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CAASD

Storm and Sanitary Drainage of the Guajimia Canal Phase II Project – Update of the ESIA and RAP

ESIA - Final Version

Volume 1

Delivering a better world

Storm and Sanitary Drainage of the Guajimía Canal Phase II Project – Update of the ESIA and RAP

ESIA – Final Version (Volume 1)

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AECOM: 2015-04-13

Executive Summary

Introduction

The municipality of Santo Domingo Oeste is located in the capital of Santo Domingo. The municipality is crossed by many waterways whose banks are densely populated by inhabitants living in ramshackle households that do not benefit from basic sanitation services. Consequently, garbage is thrown into local streams and rivers, which are also used as open sewers. This garbage disrupts the water flow, which results in floods of heavily polluted waters during the rainy season. The impacts of these floods include loss of human life, a high degree of pollution, unsanitary conditions and inhuman living conditions.

In 2003, the Dominican Republic Congress unanimously approved the Guajimía Project to solve the flood and sanitation problems in the canals of the Guajimía Watershed. The Santo Domingo Aqueduct and Sewerage Corporation (CAASD) is the governmental authority that managed the Guajimía Project. After successfully completing the first phase, the CAASD initiated a second phase in 2005. However, after the completion of an environmental and social assessment Study (ESIA), this phase was suspended and no works were conducted. In 2020, the Dominican Republic Government signed a loan agreement with J.P. Morgan. With this investment, the CAASD relaunched the second phase of the Storm and Sanitary Drainage of the Guajimía Canal and signed an agreement with the Canadian Commercial Corporation (CCC). The latter requested AECOM's services to update and improve the previous ESIA. Finally, AECOM involved the Dominican firm EMPACA as a subconsultant.

Environmental and Social Impact Assessment Process

Prior to commencement of any project that may affect the environment and communities, it is mandated by the Dominican legislation that an Environmental and Social Impact Assessment (ESIA) study be carried out, and, upon approval by Secretaría de Estado de Medio Ambiente y Recursos Naturales, a licence is secured. In the present project, this license was obtained in May 2007 (Environmental License No. 0103-07). This license was renewed on July 17, 2018 for a validity of 5 years (Environmental License No. 0103-07-RENEWED). Nevertheless, J.P. Morgan asked to update the ESIA conducted in 2008 using the current IFC standards before releasing their loan.

Policy, Legal, Regulatory and Institutional Context

Dominican policy, legal and regulatory requirements are outlined to ensure that all project related requirements are taken into full consideration throughout the project. The following laws and decrees were assessed:

- Law 1-12 National Development Strategy 2030 (NDS).
- The Environmental and Natural Resources Law No. 64-00 (the Environmental Law).
- Law 147-02, on risk management.
- Sectorial Law No. 202-04 on Protected Areas.
- Law 333-15 on Biodiversity.
- Decree 192-21 a legal standard (lesser scope than that of a law) that governs the resettlement process for affected people who are displaced within the framework of a project of social interest.

Among the 204 articles of the Environmental Law, the following ones were considered for the current ESIA:

- Environmental assessment: articles 38, 40, 41, 42, 44
- Water and Water Pollution: articles 129 and 133
- Soils and Soil Pollution: article 90

- Air Pollution: articles 92 and 93
- Noise Pollution: articles 93, 114 and 115
- Solid Waste Management: article 107
- Protected Areas: article 34 (transitory)

Furthermore, the Dominican Republic is bound to three conventions and declarations regarding environment matters that are relevant for the current ESIA, namely the 1) World Heritage Convention, 2) the Rio de Janeiro Convention on the Protection of Biological Diversity and 3) the International Convention on Trafficking and Trade in Endangered Species.

Finally, the following international standards and guidelines such as the IFC Performance Standards were examined to ensure the compliance of the project with those of the agency that is funding the project (J.P. Morgan):

Analysis of Alternatives

Several alternative options and the “no project option” were considered during the study. The no project option is not a valid option because the prevailing situation in the Guajimía Canal and its main tributaries is critical because 1) the initial capacity of the canals to evacuate water has noticeably decreased over the years mainly due to the accumulation of waste in the canals, 2) the water flowing in the canals regularly leave their canals causing flooding, devastating precarious homes located on the banks and causing loss of life and 3) The Guajimía Canal and its tributaries serve as sewers to open sky and waste disposal site for dwellings located within its area of influence.

The technical feasibility studies considered two alternatives for the capture and the rainwater drainage: 1) Rectangular section of reinforced concrete ducts cast in place (box culvert) and 2) Multi-plate corrugated sheet metal ducts. Both solutions are technically feasible but the multi-plate solution was selected for stormwater drainage due to its numerous advantages such as a) greater ease of installation when considering the intrinsic rigidity of this type of conduit, b) shorter duration of construction works and fewer inconveniences in the vicinity and c) possibility of alternatives for the collection of sanitary drainage.

The technical feasibility studies considered two alternatives for the capture sanitary water: 1) circular reinforced concrete pipes and 2) High-density polyethylene (HDPE) pipes. The latter solution was chosen because it has several advantages such as: a) greater ease of installation, b) shorter duration of work and fewer inconveniences for the surroundings and c) lower cost.

