium Power Plant project are the following:

Table 7-9. Projects and activities in the area of influence likely to generate cumulative impacts.

Company/Project Name	Sector	Description of activities
Rehabilitation and Expansion of the Port of Manzanillo (in planning)	Maritime-port	<p>The port of Manzanillo, built in the 1950's, has 227.70 linear meters of docks, with berthing depths of 36, 30 and 25 feet. Its operations are based on the export of banana and small fruit containers. Import cargo operations are also carried out at these facilities.</p> <p>The rehabilitation of the Manzanillo port includes: a solid offshore pier parallel to the coast, from the end of the existing 220 m by 40 m breakwater proposed for the expansion of the pier, including the reinforcement and reconstruction of the existing breakwater and the expansion at the end of the breakwater.</p> <p>Also, rehabilitation of access roads to the port. The roads that are planned are the Duarte highway, starting from the Villa Bisonó section at the Navarrete exit to Montecristi and highway 20, specifically the Palo Verde to Laguna Verde section.</p> <p>According to the Environmental and Social Impact Assessment, the project has been categorized by the IDB as a Type A project.</p>

Company/Project Name	Sector	Description of activities
		<p>This expansion is expected to promote the development of new exports from the agribusiness sector and the northwest free trade zones.</p> <p>The rehabilitation of the Manzanillo port began its activities, by public act, on August 4, 2023 and its general scope includes improvements to the port's access roads.</p>
Municipal Development Plan Pepillo Salcedo 2020-2024	Social-economic	<p>According to this plan, four (4) Strategic Clusters have been identified in the Province of Monte Cristi that constitute the sectors with the greatest opportunities for development and consolidation, which present an appreciable level of current exploitation and have potential for sustainable growth in the long term. These are: 1. Agriculture, 2. Logistics services, 3. Of these, the municipality of Pepillo Salcedo stands out for its high incidence and concentration of activities belonging to two (2) of the four clusters: the logistics sector and the agricultural sector.</p> <p>The strategic objectives (related to potential projects) of this plan are as follows:</p> <ul style="list-style-type: none"> • Extend the drinking water distribution network of Pepillo Salcedo. • Build a new aqueduct in Pepillo Salcedo. • Build water reservoirs in Pepillo Salcedo. • Construction of tube wells for Pepillo Salcedo's cattle ranchers. • Execution of works in the Pepillo Salcedo irrigation systems. <p>The City Council shall exercise as its own or exclusive competence in the following matters:</p> <ol style="list-style-type: none"> a) Ordering the traffic of vehicles and people on urban and rural roads. b) To regulate and manage the public space, both urban and rural. c) Prevention, extinguishing of fires and financing of fire stations. d) Land use planning, urban planning, land management, urban execution and discipline; e) To regulate and manage the maintenance and use of green areas, parks and gardens.

Company/Project Name	Sector	Description of activities
		<p>f) To regulate and manage the protection of public hygiene and health to guarantee environmental sanitation.</p> <p>g) Construction of urban infrastructure and equipment, paving of urban public roads, construction and maintenance of rural roads, construction and maintenance of sidewalks, curbs and neighborhood roads.</p> <p>h) Preservation of the historical and cultural heritage of the municipality.</p> <p>i) Construction and management of slaughterhouses, markets and fairs.</p> <p>j) Construction and management of cemeteries and funeral services.</p> <p>k) Installation of public lighting.</p> <p>l) Road cleaning</p> <p>m) Cleaning services and public ornamentation, collection, treatment and final disposal of solid waste.</p> <p>n) To order and regulate urban public transportation.</p> <p>o) Promotion, development and local economic development.</p>
Urban-residential development	Social-community	<p>The residential complex is concentrated in the northwest. Municipal development, including city hall and schools, is clustered around 27 de Febrero Street. The residential complex is dispersed to the south, where new housing is being built. Although the land in Manzanillo is owned by the government of the Dominican Republic, many families have occupied their land for generations, while others have reclaimed undeveloped land and have begun building new homes.</p>
Super 8 Manzanillo Whyndham Hotel	Tourism	<p>The Super 8 Manzanillo hotel is located in the municipality of Pepillo Salcedo, in the province. It has 54 rooms, four levels, a large parking lot, swimming pool, restaurant and gym, among other areas.</p> <p>This project is part of a total of 18 hotels that this chain will build in different provinces of the country.</p>
Pepillo Salcedo Municipal Hospital	Social-health	<p>The Pepillo Salcedo Municipal Hospital, located in Manzanillo, underwent a major renovation in 2017 and now serves as a medical center for the entire municipality. The medical services offered in the area are provided by the hospital, five Primary Care Units (UNAP) and three pharmacies. this Pepillo Salcedo hospital has X-Ray area, internal medicine, pediatrics, gyneco-</p>

Company/Project Name	Sector	Description of activities
		<p>obstetrics, delivery room, family medicine, dentistry, sonography area, highly trained laboratories, and emergency, among others.</p> <p>Pepillo Salcedo Hospital has 40 beds and a delivery room, but not many specialists.</p> <p>Expansion is planned to accommodate long-term population growth projections.</p>
LNG Energy Projects - Power Generation Plant Block 1 (In planning. The components of this project are considered as facilities related to the project under evaluation)	Energy	<p>The project is in the planning phase and consists of a high efficiency thermoelectric power plant of approximately 400 MW net capacity using primarily Liquefied Natural Gas (LNG) as fuel and an import terminal with onshore LNG storage and regasification, including marine facilities for the continuous supply of LNG to the facility. The thermoelectric power plant together with the natural gas terminal storage and regasification will occupy an area of 375,000 m².</p> <p>The project contemplates the installation of pipeline networks for the import and supply of LNG and seawater systems for the cooling system of approximately 1,000 m long with an approximate easement width of 35 m. The required exclusion area is 75 m wide. The required exclusion area is 75 m wide. Additionally, a jetty will be built in the marine space where ships will dock for the import and supply of LNG.</p>
LNG energy projects - Block 2 power generation plant (the subject of this study)	Energy	<p>The second block of the energy project consists of the installation of a 420 MW combined cycle gas turbine plant, awarded to Manzanillo Energy, composed of the companies, Coastal Dominicana, Manzanillo Energy and Lindsayca.</p>
Manzanillo Power Land Natural Gas Power Plant (under construction)	Energy	<p>The Manzanillo Power Plant project is a private initiative developed by the company Energía 2000 S.A. It consists of the construction of a 414 MW (net capacity) combined cycle gas turbine plant and a gas pipeline to connect the future plant to the new marine terminal needed to offload the natural gas. The plant will be located on an 8.5 ha (21 acre) parcel immediately south of the road between Manzanillo and Copey, about 4.5 km (2.8 miles) from Manzanillo.</p> <p>The corporate building, control station and gas pipeline were inaugurated on August 4, 2023. The rest of the components are still under construction, including adjustments to the road to be used towards the Manzanillo dock, to adapt it to the transit of heavy equipment and the construction of a provisional dock parallel to the axis of the future LNG dock, where the loading of materials, equipment and unloading</p>

Company/Project Name	Sector	Description of activities
		operations of LNG and heavy equipment for the development and supply of the Manzanillo Power Land (MPL) plant can be carried out temporarily, until the construction of the permanent dock is completed.
138 Kv Manzanillo Substation	Energy	The 138/12.5 kV S/E is a lift station that provides electric power distribution service to the area and serves as backup for the construction of the 600 MW 345 kV generation project.
Construction of a 345 KV Power Transmission Line.	Energy	<p>Empresa de Transmisión de Electricidad Dominicana is executing an expansion plan for the transmission system and high voltage substations, which includes the construction of the 345 KV electric highway from Manzanillo to Guayubín and from Guayubín to El Naranjo, Santiago.</p> <p>This expansion of the transmission system includes hundreds of kilometers of 138 KV and 69 KV lines. The purpose is to provide the national electric system with sufficient capacity to discharge and transport all the energy that will be produced by the aforementioned power plants and the renewable energy projects under development.</p>
Road projects (Duarte highway and related projects) (in planning and execution)		<p>Start of the Duarte highway project was in December 2022 and January 2023 and the promoter is the MOPC.</p> <p>Related road projects: El Pocito (Guayubín)-Copey, Guayubín-Martín García-Santiago Rodríguez, Loma Cabrera-Manuel Bueno-Lana, Palo Verde-Laguna Verde.</p>
Economic activities in the primary sector	Trade	<p>The economic dynamics of the municipality of Pepillo Salcedo is mainly boosted by agricultural activities and the development of livestock, especially in the following activities.</p> <p>And sheep raising, as well as the high rural and agricultural component.</p> <p>In agriculture, about 88,894 tareas (5,589.65 ha) of various crops are cultivated, such as rice, guineo (organic and semi-conventional), cassava, chili, plantain, tobacco and tindora.</p>
Economic activities in the secondary sector	Trade	The secondary sector of the economy of the municipality of Pepillo Salcedo is characterized by establishments engaged in the following activities: trade and repair of motor vehicles and motorcycles, real estate activities, gambling and betting activities, retail trade, except trade of motor vehicles and motorcycles, wholesale

Company/Project Name	Sector	Description of activities
		trade, except trade of motor vehicles and motorcycles, and industrial activities, the latter with very little agro-industrial development content. 15.34% (93) of the establishments that interact in the economy of Pepillo Salcedo are dedicated to industrial activities.
Economic activities in the tertiary sector	Trade	<p>Tertiary sector economic activities include supermarkets, grocery stores, bodegas, car washes, disco-bars, gas stations, LPG stations, lottery booths, clothing and appliance stores, hardware stores and motor and vehicle parts stores, chiriperos, restaurants, chicken slaughterhouses, and canteens.</p> <p>The financial sector is composed of COOPATLANTICA and Cooperativa Mormon Bueno, Inc. The municipality does not have a strong commercial banking presence and therefore does not have banks, so its residents travel to Monte Cristi and Dajabón for their financial transactions.</p> <p>Establishments: For 2014-2015 in the municipal territory of Pepillo Salcedo a total of 606 establishments were registered, representing 8.54% of the registered establishments of the province Monte Cristi, within which three groups are evidenced in correspondence to the number or amount of establishment typology, the first group is constituted by 187 (30.86%) were dedicated to retail commerce, followed by 102 (16.83%) corresponding to food and beverage service activities; the second group consisted of 93 (15.35%) establishments dedicated to industrial activities, 71 (11.72%) establishments dedicated to gambling and betting activities and 35 (5.78%) establishments dedicated to other service activities. The third group is made up of a total of 118 (19.47%) establishments dedicated to trade and repair of motor vehicles and motorcycles, associations or organizations, education, financial services, real estate, wholesale trade and public administration and defense.</p>
Industrial Park	Industries	The area where industrial activities are developed is located in the eastern half of Manzanillo with 400,000 m2, so far little developed, however, highlighting companies of deposits and storage of diesel fuel, container

Company/Project Name	Sector	Description of activities
		area and warehouses of Granade Company (currently banana exporting companies).
Manzanillo Heliport	Transport-maritime	The Manzanillo Heliport was inaugurated in 2022, as part of the projects aimed at promoting the socioeconomic development of the province of Montecristi. It will serve as an easy access road to the province of Montecristi, in an area of approximately 7,467 m ² and a construction area of 4,250 m ² , with a landing plaza and two helicopter parking areas.

Source: Prepared by AECOM-EMPACA, 2023.

The methodology proposed by IFC considers as potential sources of cumulative impacts, those events of natural origin or external social pressures that may alter the existing conditions in the project development area.

Considering the information presented in the baseline of the study area, the following natural stress events were identified, which could occur during the construction and/or operation of the project:

Extreme weather events (cyclones, hurricanes):

The Dominican Republic, due to its position in the Western Caribbean, is hit by tropical storms every year. The region has been hit by more than 40 extreme weather events over the past 168 years (NOAA's National Hurricane Center).

Floods

Floods may occur in the study area as a result of extreme precipitation events that cause the formation of peak flows, especially in the lower altitude sectors.

The province of Monte Cristi occupies an area of 1,897.75 km² of which 858.90 km² (45.26 %) corresponds to areas threatened by flooding. In the municipality of Pepillo Salcedo, land in the southern portion, which includes the Copey and Santa María sections, is flood prone. Areas of the Santa Cruz section were also identified.

Average sea level rise

The Dominican Republic is one of the most vulnerable countries in the world to climate change according to the Global Climate Risk Index 201638 (Long Term Climate Risk Index-CRI), it is in eleventh place and Haiti, with which it shares the island, is among the three most affected countries in the world, placing the island as one of the most affected globally. The analysis of the Critical Points of Vulnerability to climate change in the Dominican Republic shows that 13 provinces (about 40%) have high to very high levels of vulnerability, with the province of Monte Cristi being one of the provinces with high vulnerability. Sea level rise represents a growing threat to low-lying coastal areas.

Impacts on coastal-marine systems are coastal flooding due to sea level rise, beach erosion, coral bleaching and mangroves, also affecting coastal populations and the tourism industry (USAID/TNC/IDDI/PLENITUD, 2013).

Earthquake

Earthquakes pose a serious threat to the area, as the Hispaniola fault line is located just south of Manzanillo. According to the seismic analysis and design of structures by the Ministry of Public Works and Communications, Manzanillo is located in seismic zone I, which presents the greatest threat of seismic activity.

As social stressors (external social pressures or forces) are identified:

Human settlements:

During the operational life of the project, the illegal installation of new settlements in the open spaces could occur.

Cross-border migrations:

Manzanillo lacks infrastructure to control border crossings. Haitian workers crossing the border displace Dominican workers, working and performing tasks at a lower cost. Residents, especially young people, are migrating out of the community due to lack of opportunities.

The Table 7-10 presents the potential interactions of the projects or activities likely to generate cumulative impacts with the identified VECs. Although an impact analysis of the projects or activities cited was not performed in this study, the interactions are based on experience with similar projects.

Table 7-10. Interactions between the identified VECs of the LNG Power Plant project.

Sources of impact	VEC					
	Environmental quality	Habitats, vegetation, and terrestrial flora	Terrestrial habitats and fauna	Habitats and aquatic fauna	Economy, employment, and livelihoods	Quality of life, health, and safety of the community
Rehabilitation and Expansion of the Port of Manzanillo	x	x		x	x	x
Municipal Development Plan Pepillo Salcedo 2020-2024	x	x	x	x	x	x
Urban-residential development	x	x		x	x	x
Super 8 Manzanillo Whyndham Hotel	x	x		x	x	
Pepillo Salcedo Municipal Hospital	x	x		x	x	x
Industrial Park	x	x	x	x	x	x
LNG energy projects (Blocks 1 and 2)	x	x	x	x	x	x
Manzanillo Power Land Natural Gas Plant	x	x	x	x	x	x
138 Kv Manzanillo Substation	x	x	x	x	x	x
Construction of a 345 KV Electric Transmission Line.	x	x	x	x	x	x
Economic activities in the primary and secondary sectors	x	x	x	x	x	x
Economic activities in the tertiary sector	x		x	x	x	x
Manzanillo Heliport	x		x	x	x	x
Floods	x	x	x	x	x	x
Cyclones and hurricanes.	x	x	x	x	x	x
Sea level rise		x	x		x	x
Earthquakes	x	x	x		x	x
Human settlements	x				x	x
Cross-border migration	x				x	x

Present conditions of the VECs

The conditions in which the selected VECs are found were presented previously in this document, in the sections related to the description of the baseline information collected in the area of influence of the project.

Cumulative impact assessment

The cumulative impact analysis evaluated the modifications or changes that could occur in the current baseline conditions of the selected VECs, at the time of the interaction of the project activities with the development of the activities and natural events identified as sources of cumulative impacts.

Therefore, the cumulative impacts likely to be generated in the VECs are described below.

Cumulative impacts on Environmental Quality

Table 7-11. Description of cumulative impacts - VEC: environmental quality

Project/activities	Cumulative impacts on the VEC: environmental quality
Port of Manzanillo Rehabilitation and Expansion Project	<p>During the construction and operation stage of this project, environmental quality (air, water and soil) will be altered in the area of influence, since, according to the environmental and social impact study (January 2021) of this project, the following impacts related to environmental quality will occur:</p> <ul style="list-style-type: none"> • Impacts on soil: alteration of the hydrodynamics and morphology of the coastline, occurrence and/or intensification of erosive processes, risk of soil contamination and waterproofing of the land. • Impacts on water resources: increased turbidity in marine waters, alteration of surface water quality and risk of contamination of the water table. • Impacts on Air Quality: change in air quality <p>In addition, the environmental and social impact study for the project identified the following impacts with cumulative and synergistic effects:</p> <ul style="list-style-type: none"> • Alteration of the hydrodynamics and morphology of the coastline. • Increased truck traffic during the operation <p>According to the Environmental Impact Study for this project, one of the main consequences of the implementation of the project will be the alteration of the hydrodynamics and morphology of the coastline. These effects will be added to the effects already caused when the Port of Manzanillo was built in the first half of the 20th century.</p>
Projects/actions of the Municipal Development Plan 2020-2024 of the Municipality Pepillo Salcedo	<ul style="list-style-type: none"> • The activities of the projects and/or actions proposed in this plan, during their construction stage will require the use of heavy machinery for earthmoving, which would represent a source of

Project/activities	Cumulative impacts on the VEC: environmental quality
	<p>gas emissions into the atmosphere, which in turn could generate an increase in noise levels, affect the quality of water and soil (erosion, change in runoff regime).</p> <ul style="list-style-type: none"> During the operation stage, it is estimated that there will be impacts on environmental quality (air, water and soil) with a low degree of impact and of localized extension, since they will occur during the maintenance activities of the structures or facilities, which will be sporadic throughout the useful life of the projects.
Manzanillo Power Land Natural Gas Plant	<ul style="list-style-type: none"> During the construction stage of the electricity generation plant, air quality will be affected due to combustion gas emissions from the vehicles, equipment, and machinery that will be used for the construction and installation of the structures and equipment. There is also a risk of soil and water pollution in the area, mainly due to possible leaks of hydrocarbons or chemical substances from the equipment and machinery, as well as wastewater discharges or improper handling of solid and liquid waste. During the operation stage, especially during electricity generation activities, air quality will be affected due to atmospheric emissions from the generators (greenhouse gas emissions). In addition, maintenance activities of the structures and infrastructure may cause a slight degradation of air quality at the local level. Both operation and maintenance activities will generate an increase in noise levels in the area of influence and there will be a risk of soil contamination and risk of contamination of bodies of water due to possible spills of hydrocarbons or chemicals due to improper handling or storage.
Energy Sector Projects (345 Kv electric transmission line and Manzanillo 138 Kv electric substation).	<ul style="list-style-type: none"> During the construction stage of the transmission line and the electrical substation, air quality will be affected due to combustion gas emissions from the vehicles, equipment and machinery that will be used for the construction and installation of the structures and equipment, and there is also a risk of soil and water pollution in the area, mainly due to possible hydrocarbon or chemical leaks from the equipment and machinery, as well as wastewater discharges or improper handling of solid and liquid waste. During the operation stage, especially during maintenance activities of structures and equipment, there will be an increase in noise levels generated by tools, equipment, vehicles and workers and risk of contamination of soil and water bodies due to possible minor leaks of hydrocarbons and chemical substances from vehicles and equipment, however, on a smaller scale compared to the possible effects generated during the construction stage and those generated during the execution of electric power generation activities.
Urban residential construction activities and projects, Super 8 Manzanillo Whyndham Hotel, Pepillo Salcedo Municipal Hospital and Manzanillo Heliport.	<ul style="list-style-type: none"> Existing residential activities have had and continue to have an impact on environmental quality in various sectors of the project's area of influence. The alterations to the environmental quality of this activity are related to gas emissions such as carbon monoxide, carbon dioxide, and nitrogen oxide due to the presence of vehicles; in the case of the heliport, this alteration is also related to helicopter emissions. In addition, in residential

Project/activities	Cumulative impacts on the VEC: environmental quality
	<p>areas and the heliport, noise is generated by vehicular traffic, the use of audio equipment, the operation of recreation centers, aircraft engines, and occasional construction or remodeling of structures. Water quality could possibly be affected mainly by wastewater discharges and the generation and inadequate management of solid and liquid waste.</p> <ul style="list-style-type: none"> On the other hand, due to the future construction of residential projects, the hotel and the hospital mentioned above, in the area of influence (planned for the next few years), it is estimated that there will be an increase in the alteration or impact on environmental quality in the area of influence, because vehicular emissions and dust generation will increase, generating greater air pollution, noise levels will increase, and the generation of wastewater and solid waste will increase during the construction and operation stage of these projects.
Economic and commercial activities (primary, secondary and tertiary sectors)	<ul style="list-style-type: none"> Existing commercial activities affect environmental quality by altering air quality due to the influx of vehicles and trucks, which in turn affect noise levels in the area. In some areas there may be discharges of untreated wastewater into watercourses and inadequate disposal of hazardous and non-hazardous solid waste on the ground, contributing potentially polluting substances to the environment. Due to the execution of the Pepillo Salcedo Municipal Development Plan and the Master Development Plan by the Dominican Government, there is a high probability that more businesses and service activities will be installed in the future, which will increase the environmental quality impacts described above.
Industrial Park	<ul style="list-style-type: none"> Alterations to the environmental quality of this activity are related to possible gas emissions related to the production process of the industrial activity and the generation of gases due to the influx of vehicles and trucks. In addition, these activities can generate high noise levels due to both vehicle and truck fleet traffic and machinery operating activities, construction, or occasional remodeling of structures. In some areas with industrial uses, there may be discharges of untreated wastewater into watercourses and inadequate disposal of hazardous and non-hazardous solid wastes on the ground.
Floods, cyclones, hurricanes, sea level rise and earthquakes	<ul style="list-style-type: none"> Natural events can cause deterioration in the environmental quality of water resources by increasing the turbidity of watercourses, saline intrusion and due to the dragging of chemical substances and waste into water bodies from sectors with soils contaminated with chemical substances that are affected by floods. Air pollution will also be generated by the generation of particulate matter and possible soil contamination from solid waste due to the possible collapse of some structures.
Human settlements and cross-border migrations	<ul style="list-style-type: none"> On the border between the Dominican Republic and Haiti, the movement of citizens between countries is quite natural, as the border is riddled with passages that allow for daily cross-border

Project/activities	Cumulative impacts on the VEC: environmental quality
	<p>movements (Environmental and Social Impact Study Port of Manzanillo, 2021).</p> <ul style="list-style-type: none"> As a result, there is the possibility of an increase in the migratory processes in the area, which will increase the number of people in the area, which in turn will generate impacts on environmental quality due to the increase in the generation of liquid and solid waste that can affect or contaminate the soil, bodies of water and air, as well as an increase in noise levels in the area.
<p>LNG energy projects. Blocks 1 and 2. (project object of this study and related facilities).</p>	<p>Construction stage:</p> <ul style="list-style-type: none"> During the construction stage of the project and related facilities, the environmental quality of the area of influence will be affected (see details in chapter 7 of this document), such as: increased concentration of particulate matter, increased noise and vibration levels, increased concentration of combustion gases (vehicle emissions), risk of soil contamination, increased turbidity in coastal waters, and risk of surface water contamination. During the impact assessment, the following impacts were evaluated as cumulative: increased turbidity of coastal waters and contamination of surface waters. Based on the above-described activities and projects that are and will be developed in the area of influence and on the results of the identification and evaluation of impacts generated by the project under study, it is estimated that during the construction stage of the project, there will be a cumulative effect of the alteration on the environmental quality in the area of influence. <p>Operating stage:</p> <ul style="list-style-type: none"> During the operation stage, the power plant will generate air pollution from emissions of combustion gases into the atmosphere (greenhouse gas emissions) and particulate matter from the operation of the power generators, increased noise and vibration levels, soil contamination, groundwater contamination, overexploitation of the aquifer, modification of coastal water quality, and surface water contamination. During the evaluation of the impacts generated by the operation of the electricity generation plant, the following impacts were assessed as cumulative: air pollution from emissions of combustion gases into the atmosphere and suspended particles, increased noise and vibration levels, contribution to climate change, groundwater contamination, overexploitation of the aquifer, modification of coastal water quality, and surface water contamination. Therefore, it is estimated that the project during the operation stage will contribute to the cumulative impacts on the environmental quality of the area of influence.

Cumulative impacts on habitats, vegetation and terrestrial flora and fauna

Table 7-12. Description of cumulative impacts - VEC: habitats, vegetation and terrestrial flora.

Project/activities	Cumulative impacts on the VEC: habitats, vegetation and terrestrial flora.
Project: Rehabilitation and Expansion of the Port of Manzanillo	During the construction and operation stage of this project, according to the environmental and social impact study (January 2021) of this project, the following impacts will occur, which were evaluated with cumulative effect: loss of vegetation cover and affectation of flora and risk of impacts on protected areas around the project, especially the Estero Balsa Mangrove Park, which is the closest Dominican protected area to the project, and the Les Trois Baies Park, a Haitian protected area.
Projects/actions of the Municipal Development Plan 2020-2024 of the Municipality Pepillo Salcedo	During the construction activities of the projects proposed in this plan, there will be a loss of vegetation cover and flora will be affected, since it will be necessary to remove vegetation in order to carry out construction activities.
Manzanillo Power Land Natural Gas Plant	During the construction activities of the electricity generation plant, the loss of vegetation cover and flora will be unavoidable, since it will be necessary to remove vegetation in order to carry out construction activities. In fact, since the power plant is under construction, vegetation has already been removed from the construction area, affecting the habitat, vegetation and flora existing in the area.
Energy Sector Projects (345 Kv electric transmission line and Manzanillo 138 Kv electric substation).	During the construction of the power transmission line and the electrical substation, there will be a loss of vegetation cover and flora will be affected because it will be necessary to remove vegetation in the project areas in order to carry out construction activities. During the operation of these structures, it will be necessary to control vegetation growth along the transmission line easement and around the substation's operating structures.
Urban residential construction activities and projects, Super 8 Manzanillo Whyndham Hotel, and Pepillo Salcedo Municipal Hospital.	<ul style="list-style-type: none"> Population growth in the sectors of the project's area of influence has reduced the areas occupied by vegetation, as a large part of the vegetation is cleared for the construction of housing, commercial, service, and industrial use. The past, current, and future reduction of natural terrestrial habitats has led and will lead to a decrease in the richness of flora species in the area of influence. According to the biological baseline information for this study (see Chapter 6 of this document), two types of vegetation were identified in the project area: secondary xerophytic vegetation in the southern part and mangrove in the northern part of the study area. These climatic events, depending on their magnitude, can affect vegetation cover areas, since winds can cause defoliation or detachment of trees and shrubs, as well as the effect of earthquakes, which can also be affected by currents in the event of flooding and rising sea levels.
Economic and commercial activities (primary and secondary sector)	
Industrial Park	
Floods, cyclones, earthquakes, sea level rise and hurricanes	

Project/activities	Cumulative impacts on the VEC: habitats, vegetation and terrestrial flora.
LNG energy projects. Blocks 1 and 2. (project object of this study and related facilities).	<ul style="list-style-type: none"> During the construction stage of the project and related facilities, vegetation cover will disappear and there will be a partial loss of flora due to vegetation clearing for the construction of the works, including individuals and populations of native, endemic and endangered species. This impact on vegetation will be added to that generated by the activities and projects described above, causing a cumulative impact on this VEC in the area of influence of the project that will last throughout the useful life of these works.

Cumulative impacts on terrestrial habitats and wildlife

Table 7-13. Description of cumulative impacts. VEC: terrestrial habitats and fauna.

Project/Activities	Cumulative impacts on the VEC: terrestrial habitats and wildlife
Projects/actions of the Municipal Development Plan 2020-2024 of the Municipality Pepillo Salcedo	During the construction activities of the projects contemplated in the plan, there will be a loss of vegetation cover due to the clearing or removal of vegetation in the construction area, which in turn will lead to a loss of terrestrial fauna habitat in the area where the projects will be developed, and therefore the habitat of terrestrial fauna in the area will also be reduced.
Manzanillo Power Land Natural Gas Plant	<p>The loss of vegetation cover due to clearing or vegetation removal activities in the construction area of the power plant will result in a loss of natural habitat for terrestrial fauna in the project area.</p> <p>For the Manzanillo Power Land plant, this has already been done, reducing the natural habitat of the terrestrial fauna in the sector.</p>
Energy Sector Projects (345 Kv electric transmission line and Manzanillo 138 Kv electric substation).	<p>During project construction activities there will be a loss of vegetation cover due to clearing or removal of vegetation in the project construction area, which will result in a loss of terrestrial wildlife habitat in this area. This impact will be permanent in the area of the electrical substation.</p> <p>However, during the operation phase of the transmission line, there will be a regeneration of vegetation cover in the easement area, which will be controlled by periodic clearing, but will continue to serve as habitat for terrestrial fauna in the area.</p>
Urban residential activities and projects, Super 8 Manzanillo Whyndham Hotel, Pepillo Salcedo Municipal Hospital and Manzanillo Heliport. Economic and commercial activities (primary, secondary and tertiary sectors)	<ul style="list-style-type: none"> As a consequence of current and future anthropic activities in the area of influence, such as residential complexes, businesses, and industries, the areas occupied by vegetation have been and will be reduced, which has contributed and will contribute to a considerable loss of habitats and terrestrial fauna species.

Project/Activities	Cumulative impacts on the VEC: terrestrial habitats and wildlife
Industrial Park	
Floods, cyclones, hurricanes, sea level rise and earthquakes	<ul style="list-style-type: none"> In the presence of this type of natural event, terrestrial habitats can be completely flooded and lose vegetation cover, eliminating resident fauna, especially small species with limited mobility, by dragging or drowning.
LNG energy projects. Blocks 1 and 2. (project object of this study and related facilities).	<p>Construction stage:</p> <ul style="list-style-type: none"> During the construction stage of the project and related facilities, there will be a loss of habitat for fauna due to clearing and disturbance of fauna due to construction activities that generate noise and dust and human presence. <p>Operating stage:</p> <ul style="list-style-type: none"> During the operation stage of the project, there will be the possibility of the spread of vector and rodent pests due to poor solid waste management and the possibility of affecting fauna due to the use of chemical products to control vector and rodent pests. The development of the project (construction and operation) will affect the habitats and consequently the terrestrial fauna in its area of influence, causing a cumulative impact.

Cumulative impacts on aquatic fauna and habitats

Table 7-14. Description of cumulative impacts - VEC: habitats and aquatic fauna

Project/Activities	Cumulative impacts on the VEC: habitats and aquatic fauna.
Manzanillo Port and Rehabilitation Expansion Project	<p>During the construction and operation stage of this project, according to the environmental and social impact study (January 2021) of this project, the following impacts on fauna will occur:</p> <ul style="list-style-type: none"> Alteration of semi-aquatic and aquatic fauna habitats during construction. Alteration of the population of benthic organisms during the construction phase. Increase in the diversity and abundance of benthic and nektonic organisms in the operation phase. Introduction of organisms through ballast water in the operation phase <p>In addition, the environmental and social impact study for this project identified the following cumulative and synergistic impacts:</p> <ul style="list-style-type: none"> Increase in the diversity and abundance of benthic and nektonic organisms in the operation phase. Introduction of organisms through ballast water in the operation phase <p>Additionally, the movement of ships in Manzanillo Bay will be responsible for a series of cumulative impacts, including those associated with ballast water, which can bring invasive alien species into the bay that can have disastrous effects on aquatic biota and human activities.</p>
Projects/actions of the Municipal Development	Because the construction and operation of the projects or actions proposed in this plan will be carried out on land, there are no direct impacts to habitats and/or

Project/Activities	Cumulative impacts on the VEC: habitats and aquatic fauna.
Plan 2020-2024 of the Pepillo Salcedo City Council	aquatic fauna. However, there is a risk of accidental leaks or spills of hydrocarbons or chemical substances into the soil or if solid and liquid waste is stored or handled improperly, which could be carried by runoff into bodies of water and contaminate water bodies and in turn affect habitats and aquatic fauna.
Manzanillo Power Land Natural Gas Plant	During the construction stage of the power generation plant, there is a risk of leaks or accidental spills of hydrocarbons or chemicals into bodies of water, affecting habitats and aquatic fauna. During the operation stage, there is the possibility of affecting marine biota due to the discharge of cooling water into bodies of water and possible accidental spills of hydrocarbons or chemical substances.
Energy Sector Projects (345 Kv transmission line and Manzanillo 138 Kv substation)	Because the construction and operation of these projects will be carried out on land, there are no direct impacts on habitats and/or aquatic fauna. However, there is a risk of leaks or accidental spills of hydrocarbons or chemicals or improper handling of solid or liquid waste that could contaminate bodies of water, which in turn could affect habitats and aquatic fauna.
Urban residential activities and projects, Super 8 Manzanillo Whyndham Hotel and Hospital Municipal Pepillo Salcedo Economic and commercial activities (primary, secondary and tertiary sectors) Industrial Park	<ul style="list-style-type: none"> Human activity in the environment has affected the habitat for aquatic fauna species in the watercourses as a result of wastewater discharges, solid waste and inadequately disposed solid waste.
Floods, cyclones and hurricanes	<ul style="list-style-type: none"> It is estimated that in the event of flooding events in the area of influence of the project, some of which may be the result of cyclones and hurricanes, changes in water quality will be generated (increased turbidity, dragging of waste and chemical substances into the watercourses), which will be added to the alterations that could be generated by the work during the construction stage as a result of accidental contributions of solids, chemical substances or waste.
LNG energy projects. Blocks 1 and 2. (project object of this study and related facilities).	<p>Construction stage:</p> <p>During the construction stage of the project and related facilities, there will be the possibility of affecting marine biota due to the installation of the pipeline networks for the natural gas supply and cooling system, as well as the natural gas offloading platform in the marine space (Jetty).</p> <p>Operating stage:</p> <ul style="list-style-type: none"> During the operation stage of the project, there will be the possibility of affecting the marine biota due to the discharge of cooling water into the sea. If the existing activities, future projects and natural environmental factors described above coincide with the construction and operation activities of the project under study, cumulative impacts could be generated on this VEC.

Cumulative impacts on the economy, employment, and livelihoods

Table 7-15. Description of cumulative impacts - VEC: economy, employment, and livelihoods.

Project/activities	Cumulative impacts on the VEC: economy, employment and livelihoods
Port of Manzanillo Rehabilitation and Expansion Project	<p>This project will increase mobilization and trade in the region.</p> <p>According to the environmental and social impact study for this project, the following socioeconomic impacts will be generated during the construction and operation phases of this project:</p> <ul style="list-style-type: none"> • Impacts on Import, Export and Port Transit Volume: Increased port capacity for import, export and port transit movements. • Impacts on Employment and the Local Economy: Generation of direct and indirect jobs during construction, generation of direct and indirect jobs during operation, acquisition of goods and services in the local market during the construction phase, loss of employment and lower demand in the local economy at the end of construction, risk of impact on fishing activities. • Impacts on Infrastructure, Social Facilities and Public Services: Increased demand for health services, impact on land and maritime traffic conditions, temporary overload of solid waste disposal sites, risk of project-related migration and consequent pressure on infrastructure and services.
Projects/actions of the Municipal Development Plan 2020-2024 of the Municipality Pepillo Salcedo	The implementation of the projects and actions contemplated in this plan will increase the benefits to the local and regional economy, generate jobs and improve the livelihoods of the community.
Manzanillo Power Land Natural Gas Plant	These projects, during their construction and operational phases, will contribute to the generation of jobs and therefore to the economic movement in the area. These benefits will be similar and will be added to the impacts that will be generated by the project that is the subject of this study because they are similar activities.
Energy Sector Projects (Transmission line and electric substation Manzanillo)	These projects, during their construction and operational phases, will contribute to the generation of jobs and therefore to the economic movement in the area, which will increase the benefits to the local and regional economy.
Residential, hotel and hospital activities and projects	<ul style="list-style-type: none"> • Residential activities, as well as commercial, industrial and service activities in the area of influence contribute to the local and regional economy, generate employment and improve the livelihoods of the community. • The residential, hotel and hospitality projects to be built in the area will increase the benefits to the local and regional economy, generate jobs and improve the livelihoods of the community.
Commercial activities	
Industrial activities	
Floods, cyclones, hurricanes	<ul style="list-style-type: none"> • These weather events generate the risk of temporarily and negatively affecting the local economy, since, depending on their magnitude, they could render sections of some roads and access roads to businesses unusable, as well as directly affect the structures of businesses, even forcing their temporary closure.

Project/activities	Cumulative impacts on the VEC: economy, employment and livelihoods
Human settlements and cross-border migrations	<ul style="list-style-type: none"> There is the possibility of an increase in migration processes in the area, which will increase the number of people in the area, which in turn will have impacts on the economy, employment, and livelihoods, such as tension between local and foreign labor.
Project subject of this study	<p>The Manzanillo Energy Consortium Power Plant Project is expected to generate the following positive impacts on the economy:</p> <p>During the construction stage:</p> <ul style="list-style-type: none"> Increase in the financial flow and commercial activity in the province of Montecristi due to the contracting of services. Generation of income for the State and the Municipality of Pepillo Salcedo from the payment of taxes. Temporary increase in demand for food services for Project workers. Temporary increase in demand for rooms in the municipality of Pepillo Salcedo for Project workers residing in distant areas. Generate higher income for the sector of the population employed in the motoconcho transport sector, which is the main means of transportation in the area. <p>During the operation stage:</p> <ul style="list-style-type: none"> Increase in the financial circulation in the province of Montecristi. Increase in the flow of capital around the country's economy and tax revenues by the Municipality of Pepillo Salcedo. <p>These benefits generated by the project, together with the generation of jobs and the current and future demand for goods and services by residents, commercial, service, and industrial establishments and future projects in the area of influence of the project, will contribute to the stimulation of the regional and national economy (positive cumulative effect).</p> <p>However, in the specific case of stress caused to the VEC by natural events (floods, cyclones and hurricanes), these can have a negative cumulative effect on the project depending on the magnitude and temporal effects of each of these climatic events within the project's area of influence.</p>

Cumulative impacts on quality of life, health, and safety of the community

Table 7-16. Description of cumulative impacts - VEC: quality of life, health and safety of the community

Project/activities	Cumulative impacts on the VEC: quality of life, health and community safety.
Project: Port of Manzanillo Rehabilitation and Expansion	<p>The quality-of-life impacts indicated in the project's environmental and social impact study are as follows:</p> <ul style="list-style-type: none"> Generation of expectations in the population. Adverse impacts generated in the local community by the influx of workers from other regions during construction. General inconvenience to the nearest population. Accident risks associated with increased truck traffic during the operation.

Project/activities	Cumulative impacts on the VEC: quality of life, health and community safety.
	<ul style="list-style-type: none"> • Inconveniences associated with increased truck traffic during the operation. • Changes in the landscape. <p>These last three impacts were evaluated with a cumulative and synergistic effect in the aforementioned study.</p> <p>The environmental and social impact study of this project also points out that the operation activities of the Port and the roads under study will have a greater potential to cause cumulative effects, either by increasing road and maritime traffic, increasing the risk of accidents, causing discomfort to the population and, mainly, by changing the dynamics of the local landscape.</p>
Projects/actions of the Municipal Development Plan 2020-2024 of the Pepillo Salcedo City Council	<p>Especially during the construction phase, the activities of the projects and plans proposed in this plan could have an impact on the vehicular flow in the area, increasing traffic, disturbing the circulation of the population and therefore increasing the risk of accidents, in addition to noise, exhaust emissions, and dust nuisance to the population. However, it will also generate jobs and an increase in commercial and economic activity (construction and operation) and increase the availability of drinking water and water for irrigation in the area during the operation stage, improving the quality of life of the population.</p>
Manzanillo Power Land Natural Gas Plant	<p>This project, during its construction and operation phase, will contribute to improving the quality of life of the population by generating employment and improving the region's economy. However, noise, dust, and combustion gases, as well as possible accidents due to increased vehicular traffic flow in the area, will cause inconvenience to the population.</p> <p>These impacts will be added to the impacts that will be generated by the project that is the subject of this study because they are similar activities.</p>
Energy Sector Projects (345 Kv electric transmission line and Manzanillo 138 Kv electric substation).	<p>During the construction phase, an increase in vehicular traffic is expected, disrupting the circulation of the population and thus increasing the risk of accidents, in addition to the inconvenience to the population. However, jobs will be generated and commercial and economic activity in the area will increase, improving the quality of life of the population.</p> <p>However, during the operation phase of these projects, no major impacts on vehicular traffic are foreseen, except during maintenance activities, which will be temporary and temporary.</p>
Urban residential construction activities and projects, Super 8 Manzanillo Whyndham Hotel, Hospital Municipal Pepillo Salcedo hotel and Manzanillo Heliport.	<p>The construction activities of the aforementioned projects will generate an increase in noise, affect air and surface water quality, and increase vehicular traffic, which will increase the impact on the quality of life and health and safety of the population, although the generation of jobs will have a positive effect on the quality of life of the population.</p>

Project/activities	Cumulative impacts on the VEC: quality of life, health and community safety.
Economic and commercial activities (primary, secondary and tertiary sectors) and industrial park	<p>Commercial and industrial activities in the area provide jobs for the inhabitants, which allows them to improve their quality of life.</p> <p>All productive activities, especially industrial activities, can present risks to the health and safety of workers due to issues such as waste and wastewater management, emissions, vehicular traffic and heavy loads, presence and operation of equipment and machinery, among others.</p>
Floods, cyclones, hurricanes, sea level rise and earthquakes	<p>These climatic and natural events that may occur in the area of influence affect structures and vehicular traffic with the consequent increase in the risk of accidents.</p>
Human settlements and cross-border migrations	<p>There is the possibility of an increase in the migratory processes in the area, which will increase the number of people in the area, which in turn will generate impacts on the quality of life and health and safety of the inhabitants of the communities in the area, such as the spread of diseases, overloading of public services, increased vehicular traffic, among others.</p>
LNG energy projects. Blocks 1 and 2. (project object of this study and related facilities).	<p>The Manzanillo Energy Consortium Power Plant Project is expected to generate the following impacts on the quality of life and health and safety of the population:</p> <p>During the construction stage:</p> <ul style="list-style-type: none"> • Creation of temporary jobs. • Improvement of the quality of life and purchasing power of workers • Potential for local residents to be disturbed by increased noise and dust levels • Risk of spreading diseases among workers and residents of the communities. • Risk of physical injury or loss of life to residents arising from the use of force by Project physical security personnel. • Risk of accidents resulting in physical injury or loss of life to workers and residents as a consequence of the Project's construction activities. <p>During the operation stage:</p> <ul style="list-style-type: none"> • Possibility of affecting the population due to increased levels of gas emissions, suspended particulate matter, noise and vibrations. • Creation of permanent jobs. • Improving the quality of life and purchasing power of Project workers and their families. • Improvement in the public electric energy service due to an increase in the energy supply. • Risk of spreading communicable diseases among workers and community residents. • Risk of physical injury or loss of life to residents arising from the use of force by Project physical security personnel.

Project/activities	Cumulative impacts on the VEC: quality of life, health and community safety.
	<ul style="list-style-type: none"> • Risk of accidents resulting in physical injury or loss of life to workers and residents and visitors. • Generation of benefits for the population of Pepillo Salcedo through the implementation of the Project's Community Relationship Plan. <p>The benefits in terms of improving the quality of life and purchasing power of workers generated by the construction and operation of the projects described above are in addition to the positive impacts of improving the quality of life and purchasing power of workers that will be generated by the construction and operation of the Manzanillo Energy Consortium Power Plant project.</p> <p>However, the project that is the subject of this study could have a negative cumulative impact with the projects that are being developed and will be developed in the area, specifically with regard to the health and safety of the community due to the increase in vehicular traffic and disruption of circulation, as well as an increase in noise levels, vibrations, gas emissions and suspended particles in the event that their activities coincide in the construction stage and in specific events of their operational stages.</p> <p>In the specific case of stress caused to the VEC by natural events (floods, cyclones, hurricanes and earthquakes) these can have a negative cumulative effect on the project. The presence of risks to the safety of the population could be added to the risks related to the construction of the project and to the operation and maintenance activities, in cases where the incidence of climatic or natural conditions is present in the surroundings of the work fronts and facilities of the terminal and the power plant.</p>

Matrix 7.1 - Interaction Matrix - construction phase

ENVIRONMENTAL ELEMENTS	PROJECT ACTIVITIES										
	Construction Phase										
	Mobilization of materials, equipment and machinery to the project site.	Installation of temporary construction facilities and demand for basic services during the construction phase.	Land conditioning.	Construction of the thermoelectric power plant facilities.	Construction of service infrastructure.	Construction of transmission line to the National Interconnected Electric System.	Connection to the National Grid.	Hiring of temporary labor force	Withdrawal of temporary facilities.	Transportation of construction materials and waste.	TOTAL
Air	•	•	•	•	•	•	•		•	•	9
Weather	•	•	•	•	•	•	•		•	•	9
Soil		•	•	•	•	•	•		•		7
Vegetation		•	•			•					3
Terrestrial fauna	•	•	•	•	•	•	•	•	•	•	10
Population (workers and communities)		•	•	•	•	•	•	•	•		8
Construction Sector		•	•	•	•	•	•				6
Economy		•	•	•	•	•	•	•	•	•	9
Traffic and roads	•									•	2
Basic services infrastructure								•			1
Cultural heritage			•								1
Resources (water, energy resources, loanable materials)		•	•								2
Landscape		•	•	•	•	•	•				6
TOTAL	4	10	11	8	8	9	8	4	6	5	73

Matrix 7.2 - Interaction matrix - operation phase

ENVIRONMENTAL ELEMENTS	PROJECT ACTIVITIES												TOTAL
	Operation Phase												
	Start-up and operations of the thermoelectric power plant and the electric transmission line.	Maintenance of facilities, equipment and power transmission lines.	Liquefied Natural Gas handling and consumption.	Liquid fuel handling and consumption.	Generation and management of hazardous and non-hazardous solid waste.	Generation and management of oily waste.	Water consumption.	Electricity consumption	Treatment of industrial and domestic liquid waste generated.	Vector and rodent pest control.	Handling of chemical products.	Hiring of permanent labor force.	
Air	•	•											2
Weather	•												1
Soil		•		•	•	•			•				5
Groundwater									•				1
Surface water				•	•	•			•				4
Terrestrial fauna	•				•					•	•		4
Marine biota									•				1
Population (workers and communities)	•	•	•	•	•	•	•		•	•	•	•	11
Economy	•	•	•	•	•	•	•		•	•		•	10
Land use	•												1
Energy System	•												1
Basic services infrastructure.												•	1
Resources (water, energy resources)			•	•			•	•					4
Landscape	•				•								2
TOTAL	8	4	3	5	6	4	3	1	6	3	2	3	48

Matrix 7.3 - Identification of impacts - construction phase

ENVIRONMENTAL ELEMENTS		PROJECT ACTIVITIES								
		Construction Phase								
	Mobilization of materials, equipment and machinery to the project site.	Installation of temporary construction facilities and demand for basic services during the construction phase.	Land conditioning.	Construction of the thermoelectric power plant facilities.	Construction of service infrastructure.	Construction of transmission line to the National Interconnected Electric System.	Connection to the National Grid.	Hiring of temporary labor force	Withdrawal of temporary facilities.	Transportation of construction materials and waste.
Air	A-1,A-2,A-3	A-1,A-2,A-3	A-1,A-2,A-3	A-1,A-2,A-3	A-1,A-2,A-3	A-1,A-2,A-3	A-1,A-2,A-3		A-1,A-2,A-3	A-3
Weather	CL-1	CL-1	CL-1	CL-1	CL-1	CL-1	CL-1		CL-1	CL-1
Soil		S-1, S-2	S-2	S-2	S-2	S-2	S-2			
Vegetation		V-1	V-1							
Terrestrial fauna	F-2	F-1,F-2	F-1,F-2	F-2	F-2	F-2	F-2		F-2	F-2
Population (workers and communities)	PB-3	PB-3,PB-4,PB-6	PB-3,PB-6,PB-7, PB-8	PB-3,PB-6	PB-3,PB-6	PB-3,PB-6	PB-3,PB-6	BP-1,BP-2,BP-4,BP-5	PB-3	
Construction Sector		CT-1	CT-1	CT-1	CT-1	CT-1	CT-1			
Economy		EC-1,EC-2	EC-1	EC-1,EC-2	EC1	EC-1,EC-2	EC-1	EC-3,EC-4,EC-5	EC-1	
Traffic and roads	TV-1,TV-2,TV-3									TV-1,TV-2,TV-3
Basic services infrastructure								IS-1		
Cultural heritage			PC-1							
Resources (water, energy resources, loanable materials)		RC-1, RC-2	RC-3							
Landscape		PS-1	PS-1	PS-1	PS-1	PS-1				
TOTAL	9	18	17	12	11	12	10	8	7	6

Note: The codes in the cells represent the impacts for each environmental element generated by the respective activities.

Matrix 7.4 - Identification of impacts - operation phase

ENVIRONMENTAL ELEMENTS	PROJECT ACTIVITIES											
	Operation Phase											
	Start-up and operations of the thermoelectric power plant and the power transmission line.	Maintenance of facilities, equipment and power transmission lines.	Liquefied Natural Gas handling and consumption.	Handling and consumption of liquid fuel.	Generation and management of hazardous and non-hazardous solid waste.	Generation and management of oily waste.	Water consumption and treatment.	Electricity consumption	Treatment of industrial and domestic liquid waste generated.	Vector and rodent pest control.	Handling of chemical products.	Hiring of permanent labor force.
Air	A-4, A-5	A-5	A-6									
Weather	CL-2											
Soil		S-4		S-4	S-3	S-3			S-3			
Groundwater									AS-1			
Surface water									ASP-1			
Vegetation	V-2											
Terrestrial fauna	F-5, F-6				F-3					F-4	F-4	
Marine biota									BM-1			
Population (workers and communities)	PB-9, PB-12,PB-15,PB-16,PB-17, PB-18	BP-9, BP-15, BP-18	PB-15, PB-16	PB-15, PB-16	PB-13, PB-15,PB-16				PB-13	PB-15,PB-16	PB-15,PB-16	PB-10,PB-11, PB-13,PB-14
Economy	EC-6,EC-7	EC-6	EC-6	EC-6	EC-6	EC-6	EC-6		EC-6	EC-6		EC-7
Land use	US-1											
Energy System	SE-1,SE-2											
Basic services infrastructure												IS-2
Resources (water and energy resources)			RC-4	RC-4			RC-5	RC-4				
Landscape	PS-2				PS-2							
TOTAL	18	6	5	5	7	2	2	1	6	4	3	6

Note: The codes in the cells represent the impacts for each environmental element generated by the respective activities.

Matrix 7.5 Impact assessment - construction phase

Impact code	Impact Assessment Criteria											SF	Impact classification
	CI	I	EX	RO	PE	RV	RC	SI	AC	IMP	EF		
A-1	(-)	2	2	4	1	1	1	2	1	4	D	24	LOW
A-2	(-)	4	4	8	1	1	1	2	1	4	D	38	MODERATE
A-3	(-)	1	1	8	1	1	1	2	1	4	D	23	LOW
CL-1	(-)	1	4	2	4	4	4	2	4	4	I	35	MODERATE
S-1	(-)	1	1	2	1	1	1	1	1	2	D	14	LOW
S-2	(-)	1	1	2	1	1	1	1	1	2	D	14	LOW
V-1	(-)	8	2	8	4	4	4	4	4	4	D	60	HIGH
F-1	(-)	4	2	8	4	4	4	4	4	4	D	48	MODERATE
F-2	(-)	2	1	4	1	2	2	2	4	4	D	27	MODERATE
PB-1	(+)	8	2	4	1	4	4	4	4	4	I	53	HIGH
PB-2	(-)	2	2	2	1	4	4	2	4	4	D	31	MODERATE
PB-3	(-)	1	2	2	1	4	4	2	4	4	D	28	MODERATE
PB-4	(-)	1	2	1	1	4	4	2	4	4	D	27	MODERATE
PB-5	(-)	2	1	2	1	4	4	2	4	4	D	29	MODERATE
PB-6	(-)	1	1	8	4	4	4	2	4	2	D	33	MODERATE
PB-7	(-)	1	1	8	4	4	4	2	4	1	I	32	MODERATE

Impact code	Impact Assessment Criteria											SF	Impact classification
	CI	I	EX	RO	PE	RV	RC	SI	AC	IMP	EF		
CT-1	(+)	4	4	8	1	4	4	2	4	4	D	47	MODERATE
EC-1	(+)	8	2	8	1	4	4	4	4	4	D	57	HIGH
EC-2	(+)	2	2	8	2	4	4	2	4	8	D	42	MODERATE
EC-3	(+)	8	2	4	1	4	4	2	4	4	D	51	HIGH
EC-4	(+)	2	2	4	1	4	4	2	4	4	I	33	MODERATE
EC-5	(+)	2	2	4	1	4	4	2	4	4	I	33	MODERATE
EC-6	(+)	2	2	4	1	4	4	2	4	4	I	33	MODERATE
TV-1	(-)	1	1	8	1	4	4	2	4	2	D	30	MODERATE
TV-2	(-)	2	1	2	1	4	4	2	4	4	D	29	MODERATE
TV-3	(-)	1	1	2	1	1	1	1	1	2	I	14	LOW
IS-1	(-)	4	2	8	4	4	4	2	4	4	I	46	MODERATE
PC-1	(-)	1	1	1	4	4	4	2	4	2	D	26	MODERATE
RC-1	(-)	2	2	8	1	1	4	2	4	4	D	34	MODERATE
RC-2	(-)	2	4	8	1	4	4	2	4	4	D	41	MODERATE
RC-3	(-)	1	1	8	1	4	4	2	4	2	D	30	MODERATE
PS-1	(-)	2	2	8	1	1	4	1	1	2	D	28	LOW
CI = Character of the impact			RO = Risk of occurrence					Scale			Impact classification		
I = Intensity			AC = Accumulation					≤ 25			Low (L)		
EX = Extension			RC = Recoverability					>25 - ≤50			Moderate (M)		
SI = Synergy			RV = Reversibility					>50 - ≤75			High (H)		
PE = Persistence			IMP = Importance					>75			Very High (VH)		
EF = Effect			SF = Significance of impact										

Matrix 7.6 Impact assessment matrix - operation phase

Code	Impact Assessment Criteria											SF	Impact classification
	CI	I	EX	RO	PE	RV	RC	SI	AC	IMP	EF		
A-4	(-)	1	1	8	4	1	1	2	4	4	D	29	MODERATE
A-5	(-)	2	1	4	4	1	1	2	4	4	D	28	MODERATE
A-6	(-)	4	2	2	4	1	1	2	4	4	D	34	MODERATE
CL-2	(-)	1	4	2	4	4	4	4	4	4	I	37	MODERATE
S-3	(-)	1	1	1	2	1	1	1	1	2	D	14	LOW
S-4	(-)	1	1	1	2	1	1	1	1	2	D	14	LOW
AS-1	(-)	1	2	1	2	1	1	2	4	4	D	22	LOW
ASP-1	(-)	2	1	2	2	1	1	2	4	4	D	24	LOW
V-2	(-)	1	1	1	4	4	4	2	4	1	D	25	MODERATE
F-3	(-)	1	1	1	2	1	1	2	4	2	D	18	LOW
F-4	(-)	1	1	1	2	2	1	2	4	4	D	21	LOW
F-5	(-)	2	1	2	4	4	4	2	4	4	D	32	MODERATE
F-6	(-)	2	1	2	4	4	4	2	4	4	D	32	MODERATE
BM-1	(-)	2	2	1	2	2	2	2	4	4	D	27	MODERATE
PB-9	(-)	2	2	2	4	4	4	2	4	4	D	34	MODERATE
PB-10	(+)	8	2	4	4	4	4	4	4	4	I	56	HIGH

Code	Impact Assessment Criteria											SF	Impact classification
	CI	I	EX	RO	PE	RV	RC	SI	AC	IMP	EF		
PB-11	(+)	12	4	4	4	4	4	2	4	4	D	70	HIGH
PB-12	(-)	1	2	2	4	4	4	2	4	4	D	31	MODERATE
PB-13	(-)	1	2	1	4	4	4	2	4	4	D	30	MODERATE
PB-14	(-)	2	1	2	4	4	4	2	4	4	D	32	MODERATE
PB-15	(-)	1	1	1	4	4	4	2	4	4	D	28	MODERATE
PB-16	(-)	4	2	4	4	4	4	2	4	4	D	42	MODERATE
PB-17	(-)	1	1	1	4	4	4	2	4	4	D	28	MODERATE
EC-7	(+)	8	2	8	4	4	4	4	4	4	D	60	HIGH
EC-8	(+)	4	2	4	4	4	4	2	4	4	D	42	MODERATE
EC-9	(+)	2	4	4	4	4	4	2	4	4	D	40	MODERATE
US-1	(+)	2	1	8	4	4	4	2	4	2	D	36	MODERATE
SE-1	(+)	12	4	8	4	4	4	4	4	4	D	76	VERY HIGH
SE-2	(+)	4	4	8	4	4	4	4	4	4	D	52	HIGH
IS-2	(-)	4	2	8	4	4	4	2	4	4	I	46	MODERATE
RC-4	(-)	4	2	8	4	4	2	2	4	1	D	41	MODERATE

Code	Impact Assessment Criteria											SF	Impact classification
	CI	I	EX	RO	PE	RV	RC	SI	AC	IMP	EF		
RC-5	(-)	2	4	8	4	4	4	2	4	4	D	44	MODERATE
PS-2	(-)	2	2	8	4	4	4	2	4	4	D	40	MODERATE

CI = Character of the impact

I = Intensity

EX = Extension

SI = Synergy

PE = Persistence

EF = Effect

RO = Risk of occurrence

AC = Accumulation

RC = Recoverability

RV = Reversibility

IMP = Importance

SF = Significance of impact

Scale	Impact classification
≤ 25	Low (L)
>25 - ≤50	Moderate (M)
>50 - ≤75	High (H)
>75	Very High (VH)

8. ENVIRONMENTAL, SOCIAL, HEALTH AND SAFETY MANAGEMENT PROGRAM (ESHMP)

The environmental, social, health and safety management program (ESHMP) is composed of preventive, mitigation and compensation measures for the environmental and social risks and impacts identified for the Manzanillo Energy Consortium Power Plant project.

This ESHMP is integrated and aligned with the project's environmental and social management policy.

The ESHMP is compatible with the provisions of the environmental laws and regulations of the Dominican Republic, as well as with the Environmental and Social Sustainability Performance Standards (Table 8-1) and the IFC Environmental, Health and Safety Guidelines.

Table 8-1. IFC environmental and social sustainability performance standards.

Standard number of performance	Content
PS 1	Assessment and management of environmental and social risks and impacts.
PS 2	Labor and working conditions.
PS 3	Resource efficiency and pollution prevention.
PS 4	Community health and safety.
PS 5	Land acquisition and involuntary resettlement.
PS 6	Biodiversity conservation and sustainable management of living natural resources.
PS 7	Indigenous peoples.
PS 8	Cultural heritage.

Source: EMPACA, 2023.

It is clarified that PS 5 performance standard is not active for the project, considering that the project lands are owned by the Dominican Corporation of State Electrical Companies (CDEEE). The project developer was the winner of the international public bidding for the purchase and sale of power and associated electric energy through long-term contracts of the Electricity Distribution Companies in Block 02. As part of this bidding process, the land was offered to the winner for the development of the project, and there are no people settled on this land that need to be resettled either involuntarily or voluntarily.

On the other hand, PS 7 does not apply to the project, considering that there are no Indigenous Peoples in the Dominican Republic.

The programs and plans that are part of the ESHMP are shown in Table 8-2.

Table 8-2. Programs/plans that are part of the ESHSMP.

Item	Program/Plan
8.1	Program of preventive, mitigation and environmental and social compensation measures.
8.2	Environmental monitoring program.
8.3	Stakeholder engagement plan.
8.4	Complaints, claims and suggestions mechanism for the community.
8.5	Plan for adaptation to the effects of climate change.
8.6	Occupational health and safety plan.
8.7	Mechanism for complaints, claims and suggestions for project workers.
8.8	Community health and safety plan.
8.9	Emergency preparedness and response plan.
8.10	Decommissioning plan.
8.11	Safety, health and environmental education plan for workers and the community.

Source: EMPACA / AECOM, 2023.

The Program of Preventive, Mitigation and Environmental and Social Compensation Measures is divided into several plans. Each plan includes the following:

- Impacts targeted by the plan.
- Objective.
- Measures to be implemented.
- Performance indicators.
- Targets for performance indicators.
- Executor.
- Supervisor.
- Responsible.
- Place of implementation of the measures.
- Frequency of follow-up.
- Implementation time.
- Required records.
- Associated costs.

Specific and/or detailed targets for the indicators will be established during the planning of project activities and may be modified as the construction and operation stages of the project progress.

The Monitoring Program plans include the following:

- Impacts targeted by the plan.
- Objective.
- Measures to be implemented.
- Indicators or parameters to measure.
- Goals for the indicators and/or parameters to be measured.
- Executor.
- Supervisor.

- Responsible.
- Methodology and technology used.
- Monitoring sites
- Frequency of monitoring.
- Implementation time.
- Required records.
- Associated costs.

The Stakeholder Relations Plan includes the following:

- Introduction.
- Project stakeholders.
- Disadvantaged or vulnerable individuals or groups
- Stakeholder relations program.
- Resources, responsibilities and work schedule.

The Complaints, Claims and Suggestions Mechanism includes:

- General Objective.
- Specific objectives.
- Structure.
- Instruments for the reception and evaluation of claims, complaints and suggestions.
- Procedures.
- Claims evaluation criteria.
- Systematization of the experience.

The Plan for Adaptation to the Effects of Climate Change and Mitigation Measures contemplates:

- Introduction.
- Carbon footprint calculation.
- Climate change adaptation plan.
- Emissions mitigation plan

The Occupational Health and Safety Plan covers the following:

- Objectives.
- Scope.
- Applicable national and international legislation.
- Roles and responsibilities.
- Definitions.
- Occupational health and safety policy.
- Organizational chart.
- Communication procedures.
- Risk management.
- Follow-up and supervision of the occupational health and safety plan.
- Health and safety reports.

- Formats.

The Disclosure Mechanism on the Rights and Obligations of Employers and Workers contains the following:

- General Objective.
- Specific objectives.
- Structure.
- Instruments for the reception and evaluation of claims, complaints and suggestions.
- Procedures.
- Claims evaluation criteria.
- Systematization of the experience.

The Community Health and Safety Plan contains:

- Objectives.
- Methodology.
- Community health and safety management policy.
- Responsibilities.
- Identification and assessment of potential health and safety risks and impacts of the project to the community.
- Plan to prevent the spread of communicable diseases.
- Accident prevention and control plan and community impacts.
- Plan for prevention and control of impacts on communities due to increased levels of noise, vibrations and emissions of gases and suspended particles.
- Traffic accident prevention and response plan.

The Emergency Preparedness and Response Plan for the construction and operation phases consists of:

- Purpose.
- Scope.
- Definitions.
- Responsibilities.
- Procedures.
- Evaluation of the document.

The Decommissioning Plan includes:

- Summary of contents.
- Dismantling activities.

The Safety, Health and Environmental Education Plan for Workers and the Community includes:

- Introduction.
- Objectives.
- Scope.
- Definitions.
- Training objectives.
- Goals.
- Strategies.
- Types and modalities of training.
- Actions to be developed.
- Resources.
- Reference and orientation material.
- Responsibilities.
- Appropriate training records. Evaluation of training effectiveness.
- Performance indicators (KPIs).
- Review of the training plan.
- Execution schedule.

Policies:

Manzanillo Energy Consortium, Inc. will be responsible for the development of environmental, occupational health and safety and human resources policies. These policies must be approved by the company's governing body, published and extended to employees, suppliers and contractors.

Responsibilities:

Manzanillo Energy Consortium, Inc. will be responsible for the implementation of the Environmental, Social, Health and Safety Management Program (ESHSMP) during the construction and operation phases.

This company must ensure that the main contractor during the construction phase, the project operator during the operation phase and the subcontractors in both phases carry out the measures that correspond to them within the ESHSMP.

To this end, the contracts with these companies will include clauses on the obligation to comply with the ESHSMP, establishing possible penalties for non-compliance.

It is clarified that the contractors that will participate in the construction phase of the project and the operating company of the Manzanillo Energy Consortium Power Plant Project in the operation phase have not yet been selected.

In both phases, Manzanillo Energy Consortium, S.A. will have a Safety, Health and Environmental Coordinator within the project, who will coordinate the execution of the ESHSMP measures related to Industrial Safety, Occupational Health and the Environment, as well as a Social Responsibility Coordinator who will coordinate the social measures.

In addition, Manzanillo Energy Consortium, S.A. will hire an external company in charge of environmental, social and occupational health and safety management, which will be responsible for supervising compliance with the ESHSMP measures during the construction and operation phases.

Costs:

The costs of executing the ESHSMP during the construction phase are included in the construction budget and will therefore be borne by the contractors.

The costs of executing the ESHSMP during the operation phase are included in the operating costs of the project and will be covered by the project operator.

The costs of the monitoring plan will be covered by Manzanillo Energy Consortium, Inc. during the construction and operation phase. This monitoring cost amounts to USD\$ 34,670.00 in the construction phase and USD\$ 84,970.00 per year in the operation phase.

8.1 Program of preventive measures, mitigation and compensation environmental and social

The following are the environmental and social management measures that will prevent, mitigate or compensate for the negative impacts of the project that were identified and evaluated in Chapter VII (identification and evaluation of environmental and social risks and impacts). Management measures to enhance the effects of the positive impacts are also included.

The Environmental, Social and Health Management Program (ESHMP) shall apply to the entire organization, including major contractors and suppliers over which the organization has control or influence, or to specific sites, facilities or activities.

The hierarchy of measures to address identified risks and impacts will give priority to impact prevention over measures to minimize impacts, and where residual impacts persist, to restore or compensate for them, where technically and financially feasible. The hierarchy of measures is as follows:

1. Preventive measures.
2. Minimization measures.
3. Restoration or compensation measures.
4. Mitigation and performance measures.

8.1.1 Preventive, mitigation and compensation measures program for the construction phase

The following are the preventive, mitigation and compensation measures organized by plans to be implemented during the operation phase, grouped according to the environmental elements they address. See Annex 16: Matrix Summary of preventive, mitigation and compensation measures program for the construction phase of the project.

A.- Physical and perceptual environment

8.1.1.1 Plan of measures for the protection of air quality and the noise environment

Impacts targeted by the plan:

Impact	Code	Impact classification
Increased concentration of particulate matter due to construction activities and transportation of materials.	A-1	LOW
Increased noise and vibration levels due to construction activities and transportation of materials.	A-2	MODERATE
Increased flue gas concentration from vehicle, heavy equipment and truck operations.	A-3	LOW
Change or impact on climate due to greenhouse gas emissions from vehicle, heavy equipment and truck operations.	CL-1	MODERATE
Possibility of disturbance to local residents due to increased noise and dust levels as a result of the Project's construction activities.	PB-2	MODERATE
Potential for air pollution due to emissions of combustion gases into the atmosphere and suspended particulate matter from the operation of turbines and emergency power generators*.	A-4	MODERATE
Increased noise and vibration levels from power plant operations*	A-5	MODERATE
Changes or impacts on climate due to greenhouse gas emissions from electricity generation operations*.	CL-2	MODERATE
Possibility of affecting the population (workers and communities) due to increased levels of gas emissions, suspended particles, noise and vibrations caused by the thermoelectric power plant operations*.	PB-9	MODERATE

(*) These impacts correspond to the operation phase; however, prevention, mitigation or compensation measures must be implemented during the construction phase, which is why they are included in this plan.

Objective:

Avoid or mitigate impacts on air quality and the noise environment that may be caused by project activities during the construction phase, as well as minimize the effects on the population (workers and communities) derived from these activities.

Installation of technology to avoid or mitigate impacts on air quality and the noise environment during the operation phase of the project and the effects on the population that could be caused.

Measures to be implemented:

- Wetting of un-stabilized materials, exposed soils and internal roadways, if dust generation is visible (Photo 8-1).
- Storage of aggregates in piles and covered with tarpaulins.

- Covering the load of aggregates, waste and debris transported in trucks to prevent their dispersion along the route (Photo 8-2).
- Maintain equipment and machinery in good working condition, including brakes, mufflers and catalytic converters.
- Power generators, vehicles and machinery should be turned off when not in use.
- Restriction of equipment and vehicle speed to 20 km/h on unpaved roads. Signs will be posted to indicate this maximum speed limit within the project (Figure 8-1).
- Place perimeter fence with high-density polyethylene (saran) anti-debris mesh on the project site to prevent the dispersion of particles (dust) and debris to the exterior.
- Establish an access road to the project site on the south side for the transportation of construction materials, avoiding the use of the road that leads to the beach, which borders the Villa Ray sector, in order to minimize noise, dust, and equipment and truck traffic disturbance to residents in this sector.
- Establishment of daytime hours (7:00 am to 6:00 pm) for the execution of construction activities.
- Use existing quarries or borrow banks.
- Minimize the amount of loan material.



Photo 8-1. Wetting of unpaved roads by tanker trucks, EMPACA files.



Photo 8-2. Load properly covered with tarpaulin, EMPACA files.



Figure 8-1. Sign indicating the maximum speed limit.

Source: EMPACA Archives.

On the other hand, some necessary measures will be taken to prevent or mitigate negative impacts on air quality, noise levels and vibrations during the operation phase. These measures include the following:

- Creation of a living fence around the perimeter of the project (using species native or endemic to the area) to create an acoustic barrier to help attenuate noise levels.
- Installation of turbines and boilers on anti-vibration bases.
- Installation of combustion system in the turbines with silencers and a soundproof casing.
- The height of the chimneys to be installed should be designed in accordance with the recommended international standard for the industry (Figure 8-2).

Anexo 1.1.3 – Práctica Internacional recomendada para la Industria (GIIP)

Altura de la chimenea

(Según documento United States 40 CFR, part 51.100 (ii)).

$H_G = H + 1.5L$; donde

H_G = altura de la chimenea medida a partir de la elevación de su base sobre el nivel del suelo

H = Altura de la(s) estructura(s) próxima(s) sobre la base de la chimenea

L = Dimensión menor; altura (h) o anchura (w), de las estructuras próximas

"Estructuras próximas" = Estructuras adyacentes o que estén dentro de un radio de $5L$, y a menos de 800 m

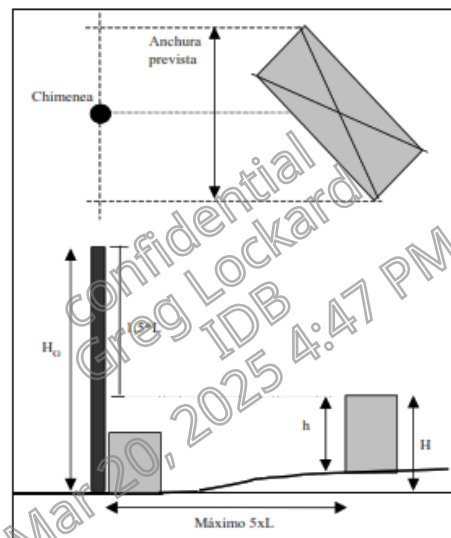


Figure 8-2. Calculation of chimney height.

Source: Guide on environment, health and safety, IFC (2007).

- Preparation of turbine stacks for measurements. The stacks should be prepared as follows:

For sampling and analysis, the turbine stacks must be prepared for access with ladders and platforms, and with 4-inch circular holes to facilitate the introduction of the necessary elements for measurements and sampling, which will be equipped with a 4-inch threaded galvanized iron pipe nipple or section of pipe that allows coupling at the end to place a male or female plug to prevent gases from escaping when the nipples are not being used. In the Figure 8-3 shows the parameters of the chimney preparation.



Figure 8-3. Parameters for chimney preparation.

Source: Environmental Technical Regulations for the Control of Air Pollutant Emissions from Fixed Sources, Ministry of the Environment and Natural Resources, 2018.

Performance indicators:

- Noise levels in dB (A).
- Airborne particulate matter concentration at immission conditions (Total suspended particulate matter or TSP, PM-10 fraction particles and PM-2.5 fraction particles in $\mu\text{g}/\text{Nm}^3$)³
- Percentage of equipment and vehicles maintained up to date.
- Number of quarries or borrow banks used.
- Turbines and boilers installed on anti-vibration bases.
- Height of the chimneys.
- Turbine stacks prepared for measurements.

Goals:

- Noise levels below the maximum limits established by the IFC's General Guidelines on Environment, Health and Safety or by the Environmental Norm for Noise Protection (NA-RU-001-03) of the Dominican Republic (whichever is more restrictive).
- Concentration of suspended particulate matter in 24-hour immission conditions below the maximum limits established by the IFC General Guidelines on Environment, Health and Safety or by the Environmental Technical Regulation on Air Quality (whichever is more restrictive).
- All turbines and boilers installed on anti-vibration bases.
- Heights of all chimneys in compliance with the recommended international standard for the industry.
- All turbine stacks prepared for measurements.

Executor: Contractors, especially the companies in charge of earthmoving, transportation of materials and debris, and installation of the turbines.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: Project sites, access roads, quarries or banks where borrow materials will be extracted.

Frequency of follow-up: Semiannual.

Timing of implementation: The measures in this plan will be implemented throughout the construction phase.

Required records:

- Recording the results of air quality and noise measurements.
- Photographic record of the activities carried out.
- Reports generated by the Safety, Health and Environment Coordinator.

Associated costs: The costs of implementing this plan are included in the construction budget.

8.1.1.2 Plan of measures for soil protection**Impacts targeted by the plan:**

Impact	Code	Impact classification
Possibility of soil contamination due to construction activities and deficiencies in the management of solid, liquid and oily waste.	S-1	LOW
Risk of soil contamination from fuel and lubricant spills.	S-2	LOW
Risk of soil contamination from fuel and lubricant spills*.	S-4	LOW

*: This impact corresponds to the operation phase; however, prevention, mitigation or compensation measures must be implemented during the construction phase, which is why it is included in this plan.

Objective:

Avoid or reduce the effects that the actions of the construction phase of the project may have on the soil element.

Measures to be implemented:

- Maintain equipment and machinery in good working condition.
- Perform maintenance work on equipment and vehicles, including oil and oil filter changes, in specialized workshops outside the project site. In the event that emergency maintenance is necessary, always use spill containment trays (Photo 8-3).
- Implementation of the plan of measures for solid waste management (see section 8.1.1.3).
- Implementation of the plan of measures for liquid waste management (see section 8.1.1.4).
- Construction of secondary containment systems for storage tanks for lubricants and liquid fuel, including diesel and liquid natural gas. Secondary containment systems for fuel tanks will have a capacity to contain 110% of the volume of the largest single tank within the containment area.
- Construction of secondary containment systems (walls or curbs) for chemical storage tanks and containers. Containment systems should have sufficient capacity to contain 100% of the liquid volume of the largest individual container or tank within the containment area.
- Construction of reinforced concrete secondary containment systems and a sump at its low point for each of the oil transformers in the project's electrical substation. The secondary containment volume will be sized according to the following criteria:
 - 100% of the transformer oil volume.
 - Plus the amount of water supplied by the flow rate of the fire protection water hose at a minimum of 500 gpm for 10 minutes.
 - Plus the amount of water delivered by the fire protection flood/suppression water over the surface area of the containment for a minimum of 10 minutes (per NFPA 850) with flow per NFPA 15.
 - Plus rainfall depth for the design storm event.
- Implementation of the Emergency Preparedness and Response Plan (see section 8.9), which includes measures for dealing with spills of fuels and lubricants and chemical products in general and the availability of means for spill collection.



Photo 8-3. Anti-spill tray,

Source: EMPACA archives.

Performance indicators:

- Percentage of equipment and vehicles maintained up to date.
- Percentage of lubricant, liquid fuel, and chemical storage tanks with secondary containment systems in place.
- Percentage of oil transformers with secondary containment systems built.
- Area of soil contaminated by solid waste.
- Area of soil contaminated by fuel and lubricant spills.

Goals:

- All (100%) equipment and vehicles without fuel or lubricant leaks.
- All (100%) storage tanks for lubricants, fuel in liquid state and chemical products with secondary containment systems built.
- All (100%) oil transformers with secondary containment systems built.
- Absence of soils contaminated by solid waste.
- Absence of area of soils contaminated by fuel or lubricant spills.
- All (100%) fuel or lubricant spill events on site collected.

Executor: Contractors, especially companies in charge of earthmoving and transportation of materials and debris, as well as those in charge of installing the substation and storage tanks for liquid fuels, lubricants and chemical products.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Location of implementation of measures: Project land.

Frequency of follow-up: Semiannual.

Timing of implementation: The measures in this plan will be implemented throughout the construction phase.

Required records:

- Equipment and vehicle maintenance records.
- Photographic record of the activities carried out.
- Reports generated by the Safety, Health and Environment Coordinator.

Associated costs: The costs of implementing this plan are included in the construction budget.

8.1.1.3 Plan of measures for solid waste management

During the construction phase of the Manzanillo Energy Consortium Power Plant project, municipal solid waste, special handling waste, and hazardous waste will be generated.

Municipal solid waste could include household waste generated by site workers, paper generated in site offices and restrooms, food containers (plastic, glass or metal), among others.

Special handling waste includes waste from construction activities, such as waste from vegetation clearing and excavations, debris, among others.

Hazardous wastes may include: welding butts, paint and solvent containers, among others.

All these types of waste can in turn be classified into recoverable (including recyclable waste and other waste with commercial value) and non-recoverable waste.

Impacts targeted by the plan:

Impact	Code	Impact classification
Possibility of soil contamination due to construction activities and deficiencies in the management of solid, liquid and oily waste.	S-1	LOW
Possibility of deterioration of the landscape due to construction activities.	PS-1	MODERATE
Possibility of soil contamination due to inadequate management of liquid, solid and oily wastes*.	S-3	LOW

(*) This impact corresponds to the operation phase; however, prevention, mitigation or compensation measures must be implemented during the construction phase, which is why it is included in this plan.

Objective:

Avoid negative impacts on the environment (soil, landscape and population) that could be caused by inadequate solid waste management during the construction phase of the project through the development and application of an adequate management strategy for each type of waste.

Construction of facilities for the adequate storage of solid waste during the operation phase, thus avoiding soil contamination during this phase.

Measures to be implemented:

- The temporary construction site facilities of the different contractors will be equipped with solid waste storage spaces with several compartments for non-recoverable urban solid waste, recoverable urban solid waste and hazardous waste.
- The compartment for the storage of hazardous waste must be roofed, with a waterproof floor and adequate natural or forced ventilation. The compartment will have restricted access and will be marked with the appropriate risk symbols according to the characteristics of the substances stored. The handling of each type of waste at the site is described below.
- For the specific landscape issue, participatory action with the community is recommended, leading to measures of: i) concealment and screening, ii) slope modeling and/or iii) dump modeling. The design of live fences can also be considered.

During the construction phase of the project, as well as during the operation phase, a Solid Waste Management program will be implemented within the framework of the "cleaner production" guidelines, which includes the following aspects:

- Minimization.
- Storage.
- Reuse and recycling.
- Transformation or treatment.
- Final provision.
- Report to local and national environmental authorities.

Waste management in this phase will be carried out as described below:

Municipal solid waste:

- The generation of solid urban waste will be reduced as much as possible. This can be done by using reusable utensils and containers for food and beverage supplies instead of disposable plastic utensils and foam containers, avoiding printing documents in the site offices if not necessary, using both sides of sheets of paper in the site offices, among other methods.
- Options for the reuse of urban solid waste at the construction site will be evaluated.
- 55-gallon tanks with plastic covers will be placed at different points of the construction site where solid urban waste is generated, such as offices, bathrooms, and employee cafeterias.
- The crates or tanks will be identified with the name of the type of waste for which they are destined: plastic, paper or cardboard, metal, non-recyclable (Photo 8-4).



Photo 8-4. Waste sorting bins

Source: EMPACA archives.

- Municipal solid wastes will be collected daily from the waste bins and transferred to the corresponding compartment in the solid waste storage area.
- Non-valuable and non-reusable solid waste will be removed in trucks from the Municipality of Pepillo Salcedo for transfer to the municipal landfill at least twice a week.
- Recoverable waste that cannot be reused on site will be sold to a manager authorized by the Ministry of the Environment and Natural Resources for this type of activity. The frequency of removal will vary according to the volume generated.
- A control record will be kept of the volume of each type of urban solid waste generated and the frequency of removal.
- Targets will be established to reduce the generation of urban solid waste or increase the percentage of recycled waste.

Special handling waste:

Excavation material:

- Excavation materials generated during construction shall be piled in an area previously defined for this purpose and delimited by tapes and stakes, where they will not interfere with the work of the construction site, cause damage to third parties, or be washed away by rain or wind.
- They can be used later for backfilling within this work if their characteristics allow it.
- They should be covered with tarpaulins supported by weights to prevent wind dispersion.
- If they cannot be used in the project area, they will be transported in trucks owned by the project contractor to the municipal landfill, which must be adequately covered with tarpaulins to prevent dispersion along the way.
- Trucks transporting these materials must have the transport and material canister stubs issued by the Vice-Ministry of Soil and Water.
- A control record will be kept of the volume of debris removed and the frequency of removal.

Debris:

- Debris generation will be reduced as much as possible.
- The debris generated during construction will be piled in an area previously defined for this purpose and delimited by tapes and stakes, where it does not interfere with the work of the construction site, does not cause damage to third parties, and cannot be swept away by rain or wind. They may also be placed in special containers for this type of waste (Photo 8-5).



Photo 8-5. Type of containers used for debris storage.

Source: EMPACA archives.

- Debris should be stored separately from other waste.
- Materials that can be reused or recycled, such as wood, metal elements, cardboard, among others, will be manually separated.
- Reusable or recyclable materials will be stored in the appropriate compartments in the solid waste storage area in the temporary site facilities.
- Non-usable materials will be transported in trucks owned by the project contractor to the municipal landfill, which must be adequately covered with tarpaulins to prevent dispersion along the way.
- Trucks transporting debris must have the transport and material canister stubs issued by the Vice-Ministry of Soil and Water.
- A control record will be kept of the volume of debris removed and the frequency of removal.

Management of hazardous solid waste:

The following procedure will be followed for the management of hazardous solid waste during construction of the project:

- The generation of hazardous waste on site shall be avoided or reduced to the minimum possible.
- Management of hazardous solid waste types will be as follows:

Paint and solvent containers:

- A space within the hazardous waste compartment shall be designated and marked for the storage of paint and solvent containers.
- Plastic tanks will be placed for temporary storage.
- Paint and solvent containers may be used prior to disposal for mixing or other operations.
- The paint in the containers must be dry before disposal.

- Use leftover paint in small amounts to apply a coat of a similar color.
- Use the same solvent for cleaning and formulation.
- Reuse the solvent that is not completely exhausted; let it decant for a few hours so that the dirt settles to the bottom and use the supernatant for cleaning brushes and surfaces that do not need a virgin solvent.
- Clean brushes after use and surfaces immediately that become stained with paint, to save significant amounts of solvents.
- Before opening another container of paint or thinner, make sure that the paint in the current container has been used up.
- Do not mix paint and solvent containers and used paintbrushes with other hazardous waste.
- Do not mix paint and solvent containers and used brushes with non-hazardous waste.

Oil-soaked cloths and rags:

- A space within the hazardous waste compartment will be designated and marked.
- Plastic tanks will be placed for temporary storage.
- Make the best use of cottons and rags before discarding them.
- Keep oiled rags separate from those contaminated with hazardous materials such as solvents.
- Do not mix cloths and rags with other hazardous waste.
- Do not mix cloths and rags with non-hazardous waste.

Oil filters:

- A space within the hazardous waste compartment will be designated and marked.
- Plastic tanks will be placed for temporary storage.
- Remove the hot oil from the filter by placing it on an inclined support, or with a pneumatic or hydraulic press.
- Do not mix oil filters with other hazardous or non-hazardous wastes.

Used oils:

- A space within the hazardous waste compartment will be designated and marked.
- Hermetically sealed plastic tanks will be placed for temporary storage.
- During maintenance and oil change services to be performed on site equipment, it will be necessary to use trays to contain the oils.

Used batteries:

- Collect and store used batteries to prevent acid leakage.
- A space within the hazardous waste storage compartment, away from heat sources, should be designated and marked.
- Batteries shall be placed in an upright position on pallets or other compatible material, not exceeding 5 units in height to prevent the battery from becoming unstable.
- Do not mix batteries with other hazardous or non-hazardous waste.

Welding butts:

- A space within the hazardous waste compartment will be designated and marked.
- They will be stored and when there is a considerable amount, they will be put together in a container and a concrete pour will be made to place them inside.

General measures for hazardous waste management:

- Deposit each type of waste in a separate container or on pallets or pallets (in the case of batteries), which will be clearly, legibly, and indelibly labeled. These containers will be stored in the hazardous waste compartment in the project area, taking into account the characteristics of the materials to be stored (that they are not incompatible).
- Hazardous waste may not be stored for more than 6 months.
- The removal of hazardous solid waste generated by the project will be carried out by a company accredited by the Ministry of the Environment and Natural Resources.
- A control record will be kept of the volume of each type of hazardous waste generated and the frequency of removal.

In addition, during this phase the warehouses or deposits for non-hazardous solid waste (municipal solid waste and special handling waste) and hazardous waste that will be used during the operation phase will be built. The characteristics of these warehouses are described below.

Storage of non-hazardous waste (municipal solid waste and special handling waste):

The area destined for solid waste storage must meet at least the following requirements:

- It should be located away from production areas, administrative areas, drinking water sources, areas with the possibility of flooding and possible external sources of danger.
- Construction materials must be non-flammable and the building must be of reinforced concrete or steel. If it is a steel structure, it must be protected with anti-corrosion insulation.
- Finishes shall be smooth to allow easy cleaning and prevent the formation of environments conducive to the development of microorganisms in general.
- It will have ventilation, water supply, drainage and fire prevention and control systems.
- It shall be constructed in such a way as to prevent access by insects, rodents and other animals.
- It will be designed with sufficient capacity to store the waste produced, according to the evacuation frequency established by the Safety, Health and Environment Coordinator.
- The area must be divided into compartments in order to carry out the necessary segregation of materials.
- It should allow easy access for collection vehicles and facilitate the transfer of solid waste to them.
- The floor should have a slope of 1% with respect to the grade, to facilitate drainage and cleaning of the room.
- Drainage systems will be segregated from public and storm water systems to avoid any possible contamination.
- Ballast-type lighting with a power of 75 watts should be installed every 2 meters.

Storage of hazardous waste:

The hazardous waste deposit will be exclusively for hazardous waste, although it may be annexed to the recycling deposit (ordinary and domestic waste).

Storage facilities for this type of waste will comply with the following minimum requirements:

- It must have perimeter channels for the collection and evacuation of runoff water.
- Its storage capacity will be in accordance with the daily generation and the frequency of evacuation, plus a percentage that, in the judgment of the generator, foresees failures in collection and treatment.
- It must have the appropriate number of compartments to avoid mixing of non-compatible waste.
- The site must have a secondary containment system with a capacity to retain at least 10% of the maximum total volume stored.
- It must be equipped with lighting, natural ventilation, water, fire protection system according to the characteristics of the stored waste, electrical power and spark-proof lamps. In the case of substances that emit vapors, there must be forced ventilation to ensure a clean atmosphere, and the evacuated air must be subjected to a treatment process to capture the contaminating substances present.
- Floors, walls and ceilings must be made of washable, easy to clean, non-combustible, solid and resistant to environmental factors.
- Floors should be sloped to allow drainage and prevent contact of containers with spilled hazardous waste, drainage system and grating to allow easy washing and cleaning. The evacuation siphon must be easy to close to avoid leakage of substances in the event of a spill.
- Have adequate signage with instructions indicating the behavior to be followed in this area, personal protection elements, measures to be followed in case of emergency and express prohibition of entry to persons not involved in the storage activity.
- Be provided with the required safety elements, according to the characteristics of the waste to be contained.
- To have protection against arthropods and rodents.
- To have permanent cleaning and disinfection, to avoid offensive odors and conditions that threaten the aesthetics and health of people.
- To have protection against environmental factors, especially against rainwater.
- Comply with the requirements on atmospheric emissions, discharges and other regulations that replace, modify or complement them.

Performance indicators:

- Volume (m³) of solid urban waste generated.
- Volume (m³) of special handling waste generated.
- Percentage of waste recovered or recycled.
- Frequency of waste removal.
- Volume (m³) of hazardous waste generated and percentage withdrawn by manager accredited by the Ministry of the Environment and Natural Resources, frequency of withdrawal.
- Volume (m³) of solid waste in soils.

Goals:

- 5% reduction in the volume of waste generated.
- Minimum frequency of solid urban waste removal twice a week.
- Minimum frequency of hazardous waste removal every six months.
- 25% of non-urban solid waste and special handling waste recovered or recycled.
- 100% of hazardous waste removed by accredited waste managers.
- Absence of solid residues in soils.

Executor: Contractors.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: Project site.

Frequency of follow-up: Monthly.

Implementation time: During the entire construction phase.

Required records:

- Records of volumes of municipal solid waste, special handling waste and hazardous waste generated and volumes of waste recycled.
- Photographic record of the activities carried out.
- Reports generated by the Safety, Health and Environment Coordinator.

Associated costs: The costs of implementing this plan are included in the construction budget.

8.1.1.4 Plan of measures for the management of liquid waste**Impacts targeted by the plan:**

Impact	Code	Impact classification
Possibility of soil contamination due to construction activities and deficiencies in the management of solid, liquid and oily waste.	S-1	LOW
Possibility of soil contamination due to inadequate management of liquid, solid and oily wastes*.	S-3	LOW
Possibility of groundwater contamination due to poor management of liquid waste*.	AS-1	LOW

(*) These impacts correspond to the operation phase; however, measures for their prevention, mitigation or compensation must be implemented from the construction phase, which is why they are included in this plan.

Objective: Avoid or reduce impacts on soils and water quality that may result from the construction and operation phase of the project.

Measures to be implemented:

- Placement of portable toilets for the use of site workers, which will be rented to companies accredited by the Ministry of the Environment and Natural Resources to carry out this type of activity, which will be in charge of their periodic maintenance (Figure 8-4). The number of restrooms will be calculated based on the number of workers who will be working at the site at the same time, at a rate of one restroom for every 10-15 workers.



Figure 8-4. Portable toilets used in construction.

Source: EMPACA Archives.

- Construction of a septic tank for the treatment of domestic liquid waste that will be generated in the buildings of the thermoelectric power plant during the operation phase, before being infiltrated into the subsoil. The septic tank must have sufficient capacity to treat the volume of liquid waste expected to be generated at the power plant facilities. The septic tank must be designed so that its effluent complies with the maximum allowable limits set by the Dominican Republic's Environmental Standard on Groundwater Quality and Subsoil Discharge.
- Construction of drainage and chemical wastewater treatment system. The chemical waste drainage and treatment system will include the following major components:
 - Chemical waste collectors, as required.
 - Wastewater transfer pumps with 100% capacity in each collector.
 - Neutralization tank with ejectors.
 - Sewage neutralization circulation and discharge pumps with 100% capacity.
 - pH measurement.
 - Acid and caustic feed supplies (can be shared with the regeneration system of the chemical feed cycle equipment).
 - Interconnection of piping, valves, instrumentation and accessories.
 - At a minimum, chemical wastes, water treatment system regeneration wastes and/or chemical cleaning wastes, and chemical drains from the containment area should be directed to the wastewater neutralization system for treatment prior to discharge to the wastewater collection basin. The neutralization tank should be located in a containment basin and sized for at least two demineralizing (or chemical cleaning) mixed bed regenerations plus the maximum volume of any unvalved chemical containment area.

- Spill containment areas for chemical storage and chemical feed equipment should be constructed of reinforced concrete with a suitable protective coating.
- Construction of drainage and oily waste treatment system. This system is described below.
 - Oily waste will be collected from areas where the potential for oil contamination exists and piped to oil/water separators. This wastewater will include runoff from transformer area drains, plant service drains, and building drains.
 - The water discharge from the oil/water separator should be directed to the wastewater collection sump. Oil removed by the oil/water separator should be retained in the separator for periodic removal and off-site disposal.
 - A secondary containment system must be provided for all oil-filled transformers. The characteristics and volume of this containment system are detailed in subsection 8.1.1.2.
 - The oil/water separator shall remove oil contamination using the difference in specific gravity between the water and oil. The oil shall be retained for eventual removal and disposal off-site by a licensed contractor in accordance with local and state regulations.
 - The effluent from the oil/water separator must be in accordance with the maximum permissible limit for fats and oils according to current regulations.

Performance indicators:

- Number of portable toilets placed/workers
- Capacity of the constructed septic tank.
- Number of areas where chemical waste is generated with drainage system connected to the chemical waste neutralization tank.
- Number of areas with drainage system connected to oil/water separators and capacity of oil/water separators constructed.

Goals:

- Availability of one portable toilet for every 10-15 workers.
- Treatment plant effluent quality design parameters that meet the standards established by the Environmental Standard on Groundwater Quality and Subsoil Discharges.
- All (100%) areas where chemical waste is handled connected to the neutralization tank.
- All (100%) areas where there is a possibility of oil contamination with drainage systems leading to oil/water separators.

Executor: Contractors.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: Project site.

Frequency of follow-up: Semiannual.

Implementation time: During the entire construction phase.

Required records:

- Portable restroom rental and maintenance records.
- Photographic record of the activities carried out.
- Reports generated by the Safety, Health and Environment Coordinator.

Associated costs: The costs of implementing this plan are included in the construction budget.

8.1.1.5 Efficiency plan for the consumption of energy resources

Impacts targeted by the plan:

Impact	Code	Impact classification
Temporary increase in electricity and fuel consumption during the construction phase of the project.	RC-2	MODERATE

Objective:

Promote the sustainable use of electricity and fuels during the construction phase of the project to reduce project-related greenhouse gas emissions.

Measures to be implemented:

- Maintain the equipment and machinery used during construction in good working condition, which ensures greater efficiency in fuel consumption.
- Power generators, vehicles and machinery should be turned off when not in use.
- Drive vehicles and equipment at moderate and constant speed to save fuel.
- Avoid excessive circulation of equipment and vehicles if it is not necessary.
- Train workers in electricity and fuel saving practices.
- Place electricity meters in the temporary facilities of the construction site to keep monthly records of the amount of energy consumed.
- Place a fuel meter in the temporary facilities at the site that will allow monthly records to be kept of the amount of fuel consumed.
- Monthly comparison of recorded electricity and fuel consumption with the objective of setting performance and consumption reduction targets (if possible).

In this phase, the following measures will also be taken to reduce energy consumption in the operation phase:

- Installation of energy-saving or LED luminaires for lighting the facilities.
- Placement of photocell lighting in outdoor areas.
- Installation of Inverter-type air conditioners in the air-conditioned areas of the buildings.

Performance indicators:

- Monthly consumption (kWh/month) of electrical energy in the temporary facilities of the construction site.
- Monthly fuel consumption (gallons/month) by number of equipment and vehicles used.
- Number of workers trained monthly on energy saving issues.
- Number of drivers trained monthly on fuel saving issues.

Goals:

- Compliance with the planned percentage reduction of electric energy consumption in the temporary facilities of the project.
- Compliance with the planned percentage reduction of fuel consumption in the temporary facilities of the project.
- All (100 %) workers trained in energy saving measures.
- All (100%) equipment and vehicle drivers trained in fuel saving measures.

Executor: Contractors.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Location of implementation of measures: Project site, especially temporary construction site facilities and access roads.

Frequency of follow-up: Monthly.

Implementation time: During the entire construction phase.

Required records:

- Monthly electricity and fuel consumption records.
- Photographic records evidencing the execution of the measures.

Associated costs: The costs of implementing this plan are included in the construction budget.

8.1.1.6 Water consumption efficiency plan**Impacts targeted by the plan:**

Impact	Code	Impact classification
Temporary increase in water consumption during the construction phase of the project.	RC-1	MODERATE

Objective:

Promote the sustainable use of water during the construction phase of the project.

Measures to be implemented:

- Establish a program of periodic inspections in the temporary facilities of the construction site with the objective of detecting and correcting leaks.
- Wetting of non-stabilized materials and exposed soils only when weather conditions require it (if it has not rained and dust generation is visible).
- Fitting of spray nozzles to the hoses used to irrigate the plants planted in the green areas of the project.
- Train workers in water saving practices.
- Place a water meter in the temporary facilities of the construction site that will allow keeping monthly records of the amount of water consumed.
- Compare recorded water consumption on a monthly basis in order to set performance and consumption reduction goals.

In addition, during the construction phase, the following measures will be implemented to reduce water consumption during the operation phase.

- Planting of native and endemic species in the project's green areas (which require little water for maintenance).
- Installation of a desalination plant that will allow the use of seawater to supply water to the project for both domestic and industrial use (including the cooling system for the thermoelectric plant). This will avoid affecting freshwater reserves and the availability of water for the population in the area of influence as a direct result of project operations.

Performance indicators:

- Monthly water consumption (m^3 /month) at the temporary construction site facilities.
- Number of workers trained in water saving measures.

Goals:

- Compliance with the planned percentage reduction of water consumption in the temporary facilities of the project.
- All (100%) workers trained in water saving measures.

Executor: Contractors.

Supervisor: Company in charge of environmental and social management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: In the area of execution of the works, especially in the temporary facilities of the subcontracted companies.

Frequency of follow-up: Monthly.

Implementation time: During the entire construction phase.

Required records:

- Monthly water consumption records for the different uses, photographic records evidencing the execution of the measures.

Associated costs: The costs of implementing this plan are included in the construction budget.

8.1.1.7 Efficiency plan for the consumption of loan materials

Impacts targeted by the plan:

Impact	Code	Impact classification
Increased consumption of loan materials.	RC-3	MODERATE

Objective:

Promote the sustainable use of quarried borrow materials on site.

Measures to be implemented:

- Take advantage of the material from excavations to use it as fill in other areas of the project, as long as its technical characteristics allow it.
- Avoid creating new quarries and borrow banks to supply fill material for the project, use existing facilities for these purposes.
- Existing quarries from which filler materials are purchased must be required to have the Environmental Authorization issued by the Ministry of the Environment and Natural Resources that is currently in force.
- Keep a control record of the volumes of backfill materials used on site.

Performance indicators:

- Volumes of backfill materials used on site (m³ / month).
- Percentage of fill material suppliers that are accredited by the Ministry of Environment and Natural Resources.

Goals:

- Less than the estimated maximum total volume of fill material during project planning.
- 100% of fill material suppliers must be accredited by the Ministry of Environment and Natural Resources.

Executor: Contractors in charge of earthmoving activities.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: Quarries and borrow banks of materials used by the project.

Frequency of follow-up: Monthly.

Implementation time: During the entire construction phase.

Required records:

- Records of the volumes of fill materials used in the work and quarries of origin.

Associated costs: The costs of implementing this plan are included in the construction budget.

8.1.1.8 Hazardous materials management plan

Impacts targeted by the plan:

Impact	Code	Impact classification
Risk of accidents resulting in physical injury or loss of life to workers and local residents as a consequence of the Project's construction activities.	PB-5	MODERATE

Objectives:

- To avoid environmental impacts resulting from poor handling of hazardous chemicals in the project.
- Avoid accidents and damage to workers and residents of the communities in the area of influence caused by poor handling of hazardous materials.

Measures to be implemented:

Avoid the use of hazardous materials as long as non-hazardous substitute materials that fulfill the same function are available. Taking this measure into account, the following has been accomplished in the project:

- Asbestos shall not be used as a building material.
- Lead-based paints shall not be used in the construction phase.
- The transformers and electrical equipment to be installed in the project are free of polychlorinated biphenyls (PCB).
- No cooling equipment containing ozone-depleting substances will be installed in the buildings or in the power plant's cooling system.
- Weed control in the facilities will be done manually or mechanically without the use of chemical products. The use of pesticides will be avoided for vector and rodent pest control.

activities, as long as they can be controlled by other methods, such as not accumulating solid waste and stagnant water in the project facilities and placing rodent traps. In the event of vector and rodent pests that cannot be controlled by other methods, low-toxicity pesticides will be applied by personnel from a company accredited by the Ministry of the Environment and Natural Resources and contracted for this purpose, as indicated in the project's Pesticide Management Plan (see section 8.1.2.6). It should be noted that there are no plans to store pesticides at the project facilities, as they will be taken by the contracted company on the same day of application, and the product containers will also be removed by the company, which will be responsible for their proper disposal.

- Adequate storage of hazardous materials, for which the following shall be considered:
 - Hazardous materials should be stored in facilities suitable for this purpose, protected from the weather, with good ventilation (natural or forced) and where they cannot be reached by water (preferably on shelves).
 - Hazardous materials storage areas will have restricted access for personnel in charge of handling them, and will be identified with the words "Chemical Products Storage Area" and a sign with the "Safety Standards to be Complied with at the Site".
 - Safety Data Sheets (SDS) of the stored products shall be available in the storage areas of hazardous materials.
 - There will be an emergency protocol in case of an accident or spill of hazardous materials.
 - There will be access to eye wash stations in case of accidents, close to the storage areas.
 - Fire extinguishers will be placed near hazardous material storage areas.
 - Storage areas for liquid hazardous materials must also have means of containment in case of accidental spills, such as retaining walls, curbs or a drainage system that conducts possible spills to a storage tank that allows for the subsequent extraction and proper final disposal of the spilled product. The containment should be adequately sized to contain the following:
 - ✓ Sufficient volume to contain 100% of the liquid volume of the largest individual vessel or tank within the containment area. Areas that are occupied by equipment are considered when determining the size of the containment.
 - ✓ Rainfall depth for the design storm event for outdoor containment areas.
 - ✓ The volume of fire/flood water suppression systems for chemical containment in the area affected by these flows.
 - ✓ Minimum of 150 mm (6 inches) curb.
 - Spill collection materials such as sand, sawdust, shovels, containers, anti-spill kits will be available, depending on the type of product spilled.
 - Stored quantities of hazardous materials shall be restricted to those strictly necessary and products shall be classified and grouped according to their hazards, avoiding the proximity of incompatible substances, as indicated in the SDS.
 - The quantities of hazardous materials stored on the project will be monitored.
- Proper handling of hazardous materials, for which the following will be considered:
 - Personnel handling hazardous materials must be adequately trained in their correct use, for which they will be provided with the required training through courses or lectures.
 - Workers handling hazardous substances will be provided with the required personal protective equipment to perform their work safely (such as gloves, masks, rubber

- boots, shirts and long sleeves, apron, among others), as indicated in the SDS for each product.
 - In the case of chemical products, they shall be applied following the dosages and application instructions recommended by the manufacturer.
 - Hazardous materials shall be stored and transported in their original containers or other appropriate containers, clearly labeled to identify their contents.
 - Used containers of hazardous materials will be managed as hazardous waste in accordance with the Solid Waste Management Measures Plan (see section 8.1.1.3).
- Make contractors and the surrounding community aware of the scope of the hazardous waste management plan and what to do in the event of a spill or similar.

Performance indicators:

- Volume of chemicals used on site.
- Number of accidents for project workers resulting from improper handling of hazardous materials.

Goals:

- Reduce the use of hazardous substances to the minimum possible.
- Non-occurrence of accidents for workers and residents of the communities in the project's area of influence due to improper handling of hazardous substances.

Executor: Contractors.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: Project site.

Frequency of follow-up: Semiannual.

Implementation time: During the entire construction phase.

Required records:

- Registration forms for traffic accidents that have occurred.
- Photographic records.

Associated costs: The costs of implementing this plan are included in the construction budget.

B.- Biotic environment**8.1.1.9 Plan of measures for the protection of terrestrial biota**

Impacts targeted by the plan:

Impact	Code	Impact classification
Disappearance of vegetation cover and loss of flora due to vegetation clearing for construction works, including individuals and populations of native, endemic and threatened species.	V-1	HIGH
Loss of habitat for wildlife due to clearing.	F-1	MODERATE
Impact on fauna due to construction activities that generate noise and dust and human presence.	F-2	MODERATE
Decrease in fauna caused by collisions of birds and bats with the towers and power lines of the transmission line (*).	F-5	MODERATE
Detriment to fauna due to the electrocution of birds and bats by the voltage of the transmission line (*).	F-6	MODERATE

(*) These impacts correspond to the operation phase; however, measures for their prevention, mitigation or compensation must be implemented from the construction phase, which is why they are included in this plan.

Objective:

Minimize negative impacts to vegetation and terrestrial fauna as a result of the project's construction activities.

Measures to be implemented:
Measures for the protection of terrestrial fauna:

Measures for the protection of terrestrial fauna include:

- Strictly prohibit hunting or harassment of any species or damage to nests and eggs.
- Prohibit illegal trafficking and sale of protected or endangered species of fauna.
- Avoid introducing fauna species considered invasive to the project area.
- Limit access of workers and vehicles only to construction areas or project-related activities or facilities.
- Actions that cause impacts on adjoining land outside the established construction limits will be avoided.
- Comply with the **Plan of Measures for the Protection of Air Quality and the Noise Environment** (see 8.1.1.1).
- Design of the transmission line route to avoid important habitats (bird nesting areas, bat foraging corridors and migratory corridors).
- Avoid carrying out construction activities on the transmission line during the breeding season of fauna species and other sensitive periods and schedules.
- Maintain a 1.5 m (60 in.) separation between live components of the transmission line and grounded equipment. If such separation is not possible, cover live components and equipment.
- Install wildlife protection elements on towers and cables of the power transmission line. To minimize bird collisions and electrocutions with the towers and cables of the electric transmission line, the following will be considered:

- In the design of the outdoor electrical connections, precautions will be taken to minimize the risk of bird collisions by contact during the operation phase. The use of visible devices that help birds to detect the cables should be implemented, such as: white polypropylene spiral, orange polypropylene spiral, small black spirals, neoprene "X" strips, braided cable (Photo 8-6). Consider the quantity rather than the size of the devices, the more devices the better.
- Installation of deterrents between the towers and the conductors to prevent birds from perching on dangerous points (elevated perches or silver balls that scare birds away, among others).

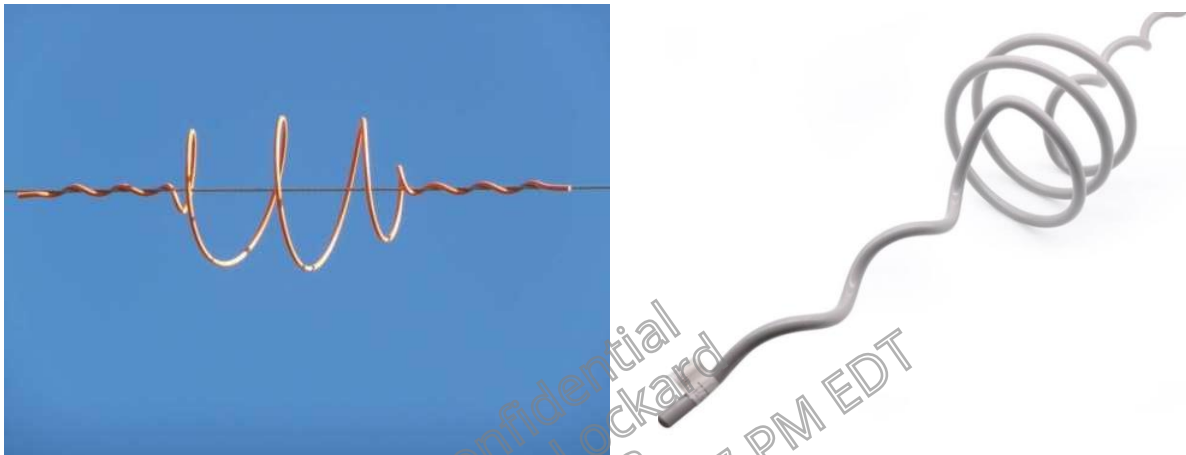


Photo 8-6. Different devices to avoid bird collisions with power lines

- Instruct site workers on the importance of wildlife protection measures through workshops.

Measures for the protection of vegetation:

Measures to be implemented for vegetation protection include:

- Designing the transmission line route to avoid critical habitats and using existing power and transmission corridors for transmission and distribution, and existing roads and tracks as access roads wherever possible.
- Prior to the clearing work for the construction of the transmission line, a rescue plan will be implemented for the protected or endangered species that will be taken to the nursery, which includes:
 - Identification and marking of the individuals of protected or endangered species identified in the Table 8-3.

Table 8-3. Protected species of flora along the route of the 345 kV power line.

FAMILY/SPECIES	COMMON NAME	CITES Appendices II (2023)	IUCN (2011)	LRFV (2016)
AVICENNIACEAE				
<i>Avicennia germinans</i>	Mangle Prieto		LC	VU
CACTACEAE				
<i>Harrisia divaricata</i>	Pitajaya	X		EN
<i>Opuntia taylorii</i>	Mulito de pollo	X		VU
<i>Pilosocereus polygonus</i>	Cayuco	X	LC	VU
<i>Lemaireocereus hystrix</i>	Cayuco	X		
<i>Selenicereus pteranthus</i>		X		
COMBRETACEAE				
<i>Conocarpus erectus</i>	Mangle boton		LC	VU
<i>Laguncularia racemosa</i>	Mangle blanco		LC	VU
FLACOURTIACEAE				
<i>Casearia illicifolia</i>	Chicharrón			CR
ZYGOPHYLLACEAE				
<i>Guaiacum officinale</i>	Guayacán	X	EN	VU
<i>Guaiacum sanctum</i>	Vera	X		VU
Abbreviations used				
CITES (2023): International Convention on Trade in Endangered Species of Flora and Fauna, Appendix II.				
LRFV (2016): National Red List of the Dominican Republic according to IUCN criteria.				
IUCN (2011): International Union for Conservation of Nature: (EN), Endangered; (CR), Critically Endangered; (VU), Vulnerable; and (LC), Least Concern.				

Source: EMPACA, 2023.

- Creation of the transplant and rescue brigade.
- Training of the transplant and rescue brigade.

- The areas to be cleared along the route of the power transmission line and its easement strip will be laid out in such a way as to affect the minimum vegetation necessary, considering the technical characteristics and maneuverability of the equipment involved. For these purposes, preference will be given to manual clearing, since it is the technique indicated for working on land where certain protected species and vegetation shoots are to be preserved. Manual clearing is selective and allows control over the area of action and detailed work thanks to current machines and brushcutters, saws or brushcutters with harness.
- Disturbance of areas outside the route of the power transmission line and its easement strip will be avoided, protecting the surrounding vegetation outside the route area so that the fauna does not suffer any additional habitat loss.
- Once the areas to be cleared along the route of the power transmission line and its easement strip and its dimensioning for the operation of the equipment have been established, a visible signaling system will be established to guide the operators on the areas to be cleared. This system can be beacons or flags, removable.
- The green areas and gardens that will be created at the thermoelectric plant, the living fence that will be created around the facilities, will be planted with species native and endemic to the area.
- Avoid planting in the green areas and gardens of the project the planting of species considered as invasive, among which are: Creole flax, *Leucaena leucocephala*; neem or nín, *Azadirachta indica*; acacia, *Acacia mangium*; flamboyant, *Delonix regia*; caliandra, *Calliandra calothyrsus*; chachá, *Albizia lebeck*; casuarina, *Casuarina equisetifolia*; yellow Acacia, *Senna siamea*; foreign javilla, *Aleuritis fordii*, among others.

Performance indicators:

For wildlife:

- Number of didactic materials developed.
- Number of training workshops conducted.
- Number of site workers trained.
- Number of protection elements installed.

For vegetation:

- Number of individuals of protected and endangered species rescued.
- Number of individuals planted.
- Number of species planted.
- Number of planted individuals belonging to native or endemic species.

Goals:

For wildlife:

- Programmed number of didactic materials to be developed.
- Programmed number of training workshops to be held.
- All workers trained in measures for the protection of terrestrial fauna.
- The entire electrical transmission line layout with the protection elements installed.

For vegetation:

- Planned number of individuals of protected or threatened species to be rescued.
- Planned number of individuals to be planted.
- Planned number of species to be planted.
- At least five (5) native and/or endemic species planted and growing in the green areas of the project.
- None of the planted plant species considered invasive.

Executor: Contractors.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: Project land, the route of the power transmission line and its easement strip.

Frequency of follow-up: Semiannual.

Implementation time: During the entire construction phase.

Required records:

- Records with the number of plants and species planted.
- Photographic record of the activities carried out.
- Reports generated by the Safety, Health and Environment Coordinator.

Associated costs: The costs of implementing this plan are included in the construction budget.

C.- Socioeconomic Environment

8.1.1.10 Social management action plan

Impacts targeted by the plan:

Impact	Code	Impact classification
Positive impacts to be enhanced:		
Creation of temporary jobs.	EC-1	HIGH
Improving the quality of life and purchasing power of the workers who will build the Project and their families.	PB-1	HIGH
Increased demand and use of construction materials and other inputs.	CT-1	MODERATE
Increase in the financial flow and commercial activity in the province of Montecristi due to the contracting of services.	EC-2	MODERATE

Impact	Code	Impact classification
Negative impacts to be prevented or mitigated:		
Possibility of disturbance to residents due to increased noise and dust levels as a result of the Project's construction activities.	PB-2	MODERATE
Possible exposure to diseases due to the influx of temporary or permanent labor.	PB-3	MODERATE
Risk of physical injury or loss of life to residents arising from the use of force by Project physical security personnel.	PB-4	MODERATE
Risk of accidents resulting in physical injury or loss of life to workers and residents as a consequence of the Project's construction activities.	PB-5	MODERATE
Economic impact on beekeepers in the area due to land clearing.	PB-6	MODERATE
Loss of area for goat grazing due to clearing of project lands.	PB-7	MODERATE
Risk of health effects to workers and residents from exposure to electromagnetic fields (*).	PB-18	MODERATE
Increased demand for services provided by government entities during the construction phase of the project.	IS-1	MODERATE

(*) This impact corresponds to the operation phase; however, prevention, mitigation or compensation measures must be implemented during the construction phase, which is why it is included in this plan.

Objectives:

Maximize the positive effects of the project for the local population through the creation of temporary jobs and demand for goods and services for the construction of the project.

Minimize the inconvenience and impact on the population of the communities in the project's area of influence as a result of the project's construction activities.

Measures to be implemented:

The measures to be implemented to maximize the effects of the project's positive impacts derived from the generation of jobs, demand for construction materials and economic dynamization include:

- Establish clauses in the contracts with the contractors that indicate that priority should be given to hiring labor from the communities in the project's area of influence, which includes the municipalities of Pepillo Salcedo and Montecristi, both in the province of Montecristi, as long as they are apt for the work to be performed. A labor recruitment strategy will be designed to prioritize the different rings of influence in relation to the project site.
- Establish clauses in contracts with contractors that indicate that priority should be given to the purchase of construction materials and the contracting of services from suppliers in the communities in the project's area of influence, as long as they are available and meet the required price/quality standards.
- Include clauses in contracts with contractors specifying mandatory compliance with the provisions of the Dominican Republic's Labor Code and the fundamental conventions of the International Labor Organization (ILO) regarding non-discrimination of workers in the

project (based on gender, age, race, religion, sexual orientation or political preference), and equal working conditions for migrant workers and women.

- Implement the **Stakeholder Engagement Plan** (see Section 8.3) to communicate effectively with communities. As part of this plan, disseminate information about newly created jobs and business opportunities that may benefit the community.
- Develop and implement a **Corporate Social Responsibility Program** that will benefit the communities in the project's area of influence, which includes the municipalities of Pepillo Salcedo and Montecristi, both in the province of Montecristi. The program may include projects in the areas of environment, community infrastructure, social development (education, health, sports, culture, income generation, strengthening of organizations, among others).
- Coordination with the Ministry of Environment and Natural Resources to collaborate with the preparation of the Management Plans for Estero Balsa and Monte Cristi National Parks.
- Develop and implement a Workforce Reduction Plan at the end of the construction phase, aimed at workers who will lose their jobs at the end of this phase. This plan will contemplate the training of workers through the National Institute for Technical and Vocational Training (INFOTEP) or other institutions, so that they will be able to obtain new jobs after the end of the construction phase.
- Strategies for the identification of employment needs and promotion of training will be promoted.
- To carry out institutional management with other projects that have already completed their construction phase in order to absorb outside local labor.

The measures to be implemented to minimize the effects of the project's negative social impacts are as follows:

- Implement the **Plan of Measures for the Protection of Air Quality and the Noise Environment** (see section 8.1.1.1), to reduce the inconvenience to the local population due to increased noise and dust levels during the construction phase of the works.
- Implement the Occupational **Health and Safety Plan** (see Item 8.6), to reduce the risk of accidents that could cause physical injury or death to workers.
- Implement the **Community Health and Safety Plan** (see Section 8.8), which includes measures to prevent the spread of diseases, prevention of accidents in the community, as well as measures to reduce risks to the population derived from the use of force by project personnel.
- Implement the Occupational **Health and Safety Training Plan** (see section 8.11) aimed at both workers and the population of the communities in the area of influence.
- Implement the project's **Complaints, Claims and Suggestions Mechanism for the community** (see section 8.4).
- Implement the **Worker Grievance Mechanism** (see section 8.7).
- Implement the **Emergency Preparedness and Response Plan** (see section 8.9).
- Coordination with the Municipality of Pepillo Salcedo and the State institutions in charge of providing the different services, actions aimed at mitigating the impact of the increased demand for services during the construction phase of the project by the construction workers (garbage collection services, drinking water, electricity, education for children, health, security, among others).

- Design of the power transmission line so that the route minimizes or avoids the installation of transmission cables and high voltage equipment over or bordering residential properties and other locations intended for high rates of human occupancy.

The measures aimed at mitigating the impact on the possible economic impact on beekeepers and goat breeders are as follows:

- Designate a community liaison analyst in the Pepillo Salcedo municipality to serve as a permanent interlocutor between the company promoting the project and the different stakeholders (beekeepers, goat farmers, Villa Ray residents, among others) in the area, so that the concerns of these stakeholders can be received, responded to and resolved in a timely manner.
- Promote alliances with technical training centers, such as the National Institute for Technical and Vocational Training (INFOTEP), to train members of the family of beekeepers and goat farmers in the area in alternative trades to their main activity, such as skilled workers in different sectors of construction (electricity, plumbing, masonry, among others) and industry (mechanics, industrial electrical maintenance).
- Coordination with the Monte Cristi ecological society and other environmental organizations on actions to protect protected and sensitive areas in the project's area of influence.
- Implement mitigation and/or compensation measures for alteration of the usual access routes to fishing areas.
- Implement mitigation and/or compensation measures for alteration of the usual access routes to reach points of ecotourism interest.
- Implement mitigation and/or compensation measures for goat and sheep farmers and beekeepers for the use of land for the construction of the power plants in Blocks 01 and 02 and the natural gas storage and gasification terminal.

Performance indicators:

- Number of workers hired for the construction of the project.
- Percentage of workers hired from communities in the project's area of influence.
- Percentage of workers hired who are women.
- Number of contracts with local commercial establishments to supply products and services to the project.
- Number of people benefited by the implementation of the project's Corporate Responsibility Programs.
- Number of cooperation agreements signed with community organizations and public and private institutions in the municipality.
- Number of community organizations involved in corporate social responsibility actions.
- Number of complaints received from community members.
- Number of complaints investigated and responded to community members.
- Number of work-related accidents that have occurred in the project.
- Number of accidents involving residents of the communities in the area of influence related to the project.
- Number of beekeepers and goat breeders benefiting from training programs.

Goals:

- Planned number of workers to be hired for the construction phase of the project.
- Planned percentage of workers to be hired belonging to the communities in the project's area of influence.
- Number of suppliers of products and services belonging to communities in the project's area of influence.
- 100% of complaints received responded to in no more than 20 days.
- Number of people planned to benefit from the Corporate Social Responsibility Program.
- Non-occurrence of disabling occupational accidents.
- No accidents involving residents of the communities in the area of influence.
- Planned number of beekeepers and goat breeders benefited.
- At least 75% of the community organizations in the urban areas of Pepillo Salcedo, Copey and Carbonera have signed cooperation agreements and are involved in the actions of the company's social responsibility program.

Executor: Contractors.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: Communities in the area of socioeconomic influence of the project (municipalities of Pepillo Salcedo and Montecristi, Montecristi province).

Frequency of follow-up: Semiannual.

Implementation time: During the entire construction phase.

Required records:

- List of workers hired, indicating gender and place of origin.
- Complaints and claims registration forms.
- Accident record forms.
- Photographic or video records evidencing compliance with the measures of the Social Management Plan.
- Attendance list for training courses.

Associated costs: The costs of implementing this plan are included in the construction budget.

8.1.1.11 Archaeological heritage management plan

Impacts targeted by the plan:

Impact	Code	Impact classification
Possibility of affecting unknown archaeological sites in the construction area.	PC-1	MODERATE

Objective:

Avoid the destruction of sites of cultural value and/or archaeological artifacts as a result of earthmoving work during the construction phase of the project.

Measures to be implemented:

- Designate a person within the Manzanillo Energy Consortium Power Plant Project to coordinate, manage and process all archaeological matters of the project who will be provided with a copy of the "Reglamento de Investigaciones Arqueológicas del Ministerio de Cultura", so that he/she can anticipate with respect to the requirements of the Ministry of Culture.
- his person shall communicate and train other project workers, especially those in charge of carrying out earthworks during project construction on the contents of these regulations and the elements that may be indicators of the existence of archaeological sites. This communication and training should include the following:
 - Inform workers who will be carrying out earthwork for the construction of the project of the possibility of finding evidence of the presence of an archaeological site.
 - Show photograph of artifacts they may find.
 - Give a simple description of the characteristics of the artifacts.
- In case of finding evidence of the presence of an archaeological site in the construction area of the project, this person will be responsible for the registration and control of the "Report of Non-existence of Cultural or Archaeological Remains". He/she will proceed to preserve the site and implement the following actions:
 - Immediately stop excavation, backfilling and soil compaction.
 - Cordon off the area with visible signs and post signs prohibiting access.
 - Notify the Museo del Hombre Dominicano to check if it is an archaeological site or not.
 - Do not begin work until the Museum of Dominican Man has performed the rescue or has indicated that work can continue, because there is no evidence of the existence of an archaeological site.
 - In case it is confirmed to be an archaeological site, the Museum of Dominican Man will carry out the rescue of the archaeological sites by implementing the following actions:
 - Drilling a borehole.
 - Take the coordinates of the deposit.
 - Deposit the material in plastic bags.
 - Label the bags with the coordinates of the site, excavation level, stratum, and observations.

Performance indicators:

- Number of archaeological sites or objects found.
- Number of archaeological artifacts (ceramic fragments, bone remains and plant remains) recovered.

Goals:

- 100% of the archaeological sites found preserved.
- 100% of the archaeological artifacts rescued.

Executor: Contractor in charge of earth moving works.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: Project land, the route of the power transmission line and its easement strip.

Frequency of follow-up: Semiannual.

Implementation time: During the entire construction phase.

Required records:

- Record of the archaeological findings found in the project.

Associated costs: The costs of implementing this plan are included in the construction budget.

8.1.1.12 Traffic management plan

Impacts targeted by the plan:

Impact	Code	Impact classification
Increased truck and vehicle traffic on access roads	TV-1	MODERATE
Risk of traffic accidents resulting in physical injury or loss of life to workers and local residents on access roads.	TV-2	MODERATE
Possibility of deterioration of the access roads due to the passage of trucks and equipment for the transportation of construction materials and equipment.	TV-3	LOW
Increase in the concentration of particulate matter due to construction activities and transportation of materials.	A-1	LOW
Increased noise and vibration levels due to construction activities and transportation of materials.	A-2	MODERATE
Increased flue gas concentration from vehicle, heavy equipment and truck operations.	A-3	LOW
Change or impact on climate due to greenhouse gas emissions from vehicle, heavy equipment and truck operations.	CL-1	MODERATE

Objective:

Reduce the risk of accidents and injuries to construction workers and the population of the communities in the area of direct influence of the project due to the transportation of materials and debris, avoid the deterioration of access roads and inconvenience to the population of the communities in the area of influence due to exposure to noise, dust and emissions generated by transportation activities.

Measures to be implemented:

The following aspects will be taken into consideration when moving the trucks and containers: accidents on the roads, excessive noise from vehicle traffic, cost of traveling on congested roads, gas emissions from the trucks moving the containers, movement of the trucks at inadequate speeds. The following measures will be taken into consideration to mitigate these potential impacts and risks:

To avoid accidents on the roads:

- Place traffic controllers at the points marked with yellow dots on the Transportation Route Map that were identified as critical due to having to make turns of almost 90°.
- Comply with the traffic and transit indications stipulated in Law 63-17 on Transit, Transportation and Road Safety of the Dominican Republic.
- Respect to the maximum speed limits established in Law 63-17 on Traffic, Transportation and Road Safety of the Dominican Republic. These limits are:
 - Urban residential area: 30 km/h.
 - Urban avenues: 60 km/h.
 - School zone or where there are churches and cemeteries: 20 km/h.
 - Road, highways and freeways: Although the MOPC establishes limits of up to 120 km/h for road, highway and freeway traffic, a limit of 80 km/h will be established for trucks and project vehicles.

On unpaved roads and internal roads of the project, the maximum speed of circulation will be 20 km/h.

On internal roads, all vehicles must drive with flashing lights on.

To avoid excessive noise from vehicular traffic:

- Respect the maximum speed limits established in Law 63-17 on Traffic, Transportation and Road Safety of the Dominican Republic.
- Do not honk.
- Perform periodic maintenance on vehicles.

To reduce the cost of traveling on congested roads:

- Compliance with established transportation routes (see Map of Transportation Routes), making the greatest use of bypasses and avoiding circulation through urban areas whenever possible.
- Coordinate with the transit authorities of the Dirección General de Seguridad de Tránsito y Transporte Terrestre (DIGESETT), the day and time that the transportation of large loads or oversized equipment will take place.
- Place traffic controllers at the points marked with yellow dots on the Transportation Route Map that were identified as critical for having to make turns of almost 90°.

Particles suspended by truck load dispersion during transport of aggregates and debris.

- Use of tarpaulins to cover the load of trucks transporting aggregates or loose debris.

To reduce gas emissions from the trucks that transport the containers:

- Respect the maximum speed limits established in Law 63-17 on Traffic, Transportation and Road Safety of the Dominican Republic.
- Perform periodic maintenance on trucks.

Circulation of trucks at inappropriate speeds:

- Coordinate with the DIGESETT transit authorities, the day and time that the transportation of large loads or large equipment will be carried out.
- Place traffic controllers at the points marked with yellow dots on the Transportation Route Map that were identified as critical for having to make turns of almost 90°.
- Respect the maximum speed limits established in Law 63-17 on Traffic, Transportation and Road Safety of the Dominican Republic.
- Signage on trucks transporting materials used on the project with telephone numbers for reporting reckless driving.

Measures to avoid accidents/incidents in populated areas:

- Placement of temporary transit signage during material transport activities if necessary (Figure 8-5).
- Communication of transit routes, mobilization frequencies to local stakeholders.
- Place traffic controllers at the points marked with yellow dots on the Transportation Route Map that were identified as critical for having to make turns of almost 90°.
- Comply with the traffic and transit indications stipulated in Law 63-17 on Transit, Transportation and Road Safety of the Dominican Republic.
- Respect the maximum speed limits established in Law 63-17 on Traffic, Transportation and Road Safety of the Dominican Republic. These limits are:
 - Urban residential zone: 30 km/h.
 - Urban avenues: 60 km/h.
 - School zone or where there are churches and cemeteries: 20 km/h.



Figure 8-5. Temporary signs that could be placed on roads in populated areas.

Source: EMPACA archives.

Other aspects to consider:

The companies in charge of transportation will be required to do so:

- Verification of the driver's documentation.
- Valid identity card.
- Valid driver's license.
- Emergency contact list.
- Proof of insured rights or medical insurance for emergency care.

Check if it is also carried in the vehicle:

- Road maps.
- Workshop book where maintenance operations are recorded.
- Parts for vehicle inspection.

Checking of auxiliary elements:

- Fire extinguisher (not past its expiration date and pressure is still correct).
- Fasteners: belts, straps, tensioners.
- Fasteners: webbing, straps.
- Indication elements: emergency triangles, red flag, orange panels if applicable.
- Repair items: toolbox, spare bulbs, hydraulic jack, spare tires, spare tire, wrench.
- Other items: gloves, flashlight, clean rags, notebook and pen for notes.

Vehicle controls:

- Check (and change, when necessary) the levels of water, battery, oil, clutch fluid... and verify that there are no leaks.

- Check oil and air pressures.
- Check that the air filter is not dirty.
- Check the condition of the fire extinguisher, mirrors, rear-view mirrors, safety triangles and bodywork.
- Verification of tire pressure, condition of the placard, suitability of the model to the circumstances.
- Check the operation of the brakes, all exterior signaling and the ignition system.
- Verify the good condition of the exhaust pipe.
- Check the general cleanliness of the truck (interior and exterior).
- Check fuel reserve.
- Verify the operation and battery status of mobile communications equipment.