Project Description

The Storm and Sanitary Drainage of the Guajimía Canal Phase II is divided into three stages as follows. The first Stage is the one currently approved in the government budget and will be assessed in this ESIA. The Stage I includes:

1) Removing the garbage from the tributaries.
2) Channeling the stormwater of the Guajimía Canal and its tributaries:
    - The completion of the "Buenos Aires" Tributary
    - The completion of the "El Indio" Tributary
    - The completion of the "La Ureña" Tributary
    - Part of the Guajimía Canal from the convergence with the "Villa Aura" Tributary to its convergence with the "Buenos Aires" Tributary
    - Part of the "Las Caobas" Tributary

AECOM added the Villa Aura and The Guajimía Canal from where it flows under the 6 de Noviembre Highway to where it flows into the Haina River.

3) Installation of sanitary drainage collectors and expansion of water main networks in the following sections:
   - The "Buenos Aires" Tributary
   - The "El Indio" Tributary
   - The "La Ureña" Tributary
   - Part of the Guajimía Canal from the convergence with the "Villa Aura" tributary to its convergence with the "Buenos Aires" Tributary
   - Part of the "Las Caobas" Tributary

AECOM added the Villa Aura and The Guajimía Canal from where it flows under the 6 de Noviembre Highway to where it flows into the Haina River.

4) Installation of urban and roadway amenities: Amenities such as playgrounds, parks, lighting, and spaces for social gathering for urban integration in the sections affected by stormwater channeling.
5) Construction for affected families and compensation:
   - Update of the Resettlement Action Plan (RAP)
   - Construction of the necessary residential units for the relocated families, as well as, on behalf of CAASD, the relocation management and payment of the monetary compensation to affected families as provided in the RAP.

In view of the importance of environmental and socio-economic considerations, the limit of the area of influence includes the entire watershed of the Guajimía Canal, which covers an area of approximately 13.58 km^2.

Stakeholder Engagement

The acceptability of the Project was studied through several public hearing that solicited the opinions of and answered stakeholders' queries.

Presentation of the Project by the CAASD

First, on May 5, 2021, the CAASD announced to the residents the resumption of the studies for Phase II in three of the critical points of the Guajimía Canal, where its general director, Eng. Felipe Subervi, answered some questions from the media and the residents. A meeting was also held on May 5, 2021 at the premises of the Sociedad de Socorro Ciudadanos Unidos, located in the Duarte neighborhood, in order to provide more details to the residents about the project and respond to their concerns, by CAASD and AECOM-EMPACA. Subsequently, a third meeting was held on June 17, 2021 at the Buenos Aires de Herrera Mutual Aid Society with another group of residents and community leaders from the project's impact area.

Consultation with Key Stakeholders

Individual and Group Interviews

For the stakeholder consultation, 30 individual interviews and 8 group interviews were conducted with key institutional and organizational stakeholders for the project. For civil society stakeholders, especially neighborhood councils in the project's area of influence and the private sector, the main concerns and suggestions are the following:

a) That housing units be delivered to families affected by the project.
b) That the work be continued where Phase I of the Project left off, that the unfinished canals be completed.
c) The right of the women and children to own the property received be guaranteed, compared to the cases of some parents who individually dispose of these.
d) Social investment is made in educating families about their duties and rights.
e) Improve the solid waste collection system in the municipality, to prevent some residents from breaking the glen and continue to throw garbage into it.
f) Necessary measures be taken to avoid the occupation of the new public spaces created by the project, as seen in Phase I, privatizing the use of spaces and hindering the life of the community.
g) It is suggested to avoid the construction of one-bedroom housing, as they will contribute to overcrowding, incentivize the sale of apartments of families that do not fit in them and are counterproductive for the purposes of family development.
h) There is a high level of concern among tenants in the Project's impact area, due to the traditional behavior of some landlords to forcibly evict them to receive the benefits that would otherwise be given to them.

Consultation through the Applied Survey

A survey was conducted among 393 residents living in the Project's impact area to gather their suggestions and opinions on Phase II of the Project. As expected, all of the respondents favored the project. However, some of their concerns are similar to those expressed by the social organizations:

a) That the garbage collection system in the municipality be improved.
b) Conclude the pending Phase I.
c) That social investment be made in the Project, by educating and accompanying the population.
d) That the treatment plant be built.
e) Relocate the families located on the banks of the glen.
f) Preserve the spaces freed by the Project for public us.

Focus Groups

As part of the consultation process, four focus groups were conducted, two on June 11, 2021 and two others on July 6, 2021. The first two with families from the Guajimía I and Guajimía II housing developments, which were resettled as part of Phase I of the project. The objective was to address the experiences in the relocation process, with the aim of learning from these experiences in order to replicate the positive elements and correct the mistakes made. Subsequently, two more focus groups were held, this time with heads of families in the areas affected of this project phase. One of these focus groups was held with women heads of household in the affected area of the Indio Derecho glen and the second with heads of families of both sexes, in the Buenos Aires glen. The objectives of these meetings were to determine the perception of families in the affected area about how the relocation process should be conducted, their expectations and recommendations, as well as an evaluation of the census process carried out.

The information obtained by means of these focus groups served mainly as a resource for triangulation of the information obtained through the interviews and surveys, highlighting the following:

- The concern that the delivery of housing is made to families really affected by the project, demanding that measures be taken to avoid that these are delivered with favoritism to people who do not currently reside in the affected area.

- Consider the opinions of the affected people during housing design, avoiding errors such as those found in the Guajimía I and II buildings, where balconies were built for the bedrooms and not for the living rooms.
- Avoid the construction of single-room houses.
- Concern that tenants in the affected area will be evicted by landlords so they can receive the benefits otherwise owed to them.
- Need for civic education of people that will be relocated and definition of rules of coexistence in the buildings.
- Housing should be built close to the places where they currently reside so as not to affect people who have their livelihoods in the same neighborhood**.**
- That they deliver homes on the first floor to those heads of households to be relocated who have businesses in their own homes**.**

Baseline Survey and Condition

The baseline assessment was carried out on the physical, biological and social environments. Descriptions of the existing environment include primary and secondary data and information from relevant and available sources.

Physical Environment

Geology

Three main geological formations cover the watershed of the Guajimía Canal. The Los Haitises Fm (calcareous group of reef origin), Yanigua Fm. represented by a monotonous succession of marls deposited in a lagoon and La Isabela Fm (reef limestones).

Geotechnical Characterization

A geotechnical study carried out in the first ESIA to determine the nature and bearing capacity of the soils in the restricted study area. Some 40 exploration wells were drilled along the canals of Buenos Aires, El Indio, and La Ureña and in general, the bearing capacity of soils is excellent.

Geomorphology

The watershed of the Guajimía Canal has a wide flood plain, highly sectioned by the strong anthropic modifications, which has lost its original structure, although shallow terraces can be recognized in the main canal with very degraded escarpments, reaching the upper levels at heights close to +20 m above the level of the current channel. The valley bottoms appear in the shape of a narrow "U" conditioned by the high anthropogenic activity and coinciding with the low water level channel. However, in the downstream area of the watershed, these valley bottoms reach open "U" dimensions, although hidden by the sheet of water.

Topography

The relief of the study area has as a predominant general feature a flat-bottomed plain represented by the river valleys of the Haina River and the Guajimía Canal , with remnants of the original relief in the form of low hills distributed as the southern and eastern edge of the lower third , while towards the northern sector the edges of the watershed flatten significantly.

Soils

Soils in the project area are classified as Recent Alluvial and Association Jalonga – Marmolejos - Caliche (53-70-71). Recent Alluvial soils due to the irregularity of action of the agents of the weathering, especially climate and biological factors, have not acted on the original material, so there is no differentiation of horizons in the profile, but only small stratified layers of the deposits. Due to these characteristics, the formation of the soils of this association is not uniform, and the nature of the profile is determined by the species of sediment deposited in the different periods of deposition. It should be noted that the tendency of these soils is sandy. At the scale of the watershed, two edaphic formations were differentiated which, interpreted by their agro-productive capacity, can be summarized within Classes II and IV according to the OAS Classification.

Soil quality was described in the ESIA of 2008 on samples taken in the materials that will eventually be excavated. No significant PAH contamination was detected. Analysis results for metals revealed the presence of manganese in one sample (mg / kg of soil) and of nickel in another (mg /k g of soil). Regarding the results of contamination with hydrocarbons derived from the oil (C10-C50), three samples showed significant levels of concentration.

Climate

The Dominican Republic has a tropical climate and has the general characteristics of the Caribbean coastal region. Information and climatic data available at the ONAMET's Santo Domingo and Las Américas Airport Stations and from the annual mean isoietic map of the Atlas of Biodiversity and Natural Resources were studied. Information on normal and maximum precipitation, as well as minimum, maximum and average temperatures, the data available from ONAMET for the stations closest to the study area was used (A. Herrera, DN and Loyola, San Cristóbal), in addition to the annual average isoietic map for the region. Climatic and other data have also been used to represent conditions within the project area. The main features are:

- The average annual temperature is almost 25º C, with minimums above 20º C and maximums above 32º C, as a result of the stabilizing action of marine currents and wind speed.
- The barometric pressure has very little variation during the year, oscillating between minimum and maximum values in ranges of 4 hPa. The maximum values are reported at the beginning of the year with values in the order of 1017 hPa, while the minimum values oscillate in 1013 hPa, generally occurring in the month of October.
- The average annual relative humidity is closest to 83%, with values ranging from 81.2% in March to 84.6% in October.
- The average evaporation over a year is 1633 mm with monthly values ranging from 104.6 mm in December to 166.3 mm in March.
- The observed cloudiness barely fluctuates over a year with values ranging between 0.3 and 0.4 okta.
- Solar radiation ranges between 11 and 13 hours. The insolation oscillates between 6.6 and 8.0 hours approximately, with the maximum values being registered in the spring months (March-June).
- Annual precipitation varies from 1200 to 1600 mm. The months of May and July, and August and September are the rainiest, with accumulated rainfall exceeding 150 mm, while the least rainy month is February, when values of less than 60 mm are generally recorded.
- The normal wind speed ranges between 7 and 11 km/h in most months, with the maximum in the season from November to April, and the minimum from May to October

Hydrology

The hydrodynamic scheme of the watershed seems to show that the main canal and its tributaries are fed by meteoric waters from precipitation. However, it was observed that the surface runoff of permanent water regime has a very high anthropic component almost over the entire fluvial network. Hydrometric calculation showed that the riverbed overflows in many places due to the lack of evacuation capacity caused by anthropic modifications or by the accumulation of solid waste that obstructs the canals.