Performance indicators:

- Number of traffic accidents involving site equipment and vehicles during the execution of their work.
- Number of project workers affected by traffic accidents during the execution of their work.
- Number of residents affected by traffic accidents during the execution of project works.

Goals:

- No disabling traffic accidents involving construction site equipment and vehicles.

Executor: Contractors involved in the transportation of construction materials and waste.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: Roads where materials and waste will be transported, especially the El Copey-Manzanillo Road and the access road to the project.

Frequency of follow-up: Monthly.

Implementation time: During the entire construction phase.

Required records:

- Forms for registration of traffic accidents.
- Photographic records.

Associated costs: The costs of implementing this plan are included in the construction budget.

8.1.2 Preventive, mitigation and compensation measures program for the operation phase

Below are the preventive, mitigation and compensation measures organized by plans to be implemented during the operation phase, grouped according to the element of the environment

to which they are directed. See Annex 16: Summary matrix of the program of preventive, mitigation and compensation measures for the operation phase of the project.

A.- Physical and perceptual environment

8.1.2.1 Maintenance Management Action Plan

Impacts targeted by the plan:

Impact	Code	Impact classification
Negative impacts to be prevented or mitigated:		
Introduction of anthropic elements in the rural landscape.	PS-2	MODERATE
Potential for air pollution due to emissions of combustion gases into the atmosphere and suspended particulate matter from the operation of turbines and emergency power generators.	A-4	MODERATE
Increased noise and vibration levels due to thermoelectric plant operations.	A-5	MODERATE
Change or impact on the climate due to the emission of greenhouse gases resulting from the operations of electricity generators.	CL-2	MODERATE
Possibility of affecting the population (workers and communities) due to increased levels of gas emissions, suspended particles, noise and vibrations from the thermoelectric plant's operations.	PB-9	MODERATE
Positive impacts to be enhanced:		
Increased capacity to deliver electric energy to the National Interconnected Electric System.	SE-1	VERY HIGH
Increased efficiency of the country's energy system through the use of cleaner and more efficient technology for electricity generation.	SE-2	HIGH

Objective: Avoid and minimize the negative environmental impacts derived from operation and maintenance activities and maximize the positive effects of the project through adequate maintenance of its different components.

Measures to be implemented:

- Programs will be developed and implemented for the adequate preventive and corrective maintenance of the thermoelectric power plant facilities, including:
 - Maintenance of the buildings (office, administration, storage, maintenance and control buildings, among others) and infrastructure, which will consist of: cleaning, painting, solving leaks, patching of internal roads, parking areas and maneuvering yards, among others.
 - Maintenance of the general and safety signage at the thermoelectric power plant, replacing those that are very deteriorated.
- Programs will be developed and implemented for the proper preventive and corrective maintenance of the thermoelectric power plant equipment including gas and steam turbines, heat recovery steam generator (HRSG), steam condenser, water desalination

plant equipment, cooling towers, transformers and other auxiliary equipment such as the emergency power generator, water circulation pumps, among others.

- Programs will be developed for the adequate preventive and corrective maintenance of the electric transmission line. The maintenance of the electric transmission line will be in charge of Empresa de Transmisión Eléctrica Dominicana (ETED) and consists of:

Preventive maintenance

- a) Maintenance of support sites: consists of reviewing the sites of each tower, and in case of destabilization problems, the construction of corrective works such as trenches, gabions, retaining walls and drainage works will be required.
- b) Review of the condition of the elements: consists of carrying out inspections with the purpose of reviewing the condition of the component elements of the transmission line, such as towers, conductors, insulators, hardware and associated equipment, among others.

Corrective maintenance

- a) Repair or replacement of elements: if the review of the condition of the component elements of a distribution network determines the need to implement corrective measures, the elements affected by damage to the network or by the termination of a life cycle (remodeling) will be repaired or replaced.

In some cases, services will be temporarily suspended when it is necessary to change important parts such as insulators or conductors.

General instructions for maintenance work:

- Maintenance work on the equipment shall be carried out in accordance with the hours of operation and following the procedures established by the manufacturer for these purposes.
- Machinery and equipment used for maintenance work should be turned off when not in use.
- Keep equipment and machinery used for maintenance work in good condition. Do not dump solid, liquid or oily waste in unauthorized places when performing maintenance activities.
- Development and implementation of an adequate strategy for the management of waste generated by maintenance activities.

Performance indicators:

- State of conservation of the project facilities.
- Percentage of equipment maintained up to date.
- Number of breakdowns reported for project equipment.

Goals:

- All (100%) facilities and equipment maintained up to date.

Specific or detailed targets for the indicators will be established during the initial phase of the operation stage and may be modified as project operation activities progress.

Executor: Empresa Operadora de la Central Termoeléctrica and Empresa de Transmisión Eléctrica Dominicana (ETED).

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible: Manzanillo Energy Consortium, Inc. and Empresa de Transmisión Eléctrica Dominicana (ETED).

Place of implementation of the measures: Facilities and equipment of the Manzanillo Energy Consortium Power Plant.

Frequency of follow-up: Semiannual.

Implementation time: Throughout the life of the project.

Required records:

- Records of maintenance performed.

Associated costs: The costs of implementing this plan are included in the operating costs of the project.

8.1.2.2 Plan of measures for solid waste management

Impacts targeted by the plan:

Impact	Code	Impact classification
Possibility of soil contamination due to inadequate management of liquid, solid and oily wastes.	S-3	LOW
Possibility of the spread of vector and rodent infestations due to poor solid waste management.	F-3	LOW
Introduction of anthropic elements in the rural landscape.	PS-2	MODERATE

Objective:

Avoid negative impacts on the environment that could be caused by inadequate management of municipal solid waste, special handling waste, and hazardous waste during the thermoelectric

plant's operations by developing and applying an adequate management strategy for each type of waste.

Measures to be implemented:

Solid Waste Management will be implemented at the project facilities within the framework of the "cleaner production" guidelines, which include the following aspects:

- Minimization.
- Storage.
- Reuse and recycling.
- Transformation or treatment.
- Final provision.
- Report to local and national environmental authorities.

Solid waste management includes all administrative and operational activities necessary for handling, segregation, collection, storage, pretreatment, treatment, conditioning, transportation and/or final disposal.

The following measures must be taken at the thermoelectric power plant facilities to minimize and mitigate the negative environmental impacts of solid waste management.

Prevention at the source:

The actions aimed at the no-waste culture start with simple practices aimed at reducing the volume of waste generation as a consequence of an industrial activity, within these practices will be considered:

- Do not waste paper, reuse it as much as possible.
- Always use both sides of the sheets.
- Use kitchen towels instead of paper rolls.
- Buy products that are minimally wrapped.
- Use recycled paper whenever possible.
- Encourage the consumption of beverages contained in returnable and family-size containers rather than canned beverages.
- Avoid products that come packaged with a lot of plastic, paper, etc.
- Store food in the refrigerator, lunches or snacks in reusable containers, not disposable.
- Avoid disposable cups and plates and replace them with glass or reusable plastic ones.
- Encourage each person in the offices to have his or her own cup or mug, and allocate some for visitors, to avoid the use of disposable ones.

Characterization, selection and quantification of solid waste:

Proper waste management begins at the site where the waste is produced. The initial action is to identify the points of waste generation and the types of waste, and to establish for each production unit the volume, typology and waste emission rate.

Solid Waste Characterization:

Waste characterization is important to determine opportunities for both pollution prevention and management, as it makes it possible to establish the pollutants that are being discharged into the soil, water and atmosphere.

The Safety, Health and Environmental Coordinator of the plant must annually make the characterization of solid waste and record it in the Solid Waste Characterization Form.

Quantification of Solid Waste:

Once all the solid waste resulting from the process has been identified, it is necessary to quantify it, select the treatment system and the final disposal to be used (with the respective suppliers/organizations receiving this waste). This record is made on the Waste Quantification, Treatment and Final Destination Form.

For these activities the following must be performed:

- Enable a space to advance the weighing of waste.
- Determine how solid waste is collected at each generation site.
- Plan the mechanism to obtain the weight of each one of them (define a methodology).
- Define the type of treatment for each waste.
- Define the company transporting and receiving the waste.
- Define packaging and waste identification labels.

Waste Classification:

Wastes should be separated according to their chemical properties and/or commercial or technical interest, considering that:

- Waste with different destinations must be separated.
- Prevent contact between incompatible substances.
- Keep the waste pure or free of impurities from other wastes.

Screening should be carried out by plant personnel, supported by the environmental education and awareness program.

This separation must be systematic, applying at least the color code described in Table 8-4.

Table 8-4. Color code for waste classification.

TYPE	CATEGORY	CODE	DESCRIPTION
Special handling waste	Electric	Orange	Remains of cable, wire, electrical capacitors and/or any other instrument or part related to the operation of the plant's electrical workshop.
	Metallics	Pink	Pipes, valves, flanges and any metallic part that due to wear or damage is discarded from the conduction networks or from the equipment itself.
Municipal solid waste	Organics	Yellow	Residues from food, resulting from the circulation process, etc.
	Ordinary	Light blue	Waste similar to that generated in the home, including items such as paper, cardboard, textiles, wood, wood chips.
Dangerous	Dangerous	Red	They include materials contaminated with oil, paint containers, solvents, penetrants, degreasers, oils, greases, chemicals and welding butts.

Source: EMPACA, 2023.

Waste should be packaged according to its physical state and hazardous characteristics, taking into account the following conditions:

- The container must have the necessary dimensions and safety conditions to prevent deterioration during loading, unloading and transportation.
- Containers should be identified with the name and hazardous characteristics of the waste.
- The container must be compatible with the waste to be contained.
- The container must be painted according to the color code in the table above.

As a form of control, the Safety, Health and Environmental Coordinator of the thermal power plant must map the location of the waste tanks and record in the Waste Tank Distribution Form.

Waste selection criteria:

Recyclable or recoverable:

Glass

It is the only material that can be fully recovered. The main requirements it must meet to be recyclable are:

- Dry glass.
- Without color mixing, it should be separated into green, amber (brown) and white (crystalline).
- No stones or sand of any type or size.
- Without metal, plastic and aluminum caps and rings.
- No labels.
- No garbage or organic matter such as: shells, cardboard, wood, etc.

- Glass from windows, light bulbs, mirrors, lenses, ceramic plates, glasses and fiberglass is not recyclable together with container glass, and is considered a contaminant in the recycling of these as it alters the purity and color of the recycled glass.

Plastic

In particular, plastic has many classifications and presentations of different types, so it is necessary to be very well informed to effectively carry out the process of separation and recycling. Most plastic bottles are marked with symbols, numbers or codes that indicate the classification to which they belong. The code consists of a triangular arrow with a number in the center and some letters below, PET1.

Among the requirements that waste must meet in order to be recycled are the following:

- Classification according to the type of polymer.
- Not having been in contact with toxic substances or pathogenic microorganisms.
- Mechanical strength, which determines how many times a plastic has been recycled.
- Be clean, rinsed with water to avoid contamination of other containers and proliferation of pests.
- No lid or label, these are generally made of other material.

Scrap (metals)

It appears when an iron or steel product has fulfilled its useful life and is discarded, this type of scrap in the recycling world is called obsolete scrap, the fraction of this waste from activities such as construction or demolition is usually contaminated with concrete, wood and other non-metallic materials, but if processed correctly, it is recyclable.

This scrap includes juice cans, beer cans, cans of various beverage containers and chemical products.

Paper

It is important to set up an area in different offices or collectives where paper from printed material, non-functional daily talks, forms, among others that can be recycled or disposed of in accordance with the provisions of this procedure, can be stored.

To favor the recycling of paper, it is recommended to separate the white, colored and cardboard fractions, and to avoid mixing them with the following impurities that can harm the recycling process:

- Carbon or carbonless.
- Plasticized, aluminum, cellophane, fax or photographs.
- Waxing (tetra packs of milk, juices, etc.).
- With stickers (post it, stickers).

- Used household items (napkins, toilet paper, cups, etc.).
- Leaflets containing any additional material other than paper and/or cardboard.

Organic matter

Organic matter refers to those products of animal or vegetable origin and constitutes the fermentable fraction of solid waste. Its recycling feasibility depends on the generation volumes, which will be evaluated in the characterization and quantification phase.

The organic matter can be composted, a process that produces an excellent fertilizer for the soil and greatly reduces the volume of waste.

Hazardous waste selection criteria:

The selection of hazardous wastes is based on their characterization, which establishes their status and predicts their hazardousness. However, in order to manage the potential risk that this type of waste represents, it is advisable to evaluate some technical criteria that will make it possible to safely establish the handling and storage mechanisms within the plants.

Storage of non-hazardous waste (municipal solid waste and special handling waste):

The area destined for the storage of non-hazardous solid waste must meet at least the requirements indicated in section 8.1.1.3 of this document. 8.1.1.3 of this document.

Hazardous Waste Storage:

The hazardous waste deposit will be exclusively for hazardous waste, although it may be annexed to the recycling deposit (ordinary and domestic waste).

Storage facilities for this type of waste shall comply with the minimum requirements indicated in subsection 8.1.1.3. 8.1.1.3 of this document.

The Safety, Health and Environmental Coordinator shall:

- Periodically inspect the physical condition of this facility to verify that there are no cracks or sources of moisture that could corrode metal storage containers.
- Periodically inspect containers to prevent spills, leaks and overfilling.
- Keep a record or log of the movement of containers in and out of the storage area.
- Conduct frequent inspections of areas where hazardous waste is handled and should document these inspections, as well as the findings of these inspections and the corresponding corrective actions.
- The inspection frequency should be at least once a week in order to verify the presence of spills or leaks from the containers due to corrosion or other factors.

The following activities will be carried out to complement the collection and storage of hazardous waste at the thermoelectric plant:

- Train personnel in charge of packaging, storage and packing of hazardous waste within the company, as well as provide equipment for proper handling and personal protection.
- Develop and adopt an emergency response plan related to hazardous waste management and have trained personnel available at all times for its implementation.
- At the storage site, all hazardous and non-hazardous waste containers should always remain closed during storage, except when it is necessary to remove or add waste.

Hazardous waste storage containers:

Containers for hazardous waste storage must meet the following requirements:

- The materials of which they are made must resist the stress exerted by the waste they contain and by their handling; furthermore, they must not react with the waste they contain.
- They must be clearly, legibly and indelibly labeled; in addition, the label must be firmly affixed to the container or package. The label must state at least:
 - Name, address and telephone number of the company.
 - The words "Hazardous Waste".
 - Container identification number.
 - Clear identification of the waste (name, physical state, type and degree of danger, measures to be followed in case of emergency and codes that identify the waste, for which the international codes listed in the following table can be used).
 - Nature of the risks presented by the waste.
 - Date of initiation of waste accumulation in the container or package.
- Be airtight to prevent the entry of water, insects or rodents, and the escape of liquids or gases through their walls or bottom when they are covered, closed or with a fixed knot. They should comply with the special requirements that the transporter or the person in charge of their treatment or final disposal determines for their correct transfer to the disposal or treatment site. Returnable containers should be washed, deactivated and disinfected as often as necessary to keep them in adequate sanitary conditions for their use and delivery to the transporter.

Waste that is combustible such as textiles contaminated with oils and fuels, flammable or reactive, or that is incompatible with other wastes should be handled with particular attention. Such handling should:

- Protect waste from sources of ignition.
- Physically separate incompatible waste.
- Install preventive signs near areas where combustible or reactive wastes are handled.
- Control the departure and arrival of materials and waste in a safe manner.

Waste storage containers for recycling or recoverable waste:

Containers for the storage of recyclable or recoverable waste must comply with the following requirements:

- The materials of which they are constructed must resist the stress exerted by the waste they contain and by their handling.
- To be watertight to prevent the entry of water, insects or rodents.

- Containers should be washed and disinfected as often as necessary to keep them in proper sanitary conditions for their use.

Storage of some waste already identified:

Used aerosols

- Aerosols should be stored in places where the auto ignition temperature is not exceeded.
- Aerosols should be stored in a separate place from other storage materials to avoid the risk of fire or the rapid spread of fires once they have started.
- They shall be arranged according to the manufacturer's requirements in each particular case.
- When aerosol containers are completely empty, carefully puncture a hole in the bottom or top of the container to release any trapped pressure.

Used containers and barrels

- Do not allow the use of used plant containers, unless it is an authorized donation. Used barrels may be donated only if they have been properly decontaminated and holes have been drilled to prevent their use as water containers. The Plant Manager authorizes the donation.
- Where practical, use alternative methods of receiving packaged consumables as "concentrate" purchases, which are diluted before use.
- Purchases of chemicals in drums may have an "exchange" program with the vendor where with each new delivery of consumables, the unoccupied drums are delivered to the vendor.
- Empty containers should be labeled "EMPTY" or sorted and stored in a designated area for this purpose only.
- Non-returnable containers can be reused in the plant to store waste, replace damaged ones or store non-chemical products (e.g. scrap metal, paper, etc.).
- Before reusing the containers, follow the steps below:
 - The container must be in good condition, free of debris, leaks, rust and have a lid.
 - New products or materials with residues (such as tow) must be compatible with the type of residue in the tanks. For example, metal drums with oil residue cannot receive residues of bases or acids.
 - Used containers should be triple rinsed in an authorized place where the drainage is directed to a specialized treatment.
 - Do not allow welding or cutting of the barrels.

Fluorescent lamps

- Proper handling of used fluorescent lamps is essential to prevent accidents and illnesses.
- Several types of lamps contain mercury in concentrations that may exceed those allowed by the Ministry of the Environment and Natural Resources.
- The following types of lamps contain quantities of mercury, the results of which are normally responsive to the mercury test for TCLP (lethal dose)
 - Fluorescent lamps
 - High Intensity Discharge (HID) lamps, which include the following:

- a. Mercury vapor.
 - b. Metal Halide.
 - c. Low-pressure sodium.
- Fluorescent lamps must be delivered to an environmental service provider approved by the Ministry of Environment and Natural Resources.
- While stored in the plants, they should be stored in wooden crates where breakage and exposure to the environment is prevented.

Used oil filters

- Place the filters in a closed container that allows the collection of excess liquids. For some filter types, making a hole in the filter can speed up oil drainage (check technical information).
- If used oil filters are collected in several areas of the plant, designate a specific area to place them and mark them "USED OIL FILTERS".
- Filter waste (metal and fabric) should be sent to a service provider authorized by the Ministry of the Environment and Natural Resources for incineration or other form of final disposal.
- The service provider or supplier may require analytical tests before accepting the product. Different analyses can be performed and a copy of the results can be provided. The analysis report should be kept on file at the plant for future reference.

Ion exchange resins and activated carbon

- Activated carbon filters, also called activated carbon filters, are based on the so-called ADSORPTION process.
- Activated carbon is available in granular and powder form.
- Granular activated carbon, with a particle size greater than 1 mm, is used in small fixed bed installations, being relatively easy to regenerate, especially thermally, being in these cases necessary to have two columns (one in service and the other in reserve for regeneration).
- Powdered activated carbon, with a size of less than 200 mesh, is used in large installations and works by intimate mixing in an agitated reactor and is subsequently separated by flocculation or filtration, in which case it is much more difficult to handle and manipulate.
- The proper handling of activated carbon, under normal conditions, does not present any risk to the health or safety of persons or facilities. The use of appropriate equipment is recommended for its handling.
- To avoid loss of properties and contamination of the product, it should be stored in 500 kg bags, in a dry and closed environment, it should not be in direct contact with the ground and the maximum stacking should be 20 bags high or 3 pallets.
- Transport should be in bags or pallets with a maximum stacking of 2 pallets or 12 bags high.
- In case of fire, activated carbon does not combust (its combustion point in pure oxygen is above 370°C).
- If in contact with eyes, flush eyes with plenty of clean water for 10 minutes and do not use eye drops (eye rinse). If there has been prolonged inhalation and respiratory disorders appear, give oxygen or apply artificial respiration.

- The disposal of ion exchange resins and activated carbon must be carried out by an environmental service provider registered with the Ministry of the Environment and Natural Resources. The most common forms of disposal for ion exchange resins are incineration or landfill.

Batteries

- The recycling and reuse of batteries, including nickel-cadmium and lead-acid batteries, will be supported.
- Battery vendors must receive the old batteries at each change and recycle them.
- The following steps should be followed when batteries are stored or disposed of in the plant:
 - Check available battery information.
 - Using the SDS product safety data sheet or other available information on specific burn hazards or toxic substances associated with batteries, personal protective equipment and other additional safety measures should be considered.
 - Depending on the hazardous material present and its concentration, the waste may be disposed of in industrial landfills.
 - The Safety, Health and Environmental Coordinator will request battery suppliers to provide a certificate of destruction/use of these wastes indicating the final destination of these materials.

Internal collection at the waste plant:

An internal route will be defined for the collection of all waste, including hazardous waste; however, this activity must be carried out separately to avoid contamination of non-hazardous waste. The design of the route should consider:

- The route between the site of origin of the waste and the storage area and between the storage area and the delivery site for collection should be as short as possible.
- During the tour, the passage through areas of high risk to people's health or safety should be avoided.
- The area where the route is to be followed must be subjected to permanent and total cleaning, with disinfection of floors, walls and walls when the characteristics of the waste so require.

Periodic supplier evaluation:

Environmental considerations when evaluating a waste disposal service provider include the following:

- General maintenance of facilities.
- Waste storage.
- Secondary containment systems.
- Odor.
- Effluent discharge.
- Site security.
- Emissions.
- Worker health and safety.

- Nearby receptors (residences, schools, bodies of water, etc.).

The following procedure should be used when evaluating waste disposal service providers:

- Local regulations and standards should be reviewed to determine permits, licensing and registration requirements for companies providing these services. Select only waste transportation and final treatment companies that have the required permits (accredited with the Ministry of Environment and Natural Resources).
- Investigate the reputation of suppliers, ask for references, including from local state agencies.
- Determine the limits of the service provider's liability insurance.
- Determine the proposed method of disposal and the location of disposal. Certain disposal methods should be avoided and include the following:
 - a. Discharge in some way and abandon the residue.
 - b. Illegal exports.
 - c. Burying hazardous materials or wastes without first stabilizing them.
 - d. Dumping above ground wastes without proper handling techniques.
 - e. Open burning.

Conduct a site visit to the service provider's area and make an appropriate internal or external environmental assessment. Qualified professional personnel should audit the area to ensure that potential environmental risks are minimized. Such audits should be done periodically and documented to ensure compliance. It is advisable to conduct a preliminary investigation prior to visiting the site.

Off-site transportation:

Documentation of transportation services should be implemented to ensure proper handling of such services. Various formats can be used for this purpose and should include the following basic information:

- Name and physical location of the disposal site.
- Name and physical location of the transporter, including vehicle number, license number, etc.
- Date.
- Type and approximate amount of waste.
- Name or initials of the personnel in charge of the transport.
- Method of disposition used.
- The plant must request the certificate of destruction of the waste.

Whether the transportation of the waste is carried out by the plant operator or by a third party, the following minimum measures must be observed:

- The transportation of waste must be carried out by companies that are authorized by the Ministry of the Environment and Natural Resources to transport this type of waste, and that comply with all the requirements and demands of the case.

- Prior to the removal of the waste from the plant's facilities, the Safety, Health and Environment Coordinator and the person in charge of transporting the waste will verify that the waste is properly classified, packaged, labeled (specifying, in addition to the information mentioned above for storage containers, the destination of the waste) and in adequate condition for shipment.
- The Thermal Power Plant Operating Company shall ensure that the transporter has and implements a procedures manual for:
 - Loading and unloading hazardous waste from their vehicles.
 - Verify that the packaging and labeling conditions of hazardous waste are adequate, when these activities have been carried out by the company's facilities.
 - Study and select appropriate routes and schedules to minimize risks to human health and the environment. As far as possible, the selection of routes and schedules should seek to avoid crossings with bodies of water and high-risk areas.
 - Adequately train their workers in order to ensure proper handling of hazardous waste and prompt attention to emergencies.
 - Attend and document contingencies in case of spillage or leakage of hazardous waste, including notification and coordination with the plant and competent authorities and local authorities along the route.
- Vehicles must have at least the following characteristics: hermetic sealing to prevent spills, equipment and devices for safety and accident control, visible identification that warns of the type of waste being transported and use symbols in accordance with industrial safety standards.
- Waste should be delivered by the transporter only to the site where it is specified unless otherwise instructed.
- The transporter may only carry out temporary storage activities of the hazardous waste received by the company before delivering it to the receiver if:
 - It has the corresponding permit granted by the competent authority as a recipient to carry out temporary storage activities of hazardous waste.
 - If such temporary storage has been previously agreed with the company and has been recorded in the certification delivered to the transporter.
- The Thermoelectric Power Plant Operating Company will ensure that the transporter at no time mobilizes in the same transport those wastes that are incompatible.
- The transporter must ensure that the equipment used for loading, unloading, packaging and transporting hazardous waste is adequate for such purposes. Likewise, the transporter must guarantee that the use of such equipment for other activities does not constitute a risk to human health or the environment.
- In order to adequately control the destination, schedule and route, the transporter must have an adequate communications system that allows the location of each of its vehicles when required.
- Vehicles used to transport hazardous waste must undergo a cleaning process after each delivery. This cleaning includes washing, disinfection and detoxification. The waste generated by this action must be properly treated and disposed of.
- In addition to the proper labeling of containers, it is necessary to track the movement and transportation of waste. This can be done through forms or a "custody document" or "waste manifest" system that accompanies the shipment and records the movement of waste from its departure at the plant, each intermediate stage of handling, until its final treatment. The document must be signed by each of the participants in the chain, who will keep a copy of it. In this document, the company must provide the companies in charge of hazardous waste management (transportation, recovery, treatment or final disposal)

with the necessary information so that they can handle the waste safely. The advantage of this system is that it increases the sense of responsibility of the companies and waste management companies, which can also help to recover lost shipments at any given time.

- The Safety, Health and Environmental Coordinator will keep a record or logbook in which the origin, quantity and characteristics of each of the hazardous waste streams generated by the plant are regularly documented. It will also regularly document the management of hazardous waste (e.g., reuse, recycling, pretreatment, treatment, and final disposal). The frequency with which these records must be updated depends on and should correspond to the rates of hazardous waste generation.
- In order to guarantee adequate and responsible integral management of hazardous waste, the Thermoelectric Power Plant Operating Company will periodically carry out audits of the transportation and receiving companies that handle its hazardous waste.

Treatment systems:

The treatment of a hazardous waste refers to the process of physical, chemical or biological transformation whose purpose is to modify its characteristics in order to dispose of it in a safe manner while reducing the risk to the environment and health.

Both the Thermoelectric Power Plant Operating Company and its service providers must promote management oriented towards pollution prevention through source reduction in the management of hazardous waste.

If the generation of hazardous wastes is not avoidable, they should be used (either through reuse or recycling), considering technical and economic criteria. If recovery is not feasible considering these criteria, treatment should be considered. As a last option, final disposal of hazardous waste in a secure landfill should be considered.

Emergency management of hazardous solid waste emergencies:

In the event of an emergency in the handling of hazardous waste, whether in storage at the plant, during transportation, treatment or final disposal, the following measures should be taken:

- The holder of the waste is obliged to immediately notify the nearest local authorities with as many details as possible in order to obtain the assistance required, and to take immediate measures to prevent the areas adjacent to the place of the event from being affected by fires, explosions or spills.
- As a safety measure, the plant will require a report listing the causes that originated the emergency, a summary of the actions implemented during and after the incident, and a description of the material and personal damages, including injuries and deaths.

Final provision:

- Non-hazardous solid waste that is not recyclable will be disposed of at the municipal landfill by the company contracted for this purpose.

- The final disposal of hazardous and recyclable waste will be the responsibility of the company accredited by the Ministry of the Environment and Natural Resources contracted for its removal.

Waste management responsibilities:

Plant Manager

- Provides the necessary resources for the execution of this plan.
- Ensure implementation and compliance with this plan.

Safety, Health and Environment Coordinator

- Provides technical guidance on waste management to company employees.
- Be involved from the beginning in the purchase of new materials to ensure that they will not be harmful to the environment.
- Request an environmental license and verify its validity with the service provider.
- Coordinate the disposal of hazardous and non-hazardous liquid and solid waste with authorized companies.
- Manage certification and manifests confirming proper disposal of shipped waste.
- Be aware of possible changes in regulations.
- Be familiar with the existing materials in the installation.
- Direct all waste-related operations in the plant.
- Ensure that all your SDSs are accessible to obtain the information to be used in the controls.
- Follow up on contractors providing environmental services.
- Conduct periodic inspections of environmental service providers.
- Verify the authenticity and status of environmental service providers' permits issued by the Ministry of Environment and Natural Resources).
- Conduct the first visit to the environmental service providers and when necessary; request documents certifying that the waste has been properly handled/destroyed/recycled.
- Properly file waste destruction/use certificates.
- Participate with the warehouse manager in the definition of material safety criteria.
- Perform weekly inspection of storage sites including tanks and pass these reports to the Plant Manager.
- Verify that SDSs are posted at storage sites.

Purchasing Department

Responsible for obtaining material safety data sheets directly from suppliers.

Warehouse Manager

- Implement material segregation criteria.
- Keep storage sites well organized.
- Report any substandard situation to the company's Safety, Health and Environmental Coordinator.

Spill Brigade Manager

- Participate or delegate to a member of the brigade the responsibility of accompanying the Safety, Health and Environment Coordinator in the weekly inspection of storage sites including tanks.

Performance indicators:

- Volume (m³) of non-hazardous waste generated.
- Percentage of waste recycled.
- Frequency of waste removal.
- Volume (m³) of hazardous waste generated and percentage withdrawn by manager accredited by the Ministry of the Environment and Natural Resources, frequency of withdrawal.
- Volume (m³) of solid waste in soils.
- Volume (m³) and category of solid waste generated on vessels and place of discharge.

Goals:

- 5% reduction in the volume of waste generated.
- Minimum frequency of household waste removal twice a week.
- Minimum frequency of hazardous waste removal every six months.
- At least 25% of non-hazardous waste recycled.
- 100% of hazardous waste removed by accredited waste managers.
- Absence of solid waste in soils.

Executor: Thermoelectric Power Plant Operating Company.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: All the facilities of the thermoelectric power plant, including the temporary storage areas for non-hazardous and hazardous solid waste.

Frequency of follow-up: Monthly.

Implementation time: Throughout the life of the project.

Required records:

- Records of removal of municipal solid waste, special handling waste and hazardous waste.
- Proof of hazardous waste removal by accredited companies.
- Photographic records.

Associated costs: The costs of implementing this plan are included in the operating costs of the project.

8.1.2.3 Plan of measures for the management of liquid wastes

Impacts targeted by the plan:

Impact	Code	Impact classification
Possibility of soil contamination due to inadequate management of liquid, solid and oily wastes.	S-3	LOW
Possibility of modification of marine water quality due to the discharge of cooling water.	ASP-1	LOW
Possibility of affecting marine biota due to the discharge of cooling water into the sea.	BM-1	MODERATE

Objective: Avoid and minimize the negative environmental impacts derived from poor maintenance of the systems that will treat domestic and industrial liquid waste generated at the thermoelectric power plant's facilities.

Measures to be implemented:

- Management of domestic liquid waste and septic tank maintenance.

The following will be considered for the management of domestic liquid waste generated at the project facilities and the maintenance of the septic tank where this water will be treated:

- Domestic wastewater must be collected and treated in the septic tank built for this purpose before being infiltrated into the subsoil.
- Proper management of this water is essential to prevent illness in personnel or the community through exposure to domestic wastewater or contamination of water bodies or the environment. Under no circumstances should domestic wastewater be discharged directly to the ground.
- The discharge of oils, grease, solvents, paints, chemicals or solid waste into the project's sanitary sewer system is prohibited.
- The septic tank will be maintained as required, including cleaning and sludge removal.
- The sludge in the septic tank will be cleaned once a year or according to the results of the inspection depending on the level of sludge and creams contained in the tank.
- A company accredited by the Ministry of the Environment and Natural Resources (MIMARENA) will be contracted to clean this tank and will be responsible for the final disposal of the extracted sludge, which will be handled as solid waste. The sludge will not be disposed of directly on the ground.
- Septic tanks should not be washed or disinfected after sludge removal as a small amount of sludge should be left for inoculation purposes and reactivation of the digestion process.

Procedure for measuring the depth of creams:

- A 1.8 m long rod will be built with a 15 cm x 15 cm articulated fin.
- The rod will be pushed through the layer to the lower edge of the connecting pipe.
- A pencil mark shall be made on the rod.
- The rod shall be raised, the flap shall be placed in a horizontal position, and raised until the resistance of the cream is felt.
- The distance between the 2 marks will determine the distance between the lower end of the connecting tube and the bottom of the cream layer.

In Figure 8-6 illustrates the procedure for measuring creams.

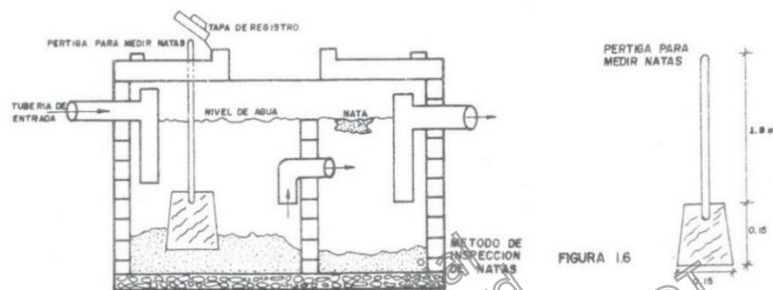


Figure 8-6. Procedure for measuring creams.

Source: Universidad del Cauca-Faculty of Civil Engineering, Environmental Sanitation.

Procedure to measure the thickness of the sludge layer:

- A 2.50 m long rod will be built, to which 90 cm of white towel cloth will be wrapped.
- The rod shall be inserted until it touches the bottom of the tank.
- After several seconds the rod will be carefully withdrawn showing the depth of the sludge and the depth of the liquid in the pond.

In Figure 8-7 illustrates the procedure for measuring sludge.

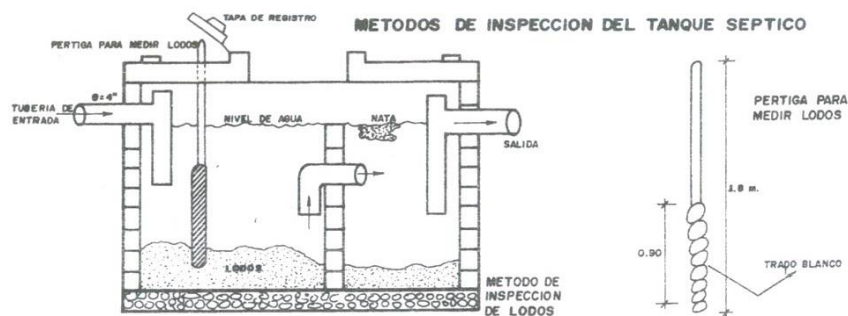


Figure 8-7. Procedure for measuring sludge.

Source: Universidad del Cauca-Faculty of Civil Engineering, Environmental Sanitation.

The tank should be cleaned if the bottom of the sludge blanket is less than 7.5 cm from the bottom edge of the outlet pipe; or if the depth of the sludge blanket is 40% or more of the depth of the liquid in the tank.

- Management of water with chemical residues and maintenance of the treatment system.
 - All water with chemical residues (resulting from the demineralized water production process, chemical cleaning, draining of chemical product containment berms, among others) will be conveyed through the chemical waste drainage system to the neutralization tank installed for the treatment of this water, where the necessary products (acids and caustics) will be injected to neutralize them.
 - The required maintenance of the equipment (pumps, neutralization tank, ejectors, among others) of this system will be carried out with the frequency and instructions recommended by the manufacturer.
 - Piping, valves and fittings of the chemical waste drainage system will be inspected periodically to detect and correct leaks.
 - Sludge resulting from the chemical waste treatment process will be managed as Hazardous Waste.
- Oily water management and maintenance of oil/water separators.
 - Oil/water separators will be periodically maintained in accordance with the manufacturer's instructions.
 - Maintenance will include cleaning of solids and extraction and removal of retained oils.
 - The removal of the retained oils will be the responsibility of a company accredited by the Ministry of the Environment and Natural Resources, which will be in charge of their final disposal.
- Cooling water management.
 - Blowdown water from the thermoelectric plant's cooling tower will be piped back to the sea.
 - The temperature of the cooling water discharged will be monitored to verify compliance with current environmental legislation.
- Monitoring of domestic and industrial wastewater quality.
 - The physicochemical and microbiological parameters of domestic and industrial effluents generated at the thermoelectric power plant facilities will be monitored.
 - The parameters to be monitored are included in subsection 8.2.2.6: Wastewater quality monitoring plan.

Performance indicators:

- Frequency of septic tank inspection and maintenance.
- Frequency of inspection and maintenance of the chemical wastewater treatment system.
- Frequency of inspection and maintenance of oil/water separators.

- Quality parameters of treated domestic and industrial water (see Liquid Waste Monitoring Plan).
- Coastal water quality parameters (see Table 8-25 of subsection 8.2.2.5)

Goals:

- Septic tank with up-to-date maintenance.
- Water treatment system with chemical residues maintained up to date.
- Oil/water separators maintained up to date.
- Quality parameters of domestic wastewater in accordance with the standards established by the Environmental Standard on Groundwater Quality and Subsoil Discharges, for type III pollutant sources.
- Industrial wastewater quality parameters that meet the standards established by the Environmental Standard on Groundwater Quality and Groundwater Discharge or the IFC General Guidelines on Environment, Health and Safety.
- Coastal water quality parameters that meet the standards established by the Environmental Standard on Surface and Coastal Water Quality (NA-CASC-12).

Executor: Thermoelectric Power Plant Operating Company.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: Drainage and treatment systems for domestic and industrial wastewater.

Frequency of follow-up: Semiannual.

Implementation time: Throughout the life of the project.

Required records:

- Records of septic tank cleaning, oil/water separators and chemical wastewater treatment system maintenance.
- Reports with the results of the analysis of domestic and industrial wastewater quality and coastal water quality.

Associated costs: The costs of implementing this plan are included in the operating costs of the project.

8.1.2.4 Oily waste management plan

Impacts targeted by the plan:

Impact	Code	Impact classification
Possibility of soil contamination due to inadequate management of liquid, solid and oily wastes.	S-3	LOW
Possibility of soil contamination from fuel and lubricant spills.	S-4	LOW

Objective: To prevent soil contamination from lubricant spills and oily residues.

Measures to be implemented:

The procedure for handling oily waste is described below:

Generation of used oils:

At the source of generation of used oils, the employees in charge of maintenance should be trained and informed about the correct way to handle them by means of posters placed in visible places.

In-plant storage:

Storage will be vertical, in containers with lids with spill containment and collection mechanisms, labeling of containers.

It is proposed that all used oil be stored in black metal drums with a legible and visible "Used Oil" label, in a shed with an impermeable (concrete) floor (secondary containment), drains that allow for the collection of oil spills, with a metal roof or cover and located in ventilated areas.

For storage, records must be kept of the volume of waste produced, filled out continuously and can be measured in the containers where they are stored. This record is made on the Control of Oily Waste Produced Form.

Transportation:

The Environmental Officer shall ensure that the waste oil transporter applies the necessary measures to prevent and manage any contingency. The following recommendations can be implemented for the selection of the waste oil transporter or, if the waste management companies are the ones providing the transport service, they can be used to evaluate the transport processes carried out by these companies.

- Registration with the Ministry of Environment and Natural Resources and provision of a copy of the Environmental Authorization.
- Specific, documented procedure for accepting used oil from used oil generators.

- Advance and/or have specific characterizations of used oils to determine their hazardousness before they are accepted.
- If you accept used oil that has not been characterized, you must store it separately from the other oils you are handling (in separate containers or in separate compartments in the tank of the transport truck) until it has been characterized.
- Specific, documented spill minimization procedures.
- Specific procedures for cleaning up spills that may occur during collection or transport.
- Documented system of truck and storage tank inspection records.
- Insurance to cover claims for possible contingencies on the way from the plant to the receiving facility.

Disposition:

In view of their polluting potential, it is proposed that oily wastes should be treated to reduce their content of heavy metals, phenols and hydrocarbons, mainly.

As part of the environmental assurance actions for suppliers, the plant must verify that the handling and facilities of the companies where the treatment is carried out are appropriate for handling these materials, by requesting the Environmental Management and Adaptation Program submitted to the Ministry of the Environment and Natural Resources, as well as its follow-up. In addition to the implementation of measures not contained in this document that allow for proper environmental protection (containment dikes in pools, monitoring of surface water, groundwater, and soil, industrial hygiene and safety procedures, fire prevention network, storage site for waste containers, among others).

Non-remediable oily solid waste:

This category includes oily waste that cannot be treated and includes textiles, tow, cardboard filters, plastic, plastic bags, foam filters that came into contact with used oil.

Generation

Like used oils, this type of waste is produced by machinery maintenance processes.

Storage

This type of waste must be managed as hazardous waste.

Disposal or final handling

Considering that they will be managed as hazardous waste, incineration is recommended as a technique to reduce the volume and degree of hazardousness. Prior to incineration, waste that allows it should be drained by means of rollers in order to reduce its oil content and comply with incineration specifications.

Solid remediable waste:

Remediable solid waste was classified as waste that can be handled or disposed of properly with minimal environmental risk, such as contaminated soils resulting from a spill and materials used in containment, such as sand.

Generation

The main source of generation of this type of waste is contaminated soil produced as a result of spills of used oils and fuel on the ground. It can occur especially in the fuel storage area and in the used oil handling area.

Another source of generation of large quantities of this type of waste is tank cleaning, an activity that generates oily sludge or sludge.

Storage

Contaminated soil should not be stored in the thermoelectric power plant; it should be removed for final disposal immediately after being used in cleaning activities.

Transportation

Transportation should be carried out in accordance with the recommendations described in the hazardous and non-hazardous waste procedure, and should be carried out by a company authorized for this purpose.

Provision

Soils contaminated with fuels and oils will be treated by means of the land farming methodology, unless specific soil studies determine the need to use different methods.

According to the requirements of the companies make the following recommendations to companies that can offer this work:

- The structures where treatment is carried out must be covered to prevent rainwater from entering and causing the pools to overflow.
- The pools must have a secondary concrete containment system because, according to what was observed in the field, there are occasional spills.
- Have a surface and groundwater monitoring program in place to detect the presence of deleterious constituents from spills.
- Adapt an area for the storage of residual oil and oils, as this work is being carried out directly on the ground and in the open air.
- For this purpose, the recommendations formulated for the storage site of the waste generated by the power plant can be followed.
- Operating conditions should be improved, including the rate and method of waste application to the treatment zone, measures to control pH, measures to carry out microbial and chemical reactions, measures to control mixing in the treatment zone, sealing and control system(s) capable of preventing flow into the treatment zone.

Performance indicators:

- Volume of oily waste generated at the thermal power plant facilities (m³).
- Percentage of oily waste removed by waste managers accredited by the Ministry of the Environment and Natural Resources.
- Area of soils contaminated by lubricant spills.

Goals:

- All (100%) of oily waste removed by a manager accredited by the Ministry of the Environment and Natural Resources.
- Absence of area of soils contaminated by fuel or lubricant spills.
- All (100%) fuel or lubricant spill events on site collected.

Executor: Thermoelectric Power Plant Operating Company.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: Thermoelectric power plant facilities.

Frequency of follow-up: Monthly.

Implementation time: Throughout the life of the project.

Required records:

- Records of removal of oily waste generated at the facilities.

Associated costs: The costs of implementing this plan are included in the operating costs of the project.

8.1.2.5 Hazardous materials management plan**Impacts targeted by the plan:**

Impact	Code	Impact classification
Possibility of affecting fauna due to the use of chemical products to control vector pests, rodents and weeds.	F-4	LOW
Risk of accidents resulting in physical injury or loss of life for workers during the operation of the thermoelectric power plant and the power transmission line.	PB-14	MODERATE
Risk of accidents resulting in physical injury or loss of life to residents and visitors during power plant and transmission line operations.	PB-15	MODERATE

Objectives:

- Avoid accidents and damage to project workers and residents of the communities in the area of influence due to poor handling of hazardous materials.
- Avoid environmental impacts resulting from poor handling of hazardous substances in the project.

Measures to be implemented:

Avoid the use of hazardous materials as long as non-hazardous substitute materials that fulfill the same function are available. Taking this measure into account, the following has been accomplished in the project:

- Lead-based paints will not be used for maintenance work during the operation phase.
- Weed control in the green areas of the facilities and the power transmission line easement strip will be done manually or mechanically without the use of chemical products.
The use of pesticides will be avoided for vector and rodent pest control activities, as long as they can be controlled by other methods, such as not accumulating solid waste and stagnant water in the project facilities and placing rodent traps. In the event of vector and rodent pests that cannot be controlled by other methods, low-toxicity pesticides will be applied by personnel from a company accredited by the Ministry of the Environment and Natural Resources and contracted for this purpose, as indicated in the project's Pesticide Management Plan (see section 8.1.2.6). It should be noted that there are no plans to store pesticides at the project facilities, as they will be taken by the contracted company on the same day of application, and the product containers will also be removed by this company, which will be responsible for their proper disposal.
- Adequate storage of hazardous materials, for which the following shall be considered:
 - Hazardous materials should be stored in facilities suitable for this purpose, protected from the weather, with good ventilation (natural or forced) and where they cannot be reached by water (preferably on shelves).
 - Hazardous materials storage areas will have restricted access for personnel in charge of handling them, and will be identified with the words "Chemical Products Storage Area" and a sign with the "Safety Standards to be Complied with at the Site".
 - Safety Data Sheets (SDS) of the stored products shall be available in the storage areas of hazardous materials.
 - There will be an emergency protocol in case of an accident or spill of hazardous materials.
 - Access to emergency showers and/or eyewash stations in case of accidents will be available close to the storage areas.
 - Fire extinguishers will be placed near hazardous material storage areas.
 - Storage areas for liquid hazardous materials must also have means of containment in case of accidental spills, such as retaining walls, curbs or a drainage system that conducts possible spills to a storage tank that allows for the subsequent extraction and proper final disposal of the spilled product. The containment should be adequately sized to contain the following:

- ✓ Sufficient volume to contain 100% of the liquid volume of the largest individual vessel or tank within the containment area. Areas that are occupied by equipment are considered when determining the size of the containment.
- ✓ Rainfall depth for the design storm event for outdoor containment areas.
- ✓ The volume of fire/flood water suppression systems for chemical containment in the area affected by these flows.
- ✓ Minimum of 150 mm (6 inches) curb.
- Spill collection materials such as sand, sawdust, shovels, containers, anti-spill kits will be available, depending on the type of product spilled.
- Stored quantities of hazardous materials shall be restricted to those strictly necessary and products shall be classified and grouped according to their hazards, avoiding the proximity of incompatible substances, as indicated in the SDS.
- The quantities of hazardous materials stored on the project will be monitored.
- Proper handling of hazardous materials, for which the following will be considered:
 - Personnel handling hazardous materials must be adequately trained in their correct use, for which they will be provided with the required training through courses or lectures.
 - Workers handling hazardous substances will be provided with the required personal protective equipment to perform their work safely (such as gloves, masks, rubber boots, shirts and long sleeves, apron, among others), as indicated in the SDS for each product.
 - In the case of chemical products, they shall be applied following the dosages and application instructions recommended by the manufacturer.
 - Hazardous materials shall be stored and transported in their original containers or other appropriate containers, clearly labeled to identify their contents.
 - Used containers of hazardous materials shall be managed as hazardous waste in accordance with the Solid Waste Management Measures Plan (see section 8.1.2.2). 8.1.2.2).

Performance indicators:

- Volume of chemicals used in the thermoelectric power plant facilities.
- Number of accidents for project workers resulting from improper handling of hazardous materials.

Goals:

- Reduce the use of hazardous substances to the minimum possible.
- Non-occurrence of accidents for workers and residents of the communities in the project's area of influence due to improper handling of hazardous substances.

Executor: Thermoelectric Power Plant Operating Company.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: All the facilities of the thermoelectric power plant (including the storage areas for hazardous materials) and the power transmission line easement strip.

Frequency of follow-up: Semiannual.

Implementation time: Throughout the life of the project.

Required records:

- Records of the quantities of hazardous materials stored and consumed in the facilities.
- Records of accidents and incidents resulting from mishandling of hazardous materials.

Associated costs: The costs of implementing this plan are included in the operating costs of the project.

8.1.2.6 Pesticide Management Plan

Impacts targeted by the plan:

Impact	Code	Impact classification
Possibility of affecting fauna due to the use of chemical products to control vector pests, rodents and weeds.	F-4	LOW
Risk of accidents resulting in physical injury or loss of life for workers during the operation of the thermoelectric power plant and the power transmission line.	PB-14	MODERATE
Risk of accidents resulting in physical injury or loss of life to residents and visitors during power plant and transmission line operations.	PB-15	MODERATE

Objective: Avoid environmental contamination and impacts to wildlife, workers and local residents due to poor pesticide management at the project due to possible vector and rodent pest control activities or weed control at the project facilities.

Measures to be implemented:

- The use of pesticides will be minimized for vector and rodent pest control work at the thermoelectric plant facilities, such as the following:
 - The accumulation of solid waste and stagnant water in the facilities that may attract vector pests will be avoided.
 - Rat traps will be set.
- In the event that vector and rodent infestations arise that cannot be controlled with the above measures, an external company that is accredited by the Ministry of the Environment and Natural Resources to provide this type of service will be contracted. The company must have its Environmental Authorization in force and must also have the Certificate of Registration of Fumigation Companies issued by the Ministry of Agriculture

and the Certificate of No Objection to the Use and Application of Pesticides for Pest Control Companies issued by the Ministry of Public Health.

- The Safety, Health and Environmental Coordinator shall request the Safety Data Sheets (SDS) of the chemicals to be used from the fumigation company. Verify that the products to be used are of low toxicity, avoiding the use of pesticides classified as extremely hazardous (I a) or highly hazardous (I b) and II according to the WHO classification or others that are prohibited by national, regional or local laws (Table 8-5).

Table 8-5. Color band of labels according to toxicological category.

Band Color	WHO classification according to risks	Hazard classification
Red (PMS 199 C)	I a - Highly Hazardous Product	VERY TOXIC
Red (PMS 199 C)	I b - Very Hazardous Product	TOXIC
Yellow (PMS Yellow C)	II - Moderately Hazardous Product	NOCIVE
Blue (PMS 293 C)	Low Hazard Product	CAREFUL
Green (PMS 347 C)	IV - Product Not Normally Offering Hazards	CAREFUL

Pesticides will be applied only by workers of the contracted company. The fumigation company must form a team of qualified people with the necessary technical skills for each position. In addition, they will receive prior training in industrial safety issues.

The company contracted for pest control shall be required to ensure that its workers have the appropriate personal protective equipment, among which are:

- Helmet.
- Safety boots.
- Safety glasses.
- Ear protectors.
- Gloves.
- Masks.
- Others as recommended by SDS.

Pesticides will not be stored in the power plant facilities. The products used for pest control will be taken by the company contracted for this purpose on the same day of application.

Pesticide containers will be removed by the contracted company on the same day of application. This company will be responsible for the proper handling and final disposal of this hazardous waste; however, proof of this must be requested from the company.

For the application of pesticides, the procedure described below shall be followed:

Detection: Before making any recommendations for pest control treatment, an extensive inspection and analysis of the problem should be made. Usually the tools for an inspection are: a lamp, a spray can with sucking power and a notebook for recording and keeping records.

Monitoring: Monitoring should be done as part of the service contract or as part of an initial inspection for a simple treatment. It should help to detect which areas need more attention. Monitoring tools are usually traps with sticky substances that serve to trap insects.

Application, storage and disposal procedures for pesticides, herbicides and insecticides are essential to prevent accidents or illnesses and to be in compliance with local environmental laws. This procedure is described below:

Define the area to be treated and select an applicator. The applicator should be administered in accordance with the product's SDS, including requirements for safety equipment to be used, handling and storage precautions.

Materials purchased by the power plant should be purchased in small quantities to avoid excess accumulation. It is preferable that all these materials be supplied, stored and applied by a contractor.

Any unusual product should be clearly identified and stored according to its SDS.

Removal of excess material supplied by contractors is their responsibility.

Procedure in case of pesticide spills:

In the event of a spill, the spill brigade and all personnel involved should wear appropriate personal protection during disposal. This means wearing a face mask that provides protection against organic vapors, eye protection, chemical resistant gloves, boots and full protective suits.

Spills should be adsorbed with sand, earth or other suitable adsorbent material and transferred to a container for disposal.

The spill area should be flushed with water. Wash water should be prevented from entering surface drains.

Spills or uncontrolled discharge into watercourses should be reported to the competent authority.

Empty containers resulting from the spill should be handled as hazardous waste. Empty containers should not be used for other applications.

Responsibilities:

Fumigation Company

- Assemble a team of qualified people with the necessary technical skills for each position with appropriate equipment, transportation, supervision, etc. Provide monthly written reports in a format agreed upon by both parties on the activities performed.
- Send your employees to a previous training on industrial safety issues specific to the company, which will be given by the Safety, Health and Environment Coordinator.

Safety, Health and Environment Coordinator

- Hire a company to control and fumigate pests and weeds in the facilities.
- Verify the SDS of the chemicals to be used and the environmental authorizations of the company to be contracted.
- Prepare the terms of reference for contracting the fumigation company.
- Manage the general contract between the company and the fumigation company.
- Provide any necessary technical assistance in the coordination of industrial safety and environment.
- Supervise the execution of fumigation activities in the plants.
- Submit periodic reports, at least monthly, on the execution of fumigation activities to the Corporate Environmental Management.
- Become familiar with the Procedures for the application, storage and final disposal of pesticides.

Plant Manager

- Enforce this procedure.

Performance indicators:

- Volume of pesticides used in the project (Liters of pesticides consumed)
- Percentage of pesticides used that are of low toxicity according to the WHO pesticide hazard classification.

Goals:

- Less than the maximum estimated volume of pesticides during project planning.
- 100% of the pesticides used are classified as low toxicity.

Executor: Thermoelectric Power Plant Operating Company.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: All the installations of the thermoelectric power plant.

Frequency of follow-up: Monthly.

Implementation time: Throughout the life of the project.

Required records:

- Record of fumigations carried out, quantity and type of products used.

Associated costs: The costs of implementing this plan are included in the operating costs of the project.

8.1.2.7 Ian efficiency in water and energy resources consumption

At the thermoelectric power plant facilities during the operation phase, water will be consumed for domestic use (cleaning, cleaning, irrigation of green areas, etc.), industrial or service use (steam system and cooling tower) and for the firefighting system.

The domestic and industrial water to be consumed at the plant's facilities will be extracted from the sea and subsequently treated in a desalination plant.

Drinking water (for human consumption) will be purchased from local bottling companies in 5-gallon containers.

Another resource that will be consumed at the thermoelectric plant facilities is fuel, which will be Liquefied Natural Gas (LNG), as the main fuel, and liquid fuels (Fuel Oil and Diesel), as alternative fuels. The estimated annual consumption of LNG will be 2 Tbtu/month.

Likewise, electricity will be consumed at the thermoelectric power plant facilities for lighting, office air conditioning, operation of electrical equipment, among other purposes; however, the amount of electricity that will be consumed is insignificant compared to the amount of electricity to be generated at the facilities.

Impacts targeted by the plan:

Impact	Code	Impact classification
Increased water consumption.	RC-5	MODERATE
Increase in fuel and electricity consumption.	RC-4	MODERATE

Objectives: Mitigate the increased consumption of water, fossil fuels and electricity that the project will generate.

Measures to be implemented:

For water saving:

- Use of sea water and installation of a desalination plant to supply the Block 01 and 02 thermoelectric plants for both industrial and domestic use, thus avoiding the use of water from the supply sources of the municipality of Pepillo Salcedo for these purposes. Only potable water (for human consumption) will be purchased bottled from local suppliers.
- Installation of meters to control the amount of water consumed in the thermoelectric power plant facilities for both domestic and industrial use.
- Periodic inspections for the detection and correction of leaks in the installations.

- Daily record of domestic and industrial water consumption to control supply and identify leaks or excess consumption and proceed to repair them.
- Monthly consumption reports and, if necessary, consumption reduction goals will be established.
- Train employees on water saving measures and the importance of compliance.

For fuel savings:

- Meters will be installed for Liquefied Natural Gas (LNG) and liquid fuels used in the thermoelectric power plant facilities.
- Daily record of fuel consumption to control supply and identify leaks or excess consumption and proceed to take control measures.
- Monthly consumption reports and, if necessary, consumption reduction goals will be established.
- Measuring the % efficiency of the turbines and making the necessary combustion adjustments.
- Train employees on fuel saving measures and the importance of compliance.

For electrical energy savings:

- Use energy-saving or LED luminaires.
- Use lamps with photocells in outdoor areas.
- Use energy-efficient air conditioners.
- Turn off lights when not in use.
- Turn off electrical equipment when not in use.
- Adjust the temperature of the air conditioners between 22 and 24°C.
- Train workers on energy saving measures.
- Install electricity meters in the facilities that allow monthly records to be kept of the amount of energy consumed.
- Compare recorded electricity consumption on a monthly basis in order to set performance and consumption reduction goals (if possible).

Performance indicators:

- Monthly domestic and industrial water consumption (m^3 / month).
- Monthly consumption (gallons/month) of fuels (LNG and liquid fuels).
- Monthly electricity consumption (kWh/month).
- Number of workers trained in water, energy and fuel saving measures.

Goals:

- Compliance with the planned percentage reduction in water consumption.
- Compliance with the planned fuel consumption reduction percentage.
- Compliance with the planned percentage reduction of electric energy consumption.

Executor: Thermoelectric Power Plant Operating Company.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: All the installations of the thermoelectric power plant.

Frequency of follow-up: Monthly.

Implementation time: Throughout the life of the project.

Required records:

- Records of water, fuel and electric energy consumption in the facilities.

Associated costs: The costs of implementing this plan are included in the operating costs of the project.

B.-Biotic environment

8.1.2.8 Plan of management measures for terrestrial biota

Impacts targeted by the plan:

Impact	Code	Impact classification
Disappearance of vegetation cover and loss of flora due to vegetation clearing for construction works, including individuals and populations of native, endemic and threatened species (residual impact of the construction phase).	V-1	HIGH
Loss of vegetation and partial elimination of flora due to cutting and pruning for clearing the transmission line easement strip.	V-2	MODERATE
Loss of wildlife habitat due to clearing (residual impact of the construction phase).	F-1	MODERATE

Objective: Mitigate the negative impacts to vegetation and fauna generated as a consequence of the project's construction actions.

Measures to be implemented:

- Maintenance of the plants planted in the green areas of the thermoelectric plant. Green area maintenance activities include: irrigation, fertilization, weed control, pruning, pest control, and planting to replace dead individuals. Below are some recommendations for carrying out these activities:

Watering: It is recommended to water green areas early in the morning or in the evening, not in the hours of high sunlight. The frequency of watering will depend on the species of plant, considering that the plants that need more watering are those that are more exposed to the sun and wind. Watering should not be neglected during the first year of planting because the roots are still shallow.

Fertilization: Preference should be given to organic fertilizers, such as manure, mulch, compost, worm humus, among others, since they cause less damage to the environment.

Weed control: Weeds should be controlled by hand weeding, hoeing or with the aid of a hand mower. The application of herbicides should be avoided.

Pruning: Dry, broken, sick or diseased branches or those that hinder the passage of people will be eliminated. Also, flowers or stale fruits will be eliminated.

Pest control: Leaves should be inspected frequently for the presence of parasites or any signs of disease and leaves that have been attacked by fungi should be cut.

Planting: Dead individuals will be replaced as far as possible with specimens of the same native and endemic species, avoiding the planting of species considered invasive in the green areas of the project.

When selecting methods for fertilization, pest and weed control, preference should be given to organic methods. Otherwise, environmentally friendly or low toxicity products should be chosen as much as possible.

The use of chemicals included in Class Ia (extremely hazardous), Ib (highly hazardous) and Class II (moderately hazardous) of the World Health Organization (WHO) classification of pesticides according to their hazardousness, in the Rotterdam Convention, in the Stockholm Convention and in the PAN International List of Highly Hazardous Pesticides and others that are prohibited by national, regional or local laws shall be avoided.

Personnel performing landscaping work should use appropriate personal protection methods such as gloves, goggles, hat and face masks when applying chemicals. Chemical containers will be handled as hazardous waste.

- Rigorous weed and vegetation control must be maintained in the surroundings of the transmission line easement strip. Weed control (herbaceous vegetation) will preferably be carried out by manual mowing or mechanical means (mowers or pruners) without the use of chemical products or herbicides that could have negative effects on the fauna in the area. In the event that the use of herbicides is strictly necessary, environmentally friendly or low toxicity products will be chosen as far as possible.

Vegetation maintenance activities in the easement strip will be scheduled outside of the breeding and nesting seasons for threatened or endangered species and preferably outside of forest fire seasons.

Selective treatments for vegetation within the transmission line easement strip will be as follows:
Felling: The trees to be felled will be delimited and marked, and they will be removed at ground level. In cases where it is necessary to cut down trees, this must be done at times that do not affect the reproduction and nesting of threatened or endangered species of fauna. Whenever possible, invasive species in the transmission line easement strip should be eliminated.

Transplanting: Those species that are protected or threatened must be transplanted according to the appropriate procedures.

Pruning: It consists of cutting the branches of trees that are compromising the safety space of the lines or to improve the tree's phytosanitary condition.

Herbicide application: In the event that herbicide application is strictly necessary, the use of chemicals included in Class Ia (extremely hazardous), Ib (highly hazardous) and Class II (moderately hazardous) of the World Health Organization (WHO) classification of pesticides according to their hazardousness, the Rotterdam Convention, the Stockholm Convention and PAN International's List of Highly Hazardous Pesticides and others that are prohibited by national, regional or local laws will be avoided. Herbicides shall be applied following the instructions established in the Pesticide Management Plan.

After the maintenance of the vegetation in the easement strip, forest residues from the maintenance work must be removed in order to prevent forest fires.

Performance indicators:

- Number of individuals planted.
- Number of species planted.
- Number of planted individuals belonging to native or endemic species.

Goals:

- Planned number of individuals to be planted.
- Planned number of species to be planted.
- At least three (3) native and/or endemic species planted in the green areas of the power plant.
- None of the planted plant species considered invasive.

Executor: Thermoelectric Power Plant Operating Company.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: Green areas of the thermoelectric power plant and easement strip of the power transmission line.

Frequency of follow-up: Semiannual.

Implementation time: Throughout the life of the project.

Required records:

- Photographic records showing the condition of green areas and gardens.

Associated costs: The costs of implementing this plan are included in the operating costs of the project.

C.- Socioeconomic environment

8.1.2.9 Social management action plan

Impacts targeted by the plan:

Impact	Code	Impact classification
Positive impacts to be enhanced:		
Creation of permanent jobs.	EC-7	HIGH
Improving the quality of life and purchasing power of Project workers and their families.	PB-10	HIGH
Generation of benefits for the population of Pepillo Salcedo through the implementation of the Community Relationship Plan Project.	PB-16	MODERATE
Negative impacts to be prevented and mitigated:		
Possibility of affecting the population (workers and communities) due to increased levels of gas emissions, suspended particles, noise and vibrations from the thermoelectric plant's operations.	PB-9	MODERATE
Possible exposure to disease due to the influx of temporary or permanent labor.	PB-12	MODERATE
Risk of physical injury or loss of life to residents arising from the use of force by Project physical security personnel.	PB-13	MODERATE
Risk of accidents resulting in physical injury or loss of life for workers during the operation of the thermoelectric power plant and the power transmission line.	PB-14	MODERATE
Risk of accidents resulting in physical injury or loss of life to residents and visitors during power plant and transmission line operations.	PB-15	MODERATE
Risk of health effects to workers and residents from exposure to electromagnetic fields.	PB-17	MODERATE
Increased demand for services provided by government entities during project operations.	IS-2	MODERATE

Objectives:

Maximize the positive effects of the project for the local population through job creation and social responsibility actions.

Minimize the inconvenience and impact on the population of the communities in the project's area of influence as a result of the project's operations.

Measures to be implemented:

Measures to be implemented to enhance the effects of the project's positive impacts include:

- Establish clauses in the contracts with the company operating the thermoelectric plant indicating that priority should be given to hiring labor from the communities in the area of influence of the project, which includes the municipalities of Pepillo Salcedo and Montecristi, both in the province of Montecristi, particularly young people, as long as they are qualified for the work to be performed.
- Establish clauses in the contracts with the thermoelectric plant operating company that indicate that priority should be given to the purchase of construction materials and the contracting of services from the communities in the project's area of influence, as long as they are available and meet the required price/quality standards.
- Include clauses in the contracts with the company operating the thermoelectric plant specifying that it is mandatory to comply with the provisions of the Dominican Republic's Labor Code and the fundamental conventions of the International Labor Organization (ILO), regarding non-discrimination of workers in the project (for aspects such as gender, age, race, religion, sexual orientation or political preference), and equal working conditions for migrant workers and women.
- Implement the **Stakeholder Engagement Plan** (see Section 8.3) to communicate effectively with communities. As part of this plan, disseminate information about newly created jobs and business opportunities that may benefit the community.
- Implement a Corporate Social Responsibility Program to benefit the communities in the project's area of influence, which includes the municipalities of Pepillo Salcedo and Montecristi, both in the province of Montecristi. The purpose of this program is to contribute to and promote sustainable development in the communities of the area of influence. Among the actions to be developed as part of this plan are:
 - Strengthening of the Fire Department of the Municipality of Pepillo Salcedo.
 - Partnerships for forest restoration projects and conservation of coastal and marine water resources.
 - Development of environmental awareness programs aimed at the population and coastal cleanup days.
 - Support for education through the sponsorship of technical courses for young people, donations of school supplies and biosafety materials to educational centers.
 - Improvements to community infrastructure, including aspects related to storm drainage, sports fields, street lighting, among others.
 - Support to the health sector through donations of medical and biosecurity materials to hospitals.
 - Support for sports, through donations of uniforms, school supplies and sponsorship of tournaments.

- Institutional strengthening of community organizations, especially neighborhood councils and mothers' centers, and involving them in identifying the investment priorities of the corporate social responsibility program.
- Support the implementation of the Management Plans for Estero Balsa and Monte Cristi National Parks.

The measures to be implemented to minimize the effects of the project's negative social impacts are as follows:

- Implement the **Maintenance Management Measures Plan** (see section 8.1.2.1), which includes measures to prevent and mitigate impacts to the population due to noise, vibrations, gas emissions and suspended particles.
- Implement the Occupational **Health and Safety Plan** (see Section 8.6) to reduce the risk of accidents that could cause physical injury or death to workers, as well as the risk of exposure to electromagnetic fields.
- Implement the **Community Health and Safety Plan** (see Section 8.8), which includes measures to prevent the spread of disease, prevention of accidents in the community, as well as measures to reduce risks to the population from the use of force by project personnel.
- Implement the Occupational **Health and Safety Training Plan** (see section 8.11) aimed at both workers and the population of the communities in the area of influence.
- Implement the project's **Complaints, Claims and Suggestions Mechanism for the community** (see section 8.4).
- Implement the **Worker Grievance Mechanism** (see section 8.7).
- Implement the **Emergency Preparedness and Response Plan** (see section 8.9).
- The community liaison analyst appointed by Manzanillo Energy Consortium, Inc. in the municipality of Pepillo Salcedo will continue to act as a permanent interlocutor between the consortium and the communities, environmental and social organizations in the area, so that concerns, complaints, suggestions and concerns of these stakeholders can be received, responded to and resolved in a timely manner.

Performance indicators:

- Number of workers hired for thermoelectric plant operations.
- Percentage of workers hired from communities in the project's area of influence.
- Percentage of workers hired who are women.
- Number of complaints received from community members.
- Number of complaints investigated and responded to community members.
- Number of contracts with local commercial establishments to supply products and services to the project.
- Number of people benefited by the implementation of the project's social responsibility programs.
- Number of workers and community members trained in the Safety, Health and Environmental Education Plan and percentage of total, number of topics covered.
- Number of work-related accidents that have occurred in the project.
- Number of accidents involving residents of the communities in the area of influence related to the project.
- Number of community organizations involved in the company's social responsibility program.

Goals:

- Planned number of workers to be hired for the operation stage of the project.
- Planned percentage of workers to be hired belonging to the communities in the project's area of influence.
- 100% of complaints received responded to in no more than 20 days.
- Number of people planned to benefit from the Corporate Social Responsibility Program.
- 100% of workers trained in the Safety, Health and Environmental Education Plan.
- 100% of the Safety, Health and Environmental Education Plan topics covered according to the training schedule.
- Non-occurrence of disabling occupational accidents.
- No accidents involving residents of the communities in the area of influence.
- 75% of community organizations in the urban areas of Pepillo Salcedo, Copey and Carbonera involved in the company's social responsibility program.

Executor: Thermoelectric Power Plant Operating Company.

Supervisor: Company in charge of environmental and social management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: Communities in the area of social influence of the project, which includes the municipalities of Pepillo Salcedo and Montecristi, province of Montecristi.

Frequency of follow-up: Semiannual.

Implementation time: Throughout the life of the project.

Required records:

- List of workers hired, indicating gender and place of origin.
- Complaints and claims registration forms.
- Accident record forms.
- Photographic or video records evidencing compliance with the measures of the Social Management Plan.
- Attendance list for training courses.
- List of organizations involved in the actions of the social responsibility program.

Associated costs: The costs of implementing this plan are included in the project's operating expenses.

8.1.3. Follow-up and supervision of the Preventive Measures, Mitigation and Compensation Plan

As part of the monitoring and supervision of compliance with the measures and requirements of the Preventive, Mitigation and Compensation Measures Program, during the construction and operation phases of the project, internal and external inspections and audits will be carried out and written reports will be generated on the results; the necessary corrective measures will be taken and a final date will be set for their implementation. These reports will monitor the performance indicators for the different plans (including records of water, electricity and fuel consumption and the volumes of solid and liquid waste generated) and will indicate whether the established goals were achieved.

Any corrective action shall be implemented immediately by the Construction Management Manager or Plant Manager in the operation phase, and this in turn shall be monitored periodically by the Safety, Health and Environmental Coordinator.

These inspections and audits should also identify opportunities for improvement whose development will strengthen the Preventive, Mitigation and Compensation Measures Plan.

Internal audits will be conducted by the Safety, Health and Environment Coordinator, while external audits will be conducted by the Environmental, Social and Health and Safety Management Company.

The Safety, Health and Environment Coordinator in the construction and operation phases must generate internal six-monthly reports on the Program of Preventive, Mitigation and Compensation Measures, which will include in its content the follow-up of the different plans of measures of this program, including measures for the protection of the air and noise environment, measures for soil protection, solid waste management, liquid waste management, archaeological heritage management, water, fuel and electricity consumption, consumption of loan materials, management of hazardous materials and pesticides, traffic management, among others.

The frequency of external reporting by the Environmental, Social and Health and Safety Management Company will be defined by contractual agreement.

8.1.3 Cumulative Impact Management Program

Introduction

Cumulative impacts should be managed through the use of the mitigation hierarchy, proposing mitigation and monitoring programs to prevent cumulative impacts from reaching unacceptable levels and involving stakeholders who are needed to collaborate and coordinate effective management actions.

Proper management of cumulative impacts requires joint action by specific undertakings and projects through the implementation of individual actions aimed at eliminating or reducing their contribution to such impacts. However, if mitigation measures can be implemented at the project level that are sufficiently effective to prevent or significantly reduce unacceptable cumulative impacts from occurring, then it may not be necessary for the project developer/operator to initiate a collaborative process with third parties.

Where there are already recognized and noted cumulative impacts, all developments impacting the same VEC may need to implement management actions to prevent cumulative impacts from reaching unacceptable levels.

In some cases, cumulative impacts may exceed a regional threshold, warranting a confluence of regional actions and strategies. The implementation of management measures that promote regional collaboration to manage cumulative impacts helps to reduce the risk that, as regional development proceeds, additional and unanticipated management measures will need to be implemented or imposed by the authorities.

Targeted impacts

Cumulative impacts on environmental quality:

It is estimated that the project during the construction and operation stages will contribute to the cumulative impacts on the environmental quality of the area of influence because:

- During the construction stage of the project, the environmental quality of the area of influence will be affected, such as: increased concentration of particulate matter, increased noise and vibration levels, increased concentration of combustion gases (vehicle emissions), risk of soil contamination, increased turbidity in coastal waters, and risk of surface water contamination.
- During the operation stage, the power plant will generate air pollution due to emissions of combustion gases into the atmosphere (greenhouse gas emissions) and particulate matter from the operation of the power generators, increased noise and vibration levels, soil contamination, groundwater contamination, overexploitation of the aquifer, modification of coastal water quality, and surface water contamination.

Cumulative impacts on terrestrial habitats, vegetation and flora

- During the construction stage of the project, vegetation cover will disappear and there will be a partial loss of flora due to vegetation clearing for the construction of the works, including individuals and populations of native, endemic and endangered species. This impact on vegetation will be added to that generated by the other activities and projects that will be carried out, causing a cumulative impact on this VEC in the project's area of influence that will last throughout the useful life of these works.

Cumulative impacts on terrestrial habitats and wildlife

- During the construction stage of the project, there will be a loss of habitat for fauna due to clearing and the impact on fauna due to construction activities that generate noise and dust and human presence.
- During the operation stage of the project there will be the possibility of the spread of vector and rodent pests due to poor solid waste management and the possibility of affecting fauna due to the use of chemical products to control vector and rodent pests.

Cumulative impacts on aquatic fauna and habitats

- During the construction stage of the project there will be the possibility of affecting the marine biota due to the installation of the piping networks for the natural gas supply and the cooling system, as well as the natural gas unloading platform in the marine space (Jetty).
- During the operation stage of the project, there will be the possibility of affecting the marine biota due to the discharge of cooling water into the sea.

Cumulative impacts on the economy, employment and livelihoods

During the construction stage:

- Increase in the financial flow and commercial activity in the province of Montecristi due to the contracting of services.
- Generation of income for the State and the Municipality of Pepillo Salcedo from the payment of taxes.
- Temporary increase in demand for food services for Project workers.
- Temporary increase in demand for rooms in the municipality of Pepillo Salcedo for Project workers residing in distant areas.
- Generate more income for the sector of the population employed in the motoconcho transport sector, which is the main means of transportation in the area.

During the operation stage:

- Increase in the financial circulation in the province of Montecristi.
- Increase in the flow of capital around the country's economy and tax revenues by the Municipality of Pepillo Salcedo.

However, in the specific case of stress caused to the VEC by natural events (floods, cyclones and hurricanes), these can have a negative cumulative effect on the project depending on the magnitude and temporal effects of each of these climatic events within the project's area of influence.

Cumulative impacts on quality of life, health and safety of the community

- Improved quality of life and purchasing power of workers (positive impact) generated by the construction and operation of the projects.
- Negative cumulative impact with the projects that are being developed and will be developed in the area, specifically with regard to the health and safety of the community due to the increase in vehicular traffic and disruption of circulation, as well as an increase in noise levels, vibrations, gas emissions and suspended particles in the event that their activities coincide in the construction stage and in specific events of their operational stages.
- Stress caused to the VEC by natural events (floods, cyclones, hurricanes and earthquakes). The presence of risks to the safety of the population could be added to the risks related to the construction of the project and operation and maintenance activities, in cases where the incidence of climatic conditions or nature is present in the surroundings of the work fronts and power plant facilities.

Target

Establish strategies and measures that adequately and effectively respond to those cumulative impacts that can significantly affect the final state or condition of the selected VECs in order to prevent these cumulative impacts from reaching unacceptable levels.

Measures to be implemented

General measures under the responsibility of the Project Developer:

- Introduce changes in project design to avoid cumulative impacts.
- Focus the project's mitigation strategy on minimizing cumulative impacts, including adaptive management as an essential component.
- Influence or propose to the promoters of other projects to implement management measures aimed at mitigating their contribution to cumulative impacts on the same VEC.

General measures of a collaborative nature:

- Contribute to the strengthening of areas under conservation regimes or areas for the protection of regional biodiversity.
- Actively interact and collaborate with existing cumulative impact management strategies and other regional strategies.
- Participate, and promote the participation of third parties, in regional monitoring programs to help establish the magnitude and significance of cumulative impacts on the condition of a VEC, and to assess the effectiveness of mitigation measures and the efficacy of management efforts.

General measures

- Conduct effects monitoring to assess cumulative impacts.
- Identify coordinated monitoring by other social actors and promoters/operators.
- Seek the support of other social actors.
- Identify and support regional multi-stakeholder mitigation and/or management.
- Seek the support of other social actors (governments, promoters/operators and communities) for its implementation.
- Update its management system and guide future impact management.
- Identify the possibility of other regional strategies that could maintain the VECs in acceptable conditions.
- Engage, enhance and contribute to a collaborative, multi-stakeholder approach.

Measures to manage cumulative impacts on environmental quality

- During construction and operation of the project, implement the measures included in the ESHSMP program of preventive, mitigation and environmental and social compensation measures.
- Execution of environmental quality monitoring (air, gas and particulate matter emissions, noise, vibrations, surface water and wastewater) recommended in the environmental monitoring program of the ESHMP during construction and operation of the project, to

support operational decisions and the establishment of eventual preventive and corrective measures.

- Carry out inter-institutional coordination for the establishment and/or improvement of an environmental quality monitoring network at the local and regional levels.
- Minimize and control the level of atmospheric emissions.
- Install a continuous monitoring system for atmospheric emissions.
- Comply with national standards on air pollution, environmental noise and liquid effluent discharge, as well as with the IFC Environmental, Health and Safety Guidelines (IFC EHS Guidelines, 2008) for Thermal Power Plants.
- For dredging activities during construction and operation, as well as for vessel transit, coordinate closely with the competent authorities.
- Optimization of the type and configuration of the design of the cooling water intake and discharge works to minimize the extent of the mixing zone and thermal plume.

Measures to manage cumulative impacts on terrestrial habitats, vegetation and flora

- During construction and operation of the project, implement the measures included in the plan of measures for the protection of terrestrial biota and the plan of wetland restoration measures of the program of preventive, mitigation and environmental and social compensation measures of the ESHMP.
- Execution of the wetland ecosystem condition monitoring plan of the ESHMP environmental monitoring program during construction and operation of the project, to support operational decisions and the establishment of eventual preventive and corrective measures.
- Carry out inter-institutional coordination for the establishment and/or improvement of a network for monitoring the state of the wetland ecosystem at the local and regional levels.

Management measures for cumulative impacts on terrestrial habitats and fauna

- During construction and operation of the project, implement the measures included in the plan of measures for the protection of terrestrial biota and the plan of wetland restoration measures of the program of preventive, mitigation and environmental and social compensation measures of the ESHMP.
- Execution of the wetland ecosystem condition monitoring plan of the ESHMP environmental monitoring program during construction and operation of the project, to support operational decisions and the establishment of eventual preventive and corrective measures.

Management measures for cumulative impacts on habitats and aquatic fauna

- During construction and operation of the project, implement the measures included in the plan of measures to mitigate impacts to coastal dynamics and the protection of marine ecosystems of the ESHMP program of preventive, mitigation and environmental and social compensation measures.
- Execution of the monitoring plan for the state of marine ecosystems of the ESHMP environmental monitoring program during the construction and operation of the project.
- Inter-institutional coordination for the establishment and/or improvement of an aquatic ecosystem monitoring network at the local and regional levels.

Measures to manage cumulative impacts on the economy, employment and livelihoods

- During construction and operation of the project, implement the measures included in the social management measures plan of the ESHMP program of preventive, mitigation and environmental and social compensation measures.
- Execution of the plan to monitor the impacts of the ESHMP on the social environment.

Measures to manage cumulative impacts on quality of life, health and safety of the community.

- During construction and operation of the project, implement the measures included in the social management measures plan of the ESHMP program of preventive, mitigation and environmental and social compensation measures.
- Execution of the plan to monitor the impacts of the ESHMP on the social environment.
- Implementation of a social responsibility policy with the communities in the area, focused on sustainability.

Performance indicators

The following cumulative impact indicators commonly used in environmental impact assessments that can be applied to the project will be used as a reference and are presented in Table 8-6

Table 8-6. Cumulative baseline impact indicators

Aspect of the project	Cumulative Impact Indicator
Addition of a pollutant to the environment (Environmental quality)	<ul style="list-style-type: none"> • Concentration of the contaminant in the receptor environment • Concentration relative to the environmental standard • Total pollutant load (from all sources) • Characterization of the spatial pattern of contaminant concentration in the downstream environment.
Conversion or degradation of natural and critical habitats	<ul style="list-style-type: none"> • Total area of habitat lost • Change in habitat loss rates • Habitat fragmentation measures
Reduction, modification and/or fragmentation of aquatic and riparian habitats	<ul style="list-style-type: none"> • Viability of migratory fish stocks
Increased mortality of a wildlife population (Wildlife disturbance)	<ul style="list-style-type: none"> • Change in global and/or regional population decline rates • Measures of population fragmentation (or ranges)
Additional salaried employment opportunities	<ul style="list-style-type: none"> • Number, size, skill levels of the regional labor force. • Measures of livelihood change and livelihood sustainability.
Additional incidences of illness, drug and alcohol problems and crime	<ul style="list-style-type: none"> • Total number of incidents, proportion of the population affected • Community and regional health and wellness measures; security

Source: Cumulative Impacts Assessment and Management Good Practice Manual, IFC, June 2015.

Executor: Contractors (construction stage) and Thermoelectric Power Plant Operating Company (operation stage).

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: Project site, access roads, quarries or banks where borrow materials will be extracted. All installations of the thermoelectric power plant.

Frequency of follow-up: Semiannual.

Timing of implementation: The measures in this plan will be implemented throughout the construction and operation phase.

Associated costs: The costs of implementing this plan are included in the construction budget.

8.2 Monitoring program

The basic function of the Monitoring Plan, as part of the Environmental, Social and Health Management Program (ESHMP), is to describe in a systematic and documented manner the actions to verify the execution of preventive, mitigation and compensation measures and compliance with local and international environmental, health and safety legislation by the project developer.

In the Table 8-7 presents a summary of the Monitoring Program for the construction and operation phases of the project.

Table 8-7. Monitoring program summary.

Phase	Plan
Construction	Air quality monitoring plan for immission conditions.
	Environmental noise level monitoring plan.
	Environmental vibration monitoring plan.
	Monitoring plan for impacts on the social environment.
Operation	Quality monitoring plan for gas and particulate matter emissions.
	Air quality monitoring plan for immission conditions.
	Environmental noise level monitoring plan.
	Environmental vibration monitoring plan.
	Surface water quality monitoring plan.
	Wastewater quality monitoring plan.
	Monitoring plan for avifauna and chiropterofauna.
	Marine ecosystem monitoring plan.
	Monitoring plan for impacts on the social environment.

Source: EMPACA-AECOM.

8.2.1 Monitoring program for the construction phase

The plans that are part of the Monitoring Program for the construction phase of the Manzanillo Energy Consortium Power Plant project are detailed below. See Annex 16: Summary Matrix of the Monitoring Program for the construction phase of the project.

8.2.1.1 Air quality monitoring plan for immission conditions

Impacts targeted by the plan:

Impact	Code	Impact classification
Increase in the concentration of particulate matter due to construction activities and transportation of materials.	A-1	LOW
Increased flue gas concentration from vehicle, heavy equipment and truck operations.	A-3	LOW

Objective:

- Monitor air quality in terms of particulate matter and gases under immission conditions during the construction phase of the project.

Measures to be implemented:

- Measurement of particulate matter and gases under immission conditions.

Indicators and/or parameters to be measured:

- Concentrations of suspended particulate matter under immission conditions: Total suspended particulate matter (TSP), PM-10 fraction particles and PM-2.5 fraction particles in $\mu\text{g}/\text{Nm}^3$.
- Concentrations of gases under immission conditions: carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), volatile organic compounds (TVOC) and formaldehyde (HCHO).

Goals for the indicators and/or parameters to be measured:

- Concentrations of suspended particulate matter in 24-hour immission conditions below the maximum limits established by the IFC General Guidelines for Environment, Health and Safety (Table 8-8) or by the Environmental Technical Regulation on Air Quality of the Dominican Republic (Table 8-9) (whichever is more restrictive).
- Concentrations of gases in immission conditions below the maximum limits established by the IFC General Environmental, Health and Safety Guidelines or by the Environmental Technical Regulation on Air Quality of the Dominican Republic (whichever is more restrictive).

Table 8-8. WHO ambient air quality guidelines.

Parameter	Average period	Guide value in $\mu\text{g}/\text{m}^3$
Sulfur dioxide (SO_2)	24 hours 10 minutes	125 (provisional limit-1) 50 (provisional limit-2) 20 (guide) 500 (guide)
Nitrogen dioxide (NO_2)	1-year 1-hour	400 (guide) 200 (guide)
Particulate matter PM-10	1-year 24-hour	70 (provisional limit-1) 50 (provisional limit-2) 30 (provisional limit-3) 20 (guide) 150 (provisional limit-1) 100 (provisional limit-2) 75 (provisional limit-3) 50 (guide)
Particulate matter PM-2.5	1-year	35 (provisional limit-1) 25 (provisional limit-2) 15 (provisional limit-3)
Ozone (O_3)	8 hours per day maximum	160 (provisional limit-1) 100 (guide)

Source: General Guidelines on Environment, Health and Safety (IFC,2007).

Table 8-9. Air quality standards.

POLLUTANT CRITERIA	AVERAGE TIME	PERMISSIBLE LIMIT ($\mu\text{g}/\text{Nm}^3$)
Total Suspended Particulates (TSP)	Annual	80
	24 hours	230
Particulate matter fraction (PM-10)	Annual	50
	24 hours	150
Particulate matter fraction (PM-2.5)	Annual	15
	24 hours	65
Sulfur Dioxide (SO_2)	Annual	100
	24 hours	150
	1 hour	450
Nitrogen Dioxide (NO_2)	Annual	100
	24 hours	300
	1 hour	400
Ozone (O_3)	8 hours	160
	1 hour	250
Carbon Monoxide (CO)	8 hours	10,000
	1 hour	40,000

Source: Air Quality Environmental Technical Regulations (MIMARENA, 2018).

Executor: Company in charge of Environmental, Social and Health and Safety Management.

Supervisor and responsible: Manzanillo Energy Consortium, Inc.

Methodology and technology used:

For suspended particles:

Measurements of the concentration of particulate matter in the air (PM-2.5, PM-10 and PST) will be made for 24 continuous hours at each monitoring point.

The monitoring points will be georeferenced and climate variables will be measured at each point. The following equipment will be used to carry out the measurements:

- Portable station to measure weather variables such as temperature, relative humidity and wind speed. Wind direction will be calculated by indirect methods.
- Portable airborne particulate matter meter that is approved by the Ministry of the Environment and Natural Resources and properly calibrated (see Photo 8-7).
- GPS to georeference the coordinates.



Photo 8-7. Air Metrics Minivol TAS portable particulate matter meter.

Source: EMPACA Archive.

For gases:

Measurements will be made of the following gases in the air under immission conditions: carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen dioxide (NO₂), ozone (O₃), volatile organic compounds (TVOC) and formaldehyde (HCHO).

To carry out these measurements, detectors with electrochemical sensors will be used to determine the presence of the different gases (Photo 8-8). The measurements will last for at least one hour at each measurement point.



Photo 8-8. Gas measurement equipment under immission conditions.

Source: EMPACA Archive.

Monitoring sites:

At least one sampling point will be selected on the project site and several points at the locations of the nearest off-site receptors in accordance with the sites where measurements were taken during the baseline survey (Table 8-10).

Table 8-10. Air quality measurement sites under immission conditions.

Point	Description	UTM coordinates	
		X	Y
A-1	Villa Barnack, west-southwest of the project area.	212432	2180065
A-2	Villa Ray, west of the project area.	212872	2180346
A-3	Northern boundary of the projected plant area.	213359	2180482
A-6	At the Pepillo Salcedo Golf Club, southwest of the port facilities.	212118	2180184
A-8	Southern boundary of Block 02 area.	213001	2179829
A-9	In front of the Manzanillo Photo Parador.	212716	2179544
A-10	Farm to the southeast of the project.	213432	2178833
A-11	In front of the Manzanillo Plant, Plantaciones del Norte.	215287	2178379
A-12	In front of the entrance to the MPL Project Site.	216687	2178155

Frequency of monitoring: Semiannual.

Implementation time: During the entire construction phase of the project.

Required records:

- Report with the results of particulate matter and gas measurements under immission conditions.

Associated costs:

According to the estimates presented in Table 8-11 the cost for semiannual monitoring during the construction phase is **US\$3,635.00**. Sampling will be carried out at both climate stations present in the country, which means monitoring twice a year, with an estimated annual cost of **US\$7,270.00**.

Table 8-11. Estimated cost of air quality monitoring under immission conditions in the construction phase.

Position	USD\$ period	
Specialists	per campaign	
Two air quality monitoring technicians	800/technician=1,600.00	
Subtotal		USD\$ 1,600.00
Logistics	Details	USD\$ period
Field personnel feeding	21.00/person/day for 3 persons for 5 days	315.00
Driver for personal field transportation	40 /day for 5 days	200.00
Fuel	Tours, coordination and meetings	100.00
Subtotal		USD\$ 615. 00
Materials	Details	USD\$ period
Field materials for monitoring	Personal protection equipment, first aid kit, field notebooks, pens, insect repellent, among others.	150.00
Expendable material for equipment used in monitoring	Filters for particulate matter measurement equipment, AA and AAA alkaline batteries for cameras and climate station.	200.00
Office supplies	Printer ink, paper, USB and other items	20.00
Subtotal		USD\$ 370.00
Contingencies	Unexpected and/or new expenses (e. g. increase in costs of a product)	550.00
Operating expenses	Internet, telephone and electricity costs	500.00
Subtotal		USD\$ 1,050.00
Cost per campaign		USD\$ 3,635.00
Total annual cost		USD\$ 7,270.00

8.2.1.2 Noise level monitoring plan environmental

Impacts targeted by the plan:

Impact	Code	Ranking of the impact
Increased noise and vibration levels due to construction activities and transportation of materials.	A-2	MODERATE
Possibility of disturbance to local residents due to increased noise and dust levels as a result of the Project's construction activities.	PB-2	MODERATE

Objective:

Monitor ambient noise levels during construction of the site.

Measures to be implemented:

- Measure environmental noise levels

Indicators and/or parameters to be measured:

- Environmental noise levels in decibels dB(A).

Goals for the indicators and/or parameters to be measured:

- Noise levels below the maximum limits established by the IFC's General Guidelines on Environment, Health and Safety (Table 8-12) or the Environmental Standard for Noise Protection (NA-RU-001-03, Table 8-13. Maximum permissible noise levels.), (whichever is more restrictive), at the boundaries of the project site and at the locations of the nearest off-site receptors.

Table 8-12. Noise level guide.

Receiver	One hour L_{Aeq} (dBA)	
	For the day 07:00-22:00	At night 22:00-07:00
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Source: General Guidelines on Environment, Health and Safety (IFC,2007).

Table 8-13. Maximum permissible noise levels.

CATEGORIES OF AREAS	EXTERNAL NOISE dB(A)	
	DAYTIME (7 AM - 9 PM)	NIGHTTIME (9 PM - 7 AM)
Areas I: Tranquility Zones		
• Hospitals, health centers, libraries	55	50
• Offices and schools	60	55
• Zoo, Botanical Garden	60	55
• Quiet areas for habitat preservation	60	50
Areas II: Residential Zone		
• Residential area	60	50
• Residential area with surrounding industries or businesses	65	55
Areas III: Commercial Zone		
• Industrial Area	70	55
• Commercial area	70	55

Source: Environmental Standard for Noise Protection (NA-RU-001-03), (Ministry of Environment and Natural Resources, 2003).

Executor: Company in charge of environmental, social and health and safety management.

Supervisor and responsible: Manzanillo Energy Consortium, Inc.

Methodology and technology used:

Noise levels will be measured for at least ten (10) minutes at each monitoring point and these points will be georeferenced. The following equipment will be used to perform the measurements:

- Digital sound level meter (Photo 8-9).
- GPS to georeference the coordinates.
- The sound level meter will be placed in situ at a height of 1.0 m at the point. UTM coordinates will be taken with GPS on a flat platform at 1.0 m above ground level at the location of the monitoring site.



Photo 8-9. CEM DT-9952 sound level meter.

Source: EMPACA File Photo.

Monitoring sites:

At least one (1) sampling point will be selected in each project area where noise-generating activities are being carried out and several points in the places where the closest external receptors are located according to the sites where the measurements were taken during the baseline survey (Table 8-14).

Table 8-14. Measurement locations of ambient noise levels.

Point	Description	UTM coordinates	
		X	Y
R-1	Villa Barnack, west-southwest of the project area.	212432	2180065
R-2	Villa Ray, west of the project area.	212872	2180346
R-3	Northern boundary of the projected plant area.	213359	2180482
R-6	At the Pepillo Salcedo Golf Club, southwest of the port facilities.	212118	2180184
R-8	Southern boundary of Block 02 area.	213001	2179829
R-9	In front of the Manzanillo Photo Parador.	212716	2179544
R-10	Farm to the southeast of the project.	213432	2178833
R-11	In front of the Manzanillo Plant, Plantaciones del Norte.	215287	2178379
R-12	In front of the entrance to the MPL Project Site.	216687	2178155

Frequency of monitoring: Semiannual.

Implementation time: During the construction phase of the project.

Required records:

- Report with the results of noise level measurements.

Associated costs: According to the estimates presented in Table 8-15, the following **costs have been estimated for the year**. the cost for the semiannual monitoring during the construction phase is **USD \$3,485.00** US dollars. Sampling will be carried out at both climate stations present in the country, which means monitoring two (2) times a year, with an estimated annual cost of **USD\$ 6,970.00 US** dollars.

Table 8-15. Estimated cost of environmental noise monitoring during construction phase.

Position	USD\$ period	
Specialists	per campaign	
Two noise monitoring technicians.	800/technician=1,600.00	
Subtotal		USD\$ 1,600.00
Logistics	Details	USD\$ period
Field personnel feeding	21.00/person for 3 persons for 5 days	315.00
Driver for personal field transportation	40/day for 5 days	200.00
Fuel	Tours, coordination and meetings	100.00
Subtotal		USD\$ 615.00
Materials	Details	USD\$ period
Field materials for monitoring	Personal protection equipment, first aid kit, field notebooks, pens, insect repellent, GPS, among others.	150.00
Expendable material for equipment used in monitoring	AA and AAA alkaline batteries for sound level meters and cameras.	50.00
Office supplies	Printer ink, paper, USB, among others	20.00
Subtotal		USD \$ 220.00
Contingencies and operating expenses	Details	USD\$ period
Contingencies	Unexpected and/or new expenses (e. g. increase in costs of a product)	550.00
Operating expenses	Internet, telephone and electricity costs	500.00
Subtotal		USD\$ 1,050.00
Cost per campaign		USD \$3,485.00
Total annual cost		USD\$ 6,970.00

8.2.1.3 Vibration monitoring plan

Impacts targeted by the plan:

Impact	Code	Impact classification
Increased noise and vibration levels due to construction activities and transportation of materials.	A-2	MODERATE

Objective:

Monitor ambient vibration levels during construction of the site.

Measures to be implemented:

- Perform measurements of environmental vibration levels.

Indicators and/or parameters to be measured:

- Particle velocity, acceleration and displacement.

Goals for the indicators and/or parameters to be measured:

- Values equal to or lower than those found during the baseline survey.

Executor: Company in charge of environmental, social and health and safety management.

Supervisor and responsible: Manzanillo Energy Consortium, Inc.

Methodology and technology used:

For environmental vibration measurements, a triaxial geophone meter will be used to measure particle velocity, acceleration and displacement (Photo 8-10). At each point, measurements will be taken for 15 minutes, with continuous recordings, and describing the type of events that could cause vibration peaks.



Photo 8-10. Meter with axial geophone for vibrations.

Source: EMPACA Archives.

Monitoring sites: At least one sampling point will be selected on the project site and several points will be selected at the locations of the nearest off-site receptors in accordance with the sites where measurements were taken during the baseline survey, for a total of 5 measurement points.

Table 8-16. Environmental vibration measurement sites.

Point	Description	UTM coordinates	
		X	Y
V-1	Villa Barnack, west-southwest of the project area.	212432	2180065
V-2	Villa Ray, west of the project area.	212872	2180346
V-3	Northern boundary of the projected plant area.	213359	2180482
V-8	Southern boundary of Block 02 area.	213001	2179829
V-9	In front of the Manzanillo Photo Parador.	212716	2179544
V-10	Farm to the southeast of the project.	213432	2178833
V-11	In front of the Manzanillo Plant, Plantaciones del Norte.	215287	2178379
V-12	In front of the entrance to the MPL Project Site.	216687	2178155

Frequency of monitoring: Semiannual.

Implementation time: During the construction phase of the project.

Required records:

- Report with the results of vibration level measurements.

Associated costs: According to the estimates presented in Table 8-17, the following costs have been estimated for the year. the cost for monitoring during the construction phase is **USD\$ 3,485.00** US dollars. Sampling will be carried out at both climate stations present in the country, which means monitoring two (2) times a year, with an estimated annual cost of **USD\$6,970.00**.

Table 8-17. Estimated cost of environmental vibration monitoring in construction phase.

Position	USD\$ period	
Specialists	per campaign	
Two vibration monitoring technicians	800/technician=1,600.00	
Subtotal		USD\$ 1,600.00
Logistics	Details	USD\$ period
Field personnel feeding	21.00/person for 3 persons for 5 days	315.00
Driver for personal field transportation	40/day for 5 days	200.00
Fuel	Tours, coordination and meetings	100.00
Subtotal		USD\$ 615.00
Materials	Details	USD\$ period
Field materials for monitoring	Personal protection equipment, first aid kit, field notebooks, pens, insect repellent, among others.	150.00

Expendable material for equipment used in monitoring	Batteries for geophone and cameras.	50.00
Office supplies	Printer ink, paper, USB, among others	20.00
Subtotal		USD \$ 220.00
Contingencies and operating expenses	Details	USD\$ period
Contingencies	Unexpected and/or new expenses (e. g. increase in costs of a product)	550.00
Operating expenses	Internet, telephone and electricity costs	500.00
Subtotal		USD\$ 1,050.00
Cost per campaign		USD \$3,485.00
Total annual cost		USD \$6,970.00

8.2.1.4 Monitoring plan for impacts on the social environment

Impacts targeted by the plan:

Impact	Code	Impact classification
Possibility of disturbance to local residents due to increased noise and dust levels as a result of the Project's construction activities.	PB-2	MODERATE
Possible exposure to diseases due to the influx of temporary or permanent labor.	PB-3	MODERATE
Risk of physical injury or loss of life to local residents arising from the use of force by Project physical security personnel.	PB-4	MODERATE
Risk of accidents resulting in physical injury or loss of life to workers and local residents as a consequence of the Project's construction activities.	PB-5	MODERATE
Economic impact on beekeepers in the area due to land clearing.	PB-6	MODERATE
Loss of area for goat grazing due to clearing of project lands.	PB-7	MODERATE
Increased demand for services provided by government entities during the construction phase of the project.	IS-1	MODERATE
Increased truck and vehicle traffic on access roads	TV-1	MODERATE
Risk of traffic accidents resulting in physical injury or loss of life to workers and local residents on access roads.	TV-2	MODERATE
Possibility of deterioration of the access roads due to the passage of trucks and equipment for the transportation of construction materials and equipment.	TV-3	LOW

Objective:

- Monitor the status of the communities in the area of direct influence of the project.

Measures to be implemented:

- Investigation and response to complaints and claims received from the local population through the established mechanism.
- Conducting roundtable discussions and in-depth interviews to determine the causes of complaints.
- Measures for monitoring negative socioeconomic impacts during the construction phase.

Indicators and/or parameters to be measured:

- Number of complaints received from community members.
- Number of complaints investigated and responded to by members of the community
- Response time to complaints.

Goals for the indicators and/or parameters to be measured:

- 100% of the complaints received investigated and responded to.
- Response time to complaints of no more than 20 days.

Methodology and technology used:

The methodology for following up and responding to complaints is presented in the Complaints, Claims and Suggestions Mechanism for the project (see section 8.4).

Monitoring sites: Communities in the area of social influence of the project, which are the municipalities of Pepillo Salcedo and Montecristi, in the province of Montecristi.

Frequency of monitoring: Semiannual.

Implementation time: During the entire construction phase.

Required records:

- Complaint record forms.
- Reports with the results of the investigation of complaints.

Executor: Community Liaison Analyst.

Supervisor and person in charge: Public Relations Department of Manzanillo Energy Consortium, Inc.

Associated costs:

According to the estimates presented in Table 8-18 the cost for semi-annual monitoring during the construction phase is **US\$6,730.00**. Monitoring will be performed two (2) times per year for an annual cost of **USD\$ 13,460.00**.

Table 8-18. Estimated cost of social environment monitoring during the construction phase.

Position	USD\$ period	
Specialists	per campaign	
2 sociologists	1200/each=2,400.00	
3 surveyors	600/each=1,800.00	
Subtotal		USD\$ 4,200.00
Logistics	Details	USD\$ period
Field personnel feeding	21.00/person/day for 6 persons for 5 days	630.00
Driver for personal field transportation	40 /day for 5 days	200.00
Fuel	Tours, coordination and meetings	200.00
Subtotal		USD\$ 1,030.00
Materials	Details	USD\$ period
Field materials for monitoring	Field notebooks, pens, insect repellent, among others.	150.00
Expendable material for equipment used in monitoring	Survey forms.	200.00
Office supplies	Printer ink, paper, USB and other items	100.00
Subtotal		USD\$ 450.00
Contingencies and operating expenses	Details	USD\$ period
Contingencies	Unexpected and/or new expenses (e. g. increase in costs of a product)	550.00
Operating expenses	Internet, telephone and electricity costs	500.00
Subtotal		USD\$ 1,050.00
Cost per campaign		USD\$ 6,730.00
Total annual cost		USD\$ 13,460.00

8.2.2 Monitoring program for the operation phase

The plans that are part of the Monitoring Program for the construction phase of the Manzanillo Energy Consortium Power Plant project are detailed below. See Annex 17: Summary Matrix of the Monitoring Program for the operation phase of the project.

8.2.2.1 Quality monitoring plan for gas and particulate matter emissions

Impacts targeted by the plan:

Impact	Code	Impact classification
Potential for air pollution due to emissions of combustion gases into the atmosphere and suspended particulate matter from the operation of turbines and emergency power generators.	A-4	MODERATE
Possibility of affecting the population (workers and communities) due to increased levels of gas emissions, suspended particles, noise and vibrations from the thermoelectric plant's operations.	PB-9	MODERATE

Objective:

- Monitor gas and particulate matter emissions from turbine stacks.

Measures to be implemented:

- Measurement of gas and particulate matter emissions from turbine stacks.

Indicators and/or parameters to be measured:

- Flue gas temperature, ambient temperature, gas outlet velocity, outlet flow rate, particulate matter content, concentration of O_2 , CO_2 , CO , SO_2 and NO_x (Mg/Nm^3) and the working efficiency of the generating units.

Goals for the indicators and/or parameters to be measured:

- Concentrations of suspended particulate matter and gases emitted below the maximum limits established by the IFC General Guidelines for Environment, Health and Safety (Table 8-19) or by the Technical Environmental Regulation for the Control of Air Pollutant Emissions from Fixed Sources in the Dominican Republic (Table 8-20) (whichever is more restrictive).

Table 8-19. Emission guidelines for small combustion plants (3 MWth-50 MWth) -(in mg/Nm^3 , unless otherwise stated).

Combustion/fuel technology	Solid particles (PS)	Sulfur Dioxide (SO_2)	Nitrogen Oxides (NO_x)	Dry gas, excess O_2 content (%)
Turbine				
Natural gas From ≥ 3 MWth to < 15 MWth	N/A	N/A	200 (spark ignition) 400 (dual fuel) 1,600 (compression ignition)	15
Natural gas From ≥ 15 MWth to < 50 MWth	N/A	N/A	25 ppm	15

Source: General Guidelines on Environment, Health and Safety (IFC,2007).

Table 8-20. Air pollutant emission limit specifications for stationary sources.

POLLUTANT	ACTIVITY	EXISTING (mg/Nm ³)	NEW (mg/Nm ³) ³	REMARKS
Nitrogen oxides (NO _x)	Generation, transmission and distribution of electric power	280	220	Thermal power plants using natural gas

Source: Environmental Technical Regulations for the Control of Air Pollutant Emissions from Stationary Sources, Dominican Republic (MIMARENA, 2018).

Executor: Company in charge of environmental, social and health and safety management.

Supervisor and responsible: Manzanillo Energy Consortium, Inc.

Methodology and technology used:

Measurements of gas and suspended particle emissions will be taken at the turbine stacks. Measurements will be made under isokinetic conditions in accordance with the provisions of the Environmental Technical Regulations for the Control of Air Pollutant Emissions from Stationary Sources.

MIMARENA approved equipment will be used for the measurements (Photo 8-11 y Photo 8-12).



Photo 8-11. Portable gas analyzer TESTO 350 XL.

Source: EMPACA Archives.

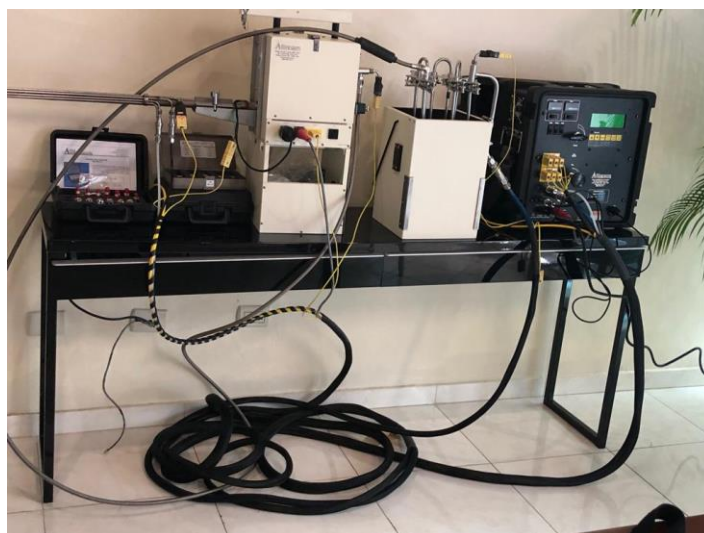


Photo 8-12. XC-5000 equipment used in the measurement of particulate matter concentration under isokinetic conditions in the stacks.

Source: EMPACA Archives.

Monitoring sites: Turbine stacks.

Frequency of monitoring: Semiannual.

Implementation time: Throughout the life of the project.

Required records:

- Report with the results of gas and particulate matter measurements.

Associated costs:

According to the estimates presented in Table 8-21 the cost of monitoring (total cost of monitoring all the chimneys) is **USD\$ 3,635.00** US dollars per semester, and sampling will be carried out in both climatic stations present in the country. This means that monitoring will be carried out twice a year, with an estimated annual cost of **US\$7,270.00**.

Table 8-21. Estimated cost of gas and particulate matter emissions monitoring in the operation phase.

Position	USD\$ period	
Specialists	per campaign	
Two technicians for monitoring gas and particulate matter emissions	800/technician=1,600.00	
Subtotal		USD\$ 1,600.00
Logistics	Details	USD\$ period
Field personnel feeding	21.00/person/day for 3 persons for 5 days	315.00
Driver for personal field transportation	40 /day for 5 days	200.00
Fuel	Tours, coordination and meetings	100.00
Subtotal		USD\$ 615. 00
Materials	Details	USD\$ period
Field materials for monitoring	Personal protection equipment, first aid kit, field notebooks, pens, insect repellent, among others.	150.00
Expendable material for equipment used in monitoring	Filters for particulate matter measurement equipment, batteries for cameras and climate station	200.00
Office supplies	Printer ink, paper, USB and other items	20.00
Subtotal		USD\$ 370.00
Contingencies	Unexpected and/or new expenses (e.g. increase in costs of a product)	550.00
Operating expenses	Internet, telephone and electricity costs	500.00
Subtotal		USD\$ 1,050.00
Cost per campaign		USD\$ 3,635.00
Annual cost		USD\$ 7,270.00

8.2.2.2 Air quality monitoring plan for air quality under immission conditions**Impacts targeted by the plan:**

Impact	Code	Impact classification
Potential for air pollution due to emissions of combustion gases into the atmosphere and suspended particulate matter from the operation of turbines and emergency power generators.	A-4	MODERATE
Possibility of affecting the population (workers and communities) due to increased levels of gas emissions, suspended particles, noise and vibrations from the thermoelectric plant's operations.	PB-9	MODERATE

Objective:

- Monitor air quality in terms of particulate matter and gases under immission conditions during thermoelectric plant operations.

Measures to be implemented:

- Measurement of particulate matter and gases under immission conditions.

Indicators and/or parameters to be measured:

- Concentrations of suspended particulate matter under immission conditions: Total suspended particulate matter (TSP), PM-10 fraction particles and PM-2.5 fraction particles in $\mu\text{g}/\text{Nm}^3$.
- Concentrations of gases under immission conditions: carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), volatile organic compounds (TVOC) and formaldehyde (HCHO).

Goals for the indicators and/or parameters to be measured:

- Concentrations of suspended particulate matter in 24-hour immission conditions below the maximum limits established by the General Environmental, Health and Safety Guidelines of the IFC or by the Environmental Technical Regulation on Air Quality of the Dominican Republic (whichever is more restrictive).
- Concentrations of gases in immission conditions below the maximum limits established by the IFC General Environmental, Health and Safety Guidelines or by the Environmental Technical Regulation on Air Quality of the Dominican Republic (whichever is more restrictive).

Executor: Company in charge of Environmental, Social and Health and Safety Management.

Supervisor and responsible: Manzanillo Energy Consortium, Inc.

Methodology and technology used:

To measure the concentrations of suspended particles and gases in the air under immission conditions during the operation phase, the same methodology described for the construction phase shall be followed (see section 8.2.1.1)

Monitoring sites:

Several sampling points will be selected at the power plant facilities according to the locations where the sources of particulate matter and gases are located, and at the locations where the nearest external receptors are located according to the sites where measurements were taken during the baseline survey.

Frequency of monitoring: Semiannual.

Implementation time: Throughout the life of the project.

Required records:

- Report with the results of particulate matter and gas measurements under immission conditions.

Associated costs:

According to the estimates presented in Table 8-22, the cost for semiannual monitoring is **US\$3,635.00**, and sampling will be carried out in both climatic stations in the country. This means that monitoring will be carried out twice a year, with an estimated annual cost of **US\$7,270.00**.

Table 8-22. Estimated cost of air quality monitoring under immission conditions in operation phase.

Position	USD\$ period	
Specialists	per campaign	
Two air quality monitoring technicians.	800/technician=1,600.00	
Subtotal		USD\$ 1,600.00
Logistics	Details	USD\$ period
Field personnel feeding	21.00/person/day for 3 persons for 5 days	315.00
Driver for personal field transportation	40 /day for 5 days	200.00
Fuel	Tours, coordination and meetings	100.00
Subtotal		USD\$ 615. 00
Materials	Details	USD\$ period
Field materials for monitoring	Personal protection equipment, first aid kit, field notebooks, pens, insect repellent, among others.	150.00
Expendable material for equipment used in monitoring	Filters for particulate matter measurement equipment, batteries for cameras and climate station	200.00
Office supplies	Printer ink, paper, USB and other items	20.00
Subtotal		USD\$ 370.00
Contingencies and operating expenses	Details	USD\$ period
Contingencies	Unexpected and/or new expenses (e. g. increase in costs of a product)	550.00
Operating expenses	Internet, telephone and electricity costs	500.00
Subtotal		USD\$ 1,050.00
Cost per campaign		USD\$ 3,635.00
Annual cost		USD\$ 7,270.00

8.2.2.3 Noise level monitoring plan environmental

Impacts targeted by the plan:

Impact	Code	Impact classification
Increased noise and vibration levels due to thermoelectric plant operations.	A-5	MODERATE
Possibility of affecting the population (workers and communities) due to increased levels of gas emissions, suspended particles, noise and vibrations from the thermoelectric plant's operations.	PB-9	MODERATE

Objective:

Monitor ambient noise levels during thermoelectric plant operations.

Measures to be implemented:

- Perform measurements of ambient noise levels.

Indicators and/or parameters to be measured:

- Environmental noise levels in decibels dB(A).

Goals for the indicators and/or parameters to be measured:

- Ambient noise levels below the maximum limits established by the IFC General Environmental, Health and Safety Guidelines (see Table 8-8) or the Environmental Standard for Noise Protection (NA-RU-001-03), (whichever is more restrictive), at the project site boundary and at the locations of the nearest off-site receptors.

Executor: Company in charge of environmental, social and health and safety management.

Supervisor and responsible: Manzanillo Energy Consortium, Inc.

Methodology and technology used:

To measure ambient noise levels during the operation phase, the same methodology described for the construction phase shall be followed (see section 8.2.1.2)

Monitoring sites:

Several points will be selected in the power plant facilities depending on the location of the noise sources and several points in the places where the closest external receivers are located according to the sites where the measurements were taken during the baseline survey (Table 8-14. of subsection 8.2.1.2).

Frequency of monitoring: Semiannual.

Implementation time: Throughout the life of the project.

Required records:

- Report with the results of noise level measurements.

Associated costs: According to the estimates presented in Table 8-23, the cost for the semiannual monitoring is **USD \$3,485.00** US dollars, and sampling will be carried out in both weather stations in the country, which means that monitoring will be carried out twice a year, with an estimated annual cost of **USD \$6,970.00** US dollars.

Table 8-23. Estimated cost of environmental noise monitoring in operation phase.

Position	USD\$ period	
Specialists	per campaign	
Two noise monitoring technicians.	800/technician=1,600.00	
Subtotal		USD\$ 1,600.00
Logistics	Details	USD\$ period
Field personnel feeding	21.00/person for 3 persons for 5 days	315.00
Driver for personal field transportation	40/day for 5 days	200.00
Fuel	Tours, coordination and meetings	100.00
Subtotal		USD\$ 615.00
Materials	Details	USD\$ period
Field materials for monitoring	Personal protection equipment, first aid kit, field notebooks, pens, insect repellent, among others.	150.00
Expendable material for equipment used in monitoring	Batteries for sound level meters and cameras.	50.00
Office supplies	Printer ink, paper, USB and other items	20.00
Subtotal		USD \$ 220.00
Contingencies and operating expenses	Details	USD\$ period
Contingencies	Unexpected and/or new expenses (e. g. increase in costs of a product)	550.00
Operating expenses	Internet, telephone and electricity costs	500.00
Subtotal		USD\$ 1,050.00
Cost per campaign		USD \$3,485.00
Annual cost		USD \$ 6,970.00

8.2.2.4 Environmental vibration monitoring plan

Impacts targeted by the plan:

Impact	Code	Impact classification
Increased noise and vibration levels due to thermoelectric plant operations.	A-5	MODERATE
Possibility of affecting the population (workers and communities) due to increased levels of gas emissions, suspended particles, noise and vibrations from the thermoelectric plant's operations.	PB-9	MODERATE

Objective: Monitor the levels of environmental vibrations generated by the thermoelectric power plant operations.

Measures to be implemented:

- Perform measurements of environmental vibration levels.

Indicators and/or parameters to be measured:

- Particle velocity, acceleration and displacement.

Goals for the indicators and/or parameters to be measured:

- Values equal to or lower than those found during the baseline survey.

Executor: Company in charge of Environmental, Social and Health and Safety Management.

Supervisor and responsible: Manzanillo Energy Consortium, Inc.

Methodology and technology used:

The same methodology described for the construction phase will be used to measure environmental vibration levels during the operation phase.

Monitoring sites: At least one sampling point will be selected at the thermoelectric power plant and four points will be selected at the locations of the nearest external receptors in accordance with the sites where measurements were taken during the baseline survey.

Frequency of monitoring: Semiannual.

Implementation time: Throughout the life of the project.

Required records:

- Report with the results of vibration level measurements.

Associated costs: the following costs have been estimated for the year.

According to the estimates presented in Table 8-24, the cost for the semiannual monitoring is **USD \$3,485.00** US dollars. Sampling will be carried out in both climatic stations in the country, which means that monitoring will be carried out twice a year, with an estimated annual cost of **USD \$6,970.00** US dollars.

Table 8-24. Estimated cost of environmental vibration monitoring in operation phase.

Position	USD\$ period	
Specialists	per campaign	
Two vibration monitoring technicians.	800/technician=1,600.00	
Subtotal		USD\$ 1,600.00
Logistics	Details	USD\$ period
Field personnel feeding	21.00/person for 3 persons for 5 days	315.00
Driver for personal field transportation	40/day for 5 days	200.00
Fuel	Tours, coordination and meetings	100.00
Subtotal		USD\$ 615.00
Materials	Details	USD\$ period
Field materials for monitoring	Personal protection equipment, first aid kit, first aid kit, field notebooks, pens, insect repellent, among others.	150.00
Expendable material for equipment used in monitoring	Batteries for sound level meters and cameras.	50.00
Office supplies	Printer ink, paper, USB and other items	20.00
Subtotal		USD \$ 220.00
Contingencies and operating expenses	Details	USD\$ period
Contingencies	Unexpected and/or new expenses (e. g. increase in costs of a product)	550.00
Operating expenses	Internet, telephone and electricity costs	500.00
Subtotal		USD\$ 1,050.00
Cost per campaign		USD \$3,485.00
Annual cost		USD \$6,970.00

8.2.2.5 Quality monitoring plan for surface waters

Impacts targeted by the plan:

Impact	Code	Impact classification
Possibility of modification of the quality of marine waters due to the discharge of cooling water.	ASP-1	LOW

Objective:

Monitor surface water quality parameters during the operation phase of the project.

Measures to be implemented:

- Marine water quality monitoring.

Indicators and/or parameters to be measured:

- Marine Water Quality Parameters (See Table 8-25).

Table 8-25. Marine water quality parameters.

Parameter	Unit	Environmental Standard NA-CASC-2012*.
pH	Units	7.5-8.5
Temperature	°C	--
Total dissolved solids	mg/l	--
Electrical conductivity	µS/cm	--
Dissolved oxygen	mg/l	--
Oxygen saturation	%	>60
Turbidity	NTU	--
Total suspended solids	mg/l	--
Total solids	mg/l	--
Total coliforms	MPN/100 ml	1000
Fecal coliforms	MPN/100 ml	400
BOD ₅	mg/l	--
COD	mg/l	--
Organic material	mg/l	--
Total phosphorus	mg/l	--
Total nitrogen	mg/l	--
Chloride	mg/l	--
Chlorine residual	mg/l	--

Parameter	Unit	Environmental Standard NA-CASC-2012*.
Total hydrocarbons	mg/l	--
Oils and fats	mg/l	1
Total cadmium	mg/l	0.005
Total Chromium	mg/l	0.1
Total cobalt	mg/l	--
Total copper	mg/l	0.05
Total iron	mg/l	0.3
Total lead	mg/l	0.05
Total nickel	mg/l	0.008
Total vanadium	mg/l	--
Total zinc	mg/l	0.05

* Environmental quality standard for surface and coastal waters, for class E coastal waters.

Goals for the indicators and/or parameters to be measured:

- Water quality parameters that meet the standards established by the Environmental Standard on Surface and Coastal Water Quality (NA-CASC-2012).

Executor: Company in charge of Environmental, Social and Health and Safety Management.

Supervisor and responsible: Manzanillo Energy Consortium, Inc.

Methodology and technology used:

- Samples will be taken from coastal waters.
- The coordinates of the points where the samples will be taken will be taken with a GPS.
- Parameters (pH, temperature, conductivity, salinity, STD, dissolved oxygen and turbidity) will be analyzed *in situ* with portable measuring equipment.
- Three (3) types of containers will be used for each sample: amber glass bottles to analyze fats and oils, special plastic sleeves or bottles to analyze coliforms and plastic bottles to analyze the rest of the parameters.
- Water samples will be refrigerated and taken to a certified laboratory for analysis.

Monitoring sites: Several sampling points will be selected in the coastal area close to the cooling water discharge area (Table 8-26).

Table 8-26. Sampling points in coastal waters.

Station sampling	Description of the stations	Coordinates UTM	
		X	Y
W-1	Coastal sector northeast of the projected plant area, in the Estero Balsa marine area.	214103	2180278
W-2	Coastal sector to the north of the projected plant area, in the Estero Balsa marine area.	213393	2180609
W-4	Coastal sector northeast of the low floodplain, at the marine entrance to the Estero Balsa area.	213625	2181452
W-5:	At the location of the jetty in Manzanillo Bay.	213049	2182134
W-6	Coastal sector to the east of the Port facilities.	212570	2181560
W-7	Coastal sector to the west of the Port facilities.	212198	2181439
W-8	Coastal sector to the south of the projected plant area.	213565	2179418
W-12	In Estero Balsa near the route of the 345 kV transmission line.	214755	2178679

Frequency of monitoring: Semiannual.

Implementation time: Throughout the life of the project.

Required records:

- Reports with the results of surface water quality analysis.

Associated costs:

According to the estimates presented in Table 8-27, the cost for semiannual monitoring is **USD\$ 4,735.00** US dollars, and sampling will be carried out in both climatic stations in the country, which means that monitoring will be carried out twice a year, with an estimated annual cost of **USD\$ 9,470.00** US dollars.

Table 8-27. Estimated cost of surface water quality monitoring in operation phase.

Position	USD\$ period	
Specialists	per campaign	
Two water quality monitoring technicians.	800/technician=1,600.00	
Subtotal		USD\$ 1,600.00
Logistics	Details	USD\$ period
Field personnel feeding	21.00/person for 3 persons for 5 days	315.00
Driver for personal field transportation	40/day for 5 days	200.00
Fuel	Tours, coordination and meetings	100.00
Subtotal		USD\$ 615.00

Materials	Details	USD\$ period
Field materials for monitoring	Personal protection equipment, first aid kit, field notebooks, pens, insect repellent, among others.	150.00
Expendable material for monitoring equipment	Batteries for water measuring equipment, reagents, glass and plastic bottles, sterile covers, gloves.	300.00
Laboratory analysis	Payment to external laboratory that performs physicochemical and microbiological analysis of water quality.	1000.00
Office supplies	Printer ink, paper, USB and other items	20.00
Subtotal		USD\$ 1,470.00
Position	USD\$ period	
Contingencies and operating expenses	Details	USD\$ period
Contingencies	Unexpected and/or new expenses (e. g. increase in costs of a product)	550.00
Operating expenses	Internet, telephone and electricity costs	500.00
Subtotal		USD\$ 1,050.00
Cost per campaign		USD\$ 4,735.00
Annual cost		USD\$ 9,470.00

8.2.2.6 Wastewater quality monitoring plan

Impacts targeted by the plan:

Impact	Code	Impact classification
Possibility of groundwater contamination due to poor management of liquid waste.	AS-1	LOW
Possibility of modification of marine water quality due to the discharge of cooling water.	ASP-1	LOW

Objective:

Monitor the quality parameters of the domestic and industrial wastewater that will be generated at the thermoelectric power plant facilities.

Measures to be implemented:

- Monitoring of domestic wastewater quality.
- Industrial wastewater quality monitoring.

Indicators and/or parameters to be measured:

- Quality parameters of domestic wastewater (See Table 8-28).

Table 8-28. Quality parameters of domestic wastewater.

Parameters	Unit	MIMARENA Groundwater Quality and Groundwater Discharge Environmental Standard, 2004*.
pH	-	6.0-8.5
Temperature.	°C	--
Electrical conductivity.	µS/cm	--
Total dissolved solids	mg/L	--
Dissolved oxygen	mg/L	--
Oxygen saturation	%	--
Turbidity	NTU	--
Total suspended solids	mg/l	50.0
Free Chlorine	mg/l	--
Total Chlorine	mg/l	--
BOD ₅	mg/l	--
COD	mg/l	250
Orthophosphates	mg/l	--
Oils and fats	mg/l	1.0
Total coliforms	MPN/100 ml	1000
Ammonium nitrogen	mg/l	10
Total nitrogen	mg/l	30

*Maximum limit for discharges into aquifers of medium vulnerability.

- Industrial Wastewater Quality Parameters (See Table 8-29).

Table 8-29. Industrial wastewater quality parameters.

Parameters	Unit	Standards Standard Environmental Control of Discharge to Surface Water, Sanitary Sewer and Coastal Waters*.	IFC General Environmental, Health and Safety Standards and Guidelines, 2007
pH	-	6.0-9.0	6-9
Temperature.	°C	--	--
Δ Temperature	°C	+3	--
Electrical conductivity.	µS/cm	--	--
Total dissolved solids	mg/L	--	--
Salinity	%	--	--
Dissolved oxygen	mg/L	--	--

Parameters	Unit	Standards Standard Environmental Control of Discharge to Surface Water, Sanitary Sewer and Coastal Waters*.	IFC General Environmental, Health and Safety Standards and Guidelines, 2007
Oxygen saturation	%	45	--
Turbidity	NTU	--	--
Total suspended solids	mg/l	75	50
Total phosphorus	mg/l	8	2
COD	mg/l	350	--
Oils and fats	mg/l	15	10
Chlorine residual	mg/l	--	--
Lead	mg/l	0.05	--
Vanadium	mg/l	--	--
Arsenic	mg/l	0.1	--
Copper	mg/l	2	--
Cadmium	mg/l	0.05	--
Cobalt	mg/l	--	--
Chrome	mg/l	0.5	--
Iron	mg/l	0.5	--
Nickel	mg/l	2	--
Zinc	mg/l	1	--
Hydrocarbons	mg/l	--	--

*: Reference of wastewater discharges from any source into Class E coastal waters.

Goals for the indicators and/or parameters to be measured:

- Domestic wastewater quality parameters that meet the standards established by the Environmental Standard on Groundwater Quality and Groundwater Discharge.
- Industrial wastewater quality parameters that meet the standards established by the Environmental Standard on Control of Discharges to Surface Water, Sanitary Sewers and Coastal Waters or by the IFC's General Guidelines on Environment, Health and Safety.

Executor: Company in charge of environmental, social and health and safety management.

Supervisor and responsible: Manzanillo Energy Consortium, Inc.

Methodology and technology used:

- Samples will be taken from the treated water in the septic tank of the thermoelectric power plant at the location of the filter and at the point of discharge of treated industrial wastewater into the sea.

- The coordinates of the points where the samples will be taken will be taken with a GPS.
- Parameters (pH, temperature, conductivity, salinity, STD, dissolved oxygen and turbidity) will be analyzed *in situ* with portable measuring equipment.
- Three (3) types of containers will be used for each sample: amber glass bottles for analyzing fats and oils, special plastic bottles or sleeves for analyzing coliforms and plastic bottles for analyzing the rest of the parameters.
- Water samples will be refrigerated and taken to a certified laboratory for analysis.

Monitoring sites:

Filter where wastewater from the septic tank and industrial liquid waste discharge point to the sea will be discharged.

Frequency of monitoring: Semiannual.

Implementation time: Throughout the life of the project.

Required records:

- Reports with the results of the quality analysis of domestic and industrial wastewater.

Associated costs:

According to the estimates presented in Table 8-30, the cost for semiannual monitoring is **US\$6,110.00**, and sampling will be carried out in both climatic stations in the country, which means that monitoring will be carried out twice a year, with an estimated annual cost of **US\$12,220.00**.

Table 8-30. Estimated cost of wastewater quality monitoring during the operation phase.

Position	USD\$ period	
Specialists	per campaign	
Two water quality monitoring technicians.	800/technician=1,600.00	
Subtotal		USD\$ 1,600.00
Logistics	Details	USD\$ period
Field personnel feeding	21.00/person for 3 persons for 5 days	315.00
Driver for personal field transportation	40/day for 5 days	200.00
Fuel	Tours, coordination and meetings	100.00
Subtotal		USD\$ 615.00
Materials	Details	USD\$ period
Field materials for monitoring	Personal protection equipment, first aid kit, first aid kit, field notebooks, pens, insect repellent, among others.	150.00
Expendable material for monitoring equipment	Batteries for water measuring equipment, reagents, glass and plastic bottles, sterile covers, gloves.	300.00

Materials	Details	USD\$ period
Laboratory analysis	Payment to external laboratory that performs physicochemical and microbiological analysis of water quality.	2,375.00
Office supplies	Printer ink, paper, USB and others.	20.00
Subtotal		USD\$ 2,845.00
Contingencies and operating expenses	Details	USD\$ period
Contingencies	Unexpected and/or new expenses (e. g. increase in costs of a product)	550.00
Operating expenses	Internet, telephone and electricity costs	500.00
Subtotal		USD\$ 1,050.00
Cost per campaign		USD\$ 6,110.00
Annual cost		USD\$ 12,220.00

8.2.2.7 Avifauna and chiropterofauna monitoring plan

Impacts targeted by the plan:

Impact	Code	Impact classification
Decrease in fauna caused by collisions of birds and bats with the towers and power lines of the transmission line.	F-5	MODERATE
Detriment to fauna due to electrocution of birds and bats by the voltage of the transmission line.	F-6	MODERATE

Objective: Monitor the impact of power transmission line operations on avifauna and chiropterofauna.