Hydrogeology

Groundwater is very limited development in the downstream area of the Guajimía Canal with depths of less than 3.0 m. The aquifer is very affected by urbanization and transformations in the surroundings of these riverbeds. In the coastal strip to the south, groundwater has a dynamic flow towards the coastline, with some very specific deviations. This aquifer in the area is very affected by anthropic modifications. In the northern part of the study area, the materials that predominate have an aqueous and low hydraulic transmissivity, although there are also preferential flow paths associated with the fractures and stratification.

Water Quality

Sixteen (16) sampling points were distributed to characterize water quality of surface water over the watershed. The results were compared to the water quality standard of the MIMARENA (Class B).

The presence of total and fecal coliforms is above its Class B standard presumably due to direct input from anthropic sources. Concentrations of biochemical oxygen demand (BOD_5) and chemical oxygen demand (COD) in surface water also had values well above the Class B limits.

Air Quality and Dust

For the study area, 16 air quality measurement points were established, distributed in such a way as to cover the entire territory, especially the urbanized sectors that will be affected by the project area. The results were compared to the air quality reference values of the MIMARENA. In general, the concentrations of particulate matter are moderate to high, very typical of urbanized areas, where the main sources are the usual socio-economic activity and traffic in streets and avenues, with a notable presence of trucks. In contrast, all gas concentrations measured remain below the limits allowed by the reference regulation, with some minor and very specific peaks associated with local industrial activities (workshops) and vehicular traffic.

Noise

Noise levels were measured and recorded at 16 sites in the project area. The results were compared to the Environmental Standard for Noise Protection (NA-RU-001-03. Nine sites have noise levels above the maximum noise emission levels allowed for residential area with surrounding industries and businesses is 65 dB.

Greenhouse Gases Emissions

It is assumed that small amounts of GHG are currently emitted from the canals.

Climate Change Risks

Based on the high carbon future (RCP 8.5) scenario, projected changes in monthly precipitation for the Santo Domingo region for the 2080-2099 projection timeframe shows an overall decrease in monthly precipitation that can be observed, especially from June to October. The peak precipitation decrease occurs in August with a median monthly precipitation decrease of 30mm. Over the majority of the projection timeframes, an increase in number of hot days with a Tmax over 35 degrees Celsius can be observed, with a rapid increase from the 2060-2079 timeframe to the 2080-2099 timeframe. The 2080-2099 timeframe is projected to have a median increase of 29 hot days more than the reference period. These increases in hot days will occur between May and November, with the peak being in August.

Biological Environment

Flora

The Guajimía Canal is located within the subtropical humid forest. Currently there is no primary vegetation anywhere in the environment of Guajimía. Today many herbs such as *Panicum maximun,* are very abundant in the area and supplant the native and endemic herbaceous species. Within the project's study area, 14 threatened species according to the IUCN National Red List and the International Convention on Trafficking and Trade in Endangered Species (CITES), and others included in the National Red List were identified.

Terrestrial Fauna

According to the global IUCN Red List of threatened species (IUCN, 2020) as well as the IUCN Red List of Threatened Species in the Dominican Republic, none of the amphibian species identified in the study area are threatened. However, the Puerto Rican Slider (*Trachemys stejnegeri)* is considered near-threatened (NT) according to the global IUCN red list and vulnerable (VU) according the national red list MIMARENA (2011).

None of the mammal species recorded are listed as threatened according to the IUCN red lists (IUCN,2020 and MIMARENA, 2011).

All species of bats recorded are designated as least concern (LC) by the IUCN global red list of threatened species.

Seven endemic species of birds are found, two of which are considered threatened (*Amazona ventralis* and *Psittacara chloropterus*).

Aquatic Fauna

During the inventories carried out in the Guajimía Canal and its tributaries, no threatened aquatic fauna was encountered.

Protected Areas

According to the National System of Protected Areas of the Ministry of Environment and Natural Resources that include those declared by Sectoral Law No. 202-04 on Protected Areas and Decree No. 571-09 and the Metropolitan Protected Areas, created by Presidential Decree No. 207-02, no protected areas overlap the study area.

Habitat Classification

Over the project's area, no habitat was identified that, according to the criteria established by IFC Performance Standard No. 6, can be considered critical because the area is very anthropized and contains no vegetation of high biodiversity value. Furthermore, Criterion 4 of PS6 includes unique and highly threatened ecosystems. No such ecosystems were identified within the Project area

Socio-Economic Baseline

Demography

The table below shows the demographic evolution in the project area of influence.