Measures to be implemented:

- The status of the avifauna and chiropterotroph fauna will be monitored so that their environmental situation can be comparatively evaluated in relation to the baseline information generated in this study.

Indicators and/or parameters to be measured:

- Richness and abundance of birds and bats.
- Number of protected bird and bat species.

Goals for the indicators and/or parameters to be measured:

- Bird and bat species richness and abundance similar or better to what was found during the baseline survey.

Executor: Company contracted by Empresa de Transmisión Eléctrica Dominicana (ETED).

Supervisor and responsible party: Empresa de Transmisión Eléctrica Dominicana (ETED).

Methodology and technology used:

For the monitoring of avifauna and chiropterofauna, the same methodology will be followed as described below:

Avifauna:

In the case of the taxonomic group of birds, the most practical and appropriate methods for collecting data on landbird populations in the Caribbean will be used to obtain information in the field, combining three sampling techniques: fixed point counts, the interview technique and opportunistic observations.

Fixed sampling points will be used to elaborate presence lists, calculate relative abundance, richness, and determine movement routes. They will be carried out considering an average observation radius of 25 m and a maximum of 50 m at each point.

The duration of sampling at each fixed point shall not exceed 10 minutes, since if it lasts longer than this time it may cause an increase in the standard error of the results during the analysis.

With the interview, information is sought on the history of the ornithofauna of the site, for details of any particular species and possible impacts that have affected the taxonomic groups treated.

Opportunistic observations, as the name suggests, are observations made at random, providing new species that are located outside the techniques used during the process and serve to add qualitative data to the list of the site.

To collect bat data, two techniques will be used: the use of mist nets for capture and the use of transects or 150-meter trails.

Monitoring sites: Electrical transmission line layout, taking into account the sites where the baseline survey was carried out (see Table 8-31).

Table 8-31. UTM coordinates of the location of the avifauna and chiropteroфаuna monitoring points.

Group	Point	UTM coordinates	
		X	Y
Birds	A-1	212797	2180004
	A-2	212901	2179816
	A-3	213407	2178996
	A-4	214135	2178686
	A-5	215158	2178457
	A-6	215796	2178716
	A-7	216660	2178200

Group	Transects	UTM coordinates			
		Start		Final	
		X	Y	X	Y
Bats	MT-1	212796	2179847	213132	2179606
	MT-2	212786	2179959	212756	2180170
	MT-3	213132	2179328	213560	2179021
	MT-4	214600	2178609	215100	2178460
	MT-5	215324	2178554	216246	2178613

Frequency of monitoring: Semiannual.

Implementation time: Throughout the life of the project.

Required records:

- Report with the results of the monitoring of avifauna and chiropteroфаuna.

Associated costs:

According to the estimates presented in Table 8-32, the cost of the semiannual monitoring is **US\$6,585.00**. Sampling will be carried out at both weather stations in the country, which means that monitoring will be carried out twice a year, with an estimated annual cost of **US\$13,170.00**.

Table 8-32. Estimated cost of monitoring of avifauna and chiropterofoauna in the operation phase.

Position	USD\$ Period	
Specialists	per campaign	
Avifauna Specialist	1300.00	
Bird assistant: transect and nets	800.00	
Specialist in chiropterofoauna	1300.00	
Assistant to chiropterofoauna: nets and cameras	1200.00	
Subtotals	4,6000	
Logistics	Details	USD\$ period
Field personnel feeding	21.00/person/day for 3 persons for 5 days	315.00
Field personnel transportation	40.00 /day for 5 days	200.00
Fuel	Tours, coordination and meetings	100.00
Subtotal		USD\$ 615.00
Materials	Details	USD\$ period
Field materials for monitoring	First aid kits, field notebooks, nets, nets, ropes, yarn, markers, insect repellent, head lamps, flashlights, among others.	250.00
Expendable material for equipment used in monitoring	AA and AAA alkaline batteries for cameras, headlamps, handheld flashlights, etc.	50.00
Office supplies	Printer ink, paper, USB and other items	20.00
Subtotal		USD\$ 320.00
Contingencies and operating expenses	Details	USD\$ period
Contingencies	Unexpected and/or new expenses (e. g. increase in costs of a product)	550.00
Operating expenses	Internet, telephone and electricity costs	500.00
Subtotal		USD \$ 1,050.00
Cost per campaign		USD \$ 6,585.00
Total annual cost		USD \$ 13,170.00

8.2.2.8 Marine ecosystem monitoring plan

Impacts targeted by the plan:

Impact	Code	Impact classification
Possibility of affecting marine biota due to the discharge of cooling water into the sea.	BM-1	MODERATE

Objective: Monitor the impact of project operations on marine ecosystems.

Measures to be implemented:

- The state of the marine ecosystems will be monitored so that their environmental situation can be comparatively evaluated in relation to the baseline information generated in this study.

Indicators and/or parameters to be measured:

- Richness and abundance of marine species.
- Number of protected or endangered marine species.

Goals for the indicators and/or parameters to be measured:

- Richness and abundance of marine species similar or better to what was found during the baseline survey.

Executor: Company in charge of environmental, social and health and safety management.

Supervisor and responsible: Manzanillo Energy Consortium, Inc.

Methodology and technology used:

The following activities will be carried out for the sampling of marine ecosystems:

Monitoring of fish associated with nekton:

- Two trammel nets or fishing nets about 100 meters long and 1.75 meters high will be placed in selected sites within the area of influence.
- The start and end coordinates of each trammel net installed at each site will be taken.
- At the same time and while the trammel nets are installed, free dives will be conducted with the support of diving and/or basic equipment, acrylic board, charcoal pencil, GPS, underwater camera in order to identify undersized species that can be caught with the trammel nets. This activity will complement the information on the relative abundance of the species present in the sampling sites.

- Two (2) hours after the trammel nets have been set, the collected species will be recovered from the trammel nets.
- The collected species will be placed in zip lock bags with their proper identification.
- The samples will be sent to the laboratory where they will be classified and identified, using specialized taxonomic keys and contrasted with specimens present in the reference ichthyological collection of the Natural History Museum of Santo Domingo. This information will allow us to estimate the richness of fish in the study area.
- In addition to the identification of the species captured in the laboratory, information will be taken on the size and weight of the species and their state of health to determine the presence of parasites or lesions.
- Photos will be taken of the species sighted during the dive and of the trammel net catches.

Monitoring of species associated with corals:

- Sampling of coral fish and as indicated in the site selection section will be done by establishing 10 x 20 m transects.
- The species observed will be identified and counted by free diving.
- The data will be recorded on an acrylic tablet with the help of a charcoal pencil.
- Using a submersible camera, photos will be taken of the process of establishing the transects, which will be delimited with the help of a tape measure.
- Coral and associated algal species will be recorded at each sampling site.

Monitoring of species associated with seagrasses:

- Three 20 x 30 m transects perpendicular to the coast will be established in order to determine the species associated with the seagrasses.
- Free diving will be carried out along each side of the central axis of each transect in order to determine the species associated with this type of habitat.
- The data will be recorded on an acrylic tablet with the help of a charcoal pencil.
- Using a submersible camera, photos will be taken of the process of establishing the transects, which will be delimited with the help of a tape measure.

Monitoring of species associated with soft bottoms:

- To characterize the fauna associated with the soft bottoms within the study area, an Ekman type dredge or similar will be used for sampling in this type of habitat.
- In each sampling site, a 10 x 10 m quadrant will be established over which 5 sets will be made with the dredge, that is, in each corner of the quadrant and in the center of this quadrant, in order to obtain a better representation of the sampled site.
- At the same time, information such as the coordinates of the four corners and center of the quadrant will be collected, the sampling will be documented by taking photographs, notes of relevance of the samples collected, each set obtained will be coded and stored in plastic bags and preserved in cold and if necessary, 4% formalin will be added.
- Samples will be taken to the laboratory where they will be identified to the taxonomic level at which they can be determined.
- The information generated will be tabulated, analyzed and developed into a report describing the findings, abundance and richness of species, identification of species of

economic and conservation interest, identification of species protected by a local and international conservation category.

Monitoring sites: Marine area near the water discharge point of the cooling system, considering the sites where the baseline survey was carried out (Table 8-33).

Table 8-33. Marine ecosystem monitoring sites.

Environmental Component	Site ID	Reference UTM coordinates (WGS 84)	
		East	North
Pastures / Corals	Pasture/Corals 1	212996.00	2181583.00
	Pasture/Corals 2	212999.00	2181485.00
	Pasture/Corals 3	213000.00	2181379.00
	Pasture/Corals 4	212234.00	2181364.00
Marine Fauna	Fauna Sea-1	213593.00	2181419.00
	Fauna Sea-2	213019.00	2182138.00
	Fauna Mar-3	213511.00	2180651.00
	Fauna Mar-4	213885.00	2180492.00
	Fauna Sea-5	212995.00	2181766.00
	Fauna Sea-6	212270.00	2181602.00
	Fauna Mar-7	213462.00	2181020.00
Soft Bottom	FB 1	213593.00	2181419.00
	FB2	213462.00	2181020.00
	FB3	213511.00	2180651.00
	FB4	213885.00	2180492.00
	FB5	213000.00	2181379.00
	FB6	212999.00	2181485.00
	FB7	212996.00	2181583.00

Frequency of monitoring: Semiannual.

Implementation time: Throughout the life of the project.

Required records:

- Report with the results of the monitoring of marine ecosystems.

Associated costs: According to the estimates presented in Table 8-34, the following, the cost of the semiannual monitoring is **US\$ 4,085.00**. Sampling will be carried out in both climate stations in the country, which means that monitoring will be carried out twice a year, with an estimated annual cost of **US\$ 8,170.00**.

Table 8-34. Estimated cost of marine ecosystem monitoring in operation phase.

Position	USD\$ Period	
Specialists	per campaign	
Specialist in marine biota	1300.00	
Marine biota assistant	800.00	
Subtotals	2,100.00	
Logistics	Details	USD\$ period
Field personnel feeding	21.00/person/day for 3 persons for 5 days	315.00
Field personnel transportation	40.00 /day for 5 days	200.00
Fuel	Tours, coordination and meetings	100.00
Subtotal		USD\$ 615.00
Materials	Details	USD\$ period
Field materials for monitoring	First aid kits, trammel, acrylic board, charcoal pencils, zip lock bag, among others.	250.00
Expendable material for equipment used in monitoring	Battery for underwater cameras and GPS.	50.00
Office supplies	Printer ink, paper, USB and other items	20.00
Subtotal		USD\$ 320.00
Contingencies and operating expenses	Details	USD\$ period
Contingencies	Unexpected and/or new expenses (e. g. increase in costs of a product)	550.00
Operating expenses	Internet, telephone and electricity costs	500.00
Subtotal		USD \$1,050.00
Cost per campaign		USD \$ 4,085.00
Total annual cost		USD \$ 8,170.00

8.2.2.9 Monitoring plan for impacts on the social environment

Impacts targeted by the plan:

Impact	Code	Impact classification
Positive impacts to be enhanced:		
Creation of permanent jobs.	EC-7	HIGH
Improving the quality of life and purchasing power of Project workers and their families.	PB-10	HIGH
Generation of benefits for the population of Pepillo Salcedo through the implementation of the Community Relationship Plan Project.	PB-16	MODERATE
Improvement in the public electric energy service due to an increase in the energy supply.	PB-11	HIGH
Negative impacts to be prevented and mitigated:		
Possibility of affecting the population (workers and communities) due to increased levels of gas emissions, suspended particles, noise and vibrations from the thermoelectric plant's operations.	PB-9	MODERATE
Possible exposure to diseases due to the influx of temporary or permanent labor.	PB-12	MODERATE
Risk of physical injury or loss of life to residents arising from the use of force by Project physical security personnel.	PB-13	MODERATE
Risk of accidents resulting in physical injury or loss of life for workers during the operation of the thermoelectric power plant and the power transmission line.	PB-14	MODERATE
Risk of accidents resulting in physical injury or loss of life to residents and visitors during power plant and transmission line operations.	PB-15	MODERATE

Objective:

- Monitor the status of the communities in the area of direct influence of the project.

Measures to be implemented:

- Investigation and response to complaints and claims received from the local population through the established mechanism.
- Dialogue roundtables and in-depth interviews will be conducted to determine the causes of the complaints.
- Conduct surveys or interviews in the communities in the area of influence of the project when deemed necessary, in which we will ask about their perception of environmental and social problems in these communities, their position on the social and economic influence of the Manzanillo Energy Consortium Power Plant project, measures in which the project benefits the community in different aspects (job creation, purchase of materials, contracting of services, Corporate Social Responsibility Programs, training, environmental protection programs, medical operations, among others).

Indicators and/or parameters to be measured:

- Number of complaints received from community members.
- Number of complaints investigated and responded to by members of the community
- Response time to complaints.
- Results of surveys or interviews.

Goals for the indicators and/or parameters to be measured:

- 100% of complaints received responded to in no more than 20 days.
- Improvement in survey results in relation to what was found during the baseline survey.

Methodology and technology used:

The methodology for following up and responding to complaints is presented in the Complaints, Claims and Suggestions Mechanism for the project.

Monitoring sites: Communities in the area of social influence of the project, which are the municipalities of Pepillo Salcedo and Montecristi, in the province of Montecristi.

Frequency of monitoring: Semiannual.

Implementation time: Throughout the life of the project.

Required records:

- Complaint record forms. Reports with the results of the complaint investigation.
- Reports with the results of the surveys or interviews.

Executor: Community Liaison Analyst.

Supervisor and person in charge: Public Relations Department of Manzanillo Energy Consortium, Inc.

Associated costs:

Sampling will be carried out every six months. According to the estimates presented in Table 8-35, the cost for six-monthly monitoring is **US\$6,730.00**, which means that monitoring will be carried out twice a year, resulting in an estimated annual cost of **US\$13,460.00**.

Table 8-35. Estimated cost of social environment monitoring in the operation phase.

Position	USD\$ period	
Specialists	per campaign	
2 sociologists	1200/each=2,400.00	
3 surveyors	600/each=1,800.00	
Subtotal		USD\$ 4,200.00
Logistics	Details	USD\$ period
Field personnel feeding	21.00/person/day for 6 persons for 5 days	630.00
Driver for personal field transportation	40.00 /day for 5 days	200.00
Fuel	Tours, coordination and meetings	200.00
Subtotal		USD\$ 1,030.00
Materials	Details	USD\$ period
Field materials for monitoring	Field notebooks, pens, insect repellent, among others.	150.00
Expendable material for equipment used in monitoring	Survey forms.	200.00
Office supplies	Printer ink, paper, USB and other items	100.00
Subtotal		USD\$ 450.00
Contingencies and operating expenses	Details	USD\$ period
Contingencies+	Unexpected and/or new expenses (e. g. increase in costs of a product)	550.00
Operating expenses	Internet, telephone and electricity costs	500.00
Subtotal		USD\$ 1,050.00
Cost per campaign		USD\$ 6,730.00
Annual cost		USD\$ 13,460.00

8.2.3 Monitoring plan reports

The monitoring plan reports will be prepared semiannually or according to the frequency established in the project's Environmental License, for the verification of the measures of the preventive, mitigation and compensation measures program and for the monitoring program of each environmental variable, which will be included in the Environmental Compliance Reports (ECRs).

Manzanillo Energy Consortium, Inc., with the support of the Company in charge of the Environmental, Social and Health and Safety Management of the Manzanillo Energy Consortium Power Plant Project, will prepare and upload the ICAs to the ICA platform of the Ministry of the

Environment and Natural Resources every six months or according to the frequency established in the Environmental License, in order to ensure their continued validity in all phases.

ICA information will be uploaded to the ICA platform according to the information demanded by the platform and requested by the Ministry of Environment and Natural Resources.

8.2.4 Responsible for program execution monitoring plan

Manzanillo Energy Consortium, Inc. will be responsible for executing the monitoring plan during both the construction and operation phases. A contract will be maintained with a company in charge of the Environmental, Social, and Health and Safety Management of the Manzanillo Energy Consortium Power Plant project, with the objective of providing advice for the execution of the project's monitoring plan.

Their functions will be external to provide advice, perform environmental audits and environmental quality measurements, they will not have responsibilities for planning and execution of environmental policies and actions. These functions will be the responsibility of Manzanillo Energy Consortium, Inc.

8.2.5 Schedule and costs

The Monitoring Plan will be developed according to the time established for the implementation of preventive, mitigation and compensation measures and the monitoring frequency indicated above for each environmental variable.

The costs of the Monitoring Program will be assumed by Manzanillo Energy Consortium, Inc. during both the construction and operation phases.

8.3 Stakeholder relations plan

8.3.1 Introduction

To identify the project's stakeholders and propose a relationship plan, we start from the four stakeholder groups into which they were classified (see chapter 5):

- a) Stakeholders who understand that the impacts of the project will only be negative for the community and the environment.
- b) Actors in agreement with the Project, with the expectation that there will be more sources of work and few or no suggestions for its execution.
- c) Actors in agreement with the Project, with observations and suggestions for its execution.
- d) Actors in agreement with the Project, but directly affected by its execution.

Within these stakeholder groups, those that could be classified as vulnerable or disadvantaged will be identified.

8.3.2 Disadvantaged or vulnerable individuals or groups

The socioeconomic baseline identified vulnerable or disadvantaged groups in the area of direct influence of the project, although it should be noted that the vulnerability of some of these groups is not necessarily related to the development of the Manzanillo Energy Consortium Power Plant project. In this regard, it is necessary to distinguish between vulnerable groups potentially affected by the project and vulnerable groups whose condition is not a result of the project.

8.3.2.1 Vulnerable groups potentially affected by project development

Vulnerable groups identified as potentially affected by the development of the Manzanillo Energy Consortium Power Plant project include:

Residents in the Villa Ray neighborhood:

The proximity of the Villa Ray neighborhood to the core area of the project makes the inhabitants of this neighborhood vulnerable to potential contaminating effects, especially during the construction phase, if appropriate mitigation measures are not taken.

Beekeepers:

The construction of the project has an impact on the biological diversity of nearby land, not only because of the clearing of plants, but also because it has an impact on beekeeping, since bees feed on substances that they collect from the flowers of plants in the surrounding area and through pollination contribute to the reproduction of the different species of flora.

The Manzanillo beekeepers' association has 10 members. Each beekeeper generates a minimum of temporary employment for three people. All of them, around 30 people, could be negatively impacted by the implementation of the project.

Seniors:

It is foreseeable that the revitalization of the economy of the municipality of Pepillo Salcedo, as well as the increase in immigration, as a result of the development of the project, will bring with it an increase in the cost of goods and services necessary for a decent life.

The elderly, because their income comes mainly from being retired from working life, often do not see their income indexed to the increase in the cost of living, which translates into less access to these goods and services and will lead to a deterioration in the quality of their lives.

8.3.2.2 Disadvantaged groups whose vulnerability is not a result of project development

Women:

Women's vulnerability derives from the condition of inequality addressed in the section on gender aspects in the socioeconomic baseline, particularly economic vulnerability, which is expressed in lower rates of employment for women.

Haitian migrants:

Haitian migrants in the Dominican Republic are a disadvantaged group due to the fact that they do not have the social capital of their country, which is aggravated by the irregular migratory status of many of them. The irregular migratory status, also related to the fact that many of them lack identity documents, is an element of vulnerability that prevents them from integrating into the formal sector of the economy, making it difficult for them to be hired for employment and to have access to social security. This does not mean that these migrants are discriminated against for ethnic or racial reasons, since they can be hired by nationals of that country who have their identity documents and their migratory status is regular.

8.3.3 Stakeholder relations plan

8.3.3.1 Introduction

Through the Stakeholder Relations Plan, the Manzanillo Energy Consortium Power Plant project intends to define the mechanisms and procedures that make it possible to establish permanent communication with the population and community stakeholders, so that they can participate with project management in the prevention and reduction of situations of vulnerability in the area of direct influence, both those existing before the project, described in the baseline, and those generated by its impacts, in its construction, operation and dismantling phases.

This relationship plan will consist of establishing two-way communication mechanisms that will facilitate access to relevant information on the different aspects of the project (job and business opportunities, corporate social responsibility program, mitigation measures for project impacts, etc.), while at the same time seeking to understand the perceptions, requests, claims and complaints of the communities in relation to the operation of the project.

This stakeholder engagement plan was developed based on the identification of four stakeholder groups:

- a) Stakeholders who understand that the impacts of the project will only be negative for the community and the environment.
- b) Actors in agreement with the Project, with the expectation that there will be more sources of work and few or no suggestions for its execution.
- c) Actors in agreement with the Project, with observations and suggestions for its execution.
- d) Actors in agreement with the Project, but directly affected by its execution.

Within these stakeholder groups, those that could be classified as vulnerable or disadvantaged have been identified.

Some of the suggested lines of action and activities are common to all four types of stakeholders identified.

8.3.3.2 Stakeholders who understand that the impacts of the project will only be negative for the community and the environment.

The first group of stakeholders is a sample of the survey applied, which represents a part of the population impacted by the project, with which several lines of action are suggested, which are aimed at the whole population (Table 8-36).

Table 8-36. Lines of action for stakeholders who understand that the impacts of the project will be negative for the community and the environment.

Lines of action	Suggested activities
1. Report the project management on the issues that have been questioned.	1. Produce short videos for social networks on topics such as: advantages of using natural gas, forestation actions, mangrove protection, noise production levels, care of beach areas, testimonials from residents.
	2. Local media tour, explaining the environmental management of the plant.
2. Educational actions that serve as a means of dissemination to the rest of society.	3. Excursions for high school and university students to learn about the operation of the plant.
	4. Invitation to high school and college students to reforestation work.

8.3.3.3 Actors in agreement with the project, with the expectation that there will be more sources of jobs and business opportunities, with few or no suggestions for its execution.

Table 8-37 shows the lines of action for the stakeholders according to the project with the expectation that there will be sources of employment and business opportunities.

Table 8-37. Lines of action for stakeholders according to the project, with the expectation that there will be sources of jobs and business opportunities.

Lines of action	Suggested activities
1. Solicit the support of these stakeholders to promote job training, especially among the youth.	a) Production of motivational videos, testimonials, of short duration, especially aimed at social networks.
	b) In-person invitation to high school and college students for job training.
2. Coordinate with State training entities, such as the National Institute for Technical and Vocational Training (INFOTEP) the company's labor demand and other similar ones.	a) Coordinate with other companies in the sector, which are established in Montecristi, the demand for skilled and technical labor.
	b) Coordinate with INFOTEP the supply of skilled and technical labor training required by these companies to operate.
3. Inform the population through community organizations and local authorities of the project's labor needs and required qualifications.	a) Use different means to communicate the labor needs of the project (community chats, local radio or television programs, mural at the town hall, etc.).

Lines of action	Suggested activities
4. Publish business opportunities (canteens, hardware stores, transportation companies, etc.) related to the project.	a) Use different media to communicate the business opportunities of the project (community chats, local radio or television programs, mural at the town hall, etc.).

8.3.3.4 Actors in agreement with the project, with observations and suggestions for its execution.

Table 8-38 presents the lines of action for the stakeholders according to the project with observations and suggestions for their execution.

Table 8-38. Lines of action for the stakeholders according to the project, with observations and suggestions for their execution.

Lines of action	Suggested activities
1. Approach community organizations, private institutions and local authorities to work jointly.	a) Establish means and persons responsible for the relationship with the community.
	b) Update the list of community organizations and institutions operating locally, compiled as part of the project baseline.
	c) Periodic and informal visits by those responsible for community relations and other company stakeholders to homes in the community.
2. The operation of the plants generates confidence in the community.	a) Develop visits by key community stakeholders to learn about the operation of the plants.
	b) The community is invited to participate in the performance monitoring process.
	c) The community participates in the company's Complaints, Claims and Suggestions Mechanism process.
3. Community participation in the definition and execution of the company's strategic actions.	a) Identify and define, in a participative manner, actions that, following the company's social responsibility policy, have an impact on the development of Manzanillo.
	b) The community participates in the implementation of the company's social responsibility actions.

8.3.3.5 Proposed measures to ensure equal participation of women and men

To facilitate the equal participation of women and men in the activities of this stakeholder engagement plan, the following measures are recommended:

- That consultation and follow-up meetings, as part of this stakeholder engagement plan, ensure that, regardless of the gender of their leaders, at least one woman from each organization participates.
- Conduct interviews and focus groups with individuals belonging to the organizations of both sexes, to determine perceptions and needs.
- Conduct focus groups with women to address gender issues relevant to this project stakeholder engagement plan.

- d) Because women often find it difficult to leave their homes and participate in meetings at times that coincide with their household chores, schedule meetings at times that do not coincide with such chores.
- e) Due to the sensitivity of certain topics related to gender issues, meetings and focus groups with women will be coordinated by a woman.
- f) In specific cases where members of vulnerable groups, of both sexes, are unable to participate in meetings where decisions are made that may affect them, project management must identify these individuals and take specific measures to ensure that they are informed and that their rights are not violated.
- g) To reach agreements with the Municipal Council of Pepillo Salcedo so that part of the resources from municipal taxes generated by the project will be invested in actions aimed at addressing the vulnerability of women.
- h) Consider the specific needs of the women of Pepillo Salcedo, for their participation in the Project's Social Investment Plan.

8.3.4 Resources, responsibilities and work schedule

The resources to carry out the actions defined in this stakeholder engagement plan will mostly be provided by the promoter company. The community may contribute by providing their premises, homes, or collaborating in the dissemination of informative or educational videos.

The work schedule should begin prior to the execution of project actions in the field, in order to inform the different stakeholders, especially the residents of Villa Ray, of the general course of action and to coordinate prevention actions and visualize possible impact mitigation actions.

This proactive action can also contribute to the training of local personnel, who can be evaluated and participate in the installation or operation of the plant.

8.4 Grievance mechanism, claims and suggestions for the project

In accordance with the International Finance Corporation (IFC) Standards, Grievance Mechanisms are instruments that ensure that Affected Communities and external communications from other stakeholders are responded to and handled appropriately.

The value of these instruments lies in the fact that they make it possible to establish solid, constructive and appropriate relationships that are essential for the successful management of a project's environmental and social impacts.

The grievance mechanism should be tailored to the risks and adverse impacts of the project, and the Affected Communities should be its primary users and should not impede access to other administrative or judicial remedies.

This promotes adequate participation of the Affected Communities, providing the means for such participation throughout the project cycle, in matters that may affect them, and ensuring that relevant environmental and social information is disclosed and disseminated.

8.4.1 General objective

Establish a set of procedures for the purpose of receiving, evaluating, responding to and/or addressing concerns, claims or complaints from people and/or communities in the area of influence of the project in relation to its construction and operation.

8.4.2 Specific objectives

Design and make available to the public instruments that can be used to receive claims and complaints from individuals and the communities of the urban area of Pepillo Salcedo (Manzanillo) and the Copey, Carbonera and Los Conucos sections, in relation to the operations of the thermoelectric power plant.

Define the structure and procedures to be used for the evaluation of claims and complaints presented by the people and/or communities of the urban area of Pepillo Salcedo (Manzanillo) and the Copey, Carbonera and Los Conucos sections, in relation to the operations of the thermoelectric power plant.

Define criteria that allow reaching agreed solutions to claims or complaints between Manzanillo Energy Consortium, Inc. and the people and/or the communities of the urban area of Pepillo Salcedo (Manzanillo) and the Copey, Carbonera and Los Conucos sections, in relation to the operations of the thermoelectric power plant, when pertinent.

8.4.3 Complaint evaluation structure and procedure

Grievance assessment team: Initially a team will be formed consisting of two people: the project director and the Community Relations officer. In some cases, a member of the community with leadership and consultation skills will be invited.

Once this mechanism is socially recognized and the experience is assumed in the community, the organizations will be invited to propose this third member, for one year.

Conciliation with the complainant(s): The first option will be to invite the claimant(s) to a meeting to find common ground leading to a solution.

Agreed decisions: When it is not possible to conciliate with the claimant(s) and whenever possible, decisions on the claim shall be made in a concerted manner among the three members of the evaluation team.

Responsible Complaints: Anonymous complaints and grievances will not merit a response, although if they are verified, they may be considered for internal purposes, as they could be indicators of situations that the project's community relations officer must prevent and address.

Relevance or eligibility of the claim: The relevance or eligibility of the claim will be the first point to be established by the evaluation team. The evaluation team shall avoid rejecting a claim based on its relevance or eligibility without first giving the claimant the benefit of the doubt, and the claimant shall be invited to discuss to determine, among other aspects, whether the claim is

related to the project, whether the evaluation team has the authority to respond to the claim, or whether the claimant has the right or justification to file the claim or grievance.

Claim response time: All claims will be responded to within 7 - 21 days. However, this may vary in cases in which, due to their urgency or peremptoriness, they must be dealt with more promptly. These cases will be considered by the members of the evaluation team.

Community complaints: In cases where the claims are of a community nature, the organizations (neighborhood councils, mothers' centers, development council, etc.) involved in the claim will be summoned to hear the concerns and worries in person.

Right of appeal: The claimant(s) shall have the right to appeal the decision made by the evaluation team, which shall be communicated to them, including the possibility for them to provide new evidence or arguments to give greater force or foundation to the claim.

External arbitration: In cases where no conciliation or compromise can be reached between Manzanillo Energy Consortium, Inc. and the claimant(s), the claimant(s) will be informed of the right to resort to the pertinent public instances and to seek protection under national laws.

Systematization of the experience: A project employee will be in charge of filing the claims in a central registry, including the response given to each claim, the status of the claim, among others.

Attached is a proposal for a central registry to follow up on complaints and claims.

8.4.4 Instruments for the reception and evaluation of claims, complaints and suggestions

Face-to-face: This method will be privileged, trying to establish direct communication between the claimant(s) and the person in charge of community relations of the Manzanillo Energy Consortium Power Plant Project, who will establish a schedule from 10 A.M. to 12 A.M. two days a week for such purpose.

Suggestions and/or complaints mailbox: This will be placed at the security checkpoint at the entrance to the project facilities with a sign that clearly identifies it and where the telephone number and address of the website and social networks are also placed. The mailbox may be used, at the option of the complainant, in the event that he/she presents him/herself at the facilities at a time when the office is not open.

Forms: The form must contain information for the Complaint or Grievance about the project and must be available on a table or shelf accessible to the public, placed at the security checkpoint at the entrance of the project for purposes of filling out a printed form; or send the complaint via letter, WhatsApp or email. Which must have the following content:

- a. Current date.
- b. Explain the claim or complaint about the Project: What is the problem? Who is affected? How has it affected them?
- c. Attach evidence of the problem, means that prove the existence of the problem: photos, videos, documents, others.
- d. Indicate the date from when the problem occurred.
- e. Report the location where the problem is occurring. If it is in a house or several houses, the name of the street with its number or several numbers, as the case may be, the name of the neighborhood.
- f. Explain if, in addition to filing this complaint, other measures have been taken to resolve the problem, indicate which measures.
- g. If you have considered proposals to solve the problem, please mention which suggestion(s) you have.
- h. Enter your first and last name. If more than one claimant, name and surname of the representatives (two or three). Cell phone number (to contact them), include the number of several people.
- i. Name of the organization or entity to which they belong (if applicable).
- j. Preferred method of sending the response: address (street, number, neighborhood, town), telephone number with WhatsApp or e-mail.

The proposed form is attached.

Telephone number of the Manzanillo Energy Consortium Power Plant Project: The automatic option of will be programmed to submit the claim or complaint.

Project page: On social networks (Facebook, Instagram, Twitter, etc.), with direct message mechanisms activated.

Company email and/or website: To send the claim or complaint.

Community chat (whatsapp/Telegram): Involving community organizations and any person residing in the project's area of influence who expresses interest.

8.4.5 Criteria and aspects to be considered in the phase of reception of claims and complaints

Written claims or complaints will be acknowledged at the Manzanillo Energy Consortium Power Plant project office and will be forwarded to the evaluation body.

The stakeholder will receive a written record of the claim or complaint.

Upon receipt of the complaint, it should be communicated in writing that a response will be provided within 7-15 days. In the case of minor issues, the response may be provided sooner.

The community relations officer for the Manzanillo Energy Consortium Power Plant project should maintain permanent contact with the leaders of the organizations (neighborhood councils, churches, etc.). In this way, community concerns and worries will be known and will prevent them from turning into claims or complaints, since they will be answered in advance.

Periodic surveys will be conducted, annually during the first two years coinciding with the construction phase and every 5 years during the operation phase, to determine the population's perceptions regarding the project's progress and potential community complaints regarding errors and undesired impacts during the construction and operation phases, so that corrective policies can be adopted when they are identified.

A brochure explaining the project's claims, complaints and suggestions mechanism will be prepared and distributed to community organizations and can be obtained at the project office. It will also be available on the Manzanillo Energy Consortium, Inc. website or on the social media page (Facebook, Instagram). The content of this proposed grievance mechanism brochure can be included in the forms, on the project website or on the WhatsApp number.

What is the Project's grievance mechanism?

Consists of a procedure to receive, evaluate, respond and/or address concerns, problems or complaints from the communities of influence of the project.

Who can use the Project's grievance mechanism?

Inhabitants of the communities of the urban area Pepillo Salcedo (Manzanillo) and the Copey and Carbonera sections.

Why is it important to use this grievance mechanism?

The operations of the thermoelectric generation plant seek to develop in harmony with the surrounding communities where it will be installed. Therefore, it is important to establish this mechanism for dialogue and grievance resolution.

What are the requirements to file a claim?

A very important requirement to file a claim or complaint is to submit evidence or documents to support the case. In this regard, and depending on the type of claim, copies of documents or photographs, among others, must be submitted.

How long does it take for the project to respond to the claim or complaint?

The maximum time to respond to a claim is 21 calendar days. This may be less depending on the urgency of the claim.

Can the decision made by the Project be appealed?

An appeal may be made in writing to the Grievance Review Team within 10 days of receipt of the response.

The Grievance Assessment Team consists of the project manager and the Community Relations Officer. In some cases a member of the community participates.

After an appeal of the response to a claim has been filed, the Evaluation Team will reconvene and provide a new response within 15 calendar days, and this review of the decision will be the last one that can be made by the Evaluation Team.

If there is still dissatisfaction with the decision taken, external arbitration will be sought and as a last resort the complainant may submit his complaint to the competent public body.

Does the project provide assistance in filing claims?

When a person or group of people have a complaint or suggestion they can come forward to the project and seek the person in charge of community relations. You can also write to the complaint box located at the entrance of the Project, or to the web complaint box, email or WhatsApp.

A brochure proposal is attached as Annex 17.

8.4.6 Systematization of the experience

The following is the proposed central registry for tracking community complaints and grievances:

Code		
Date of entry		
Time of registration		

Claim	Claimant	Organization or institution	Relevance or Eligibility of the Claim	Severity of the claim	Response or proposed solution	Response status
Manzanillo Energy Consortium, Inc. has not complied with the commitment to balance the hiring of women and men in the project.	Leader of the Mothers' Center.	Mothers Center	Relevant, inasmuch as the project promoter undertook to seek a balance in the hiring of female and male labor.	Media	The Human Resources area of Manzanillo Energy Consortium, Inc. will evaluate the possibility of prioritizing the hiring of women for new vacancies, provided that they are qualified for such positions.	Of the last ten (10) hires, seven (7) have been female. O, this claim has not been resolved because the new vacancies have not been filled by women with the qualifications required in the job description.

8.5 Climate change adaptation plan and emission mitigation measures

The Dominican Republic is a country that is highly exposed to extreme weather phenomena due to its island status and its location in the hurricane path. Moreover, its social and economic characteristics make it vulnerable to the effects of climate change.

As a developing island state, it is highly vulnerable to the impacts of climate change. Article 194 of the Constitution of the Dominican Republic contemplates this phenomenon, establishing as a priority of the State the "formulation and execution of a land use plan that ensures the efficient and sustainable use of the Nation's natural resources, in accordance with the need to adapt to climate change".

The country has been a signatory to the United Nations Framework Convention on Climate Change since 1994, which was ratified in 1998. It is also a signatory to the Kyoto Protocol, which entered into force in 2005.

Since then, agencies have been created and public policies have been developed to adapt to and mitigate the effects of climate change.

Among the public institutions in charge of formulating and following up on these policies are the National Council on Climate Change and Clean Development Mechanism and the Ministry of Environment and Natural Resources.

The National Council on Climate Change and Clean Development Mechanism is in charge of formulating public policies for the prevention and mitigation of greenhouse gases and adaptation to climate change. This council has the National Climate Change Office, with a working table made up of different ministries.

In addition, the Ministry of Environment and Natural Resources has a Climate Change Directorate that is responsible for following up on the different international agreements related to climate change in the Dominican Republic.

Likewise, the main public policies on climate change are based on the Fourth Axis of the National Development Strategy 2030, which seeks: "a society with a culture of sustainable production and consumption, which promotes adequate adaptation to climate change", whose main objectives include environmental sustainability, risk management and climate change adaptation. Regarding this last point, the specific objective is to "advance in the adaptation to the effects and mitigation of the causes of climate change."

The Dominican State formulated, through a highly participatory process, its National Climate Change Policy, which is aimed at establishing norms to prevent and mitigate emissions that cause global warming, as well as adaptation to its impacts. It was one of the first Latin American countries to submit its Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) and, in early 2017, ratified the Paris Agreement.

The above demonstrates the understanding and importance for the Dominican Republic of the impacts of climate change for sustainable, global and national development. It also evidences the commitment assumed to contribute to its mitigation and adapt to its impacts.

8.5.1 Carbon footprint calculation

With the installation of the Manzanillo Energy Consortium Power Plant project, it has been estimated that 2,943,360 MWh per year and 73,584,000 MWh will be generated during the 25-year life of the project.

In terms of climate change mitigation, the production of electricity from the Manzanillo Energy Consortium combined cycle natural gas power plant project will avoid the emission of a large amount of tons of CO₂ eq annually compared to other electricity production technologies.

Thus, in the Table 8-39 and Figure 8-8 eq tons of CO₂ avoided are shown by comparing them with the Emission Factor of the Dominican Republic Electricity Mix (Standardized baseline: Grid Emission Factor for the Dominican Republic, ASB0047-2020) and with the Emission Factors of other electricity production technologies (2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 2: Energy).

Table 8-39. Comparison of avoided CO₂ emissions eq.

Technology	Emission Factor (Tn CO ₂ eq/MWh)	Annual Electricity Production (MWh)	Electrical Production Useful Life (MWh)	Tn CO ₂ eq Annual	Tn CO ₂ eq Useful Life
Manzanillo Energy Consortium Power Plant (LNG)	0.2019	2,943,360	73,584,000	594,264.38	14,856,609.60
Electric Mix RD	0.6131	2,943,360	73,584,000	1,804,574.02	45,114,350.40
Petroleum Coke	0.3532	2,943,360	73,584,000	1,039,594.75	25,989,868.80
Diesel	0.2368	2,943,360	73,584,000	696,987.65	17,424,691.20
LPG	0.2341	2,943,360	73,584,000	689,040.58	17,226,014.40
Coal	0.4438	2,943,360	73,584,000	1,306,263.17	32,656,579.20
Municipal Waste	0.3869	2,943,360	73,584,000	1,138,785.98	28,469,649.60
Biomass (wood)*	0.4302	2,943,360	73,584,000	1,266,233.47	31,655,836.80

* The CO₂ eq emissions from biomass burning are taken with a value of 0, as they are considered as neutral, the same CO₂ eq generated by burning is the same that the tree absorbs during the growing period.

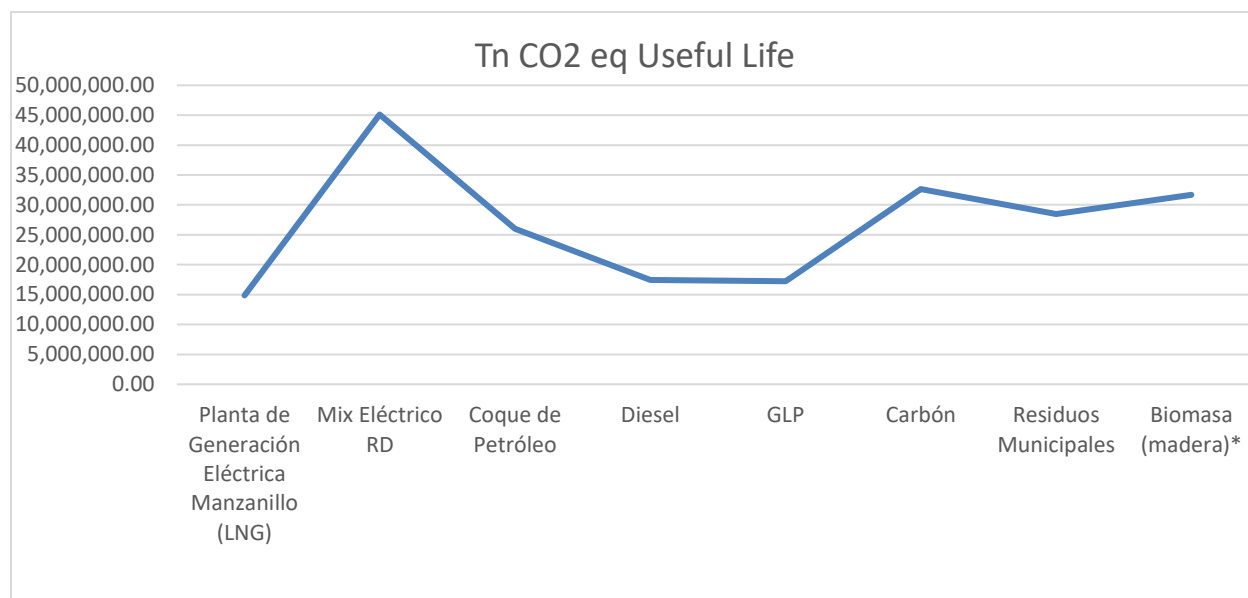


Figure 8-8. Tons of CO_{2eq} avoided during the life of the project compared to different technologies.

As a conclusion to the previous table, it can be said that with the construction of the Manzanillo Energy Consortium Power Plant project of net power, an amount of **1,210,309.64 Tn CO₂ eq** will not be emitted to the atmosphere annually and **30,257,741 Tn CO₂ eq** during the 25 years of useful life of the project (comparing it with the Dominican Republic's Electrical Mix).

8.5.2 Climate Change Adaptation Plan

Adaptation to climate change or climate adaptation is understood as the adoption of measures to prepare for and adjust to the current and expected effects of climate change. Adaptation consists of five general stages: 1) awareness, 2) assessment, 3) planning, 4) implementation, and 5) monitoring and evaluation. In this section we will focus on climate change adaptation planning according to the stages of the project: construction and operation/maintenance.

Target

The objective of the plan is to:

- Reduce vulnerability to climate change impacts, building adaptive capacity and resilience;
- Facilitate the integration of climate change adaptation, in a coherent manner, into policies, programs and activities relevant to the project, particularly in development planning processes and strategies and at different levels, as appropriate.

The main climate change adaptation actions by project stage are presented below.

Construction Stage

Table 8-40. Adaptation measures to be applied during the construction stage.

Phenomenon	Affected environment in the project area	Adaptation measures
Heavy rains/flooding.	Facilities and workers.	<ul style="list-style-type: none"> Review and incorporation of hurricane and flood factors in the design and construction of the thermoelectric power plant, such as construction of storm barriers to protect against high waters, buffer elevation of infrastructure to protect against flooding. Implementation of early warning systems. Early warning systems include detection, analysis, prediction and then dissemination of warnings, followed by decision making and implementation of responses. An early warning system should comprise four interacting elements: (i) knowledge of risk, (ii) monitoring and warning services, (iii) dissemination and communication, and (iv) response capability. Construction of adequate storm drainage system for the project. Incorporate green and soft measures such as improving and extending the stormwater management system to other areas. Establish protocols for flood prevention and response measures (see section 8.9: Emergency Preparedness and Response Plan). Strategically relocate mechanical equipment, IT infrastructure and other mission critical equipment that may be disrupted by high winds, rain, flooding.
Hurricanes and storms.	Facilities and workers.	<ul style="list-style-type: none"> Implementation of early warning systems. Early warning systems include detection, analysis, prediction and then dissemination of warnings, followed by decision making and implementation of responses. An early warning system should comprise four interacting elements: (i) knowledge of risk, (ii) monitoring and warning services, (iii) dissemination and communication, and (iv) response capability. Hurricane prevention and response measures (see section 8.9: Emergency Preparedness and Response Plan). Strategically relocate mechanical equipment, IT infrastructure and other mission critical equipment if they may be disrupted by high winds, rain, flooding.
Drought.	Facilities, workers and vegetation.	<ul style="list-style-type: none"> Establish reservoirs or alternative water sources for construction purposes and personnel consumption. Contemplate within the design and construction, the installation of low-flow showers and faucets for kitchens, sinks and bathrooms, dual-flush toilets, etc. Establish a sustainable water consumption plan and implement it when a drought period is foreseen. Implementation of early warning systems.
Temperature increase.	Facilities and workers.	<ul style="list-style-type: none"> Incorporate resilient and low-carbon construction measures in design and construction, such as: use of low-emission materials, use of equipment and machinery that generate

Phenomenon	Affected environment in the project area	Adaptation measures
		low emissions, use of materials resistant to high environmental temperatures. <ul style="list-style-type: none"> • Incorporate designs with solutions based on nature, intelligent and sustainable design, taking advantage of environmental resources such as wind currents and temperatures. • Apply protocol in case of increased temperatures, for working personnel, following the Emergency Preparedness and Response Plan).
Forest fires.	Vegetation, facilities, workers.	<ul style="list-style-type: none"> • Review and incorporate in the design and construction, fire resistant building codes, fire alarm systems. • Fire prevention and response measures (see section 8.9: Emergency Preparedness and Response Plan). • Establish a monitoring and communication system for forest fires near the project area.
Vector and pest infestation.	Facilities and workers and wildlife.	<ul style="list-style-type: none"> • Plans for solid waste management measures for the construction and operation phases (see sections 8.1.1.3 and 8.1.2.2). • Monitoring and control of vectors and rodents avoiding the use of highly toxic chemicals (see section 8.1.2.6: Pesticide Management Plan). • Incorporate fumigation plan.

Prevention and monitoring measures such as early warning systems, monitoring systems, should be incorporated into the project in an integral way, where information can be gathered about the climatic state, behavior and extreme changes that may occur in order to prepare and take action.

Operating Stage

Table 8-41. Adaptation measures to be applied during the operation phase

Phenomenon	Affected environment in the project area	Adaptation measures
Heavy rains/flooding.	Facilities and workers.	<ul style="list-style-type: none"> • Application of monitoring and early warning systems. Early warning systems include detection, analysis, prediction, and then dissemination of warnings, followed by decision making and implementation of responses. An early warning system should comprise four interacting elements: (i) knowledge of risk, (ii) monitoring and warning services, (iii) dissemination and communication, and (iv) response capability. • Establish protocols for flood prevention and response measures (see section 8.9: Emergency Preparedness and Response Plan). • Strategically relocate mechanical equipment, IT infrastructure and other mission critical equipment that may be disrupted by high winds, rain, flooding.

Phenomenon	Affected environment in the project area	Adaptation measures
		<ul style="list-style-type: none"> • Incorporate flood water pumps in the facilities. • Implement on-site green infrastructure. • Include and maintain green infrastructure that helps reduce runoff and stormwater flows that might otherwise exceed the capacity of the system. Examples of green infrastructure include: bioretention areas (rain gardens), low-impact development methods, green roofs, swales (depressions to capture water), and the use of vegetation or permeable materials in place of impervious surfaces.
Hurricanes and storms.	Facilities and workers.	<ul style="list-style-type: none"> • Implementation of early warning systems. Early warning systems include detection, analysis, prediction and then dissemination of warnings, followed by decision making and implementation of responses. An early warning system should comprise four interacting elements: (i) knowledge of risk, (ii) monitoring and warning services, (iii) dissemination and communication, and (iv) response capability. • Implement a communication plan for employees in the event of hurricane, storm, drought or forest fire warnings. • Hurricane prevention and response measures (see section 8.9: Emergency Preparedness and Response Plan). • Strategically relocate mechanical equipment, IT infrastructure and other mission critical equipment if they may be disrupted by high winds, rain, flooding. • To count on the development of alternative "off-grid" energy sources to cover electricity and potable water deficits. • Verify that circuit breakers have insulation materials or protection on mains feeders.
Drought.	Facilities, workers and vegetation.	<ul style="list-style-type: none"> • Reuse of flue gas process water. • Use ice to cool the air upstream of the gas turbine (increases efficiency and performance; melted ice can be used in the cooling tower) • Use a condenser at the cooling tower outlet to reduce evaporation losses by up to 20%. • Consider alternative technologies in air-based refrigeration (dry cooling). • Apply water desalination systems for use in supplying the thermal power plant (see sections 8.1.1.7 and 8.1.2.7). • Incorporate water saving measures, Water Consumption Efficiency Plans. • Having alternative water sources such as rainwater harvesting systems, water reservoirs, reuse and treatment of gray water.
Temperature increase.	Facilities and workers.	<ul style="list-style-type: none"> • Avoid burning waste. • Implement energy and water consumption savings plan. • Improving energy efficiency and optimizing operations • Retrofit intakes to accommodate lower flows or water levels. <i>In areas where flow decreases due to climate change, water levels may drop below the intakes of water treatment plants.</i>

Phenomenon	Affected environment in the project area	Adaptation measures
		<ul style="list-style-type: none"> Creation and maintenance of green areas with native and endemic species (see section 8.1.1.10: Terrestrial biota protection measures plan). Use of safety equipment (clothing) suitable for high temperatures, which regulate humidity.
Forest fires.	Vegetation, facilities, workers.	Fire prevention and response measures (see section 8.9: Emergency Preparedness and Response Plan).
Vector and pest infestation.	Facilities and workers and wildlife.	<ul style="list-style-type: none"> Solid waste management plans for the construction and operation phases (see sections 8.1.1.3 and 8.1.2.2). Vector and rodent pest control avoiding the use of highly toxic chemicals (see section 8.1.2.6: Pesticide Management Plan).

Climate change mitigation plan

Target

- Climate change mitigation strategies focus primarily on reducing greenhouse gas emissions from the construction and operation of the project.

Among the measures to be implemented are:

- Establish and implement an energy savings and efficiency plan.
- Optimization of processes to reduce energy needs, as well as recycling and reprocessing. Proper waste management
- The integration of vegetation into the project (nature-based solutions) as green areas
- Application of technologies for system efficiency and emissions reduction.
- Reforestation plan based on the total emissions that will originate from the construction and operation of the project.
- Implement leak review and maintenance protocol. Conducting an extensive leak survey as part of the overhaul is considered good practice, as these types of emissions are often the easiest and most cost-effective to control.

Implement a GHG emissions accounting program (greenhouse gas inventory), with a plan of actions to reduce emissions in the low, medium, and long term. GHG inventories will be conducted annually after establishing a base year.

8.5.3 Emission mitigation plan applicable to the project

Based on the analysis carried out previously, at the national level, in which more than 30% of national GHG emissions come from the energy sector, the development of the Manzanillo Energy Consortium Power Plant project itself, with a capacity of approximately 420 MW, is a mitigation measure at the national level, and can be framed within the "Replacement of coal or net oil plants with natural gas", considered a transitory energy option.

The operation of the Manzanillo Energy Consortium Power Plant project with a capacity of approximately 420 MW will generate an estimated net power generation of **3,200,000 MWh annually** and **80,000,000 MWh during the 25-year life of the project**. In terms of climate change, for example, compared to the same electricity production at a coal-fired plant, the project will be reducing **1,318,991.06 T CO_{2e} annually** and **32,974,776.50 T CO_{2e} over the 25-year life of the project** (See Table 6-65).

As with any power generation project involving the burning of fuel (natural gas), a series of mitigation measures can be implemented to help reduce the carbon footprint of the construction and operation phases of the project, as calculated in the following section. 6.1.15.2.2.

For the construction phase, the emission source with the greatest weight in the carbon footprint is indirect emissions associated with equipment transportation (96.3%) and the rest of the emissions in fixed and mobile sources and electricity consumption (3.7%).

Based on these data, mitigation measures should be targeted to this source, but since Scope 3 emissions are not under the control of the developer, it is difficult to implement mitigation measures.

Generally speaking, the mitigation measures applicable to each of the emission scopes of the construction phase may be as follows:

➤ **Scope 1:**

- Connection to the National Electric Power System to avoid the use of emergency power generators, thereby reducing fuel consumption.
- Use of natural gas or LPG-powered construction machinery instead of conventional diesel-powered equipment, depending on the availability of such equipment at the national level.
- Use of electric vehicles for the displacement of project construction personnel, within the availability of the promoter.
- Establishment of efficient transportation routes for personnel and materials transportation.
- Sensitization of personnel on efficient and defensive driving and efficient planned transportation routes.
- Maintenance of equipment, machinery and vehicles, with the frequency recommended by authorized workshops.
- To have a maintenance record and a log of oil and coolant changes performed on equipment, machinery and vehicles.
- Maintenance of fire extinguishers and establishment of a maintenance log.

➤ **Scope 2:**

- Establishment and implementation of low energy consumption or energy saving policies.
- Awareness campaigns for all personnel, contractors and subcontractors on the efficient use of resources, climate change and energy savings.
- Installation of energy-efficient lighting systems and electrical equipment such as air conditioners, refrigerators, among others.
- Keeping monthly energy consumption records.

➤ **Scope 3:**

- Purchase of equipment, structures, construction material in countries close to the Dominican Republic, when possible, to reduce transportation distances.
- Sensitization of driving personnel on efficient driving and the importance of planning routes to save time and fuel.
- Use of transportation that uses less polluting fuels as much as possible.
- Ask suppliers for maintenance reports on the equipment and machinery used, describing the frequency of maintenance and changes of oils, coolants and fuels.

As a general measure, an annual GHG emissions monitoring plan is proposed, through a report of total actual emissions from project construction and project operation on an annual basis.

For the operation phase, the emission source with the greatest weight in the carbon footprint is direct emissions from fixed sources from the burning of natural gas for electricity production (82.44%) and the rest, emissions from mobile sources (0.003%), fugitive emissions from flares (8.24%), fugitive emissions from losses (6.00%), electricity consumption (1.89%) and emissions from LNG transportation (1.42%).

In general, the mitigation measures applicable to each of the emission scopes of the operation phase may be the following:

➤ **Scope 1:**

- Use of natural gas with a higher methane composition (greater than 95% in composition).
- Installation of natural gas burning equipment and production of electricity with the highest efficiency in the market.
- Reduce heat recovery losses in the system.
- Reduce natural gas leaks in piping systems and equipment.
- Use the natural gas burned in the flare to generate electricity for the plant's self-consumption.
- Improve flare combustion with steam or air control.
- Use of electric vehicles for the displacement of project operation personnel.
- Establishment and implementation of a policy for the efficient use of resources: water, energy and raw materials.
- Awareness campaigns for all personnel on the efficient use of resources, energy savings, mitigation of greenhouse gas emissions and social responsibility.
- Maintenance of equipment, machinery and vehicles, with the frequency recommended by authorized workshops.
- To have a maintenance record and a log of oil and coolant changes performed on equipment, machinery and vehicles.
- Maintenance of fire extinguishers and establishment of a maintenance log.

➤ **Scope 2:**

- Installation of renewable electricity production systems for self-consumption (solar panels, wind turbines, etc).
- Installation of lighting fixtures and electrical equipment with low energy consumption characteristics in all power plant facilities and administrative offices.

- Implementation of energy use and efficiency policies, including air conditioning and lighting schedules.
- Keeping monthly energy consumption records.

➤ **Scope 3:**

- Purchase of LNG in countries close to the Dominican Republic, when possible, to reduce transportation distances.
- Use of transportation that uses less polluting fuels, within the availability that exists in the country.
- Procurement of materials, equipment and raw materials in the country, according to availability.

As a general measure, it is proposed to measure and report the carbon footprint of the project on an annual basis, establishing the baseline of the footprint (GHG inventory) and setting GHG reduction targets, subsequently, the implementation of mitigation measures.

Carbon neutral plan

Carbon neutrality implies achieving a net result of zero greenhouse gas (GHG) emissions, that is, emitting into the atmosphere the same amount of gases that are absorbed in other ways. Absorption of GHGs is achieved through carbon sinks. Sinks are any system, natural or artificial, that absorbs more carbon than it emits. The main natural carbon sinks are soil, forests and oceans, which assimilate atmospheric carbon and transform it into oxygen, helping to reduce the amount of CO₂ from the air. In this regard, Article 2 of the Paris Agreement establishes the goal of reducing greenhouse gas emissions in order to keep the increase in global average temperature to well below 2°C above pre-industrial levels and to continue efforts to limit this temperature increase to 1.5°C.

The Intergovernmental Panel on Climate Change (IPCC) presented a special report in 2018 on the expected impacts of global warming of 1.5 °C above pre-industrial levels and the emissions pathways corresponding to that increase. The report warned that, to limit global warming to 1.5 °C would require "rapid and far-reaching" transitions in energy, industry, architecture, transportation and urban planning. It further warned that global net emissions of man-made CO₂ would need to fall by about 45% by 2030 from 2010 levels and continue to do so until they reach "net zero" by about 2050.

Once the mitigation targets are implemented in the construction and operation phases of the project, a portion of the GHG emissions generated will be reduced, but the other portion, called residual GHG emissions, will have to be offset to achieve "carbon neutrality" for the power plant.

To achieve carbon neutrality, the project has the option of adopting the following offsetting measures:

- a) Reforestation plans at the national level in sites of conservation interest such as protected areas, if possible.
- b) Purchase of carbon credits in the United Nations regulated market, thus contributing to the development of more Clean Development Mechanism (CDM) projects. In this way, it would be receiving a certificate from the United Nations that guarantees the compensation made.

- c) Purchase of carbon credits in the voluntary carbon market, accredited by recognized international standards such as VERRA, GOLD STANDARD, VCS, among others.)
- d) Execute a mixed reforestation and carbon credit purchase project to offset project emissions.

8.6 Occupational health and safety plan

The following are the different sections of the occupational health and safety plan to prevent or reduce the impacts and risks to workers' health and safety arising from project activities.

8.6.1 Objectives

General objective:

The purpose of this document is to describe the measures to prevent the occurrence of accidents or incidents, injuries and occupational diseases during the performance of the activities that will be executed in the project.

Specific objectives:

- At the end of the project, maintain the Lost Time Injury Rate Ratio (LTIR) at zero.
- Maintain the Total Recordable Incident Rate Ratio (TRIR) at 0.
- Comply with the norms established in the project by the client and with the Safety and Health at Work Regulations, Decree number 522-06 and the applicable international norms.
- Keep site personnel informed of project changes or situations.
- Motivate all site personnel to comply with the project's health and safety plan.
- Promote good security practices.

8.6.2 Scope

This occupational health and safety plan applies to all work and activities related to the construction and operation of the Manzanillo Energy Consortium Power Plant project.

The occupational health and safety plan for the Manzanillo Energy Consortium Power Plant project will be submitted to the Ministry of Labor by the main construction contractor during the construction phase and by the power plant operator during the operation phase. The document to be submitted to the Ministry of Labor will comply with all the requirements established by the Occupational Safety and Health Regulations (Decree 522-06).

Subcontractors in both the construction and operation phases must prepare their health and safety plans, adapting them to the risks to which their workers are exposed according to the work contracted.

The costs of implementing the occupational health and safety plans will be borne by the main contractor and the corresponding subcontractors.

8.6.3 Applicable national and international legislation

National legal framework:

- Occupational Health and Safety Regulations (Decree No. 522-06).
- Regulation for Safety and Fire Protection of the Dominican Republic R-032.
- Occupational Risk Regulation (which requires the reporting of work accidents and occupational diseases to the Occupational Risk Insurance Company, ARL).
- Labor Code of the Dominican Republic (Law No. 16-92) and complementary resolutions.
- Law No. 147-02 on Risk Management.
- General Law of Social Security (Law 87-01).
- General Health Law (Law 42-01).
- Law 35-11 on HIV-AIDS (which prohibits HIV testing of employees without their authorization and discrimination against those affected by this virus).

International legal framework:

- World Bank Environmental, Health and Safety Guidelines
- IFC Performance Standards, especially Performance Standard 2: Labor and Working Conditions.

8.6.4 Roles and responsibilities

Project Manager:

- Promote among the personnel under their responsibility the compliance with the measures contemplated in this safety plan, manage the necessary equipment and resources to ensure the effective implementation of the established health and safety plan.
- Motivate personnel to carry out good safety practices during the execution of the work.
- Participate in internal inspections to determine improvements to be implemented in work areas.
- Promote safety induction and training for workers.
- Represent the company by attending the meetings established in the project.
- Participate in accident or incident investigations.

Safety, Health and Environment Coordinator:

- Instruct personnel on the specific hazards and risks of the work to be performed.
- Report unsafe acts detected in the work areas.
- Review compliance with inspections of equipment, power tools, fire extinguishers, etc., being used on the project.
- Keep records of daily safety talks.
- Promote good safety practices among personnel.
- Follow up on a daily basis the documentation that is processed in the project.
- Provide topics for daily 5-minute safety talks.
- Inspect the condition of personal protective equipment used by workers.
- Report any accident or incident to the customer and internally.
- Prepare established health and safety reports.

- Lead investigations of accidents or incidents on the project.
- Participate in the meetings established in the security plan.
- Conduct internal safety meetings.
- Collaborate with the reports established in the project.

Construction Administration Manager/Plant Manager in operation phase:

- Identify the main risks in the work area to control or eliminate them if possible.
- He shall guide the personnel under his charge on the best way to carry out the work based on technical methods.
- Motivate the personnel under his charge to comply with the objectives established in this document by the company.
- Comply with the provisions indicated in the safety plan.
- Manage regulatory documentation on the project before starting activities.
- Do not start activities until work permits are approved.
- Promote order and cleanliness in work areas.
- Report accidents or incidents that may occur upon learning of them to the Safety, Health and Environment Coordinator.
- Manage the necessary resources for the protection of personnel.
- Apply this procedure and the necessary preventive measures in order to ensure that personnel carry out their activities safely.

Company in charge of Environmental, Social and Health and Safety Management:

This company will be an external contractor in charge of:

- Supervision and advice on compliance with the Occupational Health and Safety Regulations (Decree 22-06) and World Bank Environmental, Health and Safety Guidelines, among others that may apply.
- Supervision and advice on compliance with the Environmental and Natural Resources Law (Law 64-00), Dominican environmental regulations, the International Finance Corporation's Performance Standards, and the project's Environmental, Social, and Health Management Program (ESHMP).

Joint Occupational Safety and Health Committee:

- Promote occupational health and safety.
- Participate in supervisions and inspections of workplace conditions.
- Promote and provide health and safety training.
- Facilitate the agreements that allow and guarantee the establishment and promotion of the safety and health policy in the workplace.
- Inform the employer of all hazardous situations in the workplace.
- Promote and supervise the company's compliance with occupational health and safety provisions.
- Participate in the planning of all proposals related to working conditions that influence the safety and health of workers.

- To report on planned or proposed measures related to working conditions that affect the safety and health of workers.
- To report on measures planned or implemented in the workplace aimed at preserving and promoting occupational health and safety.
- Motivate workers regarding the importance of effective occupational health and safety.
- Collaborate in the organization and implementation of occupational safety and health training programs.

All staff:

- Comply with all safety standards established in the health and safety plan and project standards.
- Identify existing risks and hazards to control or eliminate them.
- Concentrate on your work to avoid accidents due to distractions.
- Do not operate equipment or machinery in which you are not authorized.
- Report unsafe conditions on site that require immediate improvement.
- Report any accident situation to the supervisor at the time of its occurrence.
- Correctly use the personal protective equipment assigned to them on the project and maintain it in good condition.
- Collaborate with the order and cleanliness of their work areas.
- Participate in daily safety talks.
- In case you do not understand any work arrangement assigned to you or document used on site you should ask the supervisor to explain it again until it can be understood.

8.6.5 Definitions

Workplace: Covers all places where workers are required to stay or where they have to go because of their work and where they are under the direct or indirect control of the employer.

Prevention actions: These are activities aimed at eliminating or controlling risks to avoid accidents and/or occupational or occupational diseases.

Risk: It is the probability of an adverse event, impact or consequence occurring. It is also understood as the possibility and magnitude of adverse impacts, being the consequence of the hazard.

It is a potential measure of economic loss or injury in terms of the probability of occurrence of an undesirable event together with the magnitude of the consequences.

Serious and imminent occupational hazard: Any condition that is rationally foreseeable, materializes in the immediate future, and could result in serious harm to the health of workers.

Occupational hazard: A condition with the potential to generate accidents and/or occupational or professional diseases.

Health: In relation to work, not only the absence of disease or illness, but also the physical and mental elements that affect health and are directly related to occupational safety and health.

Worker: Any natural person who renders a material or intellectual service under an employment contract.

Hazard: Any situation, act, condition or energy source that has the potential to produce harm in terms of:

- Injury or illness
- Property damage
- Damage to the environment
- A combination of:

Work condition: Any characteristic of the work that may have a significant influence on the generation of risks to the safety and health of the worker.

Hazardous conditions: It is the exposure to risk.

Air pollution: Air pollution is air contaminated by substances that, whatever their physical state, are harmful to health or involve any type of danger.

Work accident: These are events that result in damage to persons, property or losses in the normal work process.

Occupational disease: It is a disease directly caused by the exercise of the profession or work performed by a person and which causes incapacity or death.

Machines: For the application of this plan, all machines moved by non-human power, whether new or second-hand, shall be considered as such.

Risk assessment: It is the qualitative and quantitative study of risk factors present in workplaces.

Safe Task Analysis (STA): This is a form that must be filled out daily by the personnel involved in an activity and must be done for each work activity of the company. It must detail the steps of the task, hazards, risks and control measures to mitigate or minimize them. It shall be signed by the supervisor and/or foreman and all employees involved in an activity at the beginning and end of the activity, as proof that the work was completed without incident. In case of any eventuality, it should be included in this document.

Joint occupational health and safety committee: This is the main body for worker participation and consultation in the risk prevention program.

8.6.6 Occupational health and safety policy

Manzanillo Energy Consortium, Inc. will establish an Occupational Health and Safety policy, defining the Health and Safety objectives and principles to be applied in the context of the project and at all activity sites, and designating the person or persons responsible for its implementation.

The policy will be based on the commitment of top management and will aim to support the day-to-day implementation of the health and safety management plan, in particular by:

- Demonstrate the importance of Health and Safety.

- Ensure the availability of the resources (economic, material and human) necessary to implement and maintain the prevention and protection measures adopted.
- Ensure compliance with applicable laws and regulations in force in the Dominican Republic, international agreements and the Performance Standards (PS) on Environmental and Social Sustainability of the International Finance Corporation (IFC).
- Promote active employee participation, communication and cooperation.
- Encourage each worker to report incidents, risks, opportunities and accidents.
- Actively promote the identification of opportunities for health and safety improvement, including visits and follow-up of objectives.

The Occupational Health and Safety Policy shall apply to all contractors and subcontractors, shall be signed by senior management, distributed to all workers, made public and reviewed annually or more frequently when necessary.

8.6.7 Project personnel organization chart

For the execution of the work on this project, an Occupational Health and Safety staff was established for both the construction and operation phases, who will be responsible for complying with the guidelines established in this document.

A Safety, Health and Environment Coordinator has been established within the project, as well as a Company in charge of Environmental, Social and Health and Safety Management, which will be an external advisor. A Joint Occupational Health and Safety Committee will also be created. This committee in the construction and operation phases is made up of:

- President-Employer Representative.
- Secretary-Employer's Representative.
- Technical advisor to the company in charge of environmental, social and health and safety management.
- Employee representative members.

Figure 8-9 shows the organization and composition of the Joint Health and Safety Committee in the construction and operation phases of the project.

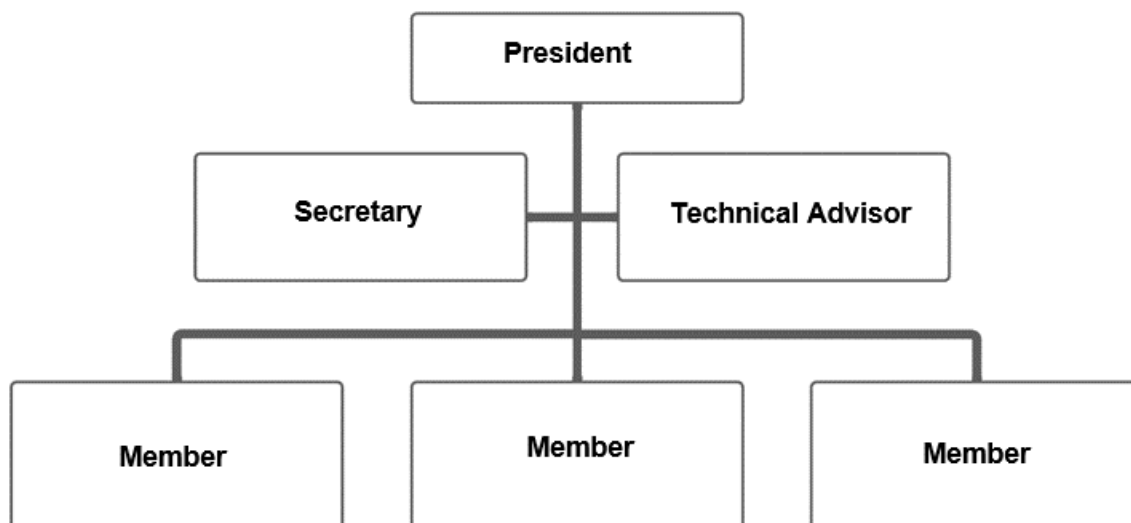


Figure 8-9. Organizational chart of the Joint Committee on Occupational Safety and Health in Construction.

The Occupational Health and Safety Committee during both the construction and operation phases must be registered with the Health and Safety Directorate of the Ministry of Labor of the Dominican Republic, by attaching a copy of its Articles of Incorporation.

8.6.8 Communication procedure

Communication is of vital importance for compliance with the standards and requirements within a project. The more informed the personnel is, the less possibility of non-compliance with health and safety standards due to lack of knowledge.

The communication procedure to be followed is as follows:

- During the daily safety talks, points of interest related to construction site issues and aspects of safety, health and the environment will be conveyed verbally to the workers.
- Bulletins and memos will also be implemented on site to provide information to personnel.

8.6.9 Risk management

8.6.9.1 Hazard identification

The different types of hazards and risks identified for the project activities are described below:

Physical risks

During the construction and operation activities of the project, various tools and equipment will be used, equipment assembly, electrical installations, natural gas processing, combustion process

for steam production, operation process of the electricity generating units and maintenance activities will be carried out, which may generate the following hazards and physical risks.

- Moving parts of machinery (cuts, bruises, bumps)
- Noise
- Vibrations
- Electrical hazard
- Eye hazards
- Welding / Hot work
- Driving of vehicles and traffic on the premises (hit-and-run)
- Working environment temperature (heat)
- Ergonomics, repetitive movements, manual handling
- Work at height (falls)
- Lighting
- Burns
- Exposure to natural elements (drowning, sunstroke, dehydration)

Chemical hazards

Chemical substances will be handled, stored and used during construction and operation activities. In addition, LNG and nitrogen will be used during the operation stage. Chemical risks may arise from handling or from spills and leaks of chemical substances.

The potential chemical hazards and risks that may occur during the execution of project activities are as follows:

- Air quality (presence of pollutants in the workplace)
- Fires and explosions
- Corrosive, oxidizing and reactive chemicals (health effects)

Improper handling of chemical substances can affect the health of workers, either through contact with the skin or eyes, or by breathing hazardous substances, and can cause damage to equipment, people and the environment.

Biological hazards

During project activities, especially during the construction phase, hazards and biohazards such as insect bites and/or insect stings may occur.

animals that can transmit diseases. Contact with poisonous, stinging or allergenic vegetation may also occur, and the SARS-CoV-2 virus (COVID-19) may be present. The latter can occur during both construction and operation.

Special risks

During the construction and operation stages of the project, special risks related to confined spaces and lone working and isolation may occur.

A hazardous atmosphere may form in confined spaces as a result of the contents, location or construction of the confined space or due to work performed in or around the confined space that can cause serious injury or death.

When a worker is performing work in solitary and isolation, i.e. when he/she is out of visual range and out of oral communication with a supervisor or other workers or other people, he/she may be exposed to a greater risk if an accident were to occur.

Other risks

During the operation stage of the power plant, workers may be exposed to electric and magnetic fields (non-ionizing radiation) because they work near electrical equipment, power generators and high-voltage transmission lines.

8.6.9.2 Risk assessment

Table 8-42 and Table 8-43 show the occupational health and safety risk assessment matrices for activities during the construction and operation stages of the project, respectively.

Table 8-42. Results of the occupational health and safety risk assessment during the construction stage.

Danger/Risk	Probability	Consequences	Risk classification
Moving machinery parts (cuts, bruises, bumps)	High	Moderate	H
Noise	High	Insignificant	L
Vibrations	Moderate	Insignificant	L
Electrical hazard	Moderate	Severe	E
Eye hazards	Low	Moderate	M
Welding / Hot work	Low	Moderate	M
Driving of vehicles and traffic on the premises (hit-and-run)	Moderate	Severe	E
Temperature of the working environment	Low	Insignificant	L
Ergonomics, repetitive movements, manual handling	Low	Moderate	M
Work at height (falls)	Moderate	Catastrophic	E
Lighting	Low	Mild	L
Burns	Low	Moderate	M
Air quality (presence of pollutants in the workplace)	Low	Moderate	M
Fires and explosions	Low	Moderate	M
Corrosive, oxidizing and reactive chemicals (health effects)	Moderate	Severe	E
Insect stings and/or bites from animals that can transmit diseases	Low	Moderate	M
Contact with poisonous, stinging or allergenic vegetation, and the following occur	Low	Moderate	M

Danger/Risk	Probability	Consequences	Risk classification
SARS-CoV-2 virus (COVID-19).	Moderate	Moderate	H
Confined spaces	Low	Severe	H
Solitary work and isolation	Low	Severe	H

E: Extreme risk; H: High risk; M: Moderate risk; L: Low risk.

Table 8-43. Results of the occupational health and safety risk assessment during the operation stage.

Danger/Risk	Probability	Consequences	Risk classification
Moving parts of machinery (cuts, bruises, bumps)	Moderate	Moderate	H
Noise	Moderate	Insignificant	L
Vibrations	Low	Insignificant	L
Electrical hazard	High	Catastrophic	E
Eye hazards	Low	Moderate	M
Welding / Hot work	Minimal	Moderate	M
Driving of vehicles and traffic on the premises (hit-and-run)	Low	Severe	H
Temperature of the working environment	Low	Insignificant	L
Ergonomics, repetitive movements, manual handling	Low	Moderate	M
Work at height (falls)	Moderate	Catastrophic	E
Lighting	Low	Mild	L
Burns	Low	Moderate	M
Air quality (presence of pollutants in the workplace)	Moderate	Moderate	H
Fires and explosions	Low	Catastrophic	E
Corrosive, oxidizing and reactive chemicals (health effects)	Moderate	Severe	E
Insect stings and/or animal bites that can transmit diseases	Minimal	Moderate	M
Contact with poisonous, stinging or allergenic vegetation, and the following occur	Minimal	Moderate	M
SARS-CoV-2 virus (COVID-19).	Moderate	Moderate	H
Confined spaces	Low	Severe	H
Solitary work and isolation	Low	Severe	H
Electric and magnetic fields (EMF) Non-ionizing radiation.	Moderate	Insignificant	L

E: Extreme risk; H: High risk; M: Moderate risk; L: Low risk.

8.6.9.3 Inspections

Personnel shall perform periodic inspections in a documented manner.

Inspections considered:

- Daily inspections.
- Pre-use inspections of equipment and tools.
- Weekly inspections.

Daily inspections:

On a daily basis, the Safety, Health and Environmental Coordinator will conduct inspections and record any deviations or unsafe acts detected. These deviations shall be corrected by the Construction Administration Manager or Plant Manager in the operation phase within the agreed time frame.

Pre-use inspection of equipment and tools:

- Prior to operating mobile equipment and machines at the start of each shift of their operation; users shall perform and document the Pre-use Inspection.
- The pre-use inspection form will be used to document the inspections (Form IV). These forms shall be completed and signed by the user and forwarded to the immediate supervisor for review.
- Each work front will prepare forms for pre-use inspections as required.
- Supervisors shall ensure that equipment shall not be put into operation if hazards exist that may prevent the safe operation of the equipment or machine.
- Pre-use inspection forms will be sent to the maintenance department for follow-up and repair purposes.
- Pre-use inspection reports shall be kept on file in the maintenance department for a minimum of one month or until the faults are repaired and the equipment is tested.

Weekly inspection:

An internal documented inspection of personnel in their work areas within the project will be carried out weekly (Form V). This evaluation will be carried out by the Safety, Health and Environment Coordinator in the company of the Project Manager and members of the Joint Occupational Safety and Health Committee.

Deviations detected in the internal inspection must be corrected as soon as possible by the construction department. Depending on the type of observations, 24 to 48 hours will be established for their correction.

8.6.9.4 Health and safety prevention, control, protection and mitigation measures

The following are the measures to be implemented to prevent, control and mitigate potential occupational health and safety hazards and risks for each of the hazards and risks identified.

General measurements:

- Develop procedures, instructions and formats on occupational health, hygiene and safety management.
- Perform the Safe Work Analysis (SWA) for each specific activity to be performed and indicate the prevention and control measures corresponding to the activity.
- Conduct regular meetings on occupational health and safety issues.
- Periodic cleaning of all areas.
- Prevent unauthorized persons from accessing dangerous areas.
- Adequately signpost hazardous areas, facilities, materials, safety measures and emergency exits.
- Conduct periodic inspections of structures and facilities and activities to identify occupational health and safety findings and opportunities for improvement.

General design aspects to be considered

- Structural integrity of workplaces
- Adverse weather conditions and plant shutdowns
- Work area and exits
- Fire prevention
- Toilets and showers
- Drinking water supply
- Clean dining areas
- Lighting
- Secure access
- First aid
- Air supply
- Temperature of the working environment

Physical risk prevention and control measuresRelated to moving machinery parts

- Use properly designed equipment, machines and tools, in good condition and with adequate guards (when applicable), that eliminate the risks of entrapment, blows, cuts and bruises.
- Delimit safety zones with respect to the circulation of machinery and vehicles.
- Do not exceed speeds of 30 km/h on the construction site and with internal load vehicles (during operation).
- Use cones and luminous signs in danger zones.
- Develop and implement a lockout/tagout procedure.
- Use of personal protective equipment (helmet, glasses, safety boots).

Occupational noise and vibration

- Try to use acoustic insulation materials, source isolation.
- Evaluate noise emission conditions and critical sites to define the need to establish and implement technical controls.

- Implement appropriate engineering or administrative controls to reduce noise exceeding 85 dB to safe levels, such as noise barriers, fixed and/or movable barriers.
- Maintain all rolling equipment and machinery in good mechanical condition.
- Minimize, as much as possible, the operation time of noise emission sources and avoid having idle equipment in operation.
- Avoid unnecessary use of alarms, horns and sirens.
- Use hearing protection when occupational noise levels exceed 85 dBA.

Electrical hazard

- Delimit the safe working area for the use of cranes and similar equipment.
- Do not allow crane booms to come within 5 meters of overhead power lines.
- Assistance of a watchman for crane work.
- Hiring of qualified personnel to carry out line laying and electrical work.
- Definition and disclosure of clear procedures for the execution of line laying and electrical works.
- Use of tools, equipment and electrical materials in good condition.
- Identify with signs or labels electrical apparatus, equipment and lines, and high voltage or prohibited or controlled access equipment.
- Establish no-access areas near or under high-voltage power lines.
- Develop and implement lockout/tagout procedures.
- Perform periodic inspections or revisions of cables, cords and electrical tools.
- Provide double insulation or grounding for all electrical equipment.
- Use extension cords fed from circuits protected by ground fault circuit interrupters (GFCIs) or outlets with GFCIs.
- Protect electrical cables from traffic with a protective coating.
- Identify and mark buried electrical wiring.
- Use of personal protective equipment (e.g. insulating gloves).

Eye hazards

- Develop and implement safe work procedures for using tools or equipment such as grinders and sanders and when working with chemicals.
- Use screens or splash guards on machinery or equipment with risk of chemical splashes or projection of solid particles.
- Establish areas or measures to restrict the passage or protection of workers near areas with machinery and equipment that can project solid particles, liquid chemical substances or gas emissions.
- Provide workers with eye and face protection equipment when machines or operations present a potential for eye or facial injuries resulting from exposure to chemical or physical agents.
- Have eye wash bottles and water for situations that require rinsing or safety eye wash.

Welding / Hot work

- Develop and implement safe procedures for hot work.
- Place protective screens around the work area where welding work is performed.

- Install systems for extraction and elimination of toxic fumes produced by welding work.
- Provide welding workers with welding goggles or welder's visors.

Driving of vehicles and traffic on the premises (hit-and-run)

- Conduct training for vehicle drivers on safe driving.
- Place speed limit signs or notices and road safety signs on the project's internal roads.
- To have the appropriate licenses for the type of vehicle to be driven.
- Perform preventive and corrective maintenance on vehicles and rolling equipment.
- Install audible reversing systems on all vehicles and rolling equipment.
- Restrict the circulation of vehicles and rolling equipment in areas or routes where there are worker crossings or work areas with workers.

Temperature of the working environment

- Avoid exposure to extreme temperatures in work areas.
- Install ventilation systems in work areas where extreme temperatures are present.
- Develop safe work procedures to prevent temperature stress.
- Provide temporary shelters for weather protection during activities or for resting areas.
- Provide means of hydration, such as drinking water, to all workers.
- Provide protective clothing to workers.

Ergonomics, repetitive movements, manual handling

- Develop and implement an ergonomics program.
- Provide adequate workstations for the worker.
- Use mechanical assistance to lift materials, objects or tools.
- Conduct training related to ergonomic risk factors and best practices.
- Conduct workplace assessments and observations to identify ergonomic problems.
- Implement breaks for rest and stretching in the work processes and perform personnel rotation.
- Workers should report to the supervisor, in case they experience any signs or symptoms of musculoskeletal disorders.
- Follow up on all worker reports of symptoms of musculoskeletal disorders.

Work at height (falls)

- Make sure to use footwear with non-slip soles when working at heights on slippery ladders.
- Use adequate means of access to high points. In the absence of such means, the use of double anchorage is mandatory.
- Any access to installations with risk of falling from heights must be carried out by a team of at least 2 people, one of them always supporting the worker performing the work at height.
- Work shall be performed by personnel tied off with fall arrest equipment (harnesses) attached to resistant points of the structure or lifeline, for the entire duration of the movement and positioning for work.

- Perform the correct use of appropriate ladders (fixed or stepladders).
- Circulate on the stairs without running, jumping or rushing, and using all the steps. Do not distract your eyes while using the stairs.
- Ensure that scaffolds are safe before climbing and that a flat, smooth walking surface is available.
- Conduct training for personnel on working at heights.
- Each work area must have personnel trained in height rescue and equipment for this purpose.
- Perform visual inspections prior to each use, to detect signs of damage or defects to all fall protection systems or equipment and their components.

Lighting

- Comply with minimum limits for lighting intensity in work areas.
- Work areas should receive, whenever possible, natural light, which should be supplemented with sufficient artificial light using energy-efficient light sources with minimal heat emission.
- To provide additional illumination for the performance of certain tasks requiring greater visual acuity.
- To have emergency lighting of adequate intensity that is automatically activated in the event of a cut in the main source of artificial light supply.
- Periodically verify that the facilities have acceptable lighting conditions and that there is no glare, reflections or flickering lights.

Burns

- Ensure proper insulation of steam lines when performing maintenance work on them.
- Use of appropriate personal protective equipment for high and low temperature work when required.
- Signaling the mandatory use of personal protective equipment in work areas that present this type of risk.
- Proper maintenance of thermal insulation systems.
- Develop safe work analysis and pre-talk prior to the start of daily activities.

Exposure to natural elements (drowning, dehydration, sunstroke)

- Drinking water to reduce the risk of heat-related illnesses. Workers should consume sufficient amounts of water throughout the day and water should be made available to each employee.
- Provide rest periods to recover from hard work in the sun before symptoms of heat stress occur.
- Require for work near aquatic environments that personnel know how to swim and the mandatory use of life jackets.

Chemical hazards

The following measures should be implemented to prevent or reduce chemical risks on air quality, fire and explosions and those related to the handling and spills of chemical substances.

Handling of chemical substances:

- Place labels and signs to inform workers of chemical hazards.
- Have available to personnel, and in the work areas, the material safety data sheets (SDS), in Spanish language, regarding the precautions to be taken for the handling of chemical substances.
- Periodically train personnel on the proper handling of the chemicals they use and the personal protective equipment to be used.
- Provide personnel with the personal protective equipment required for handling chemicals as specified in the SDS.
- To have at the work sites the minimum equipment, materials and supplies required to deal with emergency situations with chemical substances as indicated in the respective SDS.
- Have eye wash bottles and water at work sites for situations that require rinsing or safety washing.
- Maintain an updated inventory of chemicals in use.

Chemical spills or leaks:

- To minimize hazards, all spills or leaks of hazardous materials should be attended to immediately, after consulting the Material Safety Data Sheet (MSDS) for the substance.
- All emergency and safety equipment must be constantly checked and properly maintained for eventual use. Personal protective equipment should be decontaminated and cleaned after use.
- Liquid spills should be absorbed with a suitable absorbent solid, compatible with the spilled substance. The area should be decontaminated according to the instructions given by trained personnel and the residues should be disposed of according to the instructions given in the Material Safety Data Sheets (MSDS).
- Written procedures should be established to act safely in the event of a spill or leak.
- Maintenance work in work areas should be kept to a strict minimum. If maintenance work is carried out in the work areas, it should be done on surfaces that have some type of temporary waterproofing.
- When maintenance work is performed on equipment from which fuels or lubricants may drain, containers should be used for the collection of such fluids and spill containment material should be kept close to the site.
- Prior to the start of operation, prepare a Contingency Plan (including a Spill Prevention, Control and Containment Plan) specific to the operation phase.

Pesticide use and handling

- An integrated pest management (IPM) or integrated vector control (IVC) approach targeting economically significant pest infestations and disease vectors of public health importance will be applied.
- The client's IPC and VIC programs will integrate the coordinated use of environmental pest information with available pest control methods.
- When pest management activities include the use of chemical pesticides, those with low toxicity to humans, proven efficacy against the species to be controlled and with minimal effects on other species and the environment should be selected.

- When selecting chemical pesticides, the selection will be based on whether they come in safe containers, are clearly labeled for proper and safe use, and are manufactured by an entity that has a current authorization granted by competent regulatory agencies.
- Pesticides shall be handled, stored, applied and disposed of properly.
- Products included in classes "Ia" (extremely hazardous) and "Ib" (highly hazardous) and class "II" (moderately hazardous) of the WHO recommended classification of pesticides according to their hazardousness shall not be purchased, stored or used.

Fires and explosions

- Design the storage areas for flammable substances considering the entrances and exits of the facilities, inlets and vents, with ventilation system, accessories and fire-resistant materials.
- Store flammable substances away from sources of ignition and oxidizing materials.
- Provide grounding of containers and spark detection systems when flammable material consists of dust.
- Post signs about special rules that must be followed in fire hazard areas.
- Conduct training for workers on the handling of flammable substances and on fire prevention and extinguishing measures.
- Ensure the availability of the required fire prevention and extinguishing equipment.
- Always maintain access to firefighting equipment.
- Locate all firefighting equipment in accessible places and have adequate signage.
- Inspect firefighting equipment periodically and maintain it in operable condition. Defective equipment should be replaced.
- Have an equipped and trained firefighting crew (Fire Brigade).
- Prohibit smoking in all areas of the project, except in those specifically designated and authorized for this purpose. To this end, the project will post signs with the following legends: "No Smoking" or "No Unauthorized Lighting of Fires".
- Use only containers and portable tanks approved for the storage and handling of flammable and combustible liquids.

Biological hazards

Animal bites and/or insect stings:

- Require personnel to wear appropriate work clothing that minimizes skin exposure to animals and insects.
- Prohibit personnel from unnecessarily disturbing wildlife in the area.
- Instruct personnel on the hazards when working in areas presenting this type of risk and the pertinent precautionary measures.
- Develop safe work analysis and pre-talk prior to the start of daily activities.
- Provide insect repellent to personnel who require it.
- In areas where this risk exists, personnel should not circulate alone, but work in crews.

Contact with poisonous, stinging, allergenic vegetation

- Require personnel to wear appropriate work clothing that minimizes skin exposure to this type of vegetation.
- Prohibit personnel from touching or collecting vegetation in work areas.
- Provide gloves for those activities where direct contact with vegetation is unavoidable.
- Instruct personnel on the hazards when working in areas presenting this type of risk and the pertinent precautionary measures.

SARS-CoV-2 prevention measures (COVID-19) for workers and visitors

Personnel should implement measures to control the transmission of the SARS-CoV-2 virus. To this end, personnel should address the following actions:

- Frequent hand washing with soap and water for at least 20 seconds. In their absence, and if hands are not visibly soiled, use a hand sanitizer containing at least 70% or up to 95% alcohol.
- Use mask to cover nose and mouth.
- When coughing or sneezing use a disposable cloth, if not available, use the inner corner of the elbow. Wash your hands immediately.
- Keep at least two (2) meters away from other people.
- Do not touch any surface if it is not necessary.
- Avoid touching your face, mouth, nose and eyes.
- Do not share personal protective equipment.
- Clean and disinfect surfaces, tools, equipment, automobiles frequently, using an approved product.
- Waste should be properly disposed of in airtight containers to prevent the spread of materials contaminated with the virus.
- An employee who has been exposed to a known case of COVID-19 or is diagnosed with COVID-19 must strictly comply with the appropriate notification and quarantine requirements.
- If an employee shows symptoms of COVID-19: fever or chills, cough, shortness of breath, difficulty breathing, fatigue, muscle or body aches, headache, loss of taste or smell, sore throat, nasal congestion or discharge, nausea or vomiting, diarrhea, he/she should not report to the workplace. You must follow the diagnostic protocol established by the health authorities. If during the workday you begin to develop symptoms of coronavirus, stop work and immediately report the condition to your supervisor.
- Apply all the measures indicated and regulated by the health authorities.

It is clarified that the application of some of these measures in the project (use of masks, distancing) will vary depending on the COVID-19 alert level in the country, always following the recommendations of the Ministry of Public Health.

Non-ionizing radiation

Occupational exposure to EMFs should be avoided or minimized by implementing the following actions:

- Exposure to non-ionizing radiation sources should be controlled so that they do not exceed internationally recommended limits.
- Evaluate the potential exposure by comparing it to the reference levels developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). Average and maximum levels shall be kept below those recommended by ICNIRP for General Public Exposure.
- Where EMF levels are confirmed or expected to exceed recommended exposure limits, engineering techniques that reduce EMF created by power lines, substations or transformers should be considered. Examples of such techniques include:
 - Protect with specific metal alloys
 - Burying transmission cables
 - Increasing the height of transmission towers
 - Modifying the size, spacing and configuration of electrical conductors
- Development and implementation of an EMF safety program that includes the following components:
 - Identification of potential exposure levels in the workplace, including studies on exposure levels in new projects and the use of personal monitors during work activities.
 - Training of workers in the identification of occupational EMF exposure levels and risks.
 - Creation and identification of safety zones to differentiate work areas where EMF levels are expected to be elevated compared to acceptable levels of exposure for the population, and to allow entry of appropriately trained workers only.
 - Implementation of action plans to address both potential and confirmed exposure levels that exceed the reference levels for occupational exposure established by international organizations.

Special risks

Confined spaces

- Develop and implement a confined space procedure, including obtaining a special permit.
- Conduct adequate training on the procedure, risk controls and use of personal protective equipment in confined spaces.
- Check the atmosphere of the confined space to ensure that the oxygen content is between 19.5% and 23% and the presence of gas or vapor does not exceed 25% of their respective lower explosive limits.
- If atmospheric conditions are not met, the confined space should be ventilated to a safe condition or entry should be made only with the necessary additional personal protective equipment.
- Develop plans and have adequate and sufficient rescue and recovery equipment in place prior to a worker's entry into a confined space.

Lone work

- Develop and implement a procedure or protocol for solo work.
- Verify that all safety measures and personal protective equipment are in place before work begins.

8.6.9.5 Safety signage

The objectives of on-site signage are as follows:

- To draw attention to risks so that they do not materialize into accidents.
- Alerting workers when emergency situations arise that require urgent protective or evacuation measures.
- Facilitate workers to locate and identify the means and facilities for protection, evacuation, emergency or first aid.
- Orient and guide workers performing certain dangerous maneuvers.
- Orient visitors to the project.

Signaling in itself does not constitute a means of protection or prevention, but rather complements preventive action by acting on human behavior to avoid accidents.

It is a complementary measure or an interim alternative for safety prevention until the necessary measures are implemented.

Safety signage on site and at the project facilities during the operation phase will be of various types as described below.

Warning signs: These are triangular-shaped signs with a black pictogram on a yellow background and black borders. Warns of a risk or danger (Figure 8-10).





Figure 8-10. Warning signs.

Prohibition signs: These are round signs, with a black pictogram on a white background, borders and a red transverse band. They prohibit a behavior that may cause danger (Figure 8-11).



Figure 8-11. Prohibition signs.

Obligation signs: These are round signs with a white pictogram on a blue background. It obliges to a certain behavior (Figure 8-12).



Figure 8-12. Signs of obligation.

Rescue or distress signs: These are rectangular or square-shaped signs with a white pictogram on a green background. They provide indications regarding emergency exits, first aid or life-saving devices (Figure 8-13).



Figure 8-13. Rescue and distress signals.

Signs related to firefighting: These are rectangular or square shaped signs, with a white pictogram on a red background. They provide indications regarding the location of firefighting equipment, (Figure 8-14).



Figure 8-14. Signs relating to firefighting.

Colored signs referring to the risk of falling, collisions and blows: Signs shall be made by means of alternating yellow and black stripes. The stripes should have an approximate 45° inclination, (Figure 8-15).



Figure 8-15. Signs for risk of falls, collisions and blows.

8.6.9.6 Fire prevention and protection

The following will be implemented as fire prevention and protection measures:

- Avoid accumulation of combustible material such as: garbage, oil and grease waste, flammable and combustible material, cardboard.
- In places where combustible materials are stored, a 9 kg multipurpose extinguisher (ABC) or carbon dioxide (CO₂) extinguisher should be placed so that, in the event of a fire, it can be controlled, and its spread prevented.
- It is forbidden to throw flammable or toxic materials on the ground or in sewers.
- The accumulation of garbage, dust, flammable and combustible oil waste, the lack of cleanliness in machinery, equipment, installations and tools, are agents for the presentation of a fire outbreak.
- Isolate combustible wastes and garbage, providing the means for their proper disposal.
- All places where combustible materials are stored should be well ventilated and if possible a 9 kg fire extinguisher should be kept in the area.
- All areas where hot work is performed must be kept free of combustible materials and must have a 9 kg fire extinguisher. All vehicles, equipment and machinery must have a properly charged and inspected fire extinguisher.

The condition of the fire extinguishers available on site shall be inspected monthly and a record shall be kept (Form VI: Fire extinguisher inspection control form).

8.6.9.7 Personal Protective Equipment (PPE)






During the construction phase, each contractor will be responsible for supplying the necessary personal protective equipment to its workers (Form VII: Personal Protective Equipment Assignment Form).





During the operation phase, the thermoelectric power plant operator will be responsible for supplying personal protective equipment to its workers, as well as ensuring that contractors do the same.

The Safety, Health and Environment Coordinator shall inspect the different contractors to ensure compliance with this measure.

Some of the basic personal protective equipment to be provided to workers are listed in Table 8-44.

Table 8-44. Protective equipment during the construction phases of the project.

Protective equipment	Use
Safety helmet. 	Its use is always mandatory in any type of work during the construction phases.
Safety glasses. 	Its use is mandatory in all work and operations where there are risks that affect the eyes, such as projections of solids or liquids. Depending on the risk, protection will be applied to the entire face (face shields), as in the cases of welding, grinding and others.
Hand protection "Gloves". 	The use of protective gloves is mandatory in all work and operations requiring manual contact with sharp, moving, sharp, toxic, corrosive or hot materials. The use of insulating gloves is especially important for live electrical work and operations or maneuvers in electrical installations.
Safety footwear. 	Their use is mandatory in all workplaces, they protect against falling objects and others.
Safety belt. 	The use of this means of protection, combined with additional safety lines, is mandatory in all work at heights where there is a risk of falling.
Hearing protectors "Earplugs or Helmets".	Its use is mandatory in those works or areas where the noise level is higher than the permissible level.

Protective equipment	Use
	
Work clothes. 	<p>In addition to the personal protective equipment itself, each operator shall also be provided with the corresponding work clothes, which shall be worn at all times and properly cared for.</p>
Respiratory tract protection, "Filtering masks or autonomous equipment." 	<p>The mandatory use, depending on the case, of one or the other means will be determined according to the type of contaminant and exposure time or duration of the work.</p>
Reflective vest  <small>shutterstock.com · 1265370154</small>	<p>Its use will be mandatory in the areas where equipment and vehicles circulate on the construction site.</p>

Additional personal protective equipment may be required depending on the nature of the work to be performed.

8.6.9.8 Equipment and tools

Hand tools must be in good condition; the use of tools made or repaired by workers on site will not be allowed. Users are responsible for their inspection and correct use.

Power tools should be checked daily by the user before each use, considering the condition of the electrical cable and the manual application systems.

8.6.9.9 Sanitary installations

The project will have a sufficient number of portable restrooms for use by site workers (1 for every 10-15 workers), which will be rented from a company accredited by the Ministry of the Environment and Natural Resources. This company will be responsible for periodic maintenance and proper disposal of the wastewater removed. Hand-washing facilities will be provided next to the bathrooms.

During the operation phase, there will be conventional restrooms, which will be differentiated for men and women. The minimum number of toilets and sinks will be 1 for every 20 workers. In men's restrooms, 50% of the toilets may be replaced by individual or collective urinals.

Bottled drinking water of recognized brands will be supplied to project workers on a permanent basis. Water will be purchased from local suppliers.

Likewise, there will be canteens and places for shelter during work interruptions caused by bad weather and during rest hours.

8.6.9.10 Accident reporting

Any illness or incident occurring to a worker must be reported immediately to the Safety, Health and Environment Coordinator.

- In the event of an incident/accident you should immediately inform the supervisor, foreman of the area where you are working or the Safety, Health and Environment Coordinator, either verbally, by radio or telephone.
- If you have no knowledge of first aid, do not touch the injured person.
- Remain calm and wait for assistance personnel, only give indications of what happened and the exact location.
- If the accident is not serious, the injured person will be mobilized to the point where the ambulance is located.
- If you are a witness to the accident, please cooperate by giving information about what happened.

After the accident, the following actions should be taken:

- The Safety, Health and Environmental Coordinator will prepare a written accident report within 24 hours (Format X). A copy of the report will be given to all stakeholders.
- The notice of occupational accident to the Labor Risk Insurance Company, ATR-2 (Format IX: Format of notice of occupational accident to the ARL, ATR-2) shall be prepared.

Incidents resulting in property damage or serious injury to personnel and hospitalization of employees will be fully investigated and reported.

The project will be promptly informed verbally of all incidents involving the project:

- Fatal injuries and occupational diseases.
- Occupational injuries and illnesses requiring medical treatment.
- Occupational injuries and illnesses resulting in restricted work or loss of time.
- Damage to project property.
- Damage to contractors' property.
- Significant environmental incidents.
- Any incident involving site personnel.

8.6.9.11 Accident or incident investigation

Work accidents are events that result in damage to persons, property or losses in the normal work process.

Incident is any unintended or planned event that causes personal injury, property loss and damage to the environment.

All recordable and non-recordable accidents will be investigated.

- Case of death or fatality (FAT).
- Restricted work accident (RWC).
- Lost Time Injury (LTI).
- Medical treatment case (TCM).
- First Aid Case (FAC).
- Near Miss (NM).
- Motor vehicle accident (MVA).
- Environmental Impact (EI).

A committee will be appointed to conduct the investigation of the accident or incident, if necessary an immediate and informal investigation will begin promptly after the accident and the results and recommendations for preventive actions will be provided to the client prior to the formal investigation process.

They will participate in the research:

- Safety, Health and Environment Coordinator.
- Construction Management Manager/Plant Manager in the operation phase.
- Supervisor of the area where the accident occurred.
- Members of the Joint Occupational Safety and Health Committee.
- Personnel involved in the activity who can help reconstruct how the event occurred.

The number of committee members will depend on the size and complexity of the project. Once the origin and root cause of the event has been determined, a report will be issued in accordance with the Health and Safety Reports section.

Lessons learned from each accident will be distributed to the client, and to the entire project workforce.

A record will be kept of all accidents occurring on the project (Form XI). It will be the responsibility of the Safety, Health and Environmental Coordinator to keep this information up to date.

8.6.9.12 Medical evaluations

Personnel medical evaluations may include the following tests:

- Clinical history.
- Physical examination.
- Hemograms.

- General urine test.
- Electrocardiogram.
- Audiometry.
- Chest X-ray.
- Lumbar radiography in two positions.
- Spirometry.
- Ophthalmologic evaluation.

The tests to be performed will be defined according to the occupation and age of the workers.

It shall be prohibited to test workers for the human immunodeficiency virus (HIV) without their authorization in accordance with the provisions of Law 35-11 on HIV-AIDS.

8.6.9.13 Liability and all-risk insurance for construction sites

The main contractor must have civil liability coverage in the exercise of its industrial activity, covering the risk inherent to its activity as builder for damages to third parties for which it may be liable for non-contractual civil liability, due to acts arising from fault or negligence; attributable to the main contractor or to the persons for whom it is liable.

The contractor is obliged to take out an all-risk construction insurance policy during the term of execution of the work, with an extension to a maintenance period of one year, counted from the date of final completion of the work.

8.6.10 Follow-up and supervision of the occupational health and safety plan

As part of the monitoring and supervision of compliance with the measures and requirements of the health and safety plan, during the construction and operation phases of the project, internal and external inspections and audits will be carried out, generating written reports of the results; the necessary corrective measures will be taken and a final date will be set for their implementation. These reports will include statistics on the different types of accidents (FAT, RWC, LTI, MTC, FAC, NM, MVA and EI).

Any corrective action shall be implemented immediately by the Construction Management Manager or Plant Manager in the operation phase, and this in turn shall be monitored periodically by the Safety, Health and Environmental Coordinator.

These inspections and audits should also identify opportunities for improvement whose development will strengthen the Occupational Health and Safety Plan.

Internal audits will be conducted by the Occupational Health and Safety Coordinator with the support of the Joint Occupational Health and Safety Committee, while external audits will be conducted by the Company in charge of Environmental, Social and Health and Safety Management.

8.6.11 Health and safety reports

The safety, health and environmental coordinator in the construction and operation phases must generate monthly internal safety and health reports that will include statistics on incidents, accidents, injuries and occupational illnesses for the period and accumulated for the project.

The frequency of external reporting by the company in charge of environmental, social and health and safety management will be defined by contractual agreement.

8.6.12 Formats

Format I. Alcohol test registration form.

		REGISTRO DE PRUEBA DE ALCOHOL		FECHA:		
				DIA	MES	AÑO
				HORA		
PRUEBA REALIZADA POR:				FIRMA:		
RE	CODIGO	NOMBRE	% DE ALCOHOL	FIRMA DEL EMPLEADO		
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
OBSERVACIONES :						

ASIGNACION DE TAREA SEGURA

[illegible]

INSPECCION DE PRE - USO DE EQUIPOS Y VEHICULOS			
FECHA:	HORA:	TURNO: D <input type="checkbox"/> N <input type="checkbox"/>	FICHA / CODIGO:
EQUIPO:	HOROMETRO/KILOMETRAJE:		
OPERADOR:	SUPERVISOR:		
C L A V E S D E L L E N A D O			
Correcto	<input checked="" type="checkbox"/>	Corregir Inmediatamente	I
No Aplica	N.A.	Corregir Antes de las 12 Hrs.	A
		Corregir Antes de las 24 Hrs.	B
		Corregir antes de los 07 días	C
PARA TODO EQUIPO			
1. Los Cinco Niveles			
2. Sistema de Dirección			
3. Sistema de Frenos			
4. Suspensión			
5. Gomas (Llantas)			
6. Aros y Pestañas			
7. Sistema Hidráulico			
8. Alarma de Retroceso			
9. Cinturón de Seguridad			
10. Baliza Estroboscópica (Centella)			
11. Pértiga			
12. Luces			
13. Limpiaparabrisas			
14. Espejos			
15. Claxon / Bocina			
16. Panel de Controles			
17. Asientos			
18. Extintor			
19. Botiquín			
20. Conos de Seguridad (Dos)			
21. Parabrisas y Lunas de Puerta			
22. Guardafangos			
23. Cufias (2 Unidades)			
24. Estribos			
25. Escaleras			
26. Carrocería			
27. Lintera de Mano			
28. Orden y Limpieza, de cabina.			
29. Kit para Derrames (Cubeta, Paños, Lona, Punda y Pala)			
30. Emisión de Gases de Combustión			
EXCAVADORAS Y/O RETROEXCAVADORAS			
31. Agujón y Brazo			
32. Cucharón y Uñas			
33. Pines			
34. Botellas Hidráulicas			
35. Motor de Giro			
36. Mandos Finales			
37. Mangueras Hidráulicas			
38. Orugas y Rodillos			
39. Ruedas Guía			
40. Sprocket			
41. Zapatas			
42. Tomamesa			
CARGADOR FRONTAL			
31. Sistema de Frenos de Emergencia			
32. Botellas Hidráulicas			
33. Mangueras Hidráulicas			
34. Trava de Seguridad			
35. Cucharón, Uñas y Adaptador			
36. Mandos Finales			
37. Pines y Bocina			
38. Sensor de Volteo			
VOLQUETES			
31. Sistema de Frenos de Parqueo			
32. Sistema de Aire			
33. Pines y Seguro de Pistón y Tolva			
34. Seguros de Tolva (Gancho, Soporte, Orejas y Compuerta)			
35. Regulador de levante de Tolva			
36. Bisagras Estabilizadoras			
MOTONIVELADORAS			
31. Sistema de Frenos de Parqueo			
32. Tomamesa			
33. Sistema de Dirección			
34. Articulación de Escarificador			
35. Cuchillas y Cantoneras			
36. Ripper y Escarificador			
TRACTORES SOBRE ORUGAS			
31. Mandos Finales			
32. Botellas Hidráulicas			
33. Ruedas Guía			
34. Sprocket			
35. Pines y Bocinas			
36. Orugas y rodillos			
37. Zapatas			
38. Lampón, Cuchilla y Cantoneras			
39. Ripper			
CAMION GRUA - EQUIPO DE IZAJE			
31. Sistema Hidráulico			
32. Cartilla de Señales			
33. Diagrama de Cargas y Manual			
34. Control de Mandos (D-I)			
35. Estabilizador y Apoyos			
36. Pluma			
37. Pines			
38. Tomamesa			
39. Abrazaderas			
40. Gato Hidráulico (Zapata, Disco)			
41. Pasteca (Seguro)			
42. Estrobos, eslingas, grútlees			
43. Nivel de Plataforma			
CAMION CISTERNAS Y PLATAFORMAS			
31. Sistema de Frenos de Parqueo			
32. Sistema de Aire			
33. Sistema de Dirección			
34. Descarga a Tierra			
35. Válvulas y Seguros			
36. Tomamesa			
37. Gato Mecánico de Estacionamiento			
38. Motobomba / Bomba			
39. Escaleras y Barandas			
40. Banderines			
41. Amés			
42. Otros			

Nota: Este documento deberá ser firmado por el supervisor inmediato, lo antes posible.

FIRMA DEL OPERADOR	FIRMA DEL SUPERVISOR	Vº Bº
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CONTROL DE INSPECCIONES A INSTALACIONES

[illegible][illegible]

CONTROL DE INSPECCIONES A EXTINTORES

[illegible]

confidential Greg Lockard	
Mar 20, 2025 4:47 PM EDT	

Format VI. Personal Protection Equipment Assignment Form.

	Formulario de Asignacion de Equipo de Proteccion Personal	Departamento de Seguridad e Higiene Ocupacional	
		Pagina	1/1
		Codigo	Pendiente

Fecha: _____

Empleado: _____ Proyecto: _____

Area de Trabajo: _____

Equipo de proteccion para asignar

Casco de seguridad		Chaleco reflectivo	
Calzado de seguridad		Lentes oscuros de seguridad	
Lentes claros de seguridad		Mascarilla de particulas	
Mascarilla con filtro		Proteccion Auditiva	
Arnes de seguridad		Reemplazo de filtro para mascarilla	
Guantes			

Recibido por: _____

CONSIDERANDO QUE SEGÚN EL ARTICULO 5.1.3 DEL REGLAMENTO 522-06 se plantea que el Empleado debe utilizar correctamente los medios y equipos de proteccion facilitados por el empleador, de acuerdo con las instrucciones recibidas de este y el uso ordinario de los mismos. El empleado se compromete a usar el equipo

Format VII. Format of notice of work accident to the ARL.

	FORMULARIO DE AVISO ACCIDENTE DE TRABAJO (ATR - 2)	CÓDIGO DE DOCUMENTO: DR - 01 FECHA DE EDICIÓN: 01/07/08
---	---	--

1.- Identificación general de la empresa:

Nombre o Razón Social: _____ RNC: _____

Nombre de la actividad económica: _____

Dirección (Calle y No): _____

Provincia: _____ Municipio: _____

Sector: _____ Zona: U: ☐ R: ☐ Teléfono: _____ Fax: _____

Corno electrónico: _____ No de trabajadores: _____ Total HHT por año: _____

2.- Identificación de la persona accidentada:

Apellidos: _____ Nombres: _____

Cédula: _____ NSS: _____ Fecha de nacimiento (dd/mm/aa): _____ Edad: _____

Sexo: M: ☐ F: ☐ Dirección (Calle y No): _____

Provincia: _____ Municipio: _____

Sector: _____ Zona: U: ☐ R: ☐ Tel: _____ Tel. familiar o vecino: _____

Nacionalidad: _____ Escolaridad: B: ☐ M: ☐ S: ☐ N: ☐ Estado civil: S: ☐ C: ☐

ARS a la que pertenece: _____

Ocupación: _____

Fecha de ingreso a la empresa (dd/mm/aa): _____ Jornada de trabajo habitual: Diurna: ☐ Nocturna: ☐ Mixta: ☐ Turnos: ☐

Fecha de ingreso al puesto de trabajo (dd/mm/aa): _____

Tiempo en el puesto de trabajo (antigüedad): 0-6 meses: ☐ 7-11 meses: ☐ 1-2 años: ☐ 3-5 años: ☐ 6-10 años: ☐ 11-15 años: ☐ Más de 15 años: ☐

Situación en el empleo: _____

Horario de trabajo (Entrada/Salida): _____ Qué salario recibía al momento de sufrir el accidente: _____

3.- Información sobre el accidente:

Fecha del accidente (dd/mm/aa): _____ Hora: _____ Tipo de accidente: Contusión: ☐ Sin lesión: ☐

Causó la muerte al trabajador: SI: ☐ NO: ☐ Lugar donde ocurrió el accidente: Dentro de la empresa: ☐ Fuera de la empresa: ☐

Fecha en que dejó de trabajar por causa del accidente (dd/mm/aa): _____ Hora: _____

Estaba realizando su labor habitual?: SI: ☐ NO: ☐ Causa: _____

Jornada en que se produce el accidente: Diurna: ☐ Nocturna: ☐ Turno: _____

4.- Descripción y circunstancias del accidente:

¿Qué hacía el trabajador justo antes de que ocurriera el accidente?

Describe la actividad, así como las herramientas, equipos o materiales que estaba usando. Por favor sea específico. Ejemplos: Pintando una pared parado sobre un andamio; cortando madera con una sierra circular de banco; trasladándose en bus desde su casa al trabajo.

Qué pasó o cómo ocurrió el accidente?

Diga como sucedió el accidente. Ejemplo: Mientras estaba pintando al cambiarse el andamio se cayó desde tres metros de altura; mientras cortaba, la sierra se trabó en un nudo de la madera y le lesionó la mano; el bus en que viajaba chocó contra un camión.

5.- Información sobre testigos del accidente:

Alguna persona presenció el accidente: SI ☐ NO: ☐

Nombres: _____ Nombres: _____

Apellidos: _____ Apellidos: _____

Cargo: _____ Cargo: _____

Cédula: _____ Cédula: _____

Teléfono: _____ Teléfono: _____

6.- Datos de la primera atención:

PSS donde recibió la primera atención: _____

Fecha (dd/mm/aa): _____ Hora: _____

Tratamiento ambulatorio: ☐ Hospitalizado: ☐ Fallecido: ☐ Incapacitado para el trabajo: SI: ☐ NO: ☐

7.- Persona responsable del aviso:

Nombres y Apellidos: _____

Cargo: _____

FIRMA Y SELLO

Format IX. Quick accident report form.

	Reporte Rápido de Incidentes - Accidentes		
	HSE-Reporte Rápido Incidentes/Accidentes	Fecha: 27-11-2013	Page 1 of 2

La intención del presente informe es brindar una notificación inicial y rápida de un evento que ha ocurrido.

Región Proyecto Localidad Departamento Fecha Hora	Categoría Lesiones Ambiental Daño a Equipo Amago de incendio Incidente de tránsito Otro Incidente	Gravedad Actual Fatalidad Tiempo Perdido Asistencia Médica Primeros Auxilios Cuasi-Accidente Alto Potencial
--	--	--

Testigos: Si ☐ No ☐

Nombre:	Cargo:	Nombre:	Cargo:
Equipo involucrado: Si <input type="checkbox"/> No <input type="checkbox"/>			

Naturaleza del Incidente:
Descripción del Incidente:

Departamento de seguridad Higiene y medio ambiente
--

Format X. Format for recording weekly statistics.

REPORTE SEMANAL DE ESTADISTICAS DE HSE PROYECTO , DESDE EL LUNES - AL DOMINGO - 2015.						
Tipo de empleado Hire type	Horas esta semana Hours this week	Horas este mes Hours this month	Horas este año a la fecha Hours YTD	Tasa de Incidentes Recordables este año a la fecha TBR YTD	Horas Proyecto a la fecha Hours PTD	Tasa de Incidentes Recordables Proyecto a la fecha TRR YTD
Empleados Directos Direct Hire	0	0	0	0.00	0	0.00
Empleados Indirectos Indirect Hire	0	0	0	0.00	0	0.00
Horas Totales Total Hours	0	0	0	0.00	0	0.00

CLASIFICACION DE INCIDENTES/INCIDENT CLASSIFICATION				
Clasificación Classification	Esta semana This Week	Este mes This Month	Año a la fecha YTD	Proyecto a la fecha PTD
Cuasi accidentes Near Miss Incidents	0	0	0	0
Daño a la Propiedad Property Damage	0	0	0	0
Accidente Ambiental Environmental Accident	0	0	0	0
Primer Auxilio First Aid	0	0	0	0
Tratamiento Médico Medical Treatment	0	0	0	0
Trabajo Restringido Restricted work	0	0	0	0
Tiempo Perdido Lost Time	0	0	0	0
Total Incidentes Recordables Total Recordable incidents	0	0	0	0
TOTAL DE INCIDENTES TOTAL INCIDENTS	0	0	0	0

Project Manager	
HSE Manager	

8.7 Complaint or grievance mechanism for employees

Standard 2 "Labor and Working Conditions" of the International Finance Corporation (IFC) Performance Standards establishes the need for a grievance mechanism for all direct and contracted project workers.

In this context, Manzanillo Energy Consortium, Inc., as promoter of the Manzanillo Energy Consortium Power Plant project, in compliance with the aforementioned standard, must have a complaints and claims mechanism for workers that is appropriate to the particularities of the project.

Through this mechanism we will try to address the concerns, claims and complaints that workers may have regarding the workplace, the work environment and situations that may arise in the performance of their duties, maintaining the confidentiality of the claimants.

In that order, all workers to be hired with project resources must be informed about the complaints and claims mechanism at the time of hiring, and specific measures must be taken to protect them against retaliation for its use.

8.7.1 Objectives of the grievance plan

8.7.1.1 General Objective

To address the concerns, claims and complaints of workers regarding the workplace, the work environment and any situation that may arise in the performance of their work in the Manzanillo Energy Consortium Power Plant Project.

8.7.1.2 Specific objectives

Design and make available to workers instruments that can be used to receive claims and complaints during the construction and operation phases of the Manzanillo Energy Consortium Power Plant project.

Define the structure and procedures to be used for the evaluation of claims and complaints submitted by workers during the construction and operation phases of the Manzanillo Energy Consortium Power Plant Project.

Specify criteria that allow reaching agreed solutions to claims or complaints between Manzanillo Energy Consortium, Inc. and the employees who will work in the construction and operation phases of the Manzanillo Energy Consortium Power Plant Project.

8.7.2 Principles to be included in a grievance mechanism

The following table shows the principles that a grievance mechanism should include. Understanding and respecting these principles will help the company:

- Develop and maintain an effective grievance mechanism.
- Mature and effective handling of complaints.

Principle	Elements to be included
Legitimacy	<p>All parties involved should recognize the legitimacy of the grievance mechanism, especially workers should feel that they can present their grievances without fear of victimization or negative repercussions. Key elements that make a grievance mechanism legitimate include:</p> <p>Consultation: Before establishing a grievance mechanism (or revising a procedure), consultation on the project should take place between management, workers and their representatives.</p> <p>Dissemination of information: Once in place, all managers, supervisors and workers should receive all information to be aware of the procedure, roles and responsibilities.</p> <p>Training: Induction activities on grievance mechanisms should be conducted with the participation of managers, supervisors, workers and their representatives, especially those who will have an active role in investigation, facilitation and decision making.</p> <p>Consistent procedure: Adhering to the agreed procedure ensures the legitimacy of the process and the results. Exceptions should be avoided.</p>
Accessibility	<p>Internal and external stakeholders should know that the mechanism exists and how to use it. Key elements that make a grievance mechanism accessible include:</p> <p>Visibility: Copies of the mechanism's procedures should be posted on all notice boards in view of workers, as well as in workshops, locker rooms and other places where workers gather. To reach external stakeholders, a good practice is to include the information on a company web page.</p> <p>Availability (physical copies): Once established, workers should receive a physical copy of the mechanism's procedure, as well as the necessary forms.</p> <p>Orientation for new employees: When hiring new workers, ensure that an information session is held to explain how the mechanism works. The information becomes even more important if young, seasonal or migrant workers are hired.</p> <p>Information sessions: The content of these information sessions should include at least the following: what a complaint is, how to file one, where to obtain the necessary forms, where to deliver the forms and where to obtain information on the mechanism.</p>

Principle	Elements to be included
	Translations: It may be necessary to translate into different languages or use images to ensure accessibility.
Transparency	<p>Internal and external stakeholders must be able to see that the mechanism works. Key elements that achieve transparency of a grievance mechanism include:</p> <p>Confidentiality: Transparency is not about revealing names or practical details about the complaint. Confidentiality of personal data and other crucial information is mandatory to protect the complainant and other stakeholders.</p> <p>Publication: The following data may be published (without disclosing sensitive data): the date of the complaint, the description of the complaint (in general terms), the steps taken in the investigation and conciliation, the final resolution and the date of resolution.</p>
Dialogue	<p>The objective of the mechanism should be for people to engage in dialogue to reach agreement on the nature of the problem and to find solutions acceptable to all parties. Key elements that make a mechanism dialogue-focused include:</p> <p>Understand cultural differences: Each culture has a different understanding of the key elements of a grievance. For example, there are different understandings of what an offense is, what dialogue entails, and what satisfactory redress entails. Such cultural differences can only be assessed and managed with respectful engagement and listening.</p> <p>Conciliation training: At least the person in charge of receiving complaints should be trained in workplace conflict resolution, conciliation and mediation.</p> <p>External assistance: External assistance should be sought from advisors or interest groups specialized in conflict resolution and the issue in question.</p>

8.7.3 Types of concerns, complaints and grievances that arise in the workplace

Infrastructure: For example, the work room does not have sufficient lighting or ventilation, the space assigned to the worker is not sufficient to carry out the work in safe conditions.

Personal relationships: For example, a supervisor has physically or verbally harassed someone; or there is a conflict between co-workers.

Contractual rights: For example, payments are systematically delayed, illegal deductions are made or overtime is not paid more expensively (or is paid at a lower amount than originally agreed).

Human and labor rights: For example, a worker has suffered discrimination based on gender, religion or place of origin; a worker has been punished for attending a union meeting; or the water available to them during their workday is not potable.

Customary rights: For example, the requested time for prayer or to participate in community activities has not been granted.

Worker grievances may also relate to other issues not described in the five categories above. In such cases, workers can handle the complaint internally, while seeking outside assistance. A worker representative can be a valuable source of information.

8.7.4 Instruments and channels necessary for the complaint and grievance process

The form is the indispensable tool for the process of claims and complaints. It must be available to every employee working in the company. With this document there is a duty to fulfill several requirements necessary for the process and to fill out the problems and concerns of the applicant accordingly.

Referring to the avenues available to express their concerns and complaints, they are:

Company email and/or company website: To send the claim or complaint.

Telephone number of the Manzanillo Energy Consortium Power Plant Project: The automatic option to file a claim or complaint will be programmed.

Face-to-face delivery of the form at the facilities or main offices, with a specialized mailbox for this process (including anonymous deliveries).

8.7.5 Basic procedure of the complaints and grievance mechanism

The effectiveness of the grievance mechanism falls within the scope of the project sponsor's audit of Manzanillo Energy Consortium, Inc. At a minimum, the grievance mechanism procedure should ensure that workers have:

- Access to the supervisor: The ability to have an open and constructive meeting about a complaint with your immediate supervisor or manager can prevent the problem from escalating.
- Right to appeal: a channel of access to someone in a senior position to challenge a decision made by their supervisor or manager can add impartiality.
- Access to assistance: Workers should have the right to be accompanied by a co-worker of their choice or a union representative (in unionized facilities) when participating in a meeting to discuss a grievance. Workers may feel more comfortable with the process if they have access to assistance.

The following are some questions that can be used to assess the soundness of the grievance mechanism procedure:

Who can file a grievance? A good grievance mechanism should ensure that all workers, regardless of position or seniority, can file a grievance. Additional channels should be created for external grievances.

How is a complaint handled? A good grievance mechanism should describe the preferred mechanism for filing a grievance and indicate whether a form is required (see example below).

Generally, the first step is to make a verbal complaint to someone (e.g. verbal complaint to the line manager). Transmission of the complaint to a higher level in management (or to the person in charge of the grievance mechanism) is most often by means of a grievance form (see example below). Although it is valid to use an oral form, companies should encourage their employees to use the written grievance form in order to achieve greater transparency,

The grievance mechanism procedure records the nature of the grievance, the scope of the investigation and the remedial measures.

Workers can seek the support of a co-worker or worker representative to raise the concern on their behalf. This is another legitimate way of raising a grievance that can ensure that the manager or person in charge of the grievance mechanism does not reject or ignore it.

In general, it is recommended that the employee take the complaint to his or her immediate supervisor or manager.

If the complaint concerns your own supervisor or manager, it should be addressed to the person in charge of the grievance mechanism.

It is also recommended that companies designate a person trained to handle grievances and that employees know who that person is. Otherwise, complaints are processed according to the hierarchical structure of the company.

The designation of a person in charge of complaints guarantees:

- **Transparency and predictability.** All members of the company know from the outset who should receive the complaint first.
- **Efficiency.** The complaint does not get lost in the different departments and can be processed immediately.

8.7.6 Steps for handling worker complaints and grievances

Step 1: Acknowledgement of receipt

The supervisor or person in charge of the grievance mechanism should acknowledge receipt of the complaint in writing with a simple statement.

Simple statement. A simple statement at this point is sufficient, which should include the date of receipt and a time commitment for follow-up. For example:

"Complaint number 12/2022 was received on 12/14/2022. We will contact the worker within ten (10) days to proceed with next steps." The statement must be signed.

Time frame. The grievance mechanism procedure should aim to resolve grievances as quickly and efficiently as possible. However, time frames should be realistic and not create false expectations, as their resolution may vary depending on the complexity of the complaints.

Step 2: Analysis

The supervisor or person in charge of the grievance mechanism should:

- Analyze the issue.
- Try to identify the root cause of the problem.
- Identify possible solutions.
- Assessing costs and feasibility of possible solutions
- Take the necessary measures to solve the problem (or correct it).

This analytical approach:

- Shows the most viable solutions.
- Identifies the most appropriate solution for the specific type of complaint.

For example, resolving a complaint about workplace infrastructure conditions will require a different approach and timeline than resolving a complaint about personal relationships with a supervisor or co-worker.

The following table can be used to analyze a complaint:

Complaint Category	Ask			
	Do I know the possible root cause?	Is the proposed solution feasible?	Do I have the necessary influence?	What is the cost of the corrective action? And the cost of the solution?
	Do I need more information and who should I contact for this?	For when?	Who can help me?	Is it affordable and what are the alternatives?
Infrastructure-related				
Personal matters				
Related to the contract				
Human and labor rights				
Customary rights				

Step 3: Mediation

Once the analysis of the complaint has been completed, the supervisor or the person in charge must summon the employee to a meeting. The invitation to this meeting can be made orally or in

writing. The advantage of a written invitation is that it constitutes documentary evidence. However, a written invitation may not be possible due to the context of the complaint or company procedures.

Regardless of whether it is made orally or in writing, the invitation to the worker must state:

- The day of the meeting
- The place
- Persons attending (if applicable)

The employee must also be informed that he/she has the right to attend the meeting accompanied by a colleague of his/her choice or the employee representative.

During the meeting, the person in charge will present the background (steps 1 and 2) and the reasoning behind the analysis. The worker should have the opportunity to intervene in each step of the explanation and should validate whether the analytical process has been consistent and accurate.

Finally, the person in charge will present the proposed solution and ask the worker for his/her response and approval. Minutes should be taken of this meeting.

Step 4: Closing and publication

Ideally, following mediation, both parties will have reached agreement on the corrective action or solution to be taken, as well as the deadlines for implementing it. The resolution of the grievance will be published after the meeting on the notice boards for workers, respecting the confidentiality of the parties involved.

To maintain the credibility of the grievance mechanism among workers, it is crucial to publicize the solution, meet the deadlines of the procedure and implement corrective measures.

Step 5: Resource

Disagreement with the analysis and proposed corrective measures, as well as with the delay in their implementation, are grounds for appeal. In addition, the employee may file an additional grievance if he/she feels that he/she has been victimized or harassed by the manner in which his/her grievance has been handled.

Company management should immediately investigate the worker's complaint. Misuse of the grievance mechanism to harm or harass workers should be subject to disciplinary action (including dismissal of the supervisor or superior), as this behavior calls into question the integrity of the mechanism. Workers may use other channels of recourse outside the company. It will depend on national law and the various processes and arbitration platforms available to workers for filing grievances.

Finally, current labor legislation may establish legal mechanisms for conflict resolution.

8.7.7 Complaints channel

The whistleblower channel is the tool that the company makes available to all personnel, suppliers and customers in order to promote a transparent and ethical culture, free of corrupt or fraudulent behavior.

This channel is managed by an external and independent firm, and consists of several methods through which all complaints or communications are processed, which fully guarantees confidentiality.

The channel can also be used to generate inquiries and request clarification on ethical dilemmas. Any shareholder, director, employee, customer, supplier or contractor of the company has the right and the opportunity to use it to report any of the above points in a confidential manner without any retaliation.

However, the communication of facts with knowledge of their falsity, or recklessness, or with disregard for the truth, could result in dismissal and even in criminal or civil liabilities, in the terms contemplated in the current legislation.

8.7.8 Complaints at work

The following is a series of instances that serve as a warning to motivate you to file a complaint. This mention is not final, nor is it limiting, nor does it include all possibilities.

a) Complaints of sexual harassment or harassment in the workplace

All personnel who become aware of an act of sexual or workplace harassment, whether victim or witness, must report it through RESGUARDA or to the Talent Management area, which in turn will notify the Compliance Committee.

b) Inadequate processes

Processes that are being conducted in an inadequate manner, where the recommendations of the personnel are not listened to and that in one way or another affect the company's resources, its name or any other condition.

Failure to comply with benefits or other conditions agreed with the personnel and which are not processed through the corresponding channels by their supervisors.

Impositions that constitute violations of company policies or this code by senior personnel.

c) Misappropriation of assets

Taking money or assets improperly or without authorization.

Diverting funds from an account for personal benefit or for the benefit of a third party.

Obtaining money by deception or dishonesty, or by means of a fictitious statement of expenses.