Table 1-1: Demographic Evolution of the Area of Influence of the Project

Territorial division	Population Census 2002 (inhabitants)	Population Census 2010 (inhabitants)	Annual growth rate (%)	Projection to 2020
Dominican Republic	8,562,541	9,445,281	1.28	10,448,499
Santo Domingo Province	1,817,754	2,374,370	3.8	2,906,003
Municipality of Santo Domingo Oeste	280,912	363,321	3.7	--
Santo Domingo Country Club	24,681	29,784	2.6	--
The Altagracia	24,358	26,313	0.9	--
Engombe	24,783	28,729	1.9	--
The Rose	11,998	13,085	1.1	--
Mahogany	28,075	23,244	-2.1	--
poplar grove	10,910	14,290	3.9	--
Buenos Aires	18,742	19,015	0.2	--
Blacksmith	30,328	43,119	5.2	--
Duarte	30,139	31,394	0.5	--
Bayonne	11,663	29,526	19.1	--
Manoguayabo	8,439	16,215	11.5	--

Source: ONE: IX National Population and Housing Census, 2010,
VIII National Population and Housing Census 2002 and Statistical projections

Study area density is significantly higher than national and province-level averages, with Herrera, Duarte, La Altagracia, Buenos Aires and Santo Domingo Country Club neighborhoods having densities exceeding 30,000 inhabitants/km2.
In our case study, which is the municipality of Santo Domingo Oeste, and in each of the neighboring municipality, the female population is dominant by up to 6 percentage points. There is a distinction between the population under 30-year-old in neighborhoods of Engombe and Santo Domingo Country Club (El Café) and that of neighborhoods on Alameda (55%) and Mahogany (53%), where a population with middle class characteristics resides.

Characteristics of the Housing

In the municipality of Santa Domingo Oeste, there is a higher proportion of houses with high structural quality than on average for the country and province. As well, significant differences exist between the neighborhoods. As an example, while low-quality housing is predominant in many neighborhoods, such as Las Caobas, Alameda, La Rosa, Bayona and Manoguayabo, homes of moderate quality are still prevalent in the remaining neighborhoods. Rent is the most common form of housing tenure.

The 2010 national census of population and housing indicates that the predominant material used for exterior walls in Santo Domingo Oeste (89.26%) and all other neighborhoods included in the study is block or concrete. In this case, the proportions are higher compared to the national and provincial data. All neighborhoods in the study, except Santo Domingo Country Club and Manoguayabo, have at least 90% of homes with concrete or block exterior walls. Santo Domingo Oeste and most of the neighborhoods considered in the study have a high percentage of cement floors, which is lower than the national average and comparable with the province of Santo Domingo.

There is a significantly higher proportion of toilet usage in the project area than in the country or the province of Santo Domingo, reaching above 98% in the neighborhoods Las Caobas, La Rosa, and Alameda (see Table 6-66 below)

Table 6-2: Percentages of the Type of Health Service of the House

Territorial Demarcation	Toilet	Latrine	You don't have
Dominican Republic	69.71	24.28	6.01
Santo Domingo Province	88.12	8.40	3.48
Municipality of Santo Domingo Oeste	94.12	4.26	1.62
Santo Domingo Country Club	94.02	3.64	2.34
The Altagracia	95.54	3.81	0.65
Engombe	96.69	2.78	0.53
The Rose	99.26	0.44	0.30
Mahogany	99.55	0.24	0.21
poplar grove	98.44	0.96	0.60
Buenos Aires	92.87	6.02	1.11
Herrera Neighborhood	95.71	3.68	0.61
Duarte	96.07	3.27	0.67
Bayonne	97.44	1.46	1.09
Manoguayabo	94.91	3.69	1.40

Source: National Population and Housing Census 2010

As a result of the survey conducted in May 2021, people interviewed regarding their residence in the neighborhood over the past 15 years were able to distinguish that 240 households in the neighborhood had been living there for more than 15 years, accounting for 61.1% of 240 total households.

Economy

The municipality of Santo Domingo Oeste has an overall poverty rate (25.8%) eight (8) points below the national rate. In the municipality of Santo Domingo Oeste, the predominant branch of economic activity is commerce, representing 26% of the total, followed by the manufacturing industry, which represents11.44%, private households with domestic service, which reach 8%, transport, and storage that reaches 7.72% and construction, which reaches 6.70%.

Data from the survey applied by Empaca in May 2021 indicate that 24.2% of the people surveyed are employed as employees in the private sector, 30% are employed independently, 21.4% do not exercise any activity, 10.9% work in the public sector, 4.3% are self-employed or as a day laborer, while 2.5% work under the category of an employer or active partner of a company.

Planning and land use

Within the municipality of Santo Domingo Oeste, there are 11,445 fixed commercial establishments comprising semi-fixed or mobile vendors that sell raw or cooked food, fruits, and other items, as well as 1,846 establishments that occupy part of the house.

Access to basic services

The level of access to electricity from public power lines in the study area is higher than in the country, representing more than 99% throughout the municipality and the neighborhoods.

Poor drinking water service has historically been one of the problems faced by communities in the Dominican Republic, especially the popular neighborhoods of the urban area.

In Santo Domingo Oeste, the proportion of households that dispose of garbage through the City Council's truck corresponds to 98.89%, which indicates significant differences among the neighborhoods studied in terms of garbage disposal. The neighborhoods of Alameda, Las Caobas, and La Rosa stand out. Over 98% of household garbage is collected by the council while only 87% of households in Herrera do so.

By 2010, 19.68% of the people in Santo Domingo Oeste reached the level of pre-primary education, 37.94% reached the level of primary education, 32.25% reached secondary or middle education, while 20.31% reached the level of higher education. The emergency and disaster assistance structure in the municipality of Santo Domingo Oeste is made up of the Fire Department, the Civil Defense, and the 9-1-1 system. According to the National Statistics Office (2019), among the main causes of disease identified for the municipality of Santo Domingo Oeste stands out hypertension, which reaches a total of 12,044 cases in the municipality.

Gender aspects

Women in the neighborhoods face social inequality by being conditioned to marry young with men who are twice their age. According to data from the National Statistics Office, 86% of mothers who gave birth in the Dominican Republic during 2018, were registered as a single in the category of their marital status, from which 16 percent of them were under the age of 19.

Another issue related to gender aspects is rejection toward sexual diversity. There are still strong attitudes of rejection in Dominican society, influenced by fundamentalist religious currents, that oppose approaches that promote acceptance of people regardless of their sexual orientation.

In addition, there is a kind of gender inequity between men and women in the Dominican Republic, as a social practice still exists which tends to award the title of ownership of property more greatly to men, being able to use this to commit fraud on the sale of the family home.

Vulnerable groups

People with disabilities, whether physical, motor, sensory or mental, are a vulnerable group. According to data from the 2010 National Population and Housing Census, in the project area, 8,618 people, representing 2.37% of the total population have difficulty climbing stairs or walking, 8618 4,087 people lack one or both arms, representing 1.12%, 521 people lack one or both legs (0.14%) and 1751 people have mental disorders (0.48%).

Table 6-3: Levels of disability in the municipality of Santo Domingo Oeste

Disability	Frequency	(%)
Difficulty seeing, even if you wear glasses	26,994	7.43
Difficulty walking or climbing steps	8,618	2.37
Difficulty walking, missing one or both legs	521	0.14
Difficulty performing tasks, missing one or both arms	4,087	1.12
Social and work difficulty, has mental problems	1,751	0.48

Source: IX National Population and Housing Census, 2010

Landscape

An assessment of visibility, fragility and quality showed that the area's landscape is affected by the intense anthropization, which covers more than 63% of the extension of the watershed.

Historical, Archeological and Cultural Area

No historical, archeological and cultural area are threatened by the project.

Identification of Potential Impacts

This impact analysis is based on a cause/effect matrix between project-related impact sources and valued environmental and social components. This matrix is displayed in chapter 7.

Impacts are defined by their intensity (low, medium, major), their extent (regional, local, limited) and their duration (long, medium, short). The method used to identify, analyze and mitigate environmental and social impacts, or to improve positive impacts, places the project in a sustainable development perspective. The mitigation of potential negative impacts and the enhancement of positive impacts allow its environmental and social acceptability by stakeholders. Intensity of potential and residual impacts, as well as impact probability of occurrence, based on an environmental and social impact assessment report, regarding the Storm and Sanitary Drainage of the Guajimía Canal Phase II Project, are shown in Tables A and B.

Table A. Summary of Potential and Residual Impacts during the Pre-construction / Construction Phase

VESC	Sources of impact	Impact	Potential impacts	Residual impacts
Physical environment VESC				
Air quality and climate change	• Installation of temporary facilities. • Preparation of the site where the residential units will be built. • Construction of residential units and their basic service infrastructure. • Site preparation in the Guajimía Canal and its tributaries. • Water diversion for rainwater channeling works. • Construction of rainwater channeling structures in the upper part of the Guajimía Canal and its tributaries. • Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía Canal and its tributaries. • Expansion of the water distribution networks of the axes of the upper Guajimía Watershed and its tributaries. • Construction of urban amenities in the strips of intervened areas. • Exploitation of loan material. • Management of waste products from the cleaning of the channel of the Canal and its tributaries and demolitions of the affected houses. • Transportation and traffic.	• Temporary deterioration of air quality. • Contribution to climate change due to the generation of greenhouse gas emissions.	Nature: Negative Importance: Moderate Probability of impact occurrence: High	Nature: Negative Importance: Minor Probability of impact occurrence: Medium
Noise and vibrations	• Installation of temporary facilities. • Preparation of the site where the residential units will be built. • Construction of residential units and their basic service infrastructure. • Site preparation in the Guajimía Canal and its tributaries. • Water diversion for rainwater channeling works. • Construction of rainwater channeling structures in the upper part of the Guajimía Canal and its tributaries. • Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía Canal and its tributaries. • Expansion of the water distribution networks of the axes of the upper Guajimía Watershed and its tributaries. • Construction of urban amenities in the strips of intervened areas. • Exploitation of loan material. • Management of waste products from the cleaning of the channel of the Canal and its tributaries and demolitions of the affected houses. • Transportation and traffic.	• Increase in noise and vibration levels at the local level.	Nature: Negative Importance: Moderate Probability of impact occurrence: High	Nature: Negative Importance: Minor Probability of impact occurrence: High
Soil	• Preparation of the site where the residential units will be built. • Site preparation in the Guajimía Canal and its tributaries. • Construction of rainwater channeling structures and the sewerage system in the upper part of the Guajimía Canal and its tributaries.	• Erosion of the soil at the edges of the Canals due to the actions of reprofiling. • Soil compaction.	Nature: Negative Importance: Minor Probability of impact	Nature: Negative Importance: Minor Probability of impact occurrence: Low