Inappropriate use of petty cash funds, or for personal benefit.

To obtain a benefit, aid or contribution by deception or by concealing the truth in whole or in part.

Falsifying or improperly altering a document or record.

Purchasing goods or services for personal use with company resources.

Misappropriating or abusively using the company's assets for personal benefit or that of a third party, such as property, equipment, furniture, inventories, investments, materials, among others.

Making duplicate or unauthorized payments or incurring expenses that are not supported by formal documents.

Improper handling of cash surpluses for one's own benefit or for the benefit of a third party.

d) Accounting fraud

Improperly altering or manipulating income and/or expense accounts to reflect performance that does not correspond to reality.

Making accounting records in inappropriate periods with the purpose of reflecting a financial situation that does not correspond to reality.

Inappropriately valuing assets to reflect a financial situation that does not correspond to reality.

Inappropriate disclosure or omission of information in the financial statements that may mislead potential investors, lenders or other users of the financial statements.

Making or omitting adjustments to accounting records for personal benefit or for the benefit of third parties.

Intentionally concealing accounting errors.

e) Corruption

Promise, offer or grant, directly or indirectly, to a third party an undue benefit that redounds to his own advantage or to that of another person.

Requesting or accepting, directly or indirectly, from a third party an undue advantage that benefits oneself or another person.

Paying a bribe to a third party (private or public) to obtain an illegitimate advantage over the competition.

Making contributions, in cash or in kind, to a political cause for the purpose of obtaining a commercial or personal advantage.

To divert monies that have a social or sponsorship purpose for personal benefit or for the purpose of committing an act of corruption.

Unlawfully altering a contractual procedure in a bidding, auction, selection or contest process.

8.7.8.1 Whistleblower protection

The company guarantees protection against retaliation against personnel managers or third parties who report acts or events of fraud or corruption, make inquiries, express ethical dilemmas, provide information in good faith about unethical conduct, or cooperate with a duly authorized investigation.

Retaliation, if it occurs, violates the fundamental obligation of all company personnel to act with the utmost efficiency, competence and integrity and to perform their duties and perform in the best interests of the company.

To be eligible for protection, whistleblowers must act in good faith and have reasonable grounds to believe that an event of fraud or corruption or unethical conduct has occurred, including, depending on the circumstances and to the extent possible, providing evidence or accurate information that leads them to conclude that there is unethical conduct, fraud or corruption contrary to the company's values.

Activities involving the transmission or dissemination of unsubstantiated rumors may be subject to administrative or disciplinary action.

8.7.8.2 Reports

It is important that incidents of fraud or corruption identified are reported.

This will enable the company to learn and understand why such events occur and, therefore, take appropriate action.

An unreported fraud or corruption event may represent a cost even greater than the event itself. The valid and official means of receiving complaints and reports related to fraud, reported misconduct or illegal conduct, inquiries and ethical dilemmas is the Whistleblower Channel.

The company is aware that not all personnel feel comfortable reporting an event of fraud or corruption involving a superior or co-worker. In order to motivate personnel to denounce or report an event of fraud or corruption, the organization has implemented the Whistleblower Channel, through which these events can be reported confidentially, without any fear of retaliation.

Employees who believe they have been retaliated against must report all information and documentation available to them through this system or may report in person to the company. If retaliation against any employee who has reported an act of fraud, corruption or unethical conduct is established, the organization will take appropriate and necessary measures to remedy the negative consequences resulting from the retaliation.

Personnel who have engaged in an act of retaliation, when an investigation demonstrates its existence, may be subject to administrative or disciplinary measures, without prejudice to legal action when appropriate.

8.7.8.3 Complaints

Any person, group or representative of a person or group that may be affected by any operational, commercial or management activity that reports or wants to report an event of fraud, corruption,

consultation, ethical dilemma or unethical conduct, may register a complaint through the communication channels available 24 hours a day, 7 days a week and 365 days a year. Reports can be received via email, telephone, the supplier's website or physically. These communications are confidential, protecting the identity of the complainant if desired.

8.8 Community health and safety plan

As a result of project activities, infrastructure and equipment, the potential for exposure to hazards and risks to the health and safety of communities adjacent to the project may be increased.

In accordance with the IFC Performance Standards, impacts and risks to the health and safety of communities arising from routine and non-routine project activities should be prevented or reduced, with special attention to vulnerable groups and consideration of sensitive local situations so as not to exacerbate risks or generate pressure on local resources.

The following are the different sections of the Community Health and Safety Plan to prevent or reduce impacts and risks to the health and safety of communities arising from project activities.

8.8.1 Objectives

General Objective:

Identify hazards and risks to the health and safety of the community that may arise from project-related activities, assess these risks, and establish prevention and control measures to avoid or minimize risks and impacts to the health and safety of the community, with special attention to vulnerable groups.

Specific objectives:

- Identify the hazards that project activities pose to the health and safety of the community, as well as other risks associated with the operation of the project.
- Assess and rank the project's health and safety risks to the community.
- Perform risk analysis to identify opportunities to reduce the consequences of a failure or accident.
- Establish measures to prevent and control impacts and risks to the health and safety of the communities affected by the project.
- Propose mitigation measures proportional to the nature and magnitude of the impacts and risks to the health and safety of the communities affected by the project.

8.8.1 Methodology

This plan was prepared based on the provisions of Performance Standard 4, the General EHS Guidelines and the International Finance Corporation (IFC) EHS Guidelines for Thermal Power Plants.

The following activities were carried out to prepare the community health and safety plan for the project activities:

- Review and analysis of project information (characteristics, processes, activities).
- Identification of community health and safety hazards and risks that may arise from project-related activities.
- Evaluation and classification of health and safety risks.
- Establishment of prevention, control and mitigation measures for community health and safety.

8.8.2 Community health and safety management policy

Manzanillo Energy Consortium, Inc. will establish a community health and safety management policy that will contemplate the following:

- Be incorporated into the project's Health and Safety Management System.
- To define the objectives and principles regarding community health and safety.
- To guide the project to achieve good health and safety performance for the community.
- It should be a framework for the health and safety assessment and management process.
- It must be independent and specific to the project.
- Compliance with the laws and regulations applicable to the project.
- It must be consistent with the Principles of the Performance Standards.
- Indicate who is responsible for compliance with the policy within the organization.
- This policy should be communicated to all levels of the organization.

8.8.3 Responsibilities

Health and safety management responsibilities are described below:

Responsibilities of Project/Plant Managers (Top Management)

- Establish the necessary policies and procedures to ensure a safe and healthy work environment.
- Provide continuous improvement of health and safety plans and programs.
- Provide the necessary resources for the implementation and compliance with the health and safety management plan.
- Maintain and support the Health and Safety Committee.

Responsibilities of the Environment, Health and Safety Manager and/or Representative

- Support Management/Senior Management on health and safety related issues.
- Oversee the development and activities of the Health and Safety Committee.
- Coordinate health and safety training.
- Advise workers on health and safety issues.
- Support the implementation of health and safety plans, programs and procedures.
- Verify that Health and Safety policies and procedures are implemented.
- Maintain documentary records on the implementation of health and safety plans and programs.

Responsibilities of the Health and Safety Committee

- Oversee in general the implementation and compliance with safety and health plans and programs.
- Promote and ensure compliance with national occupational health and safety regulations.
- Attend courses on occupational health and safety issues.
- Support the creation of a safe workplace.
- Make recommendations for improving the effectiveness of health and safety plans and programs.

Employee responsibilities

- Know the hazards in the work area and identify, report, correct or eliminate any hazards.
- Inspect your workplace and designated and used equipment to observe any unsafe conditions before starting work.
- Participate in all assigned health and safety training.
- Report unsafe acts and conditions.
- Report incidents and accidents that occur.

8.8.4 Identification and assessment of potential health and safety risks and impacts of the project for the community

To prepare the Community Health and Safety Plan, the first step is to identify the risks to which the inhabitants of the communities in the area of socioeconomic influence of the project, which are the municipalities of Pepillo Salcedo and Montecristi, in the province of Montecristi, will be exposed. Once the risk factors have been identified, these risks will be evaluated for the affected communities.

8.8.4.1 Identification and assessment of potential health and safety risks and impacts of the project for the community

The risks and impacts of the project to community health and safety are as follows:

Construction phase:

- Possibility of disturbance to residents due to increased noise and dust levels as a result of the Project's construction activities.
- Possible exposure to diseases due to the influx of temporary or permanent labor.
- Risk of physical injury or loss of life to residents arising from the use of force by Project physical security personnel.
- Risk of accidents resulting in physical injury or loss of life to workers and residents as a consequence of the Project's construction activities.
- Risk of traffic accidents resulting in physical injury or loss of life to workers and residents on access roads.

Operating phase:

- Possibility of affecting the population (workers and communities) due to increased levels of gas emissions, suspended particles, noise and vibrations from the thermoelectric plant's operations.
- Possible exposure to diseases due to the influx of temporary or permanent labor.
- Risk of physical injury or loss of life to residents arising from the use of force by Project physical security personnel.
- Risk of accidents resulting in physical injury or loss of life to residents and visitors during power plant and transmission line operations.

It is clarified that accidents that can cause physical injuries to workers are of various kinds, including cuts, bruises, blows, electrocutions, eye injuries, falls, burns, among others.

8.8.4.2 Assessment of potential health and safety risks and impacts of the project on the community

The risks and impacts of the Manzanillo Energy Consortium Power Plant Project on community health and safety were identified and assessed following the methodology described in Chapter VII: Identification and assessment of environmental and social impacts.

Table 8-45 and Table 8-46 summarize the qualitative and quantitative assessment of community health and safety impacts and risks for the construction and operation phases of the project.

Table 8-45. Assessment of impacts and risks to community health and safety-construction phase.

Impact	Code	Character	Effect	Significance	Classification
Possibility of disturbance to residents due to increased noise and dust levels as a result of the Project's construction activities.	PB-2	(-)	D	31	MODERATE
Possible exposure to diseases due to the influx of temporary or permanent labor.	PB-3	(-)	D	28	MODERATE
Risk of physical injury or loss of life to residents arising from the use of force by Project physical security personnel.	PB-4	(-)	D	27	MODERATE
Risk of accidents resulting in physical injury or loss of life to workers and residents as a consequence of the Project's construction activities.	PB-5	(-)	D	29	MODERATE
Risk of traffic accidents resulting in physical injury or loss of life to workers and residents on access roads.	TV-2	(-)	D	29	MODERATE

Table 8-46. Assessment of impacts and risks to community health and safety - operation phase.

Impact	Code	Character	Effect	Significance	Classification
Possibility of affecting the population (workers and communities) due to increased levels of gas emissions, suspended particles, noise and vibrations from the thermoelectric plant's operations.	PB-9	(-)	D	32	HIGH
Possible exposure to diseases due to the influx of temporary or permanent labor.	PB-12	(-)	D	31	MODERATE
Risk of physical injury or loss of life to local residents arising from the use of force by Project physical security personnel.	PB-13	(-)	D	30	MODERATE
Risk of accidents resulting in physical injury or loss of life to local residents and visitors during power plant and transmission line operations.	PB-15	(-)	D	28	MODERATE

It is clarified that accidents that may cause physical injuries to the community are of various kinds, including cuts, blows, electrocutions, falls, and being run over, among others.

8.8.4.3 Plan for prevention of the spread of communicable diseases

Introduction:

There is a risk of disease spread at the facilities of the Manzanillo Energy Consortium Power Plant Project, although at low levels considering that there are no plans to set up temporary camps to house workers during the construction and operation phases. In addition, hygienic measures and the implementation of management plans for the proper handling of solid and liquid waste are planned for both phases, thus reducing the possibility of spreading waterborne diseases or water-related vectors.

The communicable diseases considered for the Manzanillo Energy Consortium Power Plant Project were classified into the following categories: water-related vector-borne diseases, water-borne diseases, and other communicable diseases. The diseases considered are presented below. Water-related vector-borne diseases:

- Dengue.
- Zika.
- Chikungunya.
- Malaria.

Waterborne diseases:

- Cholera.
- Diarrheal diseases.

Other communicable diseases:

- Leptospirosis.
- HIV.
- Hepatitis.
- Typhoid fever.
- H1N1 influenza.
- COVID-19
- Others.

Objective:

To prevent the spread of communicable diseases among and to the residents of the communities in the area of influence, which are the municipalities of Pepillo Salcedo and Montecristi, in the province of Montecristi, due to the presence of the project workers and the actions that will be carried out during the construction and operation phases.

Impacts targeted by the plan:

Construction and operation phases:

- Possible exposure to diseases due to the influx of temporary or permanent labor.

Measures to be implemented:

To prevent water-related vector-borne diseases (such as dengue, zika, chikungunya, malaria), the following measures will be taken at the facilities of the Manzanillo Energy Consortium Power Plant Project:

- Avoid having containers with standing water in the project facilities.
- Store water in jars or tanks with lids.
- Avoid storing discarded rubbers outdoors.
- Avoid excessive accumulation of solid waste in the project. Implement the **Solid Waste Management Plans** foreseen for the construction and operation phases (see **sections 8.1.1.3 y 8.1.2.2**).
- Fumigate project facilities if necessary, following the recommendations established in the **Pesticide Management Plan** (see **section 8.1.2.6**). For these purposes, avoid the use of pesticides classified as extremely hazardous (Ia) and highly hazardous (Ib) according to the WHO classification.
- Develop educational campaigns through the distribution of flyers, lectures and other methods, aimed at project workers and residents of the communities in the area of direct influence of the project to prevent these diseases.

To prevent waterborne diseases (cholera, diarrheal diseases, among others), the following measures will be taken at the facilities of the Manzanillo Energy Consortium Power Plant Project:

- Implementation of the **liquid waste management measures plan** for the construction and operation phases (see **sections 8.1.1.4 and 8.1.2.3**) and of the **solid waste management measures plans** for the construction and operation phases (see **sections**

8.1.1.3 and 8.1.2.2), which will prevent contamination of surface and groundwater that could cause illnesses in the community.

- Provide bottled drinking water for project workers.
- Availability of potable water and soap for hand washing in the project's bathrooms and dining rooms.
- Provide food to project workers in hygienic conditions.
- Install a sufficient number of portable toilets for use by site workers during the construction phase (1 toilet for every 10-15 workers), which will be maintained by a company accredited by the Ministry of the Environment and Natural Resources.
- Build a septic tank to treat the domestic liquid waste that will be generated in the buildings of the thermoelectric power plant during the operation phase, before being infiltrated into the subsoil.

The following is a brief description of some of the information on the prevention of these diseases that can be included in educational campaigns aimed at the community.

COVID-19:

- Wash hands frequently with soap and water or an alcohol-based gel.
- Cover your mouth with your forearm when coughing or sneezing or with a tissue, then throw it in the trash and wash your hands.
- Avoid close contact with people who have symptoms (cough, fever, difficulty breathing, among others).
- Avoid touching eyes, nose and mouth with unwashed hands.
- Avoid sharing glasses, plates and other personal items.
- Clean and disinfect objects and surfaces frequently.
- If you have traveled to high-risk areas or have been in direct contact with people with symptoms, seek immediate medical attention, do not self-medicate.

Leptospirosis:

- Avoid contact with stagnant water, do not submerge or swim in it.
- Use personal protective equipment, such as boots and gloves, when working in hazardous areas.
- Avoid excessive accumulation of solid waste, especially in outdoor areas. Waste should be placed in sacks with tight-fitting lids.
- Weed control in vacant lots.
- Rodent pest control if necessary.
- Plug holes in homes or buildings where rodents can enter.

HIV:

- Use of condoms during sexual intercourse.
- Reduce the number of sexual partners.
- Get tested for HIV and other STDs on a regular basis.
- Avoid abuse of drugs or alcohol.
- Do not share needles with others.
- Always use new and sterilized needles.

- Take medications that protect against HIV in case you have been exposed, following medical indications.

Hepatitis A:

- Wash hands after using the toilet or changing diapers, and before preparing or eating food.
- Drink purified water.
- Disinfect fruits and vegetables, and do not eat raw meat.
- Boil food and beverages for at least 1 minute to inactivate the hepatitis A virus.
- Frequently clean the home bathroom and pay attention to the toilet seat, handles, faucets and diaper changing tables.

Typhoid fever:

- Wash hands thoroughly before eating and after using the toilet.
- Do not consume street food that does not comply with the necessary hygienic measures.
- Wash fruits and vegetables thoroughly.
- Consume drinking water from safe sources.
- Consume uncontaminated and/or well-cooked food.

Performance Indicators: Number of training activities on communicable disease prevention conducted with project workers and communities in the project's area of influence.

Goals: No spread of communicable diseases among project workers and residents of the communities in the area of influence.

Executor: Contractors in the construction phase and Operating Company of the Thermoelectric Power Plant Operating Company in the operation phase.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: Land of the Manzanillo Energy Consortium Power Plant Project, communities in the area of socioeconomic influence of the project (municipalities of Pepillo Salcedo and Montecristi, in the province of Montecristi).

Frequency of follow-up: Semiannual.

Implementation time: During the entire construction and operation phase.

Required records:

Associated costs: The costs of implementing this plan are included in the construction budget or the operational costs of the project, depending on the phase.

8.8.4.4 Accident prevention and control plan and community involvement

Impacts targeted by the plan:

Construction phase:

- Risk of physical injury or loss of life to residents arising from the use of force by Project physical security personnel.
- Risk of accidents resulting in physical injury or loss of life to workers and residents as a consequence of the Project's construction activities.

Operating phase:

- Risk of physical injury or loss of life to residents arising from the use of force by Project physical security personnel.
- Risk of accidents resulting in physical injury or loss of life to residents and visitors during power plant and transmission line operations.

Objectives:

- Reduce the risks of accidents and injuries to the population of the communities in the area of direct influence of the project due to construction and operation activities.
- Reduce risks to the population from the use of force by project security personnel.

Measures to be implemented:

- Restrict access to the project facilities by constructing a fencing and security system consisting of the following major components:
 - Chain link safety fence
 - Pedestrian swinging doors with lock
 - Motorized door
 - Remote security: two-way loudspeakers.
 - Remote security - closed circuit television.
- Installation of a closed-circuit television system that will include:
 - Cameras.
 - Lens.
 - Camera enclosures.
 - Camera assembly.
 - Sequential switch.
 - Controller/tracker.
 - Video monitor
 - Cable and conduit.
 - All other necessary accessories.
- Permanent custody of the project site by security guards, which, in addition to preventing acts of vandalism, avoids accidents that could affect residents in the communities in the area of influence.
- Ensure that security personnel guarding the project facilities are trained in the basic principles of the United Nations (UN) on the use of force and firearms. This will prevent the occurrence of accidents or incidents involving community members resulting from the excessive use of force by security personnel. The **Safety, Health, and Environmental**

Education Plan for Workers and the Community (see **section 8.11**) includes the topics in which security personnel who will guard the project facilities will receive training.

- Placement of the necessary safety signage in the facilities and other areas to be intervened (access roads, power transmission line route and easement strip) to warn the population of these communities about the existence of different risks in order to avoid accidents.
- Implement the **Safety, Health and Environmental Education Plan for Workers and the Community**, which includes training on these topics for residents of the communities in the area of influence (see **section 8.11**).
- Implement the **Emergency Preparedness and Response Plan** (see **section 8.9**) that includes prevention and action measures for: accidents, hurricanes, earthquakes, fires, fuel and lubricant spills, and gas leaks.
- Disseminate the **Emergency Preparedness and Response Plan** to the communities in the area of influence (see **section 8.9.9**).

Performance indicators:

- Number of residents injured.

Goals:

- Non-occurrence of accidents for community members derived from the construction or operation activities of the project.

Executor: Contractors in the construction phase and Operating Company of the Thermoelectric Power Plant Operating Company in the operation phase.

Supervisor: Company in charge of Environmental, Social and Health and Safety Management.

Responsible party: Manzanillo Energy Consortium, Inc.

Place of implementation of the measures: Project land, power transmission line route and easement strip, roads where materials will be transported, communities in the area of socioeconomic influence of the project (municipalities of Pepillo Salcedo and Montecristi, in the province of Montecristi).

Frequency of follow-up: Semiannual.

Implementation time: During all phases of construction and operation.

Required records:

Associated costs: The costs of implementing this plan are included in the construction budget or the operational costs of the project, depending on the phase.

8.8.4.5 Plan for the prevention and control of impacts on communities due to increased levels of noise, vibrations and emissions of gases and suspended particulate matter.

Impacts targeted by the plan:

Construction phase:

- Possibility of disturbance to residents due to increased noise and dust levels as a result of the Project's construction activities.

Operating phase:

- Possibility of affecting the population (workers and communities) due to increased levels of gas emissions, suspended particles, noise and vibrations from the thermoelectric plant's operations.

Measures to be implemented:

Measures to prevent or mitigate impacts on local residents of the communities in the area of influence due to increased levels of noise, vibrations, suspended particles (dust) and combustion gas emissions resulting from construction and operation of the project are detailed in **section 8.1.1.1: Plan of measures for the protection of air quality and the noise environment**, for the construction phase, and in **section 8.1.2.1: Maintenance management plan**, for the operation phase.

8.8.4.6 Traffic accident prevention and response plan

Impacts targeted by the plan:

Construction phase:

- Risk of traffic accidents resulting in physical injury or loss of life to workers and local residents on access roads.

Operating phase:

- Risk of accidents resulting in physical injury or loss of life to local residents and visitors during power plant and transmission line operations.

Measures to be implemented:

Measures for the prevention of traffic accidents that may affect local residents of the communities in the area of influence are detailed in **subsection 8.1.1.13: Traffic management plan**.

Measures for responding to traffic accidents are included in **Section 8.9: Emergency Preparedness and Response Plan**.

Emergency preparedness and response

During the construction and operation of the project, emergency situations may occur at the project facilities that may pose a risk to the health or property of members of the communities adjacent to the project, as well as to the environment.

The following are general actions for emergency preparedness and response that may involve local communities:

- Support communities adjacent to the project, local government agencies and other relevant parties in preparations to effectively respond to emergency situations.
- Play an active role in emergency preparedness and response associated with the project (In the event that local government agencies have little or no capacity to respond effectively to emergencies).
- Provide appropriate emergency information to affected communities, relevant government agencies and other relevant parties.
- The design, purchase and installation of fire suppression systems and equipment for the project will be carried out.
- Create mechanisms for financing emergency response actions.
- In the event of an emergency that puts local communities at risk, communication will be made to alert the communities through alarms or sirens, and through telephone calls to representatives of the communities and, additionally, the options for protection will be communicated.
- Have a trained spokesperson to interact with stakeholders.
- Having personnel trained in first aid.
- To have adequate medical service for the type of activity.
- Have resources available to respond in the event of an emergency (equipment, trained and qualified personnel, materials, financing).
- Develop and regularly update a list of emergency contacts.

Other emergency preparedness and response measures and actions are presented in the **Emergency Preparedness and Response Plan** in section 8.9.

Follow-up and supervision

During all stages of project execution (planning, construction, operation and decommissioning), the Environmental, Health and Safety Manager and/or Representative will monitor and supervise the Community Health and Safety Plan through periodic inspections, meetings with those in charge of construction and operation of the project and members of community organizations, internal audits and documentary review of evidence of implementation of the prevention, control and mitigation measures of the Community Health and Safety Plan.

In addition, accidents and illnesses related to project activities and facilities will be monitored, and there will be a follow-up and documentary control of the training activities related to this plan offered to workers and members of the communities.

The Environment, Health and Safety Manager and/or Representative will prepare periodic follow-up reports on the implementation of the community health and safety plan.

Health and safety education plan for the community

Support will be provided to local communities in vehicle and pedestrian road safety education, training will be provided to area residents on the risks, prevention and existing treatments related to communicable diseases, and neighboring communities will be prepared to react in case of accidents. Other training topics will include firefighting, spill response, and evacuation.

All these training activities for community members will be carried out through periodic talks, handing out pamphlets and posters, and awareness campaigns, especially on health and road safety issues, previously coordinated with local community organizations and government agencies and at least once a year.

A written record (record of training received) of these training activities and the results obtained shall be kept.

8.9 Emergency preparedness and response plan

Risk analysis:

In order to design the Emergency Preparedness and Response Plan, it is necessary to identify the natural and technological risks to which the project may be exposed during its construction and operation phases. To this end, the most significant hazards and the most vulnerable areas or elements were identified.

In the Table 8-47 shows the differences in risk, hazard and vulnerability.

Table 8-47. Definitions of risk, hazard and vulnerability.

Concepts	Definitions
Risk	The probability of unfavorable economic, social or environmental consequences occurring at a given site and during a given exposure time.
Threat	A latent hazard associated with a physical phenomenon of natural, technological or man-made origin that may occur at a specific location and at a specific time, producing adverse effects on people, goods, services and the environment.
Vulnerability	Internal risk factor of a subject or system exposed to a hazard, corresponding to its intrinsic predisposition to be affected or to be susceptible to damage. Corresponds to the physical, economic, political or social predisposition or susceptibility of a community to be affected or to suffer damage in the event that a destabilizing phenomenon occurs, whether of natural or man-made origin.

It is clear from the above table that there are real hazards of a natural or technological nature, which can arise at any time. Hence the importance of keeping a simple equation in mind:



Threats:

a) Natural hazards

The natural hazards that could affect the Manzanillo Energy Consortium Power Plant Project during its construction and operation phases are as follows:

- Hurricanes and other meteorological phenomena (storms, heavy rains, strong winds).
- Earthquakes.
- Atmospheric electrical discharges.

b) Technological threats

Threats of technological origin that may affect the Manzanillo Energy Consortium Power Plant Project include:

Construction phase:

- Accidents.
- Traffic accidents.
- Fires.
- Fuel and lubricant spills.

Operating phase:

- Accidents.
- Fires.
- Gas leaks.
- Fuel and lubricant spills.

Vulnerability:

A vulnerability analysis requires identifying the systems and elements exposed to different types of hazards, estimating their degree of severity and their probable spatial and temporal distribution.

The areas, communities or people vulnerable to the different natural and technological hazards identified for the project for each phase are:

Construction Phase:

Areas, elements and communities vulnerable to emergency situations and accidents related to the project:

- Temporary facilities of the work.
- Buildings and service infrastructure under construction.
- Thermoelectric power plant equipment being installed.
- Electrical substation under construction.
- Power transmission line under construction.
- Internal project paths.
- El Copey-Manzanillo highway, access road and other roads that cover the material transportation routes.
- Soils in the project plots and along the route of the power transmission line.
- Pepillo Salcedo Municipality.
- Municipality and province of Montecristi.

People who could be affected by emergencies and accidents related to the project:

- Workers.
- Visitors.
- Residents of the municipality of Pepillo Salcedo.
- Residents of the municipality and province of Montecristi and other communities along the materials transportation route.

Operation Phase:

Areas, elements and communities vulnerable to emergency situations and accidents related to the project:

- Project buildings and services infrastructure.
- Thermoelectric power plant equipment.
- Cooling system equipment.
- Electrical substation.
- Electric transmission line.
- El Copey-Manzanillo road and access road.
- Soils in the liquid fuel storage area.
- Pepillo Salcedo Municipality.
- Municipality and province of Montecristi.

People who could be affected by emergencies and accidents related to the project:

- Workers.
- Visitors.
- Residents of the municipality of Pepillo Salcedo.
- Residents of the municipality and province of Montecristi.

Risk identification:

In order to identify the risks, it was necessary to relate the vulnerable areas or elements with the threats or hazards to which the project will be exposed, according to the mathematical expression ($Risk = Threat \times Vulnerability$).

Risks were also assessed according to the likelihood of occurrence as high, medium and low (Table 8-48 y Table 8-49), taking into account the degree of threat and vulnerability of each area, element or community.

Construction phase risks:

- Risk of loss of human life and property due to hurricanes and other meteorological phenomena.
- Risk of loss of human life and property due to earthquakes.
- Risk of loss of human life and property due to atmospheric electrical discharges.
- Risk of accidents for workers, visitors and residents of communities in the area of influence.
- Risk of traffic accidents.
- Risk of fire and explosion.
- Risk of fuel and lubricant spills.

Operation phase risks:

- Risk of loss of human life and property due to hurricanes and other meteorological phenomena.
- Risk of loss of human life and property due to earthquakes.
- Risk of loss of human life and property due to atmospheric electrical discharges.
- Risk of accidents for workers, visitors, and residents of the communities in the area of influence.
- Risk of fire and explosion.
- Risk of gas leaks.
- Risk of fuel, lubricant, and chemical product spills.

Table 8-48. Risk identification and assessment matrix for the construction phase.

Danger or threat	Vulnerable areas, elements and communities	Risk	Valuation		
			H	M	L
Hurricanes and other meteorological phenomena.	Temporary facilities of the work.	Risk of loss of human life and property due to hurricanes and other meteorological phenomena.	X		
	Buildings and service infrastructure under construction.		X		
	Thermoelectric power plant equipment being installed.		X		
	Cooling system equipment being installed.		X		
	Electrical substation.		X		
	Power transmission line under construction.		X		
	Workers.				X
	Visitors.				X

Danger or threat	Vulnerable areas, elements and communities	Risk	Valuation		
			H	M	L
Earthquakes.	Temporary facilities of the work.	Risk of loss of human life and property due to earthquakes.	X		
	Buildings and service infrastructure under construction.		X		
	Thermoelectric power plant equipment being installed.		X		
	Cooling system equipment being installed.		X		
	Electrical substation.		X		
	Power transmission line under construction.		X		
	Power transmission line under construction.		X		
	Workers.				X
	Visitors.				X
Atmospheric electrical discharges.	Temporary facilities of the work.	Risk of loss of human life and property due to atmospheric electrical discharges.		X	
	Buildings and service infrastructure under construction.			X	
	Thermoelectric power plant equipment being installed.			X	
	Cooling system equipment being installed.			X	
	Electrical substation.		X		
	Power transmission line under construction.		X		
	Workers.			X	
	Visitors.			X	
Accidents.	Workers.	Risk of accidents for workers, visitors and community members.	X		
	Visitors.				X
	Residents of the municipality of Pepillo Salcedo.				X
Traffic accidents.	Internal project paths.	Risk of traffic accidents.		X	
	El Copey-Manzanillo highway, access road and other roads that cover the material transportation routes.			X	
	Workers.			X	
	Visitors.				X
	Residents of the municipality of Pepillo Salcedo.			X	
	Residents of the municipality and province of Montecristi and other communities along the materials transportation route.			X	
Fires and explosions.	Temporary facilities of the work.	Risk of fire and explosion.			X
	Buildings and service infrastructure under construction.			X	

Danger or threat	Vulnerable areas, elements and communities	Risk	Valuation		
			H	M	L
	Thermoelectric power plant equipment being installed.			X	
	Cooling system equipment being installed.			X	
	Electrical substation.			X	
	Power transmission line under construction.				X
	Workers.			X	
	Visitors.			X	
	Pepillo Salcedo Municipality.			X	
	Residents of the municipality of Pepillo Salcedo.			X	
Fuel and lubricant spills.	Soils on the Project site and along the route of the power transmission line.	Risk of fuel and lubricant spills.			X

Legend: H = High, M = Medium, L = Low. For this assessment, the existence of the threat was considered as the degree of vulnerability of the vulnerable areas, elements and communities.

Table 8-49. Risk identification and assessment matrix for the operation phase.

Danger or threat	Areas, elements and vulnerable communities	Risk	Valuation		
			H	M	L
Hurricanes and other meteorological phenomena.	Project buildings and services infrastructure.	Risk of loss of life and property due to hurricanes and other meteorological phenomena.		X	
	Thermoelectric power plant equipment.			X	
	Cooling system equipment.			X	
	Electrical substation.			X	
	Electric transmission line.		X		
	Workers.				X
	Visitors.				X
Earthquakes.	Project buildings and services infrastructure.	Risk of loss of life and property due to earthquakes.	X		
	Thermoelectric power plant equipment.			X	
	Cooling system equipment.			X	
	Electrical substation.			X	
	Electric transmission line.		X		

Danger or threat	Areas, elements and vulnerable communities	Risk	Valuation		
			H	M	L
	Workers.			X	
	Visitors.			X	
Atmospheric electrical discharges.	Project buildings and services infrastructure.	Risk of loss of human life and property due to atmospheric electrical discharges.			X
	Thermoelectric power plant equipment.				X
	Cooling system equipment.				X
	Electrical substation.			X	
	Electric transmission line.			X	
	Workers.			X	
	Visitors.			X	
Accidents.	Workers.	Risk of accidents for workers, visitors and community members.		X	
	Visitors.				X
	Residents of the municipality of Pepillo Salcedo.				X
Fires and explosions.	Project buildings and services infrastructure.	Risk of fire and explosion.		X	
	Thermoelectric power plant equipment.			X	
	Cooling system equipment.			X	
	Electrical substation.			X	
	Electric transmission line.			X	
	Pepillo Salcedo Municipality.			X	
	Workers.			X	
	Visitors.			X	
	Residents of the municipality of Pepillo Salcedo.			X	
Gas leaks.	Workers.	Risk of gas leaks.		X	
	Visitors.			X	
	Residents of the municipality of Pepillo Salcedo.				X

Danger or threat	Areas, elements and vulnerable communities	Risk	Valuation		
			H	M	L
Spills of fuels, lubricants and chemical products.	Soils on the Project site.	Risk of fuel and lubricant spills.			X

Legend: H = High, M = Medium, L = Low. For this assessment, the existence of the threat was considered as the degree of vulnerability of the vulnerable areas, elements and communities.

8.9.1 Emergency preparedness and response plan for the construction phase

8.9.1.1 Purpose

This manual summarizes the preparedness actions and procedures to be carried out in the event of an emergency situation. This plan is a reference document which contains individual responsibilities and actions required of the project response team in the event of an emergency.

The scope of this plan goes from the preparation stage, the period of occurrence of the emergency until the restoration of the operations that affect the project.

The design and integral application of the emergency plan allows the reduction of potential damages to employees, equipment, community facilities and the environment of the thermoelectric power plant, as well as the timely establishment of safe working conditions.

8.9.1.2 Target

Indicate the essential preparedness actions to be carried out in order to respond in a correct and orderly manner in the event of an emergency situation that occurs at the Manzanillo Energy Consortium Power Plant Project site, whether due to operational or natural causes.

8.9.1.3 Specific objective

- Establish guidelines to be followed in the event of an emergency.
- Minimize injuries to personnel and contractor.
- Minimize economic losses that may occur to the project and its facilities.
- Controlling unforeseen and unexpected situations to minimize the consequences that may occur.

8.9.1.4 Definitions

Emergency: Dangerous situation generated by internal or external factors whose magnitude may affect people, equipment, buildings and the environment, and that if effective response actions are not taken, could generate extensive losses.

Emergency control: It is the set of strategic activities and procedures developed to control as far as possible the situations that may be triggered by an unforeseen event in people, facilities or processes.

Actions to be carried out during the emergency: These are those executed by the members of the emergency team to reduce the consequences of the identified emergency.

Alarm: It starts the moment the emergency situation is identified. The detection will be human, and the Emergency Team must be notified immediately so that it can take action according to the established system.

Intervention or Extinction (Control): Once the emergency situation has been identified, the brigadier must go to the site to assess the magnitude of the event and determine whether it can be controlled by his or her own means or whether it is necessary to request external assistance.

Evacuation: Once an emergency situation has been declared that means the abandonment of the work site, the Emergency Chief together with the brigade will proceed to evacuate the personnel to the meeting point defined at the work site, which will be properly signposted.

Emergency Brigade: A group of employees duly trained to deal with an emergency situation.

Brigade Coordinator: designated internal personnel who are present when the emergency occurs and are in charge of coordinating response actions.

Brigadier: All personnel who have received basic emergency response training, and who can be useful in taking control actions in an emergency situation.

Evacuation Route: Path to follow to evacuate a place safely.

Emergency Exit: An enabled or alternate route identified in an area, to exit in the event of an emergency.

Gathering Point: Designated place outside the emergency area, to gather and count people after the evacuation.

People Counting: Verification that all persons present in the area at the time of the emergency are present at the assembly point.

Fuel: Any material or chemical substance that burns or starts a fire relatively easily (LNG, gasoline, diesel oil, fuel oil, paper, wood, etc.).

Fire: Uncontrolled fire, which may occur suddenly, gradually or instantaneously, followed by material damage that may interrupt an ordinary activity.

First Aid: Action by trained medical or nursing personnel to prevent imminent serious injury or death and to attend to the most important conditions such as maintenance of vital signs, cardiopulmonary resuscitation and control of hemorrhage.

Cyclonic Season: Period of the year between June 1 and November 30, which is characterized by the generation of a considerable number of tropical storms.

Hurricane: A natural phenomenon with winds in excess of 119 km/h, accompanied by torrential rains and wind gusts that extend for kilometers.

Bulletin: An official message from a hurricane warning office that disseminates warning information along with details concerning the location, intensity and movement of a hurricane, as well as precautionary measures to be taken.

Hurricane Early Warning Meteorological Alert: Informs about the location of a hurricane that, due to its geographic location, history and trajectory, the population should follow closely. It is issued 72 hours in advance.

Hurricane Watch: General information on location, direction and intensity of the hurricane. The hurricane's landfall is expected within 36 hours.

Hurricane Warning: Hurricane landfall is expected in 24 hours or less.

8.9.1.5 Responsibilities (organization chart of the emergency brigade)

In Figure 8-16 shows the organization chart of the project's emergency brigade during the construction phase.

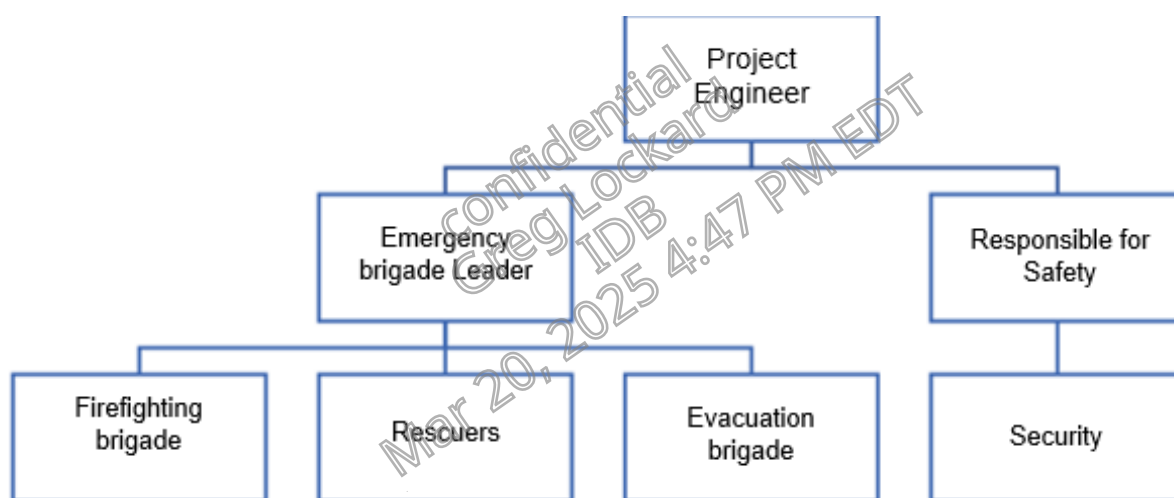


Figure 8-16. Emergency Brigade Organizational Chart

The Project Engineer corresponds to the Construction Management Manager.

In the Table 8-50 describes the roles and responsibilities of each member of the Emergency Brigade.

Table 8-50. Roles and responsibilities of the members of the Emergency Brigade.

Member	Roles	Responsibilities
Project Engineer.	<ol style="list-style-type: none"> 1. Participate in the reinstatement process. 2. Perform duties as assigned. 	<ol style="list-style-type: none"> 1. Comply with the responsibilities before, during and after the emergency, as described above.
Emergency Brigade Coordinator.	<ol style="list-style-type: none"> 1. To summon resources commensurate with the 	<ol style="list-style-type: none"> 1. To direct the actions of the emergency brigades.

Member	Roles	Responsibilities
	magnitude of the emergency. 2. Keep project supervision informed. 3. To comply with the plan according to the emergency.	2. Coordinate activities with external relief agencies. 3. Coordinate with the Committee and the Brigade Leader the restart of operations and recovery actions.
Emergency Brigade (Evacuation, Fire Fighting, First Aid and Rescue).	1. Ensure compliance with emergency procedures for effective mitigation of emergencies.	1. Direct the evacuation of people, according to the established evacuation routes: - Driving people to the evacuation routes. - Check the evacuation of your areas and monitor absences at the outside assembly point once the evacuation has taken place. 2. Locate injured, identify type and severity of injury to provide assistance. 3. Follow the instructions of the Emergency Coordinator. 4. In case of fire, manage the contact with firefighters and 911 and initiate the first steps to fight them using the available portable fire extinguishers as long as the Brigadier's life is not exposed. 5. In case of rescue of injured persons contact 911 and initiate the rescue process.
Physical Security.	Provide support to the Emergency Coordinator. 2. Carry out duties as assigned, commensurate with the emergency. 3. Participate in emergency prevention actions.	1. Monitor the egress of persons or objects during the emergency. 2. Prevent the entry of vehicles and private persons, reporters, cameramen, journalists, etc. 3. Allow the entry of the emergency support authorities (Fire Department, ambulance).

8.9.1.6 Communication in case of emergencies

When the emergency situation is identified, it must be communicated through the means available (sound the alarm), in order to activate the emergency plan. Once the emergency has been confirmed, proceed in accordance with the established procedure according to the emergency presented.

The person who activated the emergency plan notifies the Brigade Leader by providing the following information: (either by telephone, radio communication, or in person, as appropriate)

- Speak: (name of caller),
- From the telephone: (from where you are calling),
- Reporting: (type and magnitude of the emergency),
- Located at: (exact location of the emergency),
- If there are injured persons, also report them.

8.9.1.7 Contacts with emergency institutions

When the impact of an adverse event cannot be mitigated or controlled with the available resources, Project Supervision will immediately request the intervention of the corresponding support or relief institutions to manage the appropriate response.

The situation is communicated to the Project Engineer and Brigadiers, who will proceed as follows:

- It will be carried out without haste, in a group, along the evacuation routes marked according to the instructions.
- The designated officials (lifeguards) will identify the evacuees to ensure that no one is missing at the meeting point.

8.9.1.8 Emergency response

8.9.1.8.1 Response to hurricanes, atmospheric lightning strikes and other meteorological phenomena

Hurricanes:

Before the arrival of the hurricane:

- Dismantle or disassemble the arms of the cranes or petite bon and tie them to the floor.
- Collect oxygen tanks and welding machine and store them in the warehouse.
- Remove all documents and office equipment near windows and doors. Computers, printers, photocopiers and fax machines should be covered with black plastic covers. Paper from printers and photocopiers should also be protected.
- All computer equipment, including computers, printers and UPS should be turned off and unplugged. If any of this equipment is placed on the floor, it should be lifted and placed on tables or desks.
- Communication equipment (microwave radios and switches) should be turned off and disconnected.
- Cover the alternators and electric motors of the different equipment with tarpaulins.
- Operations will be suspended 24 hours prior to the arrival of the hurricane.
- Install plywood sheets in the corners of all the windows of the site's offices.
- Collect all loose objects and confine them in a safe place and tie them up.
- De-energize equipment and installations.
- Check roofs and make repairs as required.
- Arrange trucks and other equipment in a triangular shape with the cabin facing inward with the vertex upwind, in a place where nothing can fall on it, where it will not flood or be swept away by rushing water.
- Ensure that there is no truck without glass.
- Remove all loose objects and work tools on heavy equipment.
- Lower shovels, dump trucks, etc. to a place where nothing can fall on them and where they will not be flooded.
- Keep water tanks full.

- Ensure the existence of: tarpaulins, ropes, padlocks, danger tape, black plastic garbage bags, flashlights and batteries.
- The site workers will be sent home.
- In case it is necessary for security personnel to remain on site during the event, have the following supplies for a minimum of five people and three days of subsistence: water bottles, canned food, sleeping bags, basic hygiene items, among others (see Table 8-51).
- If necessary, ensure that family members of security personnel designated to stay on site during the development of an atmospheric phenomenon are placed in safe areas (shelters) and evaluate the need to offer logistical and economic support to ensure the well-being of these family members.

Table 8-51. Inventory of emergency equipment and supplies.

Supply	Quantity	Check
Disposable Plates	3 units per person for 3 days	
Disposable cutlery	3 units per person for 3 days	
Napkins	9 units per person for 3 days	
Disposable cups	5 units per person for 3 days	
Travel kit (include: 1 soap, small toothpaste, toothbrush, toothpaste, toothbrush, toothpaste, toothbrush, toothpaste, toothbrush dental, 1 deodorant)	1 kit per person.	
Large plastic sleeves	3 units per person.	
Toilet paper	1 unit per person	
Spare batteries	As required by the emergency teams.	
Plywood (wood planks)	As required.	
Ropes of different thicknesses		
Nails		
Adhesive tape		
Sleeping bags	1 unit per person	
Flashlights (battery operated)	1 unit per person	
Towels	1 unit per person	
Cooler	3	
Miscellaneous Food	For 5 persons minimum 3 days of subsistence.	
Water bottles	4	
Coffee	3 packs of 12 sachets.	
Sugar	5 pounds	
Powder for juice or soft drink Bread Fruits Sausages Canned vegetables	For 5 persons minimum 3 days of subsistence.	

Supply	Quantity	Check
Oil		
Salt		
Canned meat		
Canned foods (corn, beans, etc.).		

During the passage of the hurricane:

The Construction Engineer will suspend construction work during the passage of a hurricane.

In the event that security personnel remain on site during the critical moment of the hurricane or storm, they should remain sheltered in the designated place previously evaluated. For example: the main gatehouses, offices, warehouses, among others.

Other meteorological phenomena:

The Site Engineer shall stop outdoor work in the event of a storm, heavy rain, strong wind, or any other unfavorable environmental condition that hinders visibility.

The handling of work equipment used for lifting loads (tower or mobile cranes, etc.) must be suspended when weather conditions may limit their safety conditions. In winds of 45 km/h, the presence of people working at heights should be avoided. Winds of 60 km/h are reference indicators for suspending load lifting maneuvers with cranes.

Work at heights (on scaffolding, elevating platforms, etc.) must not be carried out when weather conditions endanger the safety of workers.

In the event of an electrical storm (atmospheric electrical discharges), suspend work in areas near power lines, electrical transformers, etc. Personnel should be trained on the dangers of using telephones and means of communication, as well as keeping receiving equipment on.

If you are outdoors at the time of a thunderstorm, if possible seek shelter indoors, away from windows. If it is not possible, do not run or go near trees, electric poles or antennas.

If a strong wind is noticed, the brigadists should:

- Guide workers outside a structure to seek shelter as quickly as possible.
- Avoid sheltering workers in light roof structures.
- Keep away from windows and doors.
- Remain in place until wind conditions have subsided.

8.9.1.8.2 Earthquake response

Drills will be carried out so that personnel are aware of how to act in the event of an earthquake and to avoid loss of life.

The safest locations within the facility will be determined and identified so that personnel present can protect themselves during the earthquake.

External areas will be reviewed to verify risk conditions for personnel.

In the event of an earthquake, the following aspects should be considered:

Before an earthquake:

- Verify and check lifting equipment.
- Continuous cleaning of the site to keep the exits clear in case of an emergency.
- Verify the condition of scaffolding and its fastening means.
- Verification of props and formwork, slab, etc. fastening elements.
- Use and revision of safety elements (helmets, safety boots, among others).
- Daily storage of tools in safe places.
- Verification of protective screens for work at heights.
- Verification of fire extinguishers.
- Maintain properly equipped first aid kits.
- Training of personnel to respond to earthquakes.

During the earthquake:

- The first and foremost recommendation is to remain calm and extend it to others.
- Keep away from glass and heavy objects that may fall.
- If you are indoors, do not leave the building until the shaking stops. Most accidents are caused by falling objects while trying to escape.
- Stand next to a load-bearing or interior wall, crouch down and cover your head and neck with your arms.
- When the shaking stops, look for emergency exits and go to them, do not run.
- If you are outdoors, stay away from buildings under construction, trees, power lines and other objects that could fall on you. Go to a clear area.
- Keep away from downed, electrically charged power lines.
- In case of being trapped under the rubble of a building, wait for help and try to be detected.

After the earthquake:

- Do not attempt to unduly move the injured with fractures, unless there is danger of fire.
- Avoid walking where there are broken glass and light wires, do not touch metallic objects that are in contact with the wires.
- Avoid using the telephone if it is not essential, as the lines will be blocked and it will not be possible to use them for really urgent cases.
- To instill absolute confidence and calmness to all the people around us.
- Respond to calls for help from the Emergency Brigade, police, fire department, authorities, etc.
- Do not spread rumors or exaggerated information about the situation.
- After an earthquake, you should avoid walking or driving on roads parallel to the coast, since tsunamis can occur after an earthquake.
- Go to the defined tsunami assembly point, located in the highest part of the area.

8.9.1.8.3 Fire and explosion response

Fires occurring on site should be extinguished with extinguishers for "Type ABC" fires (solid combustibles, liquids, and fire on an electrically live element) or with water in the case of large fires. Never use water on a combustible liquid or electrical fire.

The action to be taken in the event of fire and explosions will be as follows:

- Immediately alert the person in charge and colleagues with available means.
- If the fire is small, try to extinguish it with available extinguishing media. Always place yourself between the exit and the fire.
- Stop work and walk quickly to the exit or meeting place.
- Do not run, do not carry tools during evacuation.
- In the presence of smoke, move in a crouched position, protecting the nose and mouth with a handkerchief or a wet cloth.
- If clothing catches fire, do not run, drop to the ground, roll over and call for help.
- If you are trapped by fire, close the doors between you and the fire.
- Cover door slots with rags, wet if possible.
- Do not return to the work site during the evacuation.
- In the event that the magnitude of the fire cannot be controlled by project personnel, external support from the local fire department will be requested.

8.9.1.8.4 Response to fuel and lubricant spills

Spill preparedness or prevention measures:

The liquid fuel storage tanks to be installed on site must have secondary containment walls, with the following characteristics.

1. The height of the retaining wall shall be 10% above the calculated level of the fuel contained in the storage tank.
2. The distance from the tank walls to the berm walls shall be a minimum of 1.5 m.
3. The interior area of the berm shall be conditioned in such a way that it does not allow the development of any type of vegetation. This area shall be prepared with several compacted layers of backfill material to make the area waterproof.
4. On the interior floor the bases for the support of the metallic structure of the tanks will be placed.
5. Rainwater drainage valves will be installed, which will be kept closed and opened in case of rain.
6. The fuel supply will be provided by a specialized company.
7. Safety instructions shall be prepared to proceed with the unloading of fuel in accordance with the established standards.
8. Devices and means shall be available to control accidental spills.
9. ABC type fire extinguishers shall be available in the area to extinguish any fire that may occur.

Diesel fuel tanks will be marked with the name of the substance stored and its capacity. Safety warnings must be posted to prevent the occurrence of fires and messages such as: flammable material, do not smoke or light a fire, NFPA safety diamond, among others.

Action to be taken in case of spills:

To deal with spills, spill collection materials such as sand, sawdust, earth, shovels, containers or anti-spill kits (with worms, pads or absorbent cloths) must be available.

Personal protective equipment should also be available for workers in charge of spill collection, such as: helmet, goggles, masks, coveralls and boots.

The person who detects the spill must immediately notify the Site Engineer or the nearest superior, activate the brigade to take the following actions:

- Secure and isolate the spill area, clear the area of unauthorized personnel.
- Contain the spill with the element available on site for such purposes (sand, sawdust, earth).
- Move away other stored products that could be affected by the spill.
- Check if the spill has reached any watercourse.
- Evaluate the possibilities for reuse of collected liquid waste.
- Collect the used material and the contaminated soil layer with shovels and wheelbarrows, place it in tanks and dispose of it according to environmental regulations.
- The Safety, Health and Environment Coordinator and the Site Engineer must carry out the investigation of the event.

8.9.1.8.5 Actions in case of accidents

Accident preparedness

A first aid station shall be provided on site, under the control of a physician. The first aid station must be located in an easily accessible and signposted area.

The first aid station will have at least a first aid kit, portable stretcher, a source of drinking water, solutions and oxygen, wheelchair, immobilizers, bandages and neck brace.

In addition, well-equipped first aid kits will be available on site, located in other easily accessible places, as well as in the vehicles and trucks, for the treatment of minor injuries (Form VIII: First Aid Kit Assignment Form).

Accident response measures are applied whether the accident affects a worker, a visitor or a resident of the communities in the area of influence.

Entrapments by or between structures or moving machine parts

In the event of its occurrence, immediate notice shall be given to the Construction Engineer.

Depending on the complexity of the situation, the Site Engineer will decide if he has the necessary means to carry out the rescue or if he should contact the Fire Department.

Fall of people to depth

In the event of a person falling to depth, and being suspended from the fastening elements (harness), the Site Engineer must be notified immediately. Depending on the complexity of the

situation, the Site Engineer will decide if he has the necessary means to carry out the rescue or if he should contact the Fire Department.

General emergency procedure:

- Immediately notify the Evacuation, Search and Rescue Brigade.
- Suspend all activity within a radius of 30 meters.
- Notify the First Aid Brigade.
- Request Medical Assistance.
- If the rescue takes a long time, immediately notify the fire department or civil defense.
- Once the person has been rescued, bring him/her to the attention of a physician.
- Initiate accident investigation, identify causes and take action.
- Prevent return to work at heights until the person has undergone retraining.

Rescue procedures:

In the event of a fall, all workers shall be rescued by on-site personnel with the use of one-man ascending or descending systems or the use of ladders where feasible. Alternate rescue may be performed by employees trained in rescue procedures. These employees will use the simplest and safest procedure in which they have been trained and which is practical for the situation.

Operations in the event area:

- Secure the area: with demarcation mechanisms or others, the rescue maneuver area must be secured, so that third parties are not affected and do not affect the rescue process.
- Evaluation and planning of the operation: this is a critical moment, when the maneuver, equipment to be used and everything that should be involved in the rescue process are decided. At this point the rescuer's capacity is put to the test.
- Access to the casualty: deployment and transfer of the rescuer to the casualty site, this maneuver is very delicate and requires taking into account all the technical parameters to secure the rescuer.
- Rescue of an injured person: the rescuer, by means of a maneuver, takes the injured person and moves him/her to a safe place, this is where you can see if the evaluation and planning of the maneuver was adequate (depending on the characteristics of the event, there are different types of maneuvers).
- Stabilization and referral of the injured person: after being in a safe place, the rescuer must stabilize the injured person and refer him/her to a place where medical assistance can be provided.
- Verification of the condition of rescuers and rescued persons: in this step, a medical examination of rescuers and rescued persons must be made to ensure their health condition.

Communication procedures:

In the event of a fall, the following persons shall be notified as soon as possible:

- Rescue personnel (Emergency Brigade).
- Emergency services (fire department, civil defense).

- Safety, Health and Environmental Coordinator for the project.
- Site Engineer.

Premises of safety in rescue at heights:

- The area should always be cordoned off before rescue work begins.
- A double check of the fall protection systems used during rescue should always be performed.
- Rescuers should always wear their personal protective equipment. A group leader and a coordinator should always be chosen.
- Pre-planning should always be done prior to rescue to check for possible risks and hazards and to take early control measures.

Electrocution

Under no circumstances should you come into contact with the electrocuted person if you do not know what measures should be taken.

If at the time of the accident they are not on site the Site Engineer the command previously designated to continue the sequence shall:

- Call 911 immediately.
- Do not touch the injured person.
- Do not allow any colleague acting on impulse to touch the injured person.
- Check the area of the accident and evaluate if there are any elements that may have been energized and could electrocute when trying to help the injured person.
- Disconnect any equipment or cables from the electrical panel.
- After disconnecting the machine or electrical tool that is in contact with the person, the person is removed without any risk.
- If the risk of electrocution persists, the injured person should be moved as far away as possible from the accident area and first aid should be provided by the brigade.

Landslides / landslides

In case of occurrence, an alarm should be activated immediately and all persons should be removed from the excavation and the total evacuation should be indicated.

When a hazardous situation is noticed or when the Supervisor's warning is heard, workers shall:

- Stop the task they are performing.
- Exit the excavation by the nearest exit (the excavation must have at least 2 ladders that protrude 1 m from the edge of the excavation and that are tied off).
- Do not stop to remove tools or materials.
- Once out of the excavation, withdraw from the edge of the excavation.
- The excavation may not be re-entered without the authorization of the Site Engineer.

8.9.1.9 Evacuation procedure

The general evacuation procedure will be as follows:

- Stop operations in the area.
- In case of a heavy load, lower it immediately to the ground.
- Turn off the equipment you are working with.
- In case of operating mobile machinery, remove it from traffic routes and park it in a safe place.
- Remain calm, avoid panic and confusion.
- Identify the nearest escape routes (even if they are not yet in use).
- Remain in the work area until evacuation is indicated.
- Complete all emergency tasks assigned to you and leave quickly, but in order.
- Form a double line in the counting zones. Walk fast, but do not run, talk or push.
- In the event of abandonment of the Project site, all personnel, including brigades, must leave the counting areas and exit the site without using vehicles.

Upon hearing the emergency signal the guard (surveillance personnel) shall:

- Open parking lot doors to allow for quicker flow for exiting and entering support groups (e.g., fire department, 911, others).
- Guide outside help to the scene of the incident.
- Do not allow personnel to enter except when outside assistance has been requested and must answer incoming phone calls by saying, **"At this time site operations are interrupted please call back later, thank you."**

8.9.1.10 Action in the event of traffic accidents

In the event that truck drivers and project vehicles are involved in traffic accidents, the procedure to be followed will be as follows:

- Verify the condition of those involved and that they have no injuries that could compromise their health.
- Turn on the vehicle's emergency lights.
- Place reflective triangles or cones approximately 30 m away (in front and behind the vehicle if the road is a two-way street).
- In case of injury, call 911 emergency number.
- Avoid moving the injured if you do not have the medical knowledge, as this may worsen the injuries. If it is necessary to do so, in case it is life-threatening, do not move the spinal axis.
- If you have knowledge of first aid, give first aid to the injured person while emergency services arrive. If the accident is on the project's internal roads or on an external road very close to the project facilities, request help from the First Aid Brigade.
- Check for leaks of oil, gasoline or other hazardous fluids, insulate with sawdust.
- Write down the information of the parties involved, name, telephone number, address, license, license plate and vehicle insurance.
- Write down the names and telephone numbers of witnesses (if any).
- Take photographs of what happened.

- Call the company's facilities to report what happened.
- Do not move the vehicle from the accident site until instructed to do so by the traffic authorities.
- Have the necessary documentation at hand (identity card, driver's license, vehicle registration and insurance) and hand it over to the traffic authorities when requested.
- File a police report at the nearest DIGESETT (Dirección General de Seguridad de Tránsito y Transporte Terrestre) post.
- The company that owns the vehicle will be in charge of making the necessary arrangements with the insurance company, as well as the Occupational Risk Insurance Company (if applicable).
- The company will be in charge of filling out the Traffic Accident Investigation Report Form in order to proceed with the investigation of the accident and take the necessary measures to prevent a recurrence.

8.9.1.11 Action at the end of any emergency

Once any emergency has ended and the situation of the event has been controlled, the Safety, Health and Environment Coordinator, together with the Site Engineer and those designated by him, will carry out an investigation of the event in order to identify and study the causes that originated the event and the adoption of the corresponding measures.

The results of the investigation should be presented to the project supervision, together with the other managers. Lessons learned should also be disseminated to site personnel.

8.9.2 Emergency preparedness and response plan for the operation phase

8.9.2.1 Purpose

The objective of this general plan is to clearly define the actions to be taken to minimize the effects of a possible emergency situation occurring in the facilities of the Manzanillo Energy Consortium Power Plant. The specific objectives of the emergency plan are summarized below:

- Preserve the physical integrity of personnel, visitors and contractors.
- Identify preliminary actions to be taken to mitigate the impact of an emergency.
- Establish the operations necessary to effectively deal with the various risk scenarios to which the plant and its personnel are exposed.
- Minimize damages that may occur in different risk scenarios.
- Identify actions to recover operations in the shortest possible time.
- Establish responsibilities before (preventive), during and after the occurrence of the identified risk scenarios.
- Establish clear lines of communication with municipal and provincial response services.
- Identify the resources available to the facility to deal with emergencies.
- Present the necessary resources and supplies to be prepared.

8.9.2.2 Scope

This procedure is intended for all Manzanillo Energy Consortium Power Plant personnel, including contractors and visitors, as well as residents of the communities surrounding the facilities. The following are the emergencies for which specific responses have been developed in this plan:

- Hurricanes and other meteorological phenomena.
- Earthquake.
- Fire/explosion.
- Spill/release of fuels, lubricants and chemicals.
- Gas leaks.
- Medical emergencies.
- Bomb threat.
- Violence in the workplace.
- Plant evacuation plan.

8.9.2.3 Definitions

Event

Incident or Accident. An undesired event that interrupts or interferes with the normal course of an activity or process and results in injury, physical damage or loss of time.

PRC

Crisis Response Plan.

COE

Emergency Operations Center.

EMC

Crisis Management Team.

PRH

Hurricane Response Plan.

Designee

This is the person who has been appointed to act on behalf of one of the positions with roles in this procedure.

Biohazard

A biological hazard is the presence of organisms or substances derived from organisms that are harmful to human health. The most common types of biohazards include bacteria, viruses, toxins

and animals. All of these can cause a variety of health effects, ranging from irritations and allergies to infections, cancers and other diseases.

Epidemic

It is a description in community health that occurs when a disease affects a higher number of individuals than expected in a population during a given time.

Pandemic

The affectation of an infectious disease of humans over a geographically large area.

8.9.2.4 Responsibilities

The following are the general and specific responsibilities of each position in the company regarding the implementation of this General Emergency Plan:

Crisis Management Team:

Audits the effectiveness of the plan on an annual basis, in accordance with market best practices and lessons learned from previous periods.

Plant Management:

- Manage an annual drill to verify the effectiveness of this plan.
- Ensures that the meetings and actions established in this plan are carried out.
- Ensure staff training on this plan.
- Identifies actions to recover operations in the shortest possible time.
- Maintains an up-to-date emergency contact list of plant personnel.
- Verify the various fire protection and suppression systems and review the results of the latest inspections.
- Ensures compliance with preventive maintenance schedules for all plant systems in accordance with the operations maintenance plan.

Maintenance Superintendence:

Fully implements maintenance programs in accordance with the annual operations plan, so that no system can produce an emergency due to lack of maintenance.

The Operator or Control Room Operator:

Will be in charge of giving the evacuation signal when a state of emergency is established. Makes the decision to maintain or interrupt plant operation, depending on the nature of the emergency. Communicates with his/her superior and with the Plant Manager to inform him/her about the events.

Administrative Superintendency:

Provides logistical support to Plant Management and Superintendents to guarantee basic supply and transportation services.

Safety, Health and Environment Coordinator:

- Responsible for having the Command Center ready in case the Plan has to be activated.
- Train plant personnel in the implementation and roles of this plan.
- Responsible for collecting personnel contacts to maintain an emergency contact list.
- Establish good relations with the representatives of the relief agencies, achieving a familiarity that facilitates any support action.
- Train emergency brigades to ensure their effective response during an emergency.
- Develops and conducts in-plant multi-event drills to implement emergency brigades.
- Summons relief agencies to the drills to act as evaluators of the brigades and contribute their experiences to strengthen them.

All Staff:

- Notifies his superiors of any occurrence or emergency.
- Make prudent decisions about interruption or continuation of the operation in case of witnessing an emergency.
- Follow the instructions of the emergency/intervention chief or the first aid and/or rescue brigades.
- Evacuate safely and according to instructions.
- Report to the meeting point.

Emergency Response Team (ERE):

- Expedite the evacuation of the plant to the assembly points or to the place indicated by the emergency/intervention chief or the first aid and/or rescue brigades.
- They provide first aid care in the event of a medical emergency.
- Maintain organization at meeting points with the help of area leaders.
- They fight fires.
- Search and rescue of personnel is carried out.

Communication Brigade:

For emergencies, radio and telephone communications are channeled internally from the control room. An updated list of emergency contacts, which is updated annually, is available in the area. If the control room needs to be vacated, internal communication is done through the Shift Supervisor through the different communication channels available (radio, cell phones and telephones).

Formation of the Emergency Brigades.

In order to guarantee the continuity of the Emergency Brigades over time, they are formed according to the existing positions in the plant. Table 8-52 shows how they are formed.

Table 8-52. Formation of Emergency Brigades.