VESC	Sources of impact	Impact	Potential impacts	Residual impacts
	• Management of waste products from the cleaning of the channel of the Canal and its tributaries and demolitions of the affected houses. • Transportation and traffic.	• Soil contamination on the banks of the Canals.	occurrence: Medium	
Water Resources	• Site preparation in the Guajimía Canal and its tributaries. • Water diversion for rainwater channeling works. • Construction of rainwater channeling structures and the sewerage system in the upper part of the Guajimía Canal and its tributaries. • Management of waste products from the cleaning of the channel of the canal and its tributaries and demolitions of the affected houses. • Transportation and traffic.	• Change in the quality of surface water in the canals under intervention. • Modification of the parameters of the rainwater drainage of the canals under intervention.	Nature: Negative Importance: Moderate Probability of impact occurrence: Medium	Nature: Negative Importance: Minor Probability of impact occurrence: Medium
Biological environment VESC				
Terrestrial Habitat, Vegetation and Flora	• Preparation of the site where the residential unitswill be built. • Site preparation in the Guajimía Canal and its tributaries. • Construction of urban amenities in the strips of intervened areas.	• Disappearance of vegetation and loss of flora in the areas to clear. • Modification of the species composition in the flora communities present in the project area. • Introduction of invasive species and risk of spread.	Nature: Negative Importance: Minor Probability of impact occurrence: High	Nature: Negative Importance: Minor Probability of impact occurrence: High
Terrestrial habitats and fauna	• Preparation of the site where the residential units will be built. • Construction of residential units and their basic service infrastructure. • Site preparation in the Guajimía Canal and its tributaries. • Water diversion for rainwater channeling works. • Construction of rainwater channeling structures in the upper part of the Guajimía Canal and its tributaries. • Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía Canal and its tributaries. • Expansion of the water distribution networks of the axes of the upper Guajimía Watershed and its tributaries. • Construction of urban amenities in the strips of intervened areas. • Exploitation of loan material. • Management of waste products from the cleaning of the channel of the Canal and its tributaries and demolitions of the affected houses. • Transportation and traffic. • Work force	• Fragmenting and degradation of terrestrial habitat in small areas to be cleared. • Modification of the species composition in the fauna communities present in the project area. • Displacement and reduction of fauna, caused by dust and noise caused by construction activities, mainly by personnel,	Nature: Negative Importance: Minor Probability of impact occurrence: Medium	Nature: Negative Importance: Minor Probability of impact occurrence: Low

VESC	Sources of impact	Impact	Potential impacts	Residual impacts
		equipment and machinery		
Aquatic Habitats and Fauna	• Site preparation in the Guajimía Canal and its tributaries. • Water diversion for rainwater channeling works. • Construction of rainwater channeling structures in the upper part of the Guajimía Canal and its tributaries. • Management of waste products from the cleaning of the channel of the Canal and its tributaries and demolitions of the affected houses.	• Disturbance of the aquatic fauna present in the Canals. • Modifications of aquatic habitats and their associated fauna.	Nature: Negative Importance: Moderate Probability of impact occurrence: Medium	Nature: Negative Importance: Minor Probability of impact occurrence: Medium
Critical Habitats	No critical habitats were identified that could be affected by the project's actions in the pre-construction and construction phases.			
Human Environment VESC				
Land planning and use	• Acquisition of land for the construction of apartment buildings. • Resettlement of the population and payment of corresponding compensations. • Site preparation in the Guajimía Canal and its tributaries. • Construction of rainwater channeling structures in the upper part of the Guajimía Canal and its tributaries. • Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía Canal and its tributaries. • Expansion of the water distribution networks of the axes of the upper Guajimía Watershed and its tributaries. • Construction of urban amenities in the strips of intervened areas.	• Impact on land properties. • Nonconformity of the population to be resettled.	Nature: Negative Importance: Moderate Probability of impact occurrence: High	Nature: Negative Importance: Moderate Probability of impact occurrence: High
Existing Infrastructure	• Resettlement of the population and payment of corresponding compensations. • Site preparation in the Guajimía Canal and its tributaries. • Construction of rainwater channeling structures in the upper part of the Guajimía Canal and its tributaries. • Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía Canal and its tributaries. • Expansion of the water distribution networks of the axes of the upper Guajimía Watershed and its tributaries. • Construction of urban amenities in the strips of intervened areas. • Transportation and traffic.	• Destruction of homes and other buildings located on the banks of the Canals that will be intervened. • Damage to existing infrastructures (roads, drinking water supply, sewage collection, among others). • Increased traffic and disturbance of circulation.	Nature: Negative Importance: Major Probability of impact occurrence: High	Nature: Negative Importance: Minor Probability of impact occurrence: Low
Economy, employment and livelihoods	• Preparation of the site where the residential units will be built. • Construction of residential units and their basic service infrastructure. • Resettlement of the population and payment of corresponding compensations.	• Disturbance of commercial and service activity.	Nature: Negative Importance: Major	Nature: Negative Importance: Minor