Fires	Evacuation	Spills	Communication	First Aid	Rescue
Operations Superintendent	Electrical Coordinator	Chemical Analyst	Plant Manager	Planner	Mechanical Maintenance Superintendent
Operations Shift Supervisor	Instrumentalist	Field Operator D	O&M Manager	Mechanic D	Mechanical Maintenance Shift Supervisor
Field Operator B	Administrative Assistant	General Services Supervisor	Control Room Operator A	Mechanic B Workshop	Mechanic C - SHIFT
Mechanic C			HSE Coordinator	Administrative Superintendent	

8.9.2.5 Emergency response

Plant access control.

The Operator or Control Room Operator communicates the state of emergency to the Property Security personnel at the plant access door.

It is the responsibility of Property Security to restrict the entry of unauthorized personnel during an emergency. Authorized personnel are considered to be employees or persons who have direct or indirect involvement in the emergency process, e.g. brigade personnel, management, and/or external entities with prior authorization from management. If there is any doubt about the authorization for the entry of a person, Property Security should contact Plant Management to request authorization.

The media is not allowed on site, unless access is authorized by the operations management.

Generalities of the emergency process.

- If you have radio communication available, use it to communicate the event, making sure to give a precise and concise message of what happened.
- Keep management informed of the evolution of the emergency.
- Only the Director of Operations or his/her designee may activate the Crisis Committee.
- The Plant Manager or his/her Delegate must inform the competent authorities (Fire Department, National Police, Civil Defense, etc.) of the location of the event.
- The ERE and Plant Manager meet after an event to discuss what happened in the incident.

Recording of emergency incidents.

All incidents resulting in an emergency must be reported through the company's incident platform on the intranet.

All incidents that produce an emergency must be investigated to determine their root cause and proceed to generate corrective and preventive actions.

Emergency equipment.

The plant will have an inventory of emergency equipment, and scheduled inspections will be carried out through the company's preventive maintenance system.

In case of any emergency, analyze the following elements:

- What is the type of emergency?
- Location where the emergency occurred?
- When did the emergency occur?
- Are there any injuries or casualties in the area?
- Is there Hazardous Material involved in the emergency?

8.9.2.5.1 Response to hurricanes, atmospheric lightning strikes and other meteorological phenomena

The measures to be taken in the event of hurricanes will be as follows:

Before the arrival of the hurricane:

Before the arrival of the hurricane, the following equipment and emergency supplies must be available at the power plant facilities:

Emergency Command Center (ECC) equipment

The Command Center shall be equipped with the following items and supplies:

- List of updated emergency contacts of relief agencies and authorities in the electricity sector with whom contact could be established.
- Updated emergency contact list for each plant employee.
- Local and country maps and hurricane trajectory maps for tracking the phenomenon
- Data sheets of stored chemicals.
- Alternative communication equipment, such as: fixed line telephones, cellular phones, radios, etc.
- First aid kit.
- Health, safety and environmental procedures manuals
- AM and FM radio to follow news and weather reports.

Emergency Supplies

There will be sufficient emergency supplies to self-sustain plant personnel and property security personnel for at least 3 days. Table 8-53 shows an inventory of supplies and suggested quantities for 20 people.

Table 8-53. Inventory of emergency equipment and supplies.

Supply	Quantity	Check
Disposable Plates	3 units per person for 3 days	
Disposable cutlery	3 units per person for 3 days	
Napkins	9 units per person for 3 days	
Disposable cups	5 units per person for 3 days	
Travel kit (include: 1 soap, small toothpaste, toothbrush, toothpaste, toothbrush, toothpaste, toothbrush, toothpaste, toothbrush dental, 1 deodorant)	1 kit per person.	
Large plastic sleeves	3 units per person.	
Toilet paper	1 unit per person	
Spare batteries	As required by the emergency teams.	
Plywood (wood planks)	As required.	
Ropes of different thicknesses		
Nails		
Adhesive tape		
Sleeping Bags	1 unit per person	
Flashlights (battery operated)	1 unit per person	
Towels	1 unit per person	
Cooler	3	
Miscellaneous Food	For 20 people minimum 3 days of subsistence.	
Water bottles	12	
Coffee	3 packs of 12 sachets.	
Sugar	20 pounds	
Powder for juice or soft drink Bread Fruits Sausages Canned vegetables Oil Salt Canned meat Canned goods (corn, beans, etc.).	For 20 people minimum 3 days of subsistence.	

Levels of Alerts and Preventive Actions.

It is the responsibility of the Safety, Health and Environment Coordinator to keep the organization informed in accordance with the official communications media of the behavior of the phenomenon and the different levels or colors of alert.

Yellow Alert - Tropical Storm Warning.

Hurricane or tropical storm warning. It is issued by the official media when the tropical disturbance in question has penetrated the Caribbean area, and its path is expected to cause some impact on the national territory.

Orange Alert - Hurricane Warning

Hurricane Warning. Hurricane conditions are expected to impact our assets for 24 to 36 hours.

Red Alert - Hurricane Warning.

Imminent Hurricane Warning. Hurricane conditions are expected to impact our assets within 12 hours or less.

Warning Plan 48 hours before the arrival of a Hurricane.

- Follow up on bulletins from governmental and international institutions.
- The Safety, Health and Environment Coordinator must keep the company's personnel informed about the atmospheric phenomenon.
- Operations, Maintenance and Property Safety teams must assess critical areas in and around the plant to identify hazards such as: flammable materials, chemicals, loose equipment, and pressurized cylinders. Necessary measures are taken to secure or relocate them.
- The Operations Superintendent identifies and contacts suppliers for the rental of heavy equipment, portable generators, motor pumps; requests the necessary equipment to have it available in the plant.
- The Administrative Superintendent must request from each department manager the list of personnel that will be on duty at the plant (operations, maintenance, guards, military on duty) and update, if necessary, telephone numbers and addresses.
- The Administrative Superintendent ensures the following actions:
 - Purchase supplies and supplies related to the atmospheric phenomenon.
 - Coordinate the transfer of personnel to and from the site to cover shifts during the weather event.
 - Reserve the rental of vehicles, generators or other emergency devices as necessary.
 - Secure a locally available emergency vehicle.
 - That available vehicles have full fuel tanks and that resources are available for additional fuel purchases.

Alert Plan 12 hours in advance:

The Operations and Maintenance and Property Safety teams perform a second inspection of the plant, both internally and externally, using the pre-hurricane checklist.

The Administrative Superintendent, with the collaboration of the Safety, Health and Environment Coordinator, distributes the necessary supplies to the required personnel of the Operations and Maintenance and Property Security areas.

The Health, Safety and Environmental Coordinator provides equipment as required to personnel staying during the hurricane or storm (e.g., radio, flashlights, coats, first aid material, etc.).

The General Manager, with the advice of the Health, Safety and Environmental Coordinator, determines when all personnel who are not essential to the continuous operation of the plant will be allowed to go home.

It is the responsibility of the Operations Director, with the advice of the Health, Safety and Environment Coordinator and the Plant Manager, to give the order for disconnection, shutdown, or decommissioning of the plant, taking into consideration the time required for each operation. Consideration will be given to the execution of the pertinent maneuvers that must be carried out in a prudent time before the arrival of the effects of the hurricane or storm, so that the personnel can take shelter.

During the passage of the hurricane:

- During the critical moment of the storm, all personnel must remain sheltered in the designated place previously evaluated. In the case of Property Security, the sentry boxes at the main doors to each plant serve as a shelter and tactical logistics area.
- It is necessary to ensure that the family members of direct personnel designated to stay on site during the development of an atmospheric phenomenon in the different alerts are placed in safe areas (shelters) and the need to offer logistical and economic support to ensure the well-being of these family members will be evaluated.
- Personnel remaining on site should document and keep a record of observations and events during the passage of the storm.

After the hurricane:

Communication/Use of Satellite Phone.

In the worst-case scenario that all traditional communication systems collapse (internet, telephones, cell phones), the Plant Manager or designee must establish communication with the Dispatch Center (CDH), the Director of Operations, or any of the members of the Crisis Committee, through the assigned satellite phone. The purpose of this communication is to indicate the status of people and assets, and the availability of plant resources.

Depending on the magnitude or seriousness of the event reported by the Plant Manager or Designee, the Crisis Committee will be called upon to act.

To ensure communication with the central station after the storm has passed, the user should verify that the weather conditions allow the use of the satellite phone. If this is the case, the user should try to establish communication until this is achieved, with at least one attempt every hour.

If unable to reach the HRC, the Director of Operations, or a member of the Crisis Committee, the user should attempt to establish communications with another Plant Manager.

Chain of command:

The flow of internal information runs as follows:



System Reconstruction Committee (CRS) (including the Superintendency of Electricity, Director of Operations and agents):

Once the storm has passed, the company will execute actions to recover operations in the shortest possible time. Below are the roles and responsibilities during the recovery phase:

Safety, Health and Environmental Coordinator: Performs a risk assessment at the plant to verify unsafe conditions originating from the hurricane and/or storm.

Maintenance Departments, Projects, Maintenance, and other support areas: They must prioritize the corrections of all emergency situations such as: water leaks, electrical problems, dangerous debris, for the start-up of operations. The requirements to these departments will be made through the Operations Management or its Delegate, and the Plant Managers.

Operations Manager: He will be responsible for the restart of the operations of each plant. His specific functions during the recovery phase will be the following:

- Attend meetings called by the Superintendency of Electricity (SIE), or delegate a substitute.
- Consolidates information on the availability of all the company's assets and defines, together with the Operations Director and the General Manager, the start-up.
- Defines the special modes of operation of the electrical system or islands that may be formed as a result of the emergency. Inclusion of additional substation operators to cover substations that normally operate unattended.
- Confirmation of departure schedules of generating units and transmission elements.

Atmospheric electrical discharges

The measures to be taken in the event of atmospheric electrical discharges are described below.

Before an electric shock event:

- Qualified personnel should determine the possible points or elements at risk within the project area.
- All personnel will be trained on how to act in the event of an electric shock event, so that they can act appropriately to protect themselves.
- Train personnel on the dangers of using telephones and communication media, as well as keeping receiving equipment turned on.

During an electric shock event:

- Seek shelter indoors, away from windows.
- In case of being outdoors in open spaces, do not run or approach trees, poles or antennas.
- Suspend work in places close to power lines, electrical transformers, etc.

8.9.2.5.2 Earthquake response

The measures to be taken in the event of earthquakes are as follows:

Before an earthquake:

- Confirmation of existence of critical parts and equipment:

A list of available and required critical equipment and parts shall be kept on hand. The Plant Manager or his/her designee shall have available a list of all suppliers of equipment, supplies, and fuels, in order to ensure self-management in case of loss of functionality at the Corporate Office.

Suppliers of all critical, non-critical and auxiliary equipment, both new and used, should be identified for quick purchase.

- Designation of Seismic Evaluation Team

Each Plant Manager will designate a post-seismic evaluation team at each plant, which will act immediately after the personnel have been stabilized following an earthquake and the plant's SCC is functioning.

This team will carry out the review of the electric generation and transmission infrastructure, fuel storage and conduction, among others.

Existing evacuation routes will be checked to see if objects could fall into them. The meeting point will be reviewed to ensure it is adequate in the event of an earthquake.

- Staff training and drills

Training and refresher training will be scheduled annually for all company personnel. Evacuation drills will be conducted.

The improvements identified in these drills will feed into this plan on an ongoing basis.

- Information Back Ups

All the company's sensitive information will be located in at least 2 backups, in servers at the national and international levels.

Committee for the Reestablishment of the Plants and Interaction with the Authorities of the Electric Sector.

The Crisis Committee will act as the Committee for the follow-up of the reestablishment of Operations. It will also act as the Committee for Interaction with the Electric Sector Authorities.

- Interaction with relief agencies

Meetings should be held with relief agencies (COE, Civil Defense, Red Cross, Fire Department, Public Health, etc.) so that they are aware of the facilities and programs. This will make it easier for them to provide assistance after an earthquake.

During the earthquake:

During the earthquake, the personnel will have to implement the knowledge acquired in the training and drills conducted by the company.

Among the general practices modernly recommended to save life in this type of case are:

- Remain calm and avoid scaring others by shouting.
- Keep away from windows, glass, showcases, partitions, and objects that can fall and hit you.
- If you are in a multi-story building, do not use an elevator because you could get stuck or fall.

- Use flashlights for lighting and avoid the use of candles, matches, or any type of flame during or immediately after the earthquake, which could cause an explosion or fire.
- Remain alert to the risk of building collapse. If there is a risk of collapse and you have an exit nearby, proceed carefully to evacuate the building. However, be aware that falling or unsafely suspended materials during and after an earthquake can be fatal. If you are not in danger or do not have a nearby route out, seek the safest possible shelter by adopting the Triangle of Life position (lying next to a large piece of furniture and in the fetal position).
- A general rule of thumb for evacuation is that, if you are not in danger, do not evacuate unless directed to do so by the Shift Supervisor, the Safety, Health and Environmental Coordinator or the proper authorities. Evacuation normally occurs after the initial earthquake has subsided.
- If it is not possible to go out in the open, adopt the triangle of life position. This can be done by lying in the fetal position next to a couch, chair or large piece of furniture.

Other measures include:

- Do not go out, unless the building requires it.
- Do not attempt to jump out of a window.
- Do not run.
- Do not rely on columns.

If it is outdoors:

- Move away from buildings, trees, electric lighting and utility wires.
- Remain outdoors until the movement passes.
- Be careful not to approach or enter damaged buildings. The greatest danger from falling debris, cladding, glass, etc., is in the vertical of the facades.
- If you are driving a vehicle, it is advisable to stay inside the vehicle, as well as to be careful to stay away from bridges, electric poles, degraded buildings or landslide areas.

After the earthquake:

General

After an earthquake, the following general processes will be executed:

- Immediately after the earthquake, the Evacuation Brigade should carry out a head count of the people in the plant and preliminarily assess their integrity and availability to engage in relief and rehabilitation work.
- Rescue work should begin at the plant and first aid should be given to the personnel and then they should be sent to the nearest health centers. All vehicles available at the plant should be used for this purpose.
- All off-site personnel should communicate with their direct supervisor. If communication is impossible, they should report in person as soon as possible, if it is safe to do so. The objective is to integrate as quickly as possible into the recovery work, in order to stimulate the continuation of productive activities.
- Depending on the available personnel, work groups will be formed for the reestablishment of the operation, which includes the evaluation of the conditions, enabling the Command

Center, maintenance, commissioning and start-up of the units, in coordination with the authorities of the electricity sector.

- Create awareness among staff that it is understandable that there is a priority to resolve family-related issues, but once these are handled, they should come to the workplace to facilitate the recovery activity.
- All the information gathered in the assessment phase must go to the Operations Department to seek the necessary resources for reconstruction/rehabilitation.
- The form of communication will be by telephone, either conventional or satellite.
- Emergency brigades should have the responsibility to attend to personnel before they leave the workplace. This responsibility should be established. Shifts will be scheduled to go to and from homes.

After the occurrence of an earthquake, a possible tsunami emergency may occur due to the conjunction of the following conditions:

- If an earthquake greater than 6.5 on the Richter scale occurs.
- If such an earthquake is generated in the zones of influence on the neighboring faults in the north of South America or in the collision zone of the Caribbean and North American faults, the earthquake is generated in the zones of influence on the neighboring faults in the north of South America or in the collision zone of the Caribbean and North American faults.
- An earthquake with a hypothermal depth of 25 km.

In case of a suspected tsunami, the Safety, Health and Environment Coordinator or his Delegate:

- Communication should be established with international organizations (Pacific Tsunami Center <http://ptwc.weather.gov/>) and local authorities to validate the possible occurrence of the event.
- Keep in mind that the earthquake may have triggered the evacuation of plant personnel to the assembly point and the process of confirming a tsunami threat occurs while the consolidation of personnel at the assembly points is being completed.

The Emergency Response Team (ERE) must remain attentive to abnormal natural phenomena that may occur.

Only when the Safety, Health and Environment Coordinator or his/her Delegate confirms the tsunami threat does he/she instruct the ERE to evacuate plant personnel out of the plant to an elevated point or to gain ground on land. After the event has passed, instructions from the national authorities should be awaited.

Start-ups after an earthquake

- Wait for confirmation from the authorities of the sector and the plants will be started up according to the load requested.
- The load will be taken slowly, observing the system parameters (voltage and frequency).

Observe how the machinery is behaving, if there are drips or abnormal conditions. Resume routine operations.

- All deviations will be documented, and a maintenance plan will be prepared to address these deficiencies gradually, to the extent possible.
- Existing maintenance plans will be adapted.

Staff turnover

- The Plant Manager, or his or her designee, should organize the rotation of personnel so that staff can attend to family matters.

Controlled distribution of the Crisis Response Plan

- An updated copy of this plan must be available in digital format in the shared folders of all plants.
- No copy of any part of the plan shall be sent to any outside organization without authorization from the Chief Operating Officer.
- No one is permitted to make any changes to any of the elements of this plan.
- The Coordinator or the Safety, Health and Environment Coordinator will establish and maintain an official list of the holders of controlled copies of the PRT, the list of copies will include the following information:
 1. Copy Number
 2. Responsible
 3. Location
 4. Delivery date
 5. Acknowledgement of receipt
 6. Distribution of the TRP in general will follow the provisions of procedure I-P02, Document Control.

8.9.2.5.3 Fire/explosion response

In the event of a fire/explosion in the plant should proceed to:

- Report the location of the fire or explosion to the control room.
- The communication protocol is immediately activated at all plant levels, the Operations Department and the Property Security Management.
- If the magnitude of the event warrants it, the fire alarms are activated to evacuate the plant (if it is safe, use the available fire extinguishers).
- If the magnitude of the fire automatically activated the alarm system, the control room personnel should check the fire system panel to notify the location of the event to the review team, who goes to the area to verify the hazardous condition.
- At the sound of the alarm, all plant personnel, except for the control room, proceed to evacuate.
- The brigades proceed to prepare to respond to their respective emergencies.

- A selected personnel (reviewer team item 3) is sent to verify the magnitude of the event, if the result of this verification warrants the general shutdown of the plant; he/she proceeds to shut down or gives the order to the control room to shut down the plant and proceed to notify the fire brigade to fight the fire; once the brigade is activated, the control room proceeds to evacuate the plant.
- If the intervention of external support (firefighters, ambulance/air rescue, among others) is necessary, the Shift Supervisor makes the call.

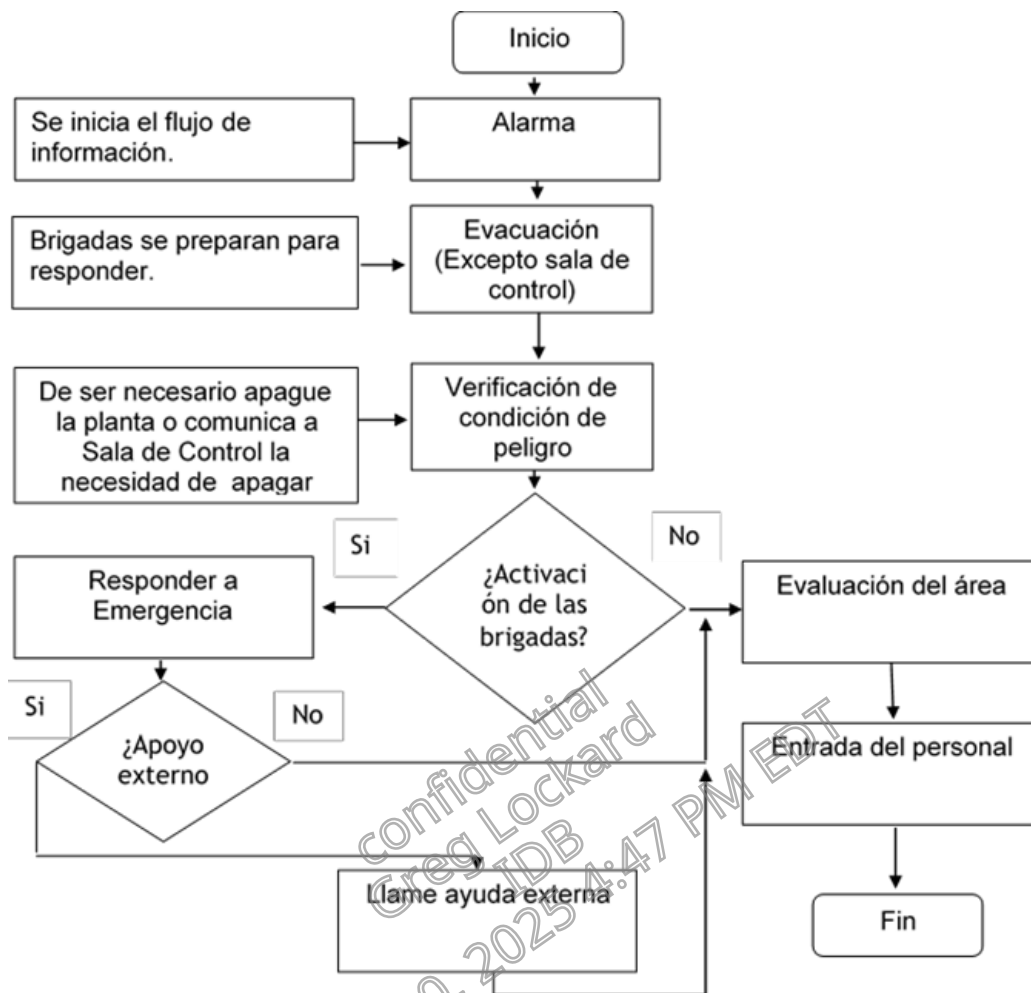
Important note: Only the Director of Operations or his or her Delegate can authorize the entry of the media into the plant or activate the Crisis Committee.

Once it is assessed that the risk zone is under control and safety in the plant is evidenced, the Plant Manager or his/her Delegate proceeds to allow personnel to enter.

All incidents must be reported through the intranet within the organization and the appropriate investigation must be carried out by the Shift Supervisor.

The following is a flow chart of decision making during an emergency:

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IDB
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Response Levels

There are three (3) levels of response, and each of them respond to the severity or impact of the emergency event.

Response Level 3, described below, can only be declared by the Operations Director or her Delegate, upon the recommendation of Plant Management. A Level 3 emergency must be declared using available communications channels to ensure that it is disseminated to the entire plant population and to the appropriate company and external authorities.

At the moment Level 3 is declared, the Crisis Management Team (CMT) is activated. The Plant Manager or his/her Delegate will be responsible for generating the reports to the EMC.

Level 1

Level 1 incidents are easily handled by internal plant personnel or in accordance with the emergency management procedures of each location. Some examples of Level 1 incidents are: fire outbreaks, small spills, minor lacerations, among others.

An incident investigation report is made which is disseminated to the rest of the organization through the intranet (non-EMC active event).

Level 2

Level 2 incidents require the intervention of outside professionals such as firemen and firewomen, ambulance, etc. The Shift Supervisor gives the order to call in reinforcements. Examples of Level 2 incidents are: incapacitating incidents requiring transport to a medical care facility, property damage not involving cessation of operations but significant economic loss, and spills with contact to the environment with a spill volume greater than 10 gallons.

Level 3

The Director of Operations declares a Level 3 incident, and immediately activates the EMC at this level. Examples of a Level 3 incident are:

- Death or serious injury to persons.
- Accident with property damage involving cessation of operations and/or substantial financial loss.
- An incident with a significant impact on the environment (spill with contact to the environment of a significant volume of chemical, release of gases to the atmosphere, explosions) or impact to the community.
- When the incident attracts regional or national media attention.
- It requires the participation of national regularizing institutions.
- When it is necessary to call in external reinforcements of greater magnitude.
- If protection is required for people outside the plant, either residents or neighboring industries.
- Bomb threat.
- Extreme weather conditions and hurricanes.
- Risk of biological contagion.

8.9.2.5.4 Response to spills and releases of fuels, lubricants and chemicals

Prevention measures for spills and releases of liquid fuels (diesel), lubricants and chemical products are as follows:

Spill prevention measures:

The following preventive measures shall be implemented continuously at the power plant facilities:

- Plant inspections: The Safety, Health and Environmental Coordinator, as well as the members of the Spill Brigade, must carry out periodic inspections of the entire facility to minimize possible causes of spills (oil or fuel leaks, poor storage of materials and waste, etc.). All plant personnel (operations and maintenance) should play an active role in identifying risk conditions in the performance of their duties. This should be communicated to all personnel in daily and monthly meetings and training sessions.
- Inspections of spill containment/collection equipment/supplies: Inspections to ensure the functionality of spill control equipment and supplies will be carried out on a monthly basis.
- Maintenance routines: Emphasis will be placed on preventive, predictive and corrective maintenance processes in order to eliminate possible failures that could result in a spill.
- Care in handling fuel and chemicals: The transfer of fuels and chemicals in the plant will be carried out according to what is stated in the Material Safety Data Sheets (SDS) and to what is established in the operating procedures to prevent spills from occurring.
- Care in handling oily waste: Oily waste will be carefully stored and monitored (on rounds by operating personnel, as well as during inspections) to prevent spills.
- Segregation by physical-chemical characteristics: A chemical segregation table will be used to avoid storing products that may react spontaneously when in close proximity to others, as well as in the event of an emergency (e.g., earthquake) that may suddenly release them.
- Identify hazardous material locations and associated activities on an emergency plan situation map.
- Other measures: The Safety, Health and Environmental Coordinator and the members of the Spill Brigade will constantly keep identifying measures to minimize the occurrence of spills in the facilities.

Fuel storage

Operations personnel will conduct daily inspections of fuel storage tanks and ensure that secondary containment infrastructure valves are closed and padlocked to prevent the spread of any spills.

Weekly inspection tours of all bins in the facility will be conducted.

Maintenance and inventory of emergency equipment and supplies

- A quarterly inventory of all emergency equipment, or after each time it is used, shall be taken.
- Where applicable, all emergency equipment shall be subjected to operational tests, which shall be carried out in accordance with the manufacturer's recommendations, or after each time it is used.
- All emergency equipment shall undergo routine maintenance, which shall be carried out as prescribed by the manufacturer, at the recommended intervals.
- Where applicable, all emergency equipment shall be cleaned as prescribed by the manufacturer, at the intervals recommended by the manufacturer and after each time it is used.
- Respiratory protection equipment shall have an annual calibration.
- Any emergency equipment removed from its designated storage area should be inspected and replaced if necessary.

- When any emergency equipment is found to be inoperable, or improperly calibrated, it should be immediately removed from service and replaced within 24 hours.
- Emergency cabinets and/or cases cannot be resealed until the appropriate bill of materials has been satisfied.
- Perishable materials should be date stamped to ensure a proper replenishment cycle.
- All batteries intended for use in emergency equipment should be replenished semi-annually.
- Emergency equipment shall not be used for routine work, or for non-emergency tasks and functions, without the permission of the Area Manager.
- The Area Manager is responsible for ensuring that inventory checks and the operability of emergency equipment.
- Facility personnel who have received appropriate training can perform these checks or inspections (Spill Brigade).
- Designated personnel will test the equipment for operability, as indicated in the inspection checklists.
- All equipment inspections should be recorded.

Specialized inspections and meetings

- The spill brigade shall conduct monthly meetings and inspections to ensure the suitability of equipment to be used in spill control and the existence of equipment and materials related to this plan.
- All operations and maintenance personnel are required to report sub-standard conditions that may result in oil spills.

Fuel spill response measures:

Staff Organization and Responsibilities

Spill Brigade

- At least 3 people from each basic shift belong to the spill brigade, including the Shift Supervisor.
- In the event that the spill occurs on working days, the minimum number of personnel in the plant will be approximately 80 people, of which approximately 10 will belong to the spill brigade.
- During working days, the Safety, Health and Environment Coordinator leads the brigade. During holidays, the Shift Supervisor assumes the role of brigade leader.
- The spill brigade is the primary spill response team at the plant. Contracts should be made with local relief agencies, as well as with the Ministry of Environment and Natural Resources, to seek support in the event of a spill that gets out of the hands of personnel.

Shift personnel in operations/maintenance

- Operations and maintenance personnel are trained in spill management techniques and each shift has representation from the facility's Spill Brigade, which will serve as the lead for any action taken until reinforcements arrive.

- The minimum operating shift (11:00 p.m. to 7:00 a.m.) includes a shift supervisor, a control room operator, 3 field operators, an electrician, and a service mechanic, in addition to the people who will make up the surveillance corps.

During daytime hours, more trained personnel from the Maintenance Department are available.

Personal Protective Equipment for Spill Collection

The minimum personal protective equipment to be used are:

- Helmet
- Glasses
- Masks with suitable filters
- Gloves
- Covering suit
- Boots

Depending on the type of spill, on-site evaluations (Hazard Analysis, HSA) will be performed to determine the need for further protection.

Equipment and materials needed to deal with a spill

The basic equipment to be used are:

- Various absorbent materials (absorbent boxes, absorbent cloths for hydrocarbons, granulated materials - universal absorbent)
- Waste tanks (5 55-gallon tanks, permanently reserved)
- Degreasing chemicals (5 gallons e.g.: GALACTICO)
- Lighting and Power Plant (4 sets of spark-proof, intrinsically safe luminaires and a 25 kW power plant - same for offshore spills)
- Anti-spark tools (shovels, picks, others)
- Others

Backhoes and trucks should be in contact with the area in case they are needed.

General spill response/control measures

- Warn and ask for help.
- The source of the spill should be eliminated immediately by closing valves to isolate the source. Use valves to divert the release, and/or use existing containment structures or containment berms/dikes.
- To avoid fire or explosion hazard, use water fog to disperse vapors or use foam to cover vapors.

- To control a large spill that has not been contained, divert the flow to a convenient area that has the capacity to contain the material (trenching with backhoes is possible).
- Appropriate fire protection equipment and explosion-proof and spark-proof mechanical devices must be provided.
- For large spills that may reach a sewer system, the spill should be intercepted and contained in ditches.

Chemical spill response measures:

In case of spillage or release of chemicals, the following should be done:

- Personnel who discover the spill must notify the Shift Supervisor of the emergency, who in turn will activate the communication channels and the spill brigade.
- Check if the Safety Data Sheet (SDS) of the spilled substance is required.
- If the spill turns out to be a non-hazardous substance, it can be controlled by area personnel while the spill brigade arrives.
- If the spill is of a hazardous substance and/or chemical, personnel in the area should wait for trained emergency personnel.
- The Safety, Health and Environmental Coordinator and the Shift Supervisor assess the situation with the available information. They make the decision to clean up the spill, and/or evacuate one or more areas of the plant.

To contain and/or control the spill, the equipment in the spill kits (worms, pads, absorbent cloths) are used.

8.9.2.5.5 LNG leak action

- To detect natural gas leaks, gas detectors will be installed in the power plant facilities.
- In the event of a gas leak detection alarm, the gas supply is shut off until the leak is corrected.
- Immediate and continuous action shall be taken until the hazardous condition is eliminated. The personnel in charge of the classification shall evaluate and determine the immediate action to be taken, and may take one or more of the following actions:
 - Venting of the leak under safe conditions.
 - Blocking of gas flow by closing valves or other means.
 - Evacuation of the risk area.
 - Isolation of the risk area.
 - Elimination of possible ignition sources (no smoking, no flames, no engines, no welding, among others).
 - Emergency action according to the pre-established plan, which includes reporting the situation to the appropriate supervisor immediately and requesting instructions or assistance if necessary.
- The action and date of containment should be properly recorded.
- The Safety, Health and Environment Manager will coordinate with the corresponding public agencies (Fire Department, Civil Defense, Ministry of the Environment and Natural Resources, among others), as well as other authorities.

8.9.2.5.6 Medical emergencies

- In the event of a medical emergency (affecting a worker, visitor or a resident of the communities in the area of influence within the company's facilities), contact the Shift Supervisor or the Safety, Health and Environment Coordinator. They should initiate communication and first aid protocol through the necessary channels to provide primary medical care. If possible, move the affected person to an appropriate place for first aid maneuvers. Use available emergency equipment (defibrillator, first aid kit, stretchers, wheelchair, among others).
- The Shift Supervisor, the Safety, Health and Environment Coordinator and the ERE should promote a calm environment to the affected person and all personnel present.
- Depending on the seriousness of the injury, if it is necessary to contact an external medical service or to transport the affected person by mobile unit or by air, the Shift Supervisor or Safety, Health and Environment Coordinator will make this request or may ask for support from the Property Safety department to contact the necessary services.

Note: only the Plant Manager or his Delegate can act as the channel of communication between the relatives or related persons of the affected person.

8.9.2.5.7 Action to be taken in the event of workplace violence

- It is recommended that in situations where any person, directly or indirectly associated with the company, is detected exhibiting behavior related to threats, suicide, acts of destruction of property, fascination with weapons, sudden mood swings, excessive anger or other unusual behavior, contact Property Security.
- In case of emergencies or accidents related to violence in the workplace, the following should be done:
 - Report the incident or event involving threatening behavior and/or violence to the Safety, Health, and Environment Supervisor and/or Coordinator. Initiate the communication protocol immediately.
 - The Shift Supervisor, the Safety, Health and Environment and Property Safety Coordinator must confirm the validity and magnitude of the event.
 - If the situation requires response and support from external entities, it is the responsibility of Security personnel to contact them.
 - The Safety, Health, and Environment Coordinator in conjunction with the Shift Supervisor and Property Safety shall identify a safe area to protect employees.
 - The Safety, Health and Environment Coordinator must document all actions taken.
 - Incident notification must be made by the Safety, Health and Environment Coordinator with the support of the Shift Supervisor and Property Safety Supervisor.
 - The Talent Management department makes the decision related to the case.

8.9.2.5.8 Action in the event of a bomb threat

In case of emergencies or accidents related to bomb threats, proceed as follows:

- In case of receiving a call, text message, mail, among others, related to a bomb threat, you should remain calm and listen to the background clues, being inquisitive to get as much detail as possible of the facts.

- After terminating the communication, immediately contact any member of the HSE Department, Shift Supervisor, Plant Manager, Safety, Health and Environment or Property Safety Coordinator, giving full details of the situation.
- The Plant Manager, with the advice of the Safety, Health and Environment and Property Safety Coordinator, determines if a general evacuation of the plant is necessary.
- Security personnel is responsible for alerting the police or military authorities, if necessary.

8.9.2.6 Evacuation plan

In case of emergencies related to plant evacuations, proceed as follows:

- When an emergency occurs that requires an evacuation, an employee activates the alarm to announce the evacuation. The signal for evacuation is the fire alarm.
- The personnel of the different brigades are prepared to respond to any emergency (placement of fire suits, SCBA, first aid kit and stretchers at the assembly point).
- Property Security is responsible for having on hand the evacuation card or the IDs of the personnel in the plant, in order to count the personnel at the designated assembly point.
- All personnel evacuate the area with the help of the evacuation brigade and/or the emergency response team and meet at the assigned meeting point. All personnel must know their main and alternate evacuation route, and for this purpose there are maps, signage of evacuation routes, emergency exits and meeting points. Plant personnel who at the time of evacuation have contractors, suppliers or visitors in their charge are responsible for ensuring and verifying that these people have evacuated and follow the instructions issued. The route to the nearest hospital should be clear.
- Search and rescue personnel are responsible for checking in the areas that there is no one inside the facility or plant and verifying what type of event is occurring.
- Once at the meeting point, the Shift Supervisor is responsible for verifying that his or her staff has evacuated. When handing out the evacuation badges and identifying a missing employee, he or she must report it to the search and rescue team, and it is the responsibility of the Shift Supervisor to state the location of the work being performed by this employee.
- After the evacuation of the emergency response team personnel, they should assemble at the assembly point in case they are required for a particular event (fire, search and rescue, etc.).
- The Safety, Health, and Environmental Coordinator or delegate should coordinate the evaluation of the workplace conditions after the emergency has been controlled.
- The Plant Manager or his/her Delegate defines when re-entry to the plant is allowed.

Basic Chain of Command

The flow of internal information runs as follows:

Person notifies his/her Supervisor, Coordinators or Superintendents



Superintendents and Coordinators notify Plant Management Plant



Management notifies Operations Management or his/her Delegate



Operations Management manages the necessary resources, if needed, Contact General Management.



Operations Management handles the necessary resources, if the case merits it.



General Management handles the necessary resources, if the case warrants it, and convenes the Crisis Committee.

All communications and sequences of events that occur must be duly recorded in the logbooks in the Operation Room.

Command center:

The Command Center will have a fixed telephone, communications radio on the frequencies used at the plant, projector, computer, printer and space for food storage. It will be located in the hall of the plant's administrative building. If necessary, a room in a local hotel will be used.

8.9.2.7 Emergency investigation

In the event of an emergency in the workplace:

- The causes that made possible its origin, spread and consequences will be investigated.
- The behavior of people and self-protection equipment will be analyzed, and the necessary corrective measures will be taken.
- A report will be drafted and made known to Management.

For the investigation of emergencies, the procedure and form for the investigation of incidents and accidents established in the company's safety management system shall be used.

8.9.2.8 Training of all personnel

Training meetings will be held for all personnel during the course of each year. The main objective of this training is the dissemination of prevention measures.

The minimum program for these training meetings is:

- Disclosure and explanation of actions to be taken in the event of an emergency.
- The individual responsibility of each person when detecting an emergency.
- How to raise the alarm.
- What to do upon hearing or receiving an evacuation order.
- Routes of evacuation routes.
- Use of fire extinguishers (practical fire extinguishing).

The minimum frequency will be annually. Coordination will be made with the HSE department for inclusion in the annual training schedule.

8.9.2.9 Emergency brigade training

Table 8-54 presents the minimum requirements for specialized training for brigadists.

Table 8-54. Minimum training requirements for the brigaders.

Emergency brigade	Training
Emergency Chief / Chief of Intervention	<ul style="list-style-type: none"> • Knowledge of the means and procedures for dealing with different potential emergencies. • Knowledge of the sites they are in charge of, as well as the processes and people. • Basic first aid training.
Intervention Brigades (Fires and Spills)	<ul style="list-style-type: none"> • Theoretical and practical training in handling simple and complex means to manage an emergency: Specialized training in spill management. Training of industrial fire brigade members.
Alarm and Evacuation Brigade	<ul style="list-style-type: none"> • Knowledge of the site, its evacuation routes and the number and special characteristics of the people who will have to lead the evacuation. Training on the implementation of evacuation plans. Basic first aid training.
First Aid Brigade	<ul style="list-style-type: none"> • Theoretical and practical training in first aid.
Rescue Brigade	<ul style="list-style-type: none"> • Theoretical and practical training in victim movement and rescue techniques.
Communications Brigade	<ul style="list-style-type: none"> • Specialized training in emergency communication techniques.

8.9.2.10 Carrying out of simulations

At least once a year, a general emergency drill (multi-events) will be carried out in order to highlight the conclusions aimed at achieving greater effectiveness in the use of resources, both human and material, communication of alerts, reception of external assistance, etc.

The main purpose of the drill is to evaluate, in a real way, the degree of implementation of the Emergency Response Plan, as well as to serve as practical training for the teams that participate in it.

It will also be possible to check the maintenance of detection and extinguishing means and the response times of external aids.

In addition, and in preparation for this event, each brigade will conduct drills of a single event (spills, fire, medical emergency, etc.), which may be a "tabletop" drill to maintain emergency response skills.

The competent authorities will be notified in due time of the intention to carry out a drill, who may even collaborate and appear in the area, serving as expert evaluators of the drill.

8.9.2.11 Post-emergency recovery activities

The Plant Management will decide, together with the Operations Management and the General Management, the moment to return to normal operation.

The General Management and the Operations Department will establish the recovery plan to be followed, in coordination with the authorities of the electricity sector.

A copy of any part of the plan shall not be sent to any outside organization without authorization from Operations Management.

8.9.2.12 Document evaluation

This plan shall be reviewed every three (3) years by the area responsible for Safety, Health and Environment.

8.10 Decommissioning Plan Report

8.10.1 Summary of contents

The dismantling activities to be carried out in the project at the end of construction activities are as follows:

- Dismantling of temporary facilities.
- Transportation of temporary facilities and site equipment to their place of origin.
- Cleaning of the land occupied by the temporary facilities.
- Final disposal of solid waste generated during the dismantling phase of the temporary facilities.

- Leveling of the terrain and restoration of pavements and basic service infrastructure where necessary along the route of the power transmission line and the transportation routes for materials and equipment.

8.10.2 Decommissioning activities

At the end of the construction works, in accordance with the execution schedule, the facilities created for the works, which are limited to the containers used as offices, portable restrooms, facilities for workers and temporary warehouses for storage of materials, will be dismantled. The portable toilets and containers used as offices will be removed by the company that provided the rental service.

The 55-gallon tanks used for solid waste storage will be removed and all areas occupied by temporary facilities will be cleaned. Hazardous and non-hazardous solid waste generated in this phase will be handled following the same procedures as in the construction phase and by managers accredited by the Ministry of the Environment and Natural Resources of the Dominican Republic.

Equipment used during construction, containers and portable toilets by subcontracted companies will be moved to their place of origin using the same routes used for their transfer during the construction phase.

Where necessary, the land will be leveled and the pavement or any other service infrastructure (drinking water, electricity, sewage, etc.) affected by the installation of the power transmission line, as well as by the transportation of temporary facilities, equipment and construction materials, will be restored.

8.11 Safety, health and environment training plan

8.11.1 Introduction

This document constitutes the Safety, Health and Environmental Training Plan to be implemented during the operations of the Manzanillo Energy Consortium Power Plant Project.

Safety, health and environmental training is a systematic, planned and permanent activity, whose purpose is to promote preventive mechanisms for the protection of the safety and health of workers and the environment; it is a participatory process that involves the entire working community and the population of the communities in the project's area of influence.

This training plan is aimed at contributing to the strategic management of risk prevention and proper environmental, health and safety management, and in turn is a tool for guidance and support, aimed at workers of the facilities of Manzanillo Energy Consortium Power Plant and the population of the communities in the area of influence; it is also an important instrument that contains training methodologies and strategies, resulting in sensitized workers and community members, willing to contribute responsibly to self-care to prevent accidents and diseases inherent to their activity and to protect the environment.

8.11.2 Objectives

8.11.2.1 General Objective

Train workers, contractors, visitors and residents of the communities in the area of influence on safety, health and the environment, based on the risk factors to which they will be exposed and the environmental impacts that could arise from the activities that will be carried out at the Manzanillo Energy Consortium Power Plant for the generation of electricity during the construction and operation stages of the project.

8.11.2.2 Specific objectives

- To develop an adequate culture of prevention in terms of health and safety and environmental protection.
- Establish promotion and prevention activities aimed at improving the working conditions and health of the working population, protecting them against the risks derived from the work they perform.
- To provide a guide to activities aimed at the continuous improvement of the working conditions and health of workers.
- To promote and strengthen the technical knowledge necessary for the best performance of work activities.
- Inform site workers of the measures that are part of the project's Environmental, Social, Health and Safety Management Program (ESHSM).
- Give instructions to workers on how to carry out their work in their respective workplaces, in order to minimize environmental impacts.
- Raise awareness among site workers about the importance of their collaboration with compliance with the ESHSM to avoid, mitigate or compensate for the negative impacts that the project may cause to the environment.
- To inform the residents of the communities in the area of influence about the measures for accident risk prevention and environmental protection.

8.11.3 Scope

The scope of the training plan has been designed for the different jobs that will be created during the construction phase of the project and during the operations of the Manzanillo Energy Consortium Power Plant Project, who will be provided with general orientation on the risks, hazards, parameters, guidelines, standards and procedures established by the applicable legislation on safety, health and the environment.

The jobs targeted for training in the construction phase are as follows:

- Project Manager.
- Safety, Health and Environment Coordinator.
- Social Responsibility Coordinator.
- Construction Management Manager.
- Employees of the contractors and subcontractors that will participate in the work.

The jobs targeted for training in the operation phase are as follows:

- Plant Manager.
- Safety, Health and Environmental Coordinators.
- Operation and Maintenance Managers.
- General Services Supervisors
- Maintenance Superintendents.
- Operations Superintendent.
- Tool room managers.
- Maintenance shift supervisors.
- Mechanics A.
- Mechanics B.
- Mechanics C.
- Mechanics D.
- E&I Superintendent
- Electrical Instrumentalist A.
- Electrical Instrumentalist B.
- Electricians A.
- Electricians B.
- Electricians C.
- Control room operators A.
- Control Room Operators B.
- Field operators B.
- Field operators D.
- Maintenance planners.
- Assistant maintenance planners.
- Cleaning and gardening (subcontractors).
- Administrative Superintendent.
- Administrative assistant.
- Drivers.
- Warehouse Supervisor
- Warehouse managers.
- Plant engineer (efficiency control).
- Social Responsibility Coordinator.
- Climate consultant (subcontracted).
- Employees of other contractors servicing the project.

The training plan includes safety, health, and environmental inductions for visitors to the project facilities.

Likewise, the safety, health and environmental training plan is aimed at the residents of the communities in the area of influence of the project, which are the municipalities of Pepillo Salcedo and Montecristi, in the province of Montecristi.

8.11.4 Training purposes

Being its general purpose to promote the promotion and prevention of health and safety risks and the prevention and mitigation of negative environmental and social impacts, the plan will be carried out to contribute to:

- Stimulate interest in the benefits of applying a safety, health and environmental management system in relation to work activities.
- Participation in self-initiated measures to employ self-care techniques in the face of risk factors and unsafe conditions.
- Generate positive behaviors that improve the work environment, productivity, quality, physical and mental health, to help prevent accidents and occupational diseases and protect the environment.
- Strengthen workers' ability to identify risk factors present in the activity.
- Educate the population of the communities in the area of influence on safety, health and environmental issues in order to prevent accidents and environmental damage.

8.11.5 Goals

- Train 100% of the workers referred to in the scope of this program.
- Comply with 100% of the training topics included in the employee training schedule.
- Train residents of the communities in the area of influence in all (100%) of the topics considered.
- Post-training evaluations have scores greater than four (out of five).
- Comply with the established budget.

8.11.6 Strategies

The strategies to be employed are:

- Courses.
- Lectures.
- 5-minute talks at the beginning of the day.
- Presentation and analysis of real cases with the use of tools (photos or videos) of accidents and diseases derived from their activity.
- Conduct educational workshops.
- Methodology of exposition - dialogue.
- Simulations.
- Placement of posters and murals.

8.11.7 Types, modalities and levels of training

8.11.7.1 Types of training

Preventive training: This is aimed at anticipating changes in personnel, since their work activities become routine and their performance may vary over the years, their skills may deteriorate, and technology may make their knowledge obsolete.

The objective of this training is to prepare personnel to assimilate new work techniques, using new resources.

Corrective training: Aims to solve and apply corrective measures to risk factors present in the activity, with tools such as diagnostics, studies and identification of these.

8.11.7.2 Training modalities

The types of training that were considered for the development of the project are as follows:

Training: Its objective is to provide basic knowledge oriented to the promotion and prevention of risk factors in the activity.

Improvement: The objective is to broaden and reinforce the level of knowledge and experience in order to apply new techniques to mitigate the risk factors present in the activity.

8.11.8 Actions to be developed

The actions for the development of the Training Plan will allow workers at the facilities of the Manzanillo Energy Consortium Power Plant Project, contractors, and visitors, during the construction and operation phases, to comply with measures to prevent risk factors and occupational diseases, as well as environmental protection measures.

For this purpose, the Training Plan will be structured in several levels of training (training and improvement), as well as inductions for new workers and induction for workers from contracted and visiting companies, according to the jobs defined in the scope.

Also included are environmental education activities aimed at the residents of the communities in the project's area of influence.

8.11.8.1 Training and development

The topics considered for training and improvement in health and safety for workers during the construction and operation phase are as follows:

- Safety and health risks of the job or tasks.
- Use and care of Personal Protective Equipment (PPE).
- LOTO (Lock and Tag).
- Prevention in the transportation, filling, storage, use and handling of hazardous products (Chemicals and SDS or MSDS), including pesticides.
- Prevention in work at heights / scaffolding.
- Elaboration and filling of ATS (Analysis in Safe Task Assignment).
- Fire prevention and extinguishing (Use of fire extinguishers).
- Risk assessment / unsafe conditions.
- Knowledge of the firefighting system.
- Work in confined and restricted spaces / entry permit.
- Fuel/sludge handling, spill control and attention.
- Handling of Natural Gas leaks (*).
- First aid/preparedness for help.
- Electrical safety - Basic aspects.
- Procedure for the use and inspection of Self-Contained Breathing Air Apparatus (SCBAs).

- Industrial ergonomics.
- Contractor safety.
- Incident and accident reporting and investigation procedure.
- Electrical safety - work in substations.
- Medical emergency response plan.
- Procedure for handling equipment and tools.
- Packaging, labeling, and handling.
- Safety inspections.
- Emergency and crisis management plans.
- Ladders and portable ladders.
- Respiratory protection.
- Procedure for handling compressed gas cylinders.
- Work permit procedure.
- Tidiness and cleanliness program.
- Operation of generator breakers (*).
- Operation of the substation breaker and disconnectors (*).
- Root cause analysis.
- Elaboration of operation reports.
- Steam turbine start-up and operation (*).
- High risk valve procedures.
- Preparation of maintenance reports (*).
- Alignment and commissioning of the electric fire pump (*).
- Alignment and commissioning of the diesel fire pump (*).
- Maintenance and inspection procedures.
- Safe work procedures.

The topics considered for environmental training and improvement are:

- Environmental management and resource efficiency.
- Emissions management.
- Management and handling (handling and storage) of hazardous and non-hazardous solid waste (including recycling and reuse)
- Oily waste management.
- Liquid effluent management and water quality.
- Pesticide management.
- Terrestrial biota management.
- Social management.

(*): These topics will be taught only during the operation phase.

The topics considered for the training and improvement of Property Security or Physical Security workers during the construction and operation phases are as follows:

- Industrial Safety, Occupational Health, and Environment.
- Specialized security:
 - National and international legislation on the use of force.
 - United Nations Basic Principles on the Use of Force and Firearms by Law Enforcement Officials.

- Use of non-lethal weapons.
- Knowledge and correct use of firearms (practical and polygon) and non-lethal weapons.
- Human relations and human rights.
- Procedures on access control, surveillance, private security, and supervision.
- First aid.
- Protocol for emergencies, evacuation, and fire extinction.
- Physical security factors.
- Patrolling.
- Combat and self-defense techniques.
- Techniques of arrest and detention of individuals.

Vehicle drivers will be trained on vehicle driving practices that reduce both the risk of accidents and fuel consumption, as well as on the importance of avoiding sudden accelerations and respecting speed limits.

8.11.8.2 Induction for new employees

The topics to be covered in the induction for new workers at Manzanillo Energy Consortium Power Plant's facilities are:

- Who are we?
- Mission, vision, and objectives.
- Values of the organization.
- Occupational Health and Safety Policies.
- Environmental Policy.
- Human Resources, Inclusion and Diversity Policy
- Structure of the Safety, Health, and Environmental Management System (HSE).
- Working hours, days off, paydays.
- Employee responsibilities.
- Internal regulations and procedures for occupational health and safety.
- Hazard identification and risk assessment.
- Unsafe acts and conditions at work.
- Safety inspections.
- Cleaning and maintenance of work areas.
- Personal Protective Equipment (PPE).
- Incident and accident reports.
- Signage meanings and types.
- Emergency prevention and response.
- Evacuation routes.
- Occupational medical examinations.
- Environmental procedures.

8.11.8.3 Induction for workers of the contractor companies

The topics to be covered in the induction for workers of contractor companies to provide their services at the facilities of Manzanillo Energy Consortium Power Plant are:

- Who are we?
- Structure of the Safety, Health, and Environment Management System.
- Important definitions.
- Occupational Health and Safety Policies.
- Environmental Policy.
- Working hours.
- Responsibilities of the service provider.
- General safety standards.
- Hazard identification and risk assessment.
- Unsafe acts and conditions at work.
- Safety inspections.
- Personal Protective Equipment (PPE).
- Incidents and accidents.
- Safety signage.
- Emergency prevention and response.
- Evacuation routes.
- Occupational medical examinations if necessary.
- Environmental procedures.

The companies that provide their services in the facilities of Manzanillo Energy Consortium Power Plant must present their Certificates from the General Directorate of Industrial Hygiene and Safety in compliance with the Regulation 522-06 on Occupational Safety and Health of the Dominican Republic., in force at the Ministry of Labor, which guarantees that these companies are prepared with the requirements established by the Ministry of Labor regarding Occupational Health and Safety.

8.11.8.4 Induction for visitors to the facilities of Manzanillo Energy Consortium Power Plant

The topics to be covered in the induction for visitors to the facilities of Manzanillo Energy Consortium Power Plant are:

- Who are we?
- Structure of the Safety, Health, and Environment Management System.
- Important definitions.
- Health and Safety Policy.
- Environmental Policy.
- General safety standards.
- Basic Personal Protective Equipment for visitors.
- Incidents and accidents.
- Safety signs.
- Evacuation in case of emergency.

8.11.8.5 Safety, health and environmental education for the residents of the communities in the area of influence.

The environmental, health and safety education topics for the residents of the communities in the project's area of influence are as follows:

- Basic safety measures (including vehicle and pedestrian road safety).
- Emergency Preparedness and Response Plan.
- Mechanism for complaints, claims, and suggestions of the project.
- Environmental protection (basic principles in solid waste management, water and electricity consumption, protection of flora and fauna, among others).
- Awareness campaigns for disease prevention.

8.11.9 Resources

The following resources are available for the development of the Training Plan:

8.11.9.1 Human Resources

At the facilities of the Manzanillo Energy Consortium Power Plant, there will be a Safety, Health and Environment Coordinator who will develop and execute the Training Plan with the objective of achieving adequate and continuous training in safety, health, and environmental issues.

The Health and Safety and Environmental Coordinator will have the support, supervision, and advice of the Plant Manager.

8.11.9.2 Material resources

- Training venue at the facilities of Manzanillo Energy Consortium Power Plant.
- Multimedia projection equipment.
- Laptop computer.
- Photocopier/Printer.
- Stationery.
- Induction videos.

8.11.10 Reference and Guidance Material

The following documentation is available for consultation and orientation:

- Decree No. 522-06 Regulation of Occupational Safety and Health.
- Labor Code (Law 62-92).
- Fire Protection Regulation (R-32).
- Internal Occupational Health and Safety Regulations.
- Law 64-00 on Environment and Natural Resources.
- Publications of specialized agencies: International Labor Organization, International Red Cross, Ministry of Labor, Ministry of Health, Ministry of Environment and Natural Resources, among others.

Promoter's documents:

Health and Safety:

- Occupational Health and Safety Program.
 - Health and Safety Policy.
 - Alcohol and Drug Policy.
 - Industrial Safety Procedures.
 - Safety plans, procedures, and programs.
 - Others approved by the General Management, Vice-Presidency, and Corporate Management.
- Environmental Documents:
- Environmental and Social Management Plan for the Manzanillo Energy Consortium Power Plant project.
 - Environmental Policy.
 - Environmental Procedures.
 - Others approved by the General Management, Vice-Presidency and Corporate Management.
 - Materials developed to deliver the training and induction modules.

8.11.11 Responsibilities

Health, Safety and Environmental Coordinator: This will develop the programming of the Training Plan. He/she will provide induction training to new workers, contractors, visitors, and community workers.

Personnel in general: Participate in the periodic trainings scheduled in the Training Plan.

8.11.12 Appropriate training records

Attendance records shall be kept for all training given to project workers, including practical exercises for emergency situations (drills).

Attendance records should include at least the following information:

- Name of training.
- Date.
- Location.
- Duration.
- Facilitator.
- Lists with the names and surnames of the attendees, contractor company or community to which they belong and signature.

In the Table 8-55 shows an example format of the records to be kept.

Table 8-55. Record of attendance to training activities.**Activity:****Date:****Place:****Duration:****Facilitator:**

Name	Area	Signature
------	------	-----------

In addition, when training sessions are conducted, photographs or videos should be taken to serve as evidence of the activities carried out. Documents will be prepared with the reports of these activities.

Other training records may include training materials used, certificates of participation, evaluation results, among others.

Service providers and contractors (in contracts) will be required to submit documentation proving the training received by their employees before starting any work for the company.

8.11.13 Evaluation of training effectiveness

At the end of the courses or lectures, simple questionnaires can be used to evaluate the level of understanding of workers, contractors, visitors and community members on the topics covered.

8.11.14 Performance indicators (KPIs)

The performance indicators will be as follows:

- Number of workers, visitors and community members trained.
- Percentage of workers trained.
- Number of hours of training provided per employee.
- Training evaluation scores (at least 4 out of 5).
- Training cost per worker.

8.11.15 Review of the training plan

The Training Plan of the Manzanillo Energy Consortium Power Plant will be reviewed and updated once a year.

8.11.16 Training program by position and execution schedule

For the construction phase of the work, the training program for each job position will be defined once the complete organizational structure of each of the contractors that will participate in this phase is in place. The Safety, Health and Environment Coordinator will be in charge of this activity.

The Training Program by position for the project workers for the first year of the operation phase is presented in Annex 18.

The schedule for executing the training plan for the contractor's workers in charge of the project's physical security (property security) during both the construction and operation phases is included in Annex 19.

During the first year, in both phases (construction and operation), training will be provided, and in the second year, the training will be followed by advanced training in accordance with the functions performed by each worker.

Training sessions will preferably be held on the last Friday of each month.

In addition, drills will be conducted at least twice a year.

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9. CONCLUSIONS AND RECOMMENDATIONS

After executing the activities related to the preparation of the environmental and social impact study of the Manzanillo Energy Consortium Power Plant Project, set out in previous chapters, the following conclusions and recommendations are drawn:

9.1. Conclusions

- The Manzanillo Energy Consortium Power Plant project was awarded as Block 02 through international public bidding for new generation, as part of the Dominican government's interest in supporting the country's development to ensure the present and future supply of electricity.
- The power plant will occupy an area of 111,134.19 m². The power transmission line will have a length of approximately 5 km with an easement width of approximately 60 m, for a total area of approximately 300,000 m².
- The total estimated investment for the project is estimated at approximately USD \$550,000,000.00.
- Three alternatives were analyzed for the design of the cooling system, and option 1 was selected, which consists of a wet cooling system using seawater. Alternative 2 (see Figure 3-2 in Chapter 3) was selected for the electric transmission line, considering that it has technical, social, and commercial advantages and an intermediate situation for the environmental impacts that can be mitigated.
- The study area in this regional context is located between the domain of the Northern Cordillera and the Cibao Valley, whose tectonics are conditioned by two fundamental factors at the plate scale: the displacement between the North American and Caribbean plates, and the oblique subduction of the insular platform.
- The current relief of the area has the main features of plains with different levels characterized as low and medium. Two topographic levels stand out, the first includes elevations that do not exceed +3.0 masl and the second includes elevations between 10 and +20 masl, with escarpment slopes that can reach values between 20-25%.
- There are brown soils of silty-clay texture, of medium thickness and a large granulometry where the fine fraction predominates, although in sectors close to the embankments and with technical fillings, certain portions of gravel are noticeable. There is evidence of plots with intervening vegetation cover and rocky sediments of fills mixed with soils with absent edaphic horizons.
- The soil use capacity of the zone corresponds to class IV, soils limited for crops and not suitable for irrigation, except for very profitable crops with severe limitations and requiring intensive management practices. These soils are distributed mainly in the middle plains of the project area.

- In the study area there were no fluvial streams or rainwater concentration routes that could form extreme flood flows in times of intense rainfall.
- From these water quality results, it was determined that the surface water accumulated in the marsh has a very high mineralization and temperature, with variable concentrations of dissolved oxygen depending on the sector where it accumulates.
- The groundwater quality showed low dissolved oxygen concentrations, which may be related to bacteriological conditions, and reported high levels of nitrate, a product of nearby agricultural activities that contribute these nutrients.
- In general, concentrations of particulate matter were found to be at moderate levels, with some notable levels. These levels are characteristic of urbanized areas in rural zones, where the main sources of emissions are the usual socioeconomic activity and vehicular traffic.
- The concentrations of combustion gases in immission in ambient baseline conditions remain below the limits established by national regulations and by the WHO Air Quality Guidelines for short measurement times and tend to be above the limits recommended by the WHO Air Quality Guidelines when compared to the values for longer measurement times.
- In general, daytime noise levels are moderate. At night, in most points, values above 70 dB(A) were identified, which were caused by the particularities of the anthropic activity associated with these sites.
- Regarding vibration levels, low peak velocities were reported in terms of causing damage to the type of infrastructure that predominates in the western sectors of the study area, which correspond to buildings without reinforcement of structures with light roofs.
- The evaluation of vulnerability to natural hazards indicates that the area is susceptible to earthquakes, hurricanes, electrical storms, and rising sea levels. It is therefore important to take preparedness and response measures at the exposed project facilities.
- The GHG emissions that the project is estimated to generate for the construction phase: 14,194.32 Tn CO₂ eq. and a total estimated emissions for the operation phase (25 years): 35,933,169.22 Tn CO₂ eq.
- Regarding the characterization of the biotic environment of the terrestrial space, it is important to note that the land where the project will be located was previously modified, as in the case of the El Patio wetland and the Estero Balsa beach.
- Three types of vegetation were identified in the project area: secondary xerophytic vegetation in the area where the Block 02 facilities will be built and along the transmission line; grassland and secondary xerophytic vegetation in transition to mangrove along the transmission line.
- With respect to the flora component, 106 species of vascular plants were identified in the project area, distributed in 43 families and 95 genera, including 4 endemics to Española Island, 94 native and 8 naturalized exotic species.

- Eleven species of flora that are protected by the Convention on International Trade in Endangered Species (CITES), the Red List of the World Conservation Union (IUCN, 2022) and the Red List of Vascular Flora in the Dominican Republic according to the criteria of the International Union for Conservation of Nature (IUCN) were identified along the route of the power transmission line and in areas surrounding Block 02.
- In the characterization of the terrestrial fauna, it was identified that in the case of the herpetofauna, no significant differences were found in the results of the sampling of the rainy and dry seasons; during the rainy season for amphibians, a total of 2 species and 9 individuals were located, while in the dry season there were 3 species and 15 individuals.
- With respect to reptiles, 12 species and 47 individuals were recorded during the rainy season. In terms of the number of individuals, 47 were recorded during the rainy season, while 11 species and 44 individuals were recorded during the dry season.
- For the group of terrestrial mammals, the same 6 species were recorded in both seasons, with 190 individuals in the dry season and 114 individuals in the rainy season. As for bats, 3 species and 206 individuals were recorded during the dry season. 4 species and 61 individuals in the rainy season.
- As for avifauna, 92 species were recorded during the rainy season, while 84 species were recorded during the dry season. The abundance of individuals during the dry season was higher with 927, while in the rainy season it was 892 individuals.
- No habitats with significant importance for the survival of threatened or critically endangered species have been found in the project area, no habitats with significant importance for the survival of endemic species or species restricted to certain specific areas were located. Nor is the area part of unique or highly threatened ecosystems and is not associated with key evolutionary processes; consequently, this site does not have any critical habitat characteristics with high biodiversity value.
- The vegetation in the area has been impacted by timber, firewood, and charcoal extraction, as well as livestock activities, especially goat raising, where the tree stratum is the most affected. Despite the indiscriminate extraction, the vegetation still conserves species typical of this type of environment. The vegetation is dominated by bayahonda.
- The results obtained from the surveys, interviews and public hearings indicate that the population is in favor of the project, favoring its benefits; however, they emphasize the need to take measures to reduce the negative impacts that could be generated by the development of the project.
- During the construction phase, 32 impacts were identified, of which 24 are negative (75%) and 8 (25%) are positive. In the operation phase, 32 impacts were identified, of which 23 (72%) are negative and 9 (28%) are positive. Compared to the construction phase, the proportion of positive impacts increases. It should be noted that the negative impacts in the operation phase are of low, medium, or moderate significance; the impacts of high or very high significance are all positive.

- The project will require goods and services in all its stages (construction and operation) that will be purchased mainly in the region, which will contribute to mobilize the economy in the area, as well as contribute to the dynamics of the national and municipal economic sector.

9.2. Recommendations

- Prior to the start of project construction, it is recommended that the developer request the contractor to develop and submit a detailed work plan that includes compliance with the mitigation measures proposed in the environmental and social impact study and any other documents that form part of the environmental and social management of the project.
- Implement the Environmental Management Plan and each of its programs and plans, including the Monitoring and Follow-up Plan to ensure that all impacts are controlled. If opportunities for improvement are detected, notify the responsible entity to ensure their incorporation once they are approved.
- It is recommended that the developer maintain channels of communication with the communities and companies surrounding the project at all times, in order to achieve fluid communication regarding the mechanisms for presenting their concerns about the project and the way in which these will be addressed, as well as to achieve adequate coordination of construction activities to minimize the interference of the works with the operation of these companies and neighboring communities.

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