VESC	Sources of impact	Impact	Potential impacts	Residual impacts
	• Site preparation in the Guajimía Canal and its tributaries. • Construction of rainwater channeling structures in the upper part of the Guajimía Canal and its tributaries. • Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía Canal and its tributaries. • Expansion of the water distribution networks of the axes of the upper Guajimía Watershed and its tributaries. • Construction of urban amenities in the strips of intervened areas. • Transportation and traffic.	• Changes in lifestyle habits. • interruption of the livelihood activities of the inhabitants in the area of influence of the project.	Probability of impact occurrence: Medium	Probability of impact occurrence: Low
Quality of life, health and safety	• Installation of temporary facilities. • Preparation of the site where the residential units will be built. • Construction of residential units and their basic service infrastructure. • Resettlement of the population and payment of corresponding compensations. • Site preparation in the Guajimía Canal and its tributaries. • Construction of rainwater channeling structures in the upper part of the Guajimía Canal and its tributaries. • Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía Canal and its tributaries. • Expansion of the water distribution networks of the axes of the upper Guajimía Watershed and its tributaries. • Construction of urban amenities in the strips of intervened areas. • Management of waste products from the cleaning of the channel of the Canal and its tributaries and demolitions of the affected houses. • Transportation and traffic. • Work force.	• Accidents and physical injuries involving workers and local residents. • Traffic accidents involving workers and local residents. • Increase in population stress due to noise, dust, air pollution and unforeseen events generated by works of this magnitude in their surroundings.	Nature: Negative Importance: Moderate Probability of impact occurrence: High	Nature: Negative Importance: Minor Probability of impact occurrence: Medium
Social cohesion and gender	• Acquisition of land for the construction of apartment buildings. • Resettlement of the population and payment of corresponding compensations. • Purchase of materials, goods and services. • Work force.	• Generation of conflicts related to compensation for tenants, homeowners, businesses, workshops, among others. • Generation of tensions due to problems in the interaction of the communities with the construction workers. • Tensions generated in the neighborhoods	Nature: Negative Importance: Moderate Probability of impact occurrence: Medium	Nature: Negative Importance: Minor Probability of impact occurrence: Low

VESC	Sources of impact	Impact	Potential impacts	Residual impacts
		of the project's area of influence due to the low or limited allocation of jobs and service contracts to residents, workers and professionals in said neighborhoods. • Women marginalized in the compensation process for tenants, homeowners, businesses, workshops, among others.		
Vulnerable groups	• Acquisition of land for the construction of apartment buildings. • Resettlement of the population and payment of corresponding compensations.	• Increase in marginalization and poverty levels of vulnerable groups.	Nature: Negative Importance: Moderate Probability of impact occurrence: Medium	Nature: Negative Importance: Minor Probability of impact occurrence: Medium
Landscape	• Preparation of the site where the residential units will be built. • Construction of residential units and their basic service infrastructure. • Construction of rainwater channeling structures in the upper part of the Guajimía Canal and its tributaries. • Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía Canal and its tributaries. • Expansion of the water distribution networks of the axes of the upper Guajimía Watershed and its tributaries. • Construction of urban amenities in the strips of intervened areas. • Exploitation of loan material. • Management of waste products from the cleaning of the channel of the Canal and its tributaries and demolitions of the affected houses.	• Temporary degradation of the landscape at the site.	Nature: Negative Importance: Moderate Probability of impact occurrence: High	Nature: Negative Importance: Minor Probability of impact occurrence: High
Cultural and archaeological heritage	• Preparation of the site where the residential units will be built. • Site preparation in the Guajimía Canal and its tributaries. • Exploitation of loan material.	• Possible alteration or destruction of non discovered sites with cultural value and/or archaeological objects.	Nature: Negative Importance: Minor Probability of impact occurrence: Low	Nature: Negative Importance: Minor Probability of impact occurrence: low

VESC	Sources of impact	Impact	Potential impacts	Residual impacts
Resources	• Installation of temporary facilities. • Preparation of the site where the residential units will be built. • Construction of residential units and their basic service infrastructure. • Resettling of the population • Site preparation in the Guajimía Canal and its tributaries. • Water diversion for rainwater channeling works. • Construction of rainwater channeling structures in the upper part of the Guajimía Canal and its tributaries. • Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía Canal and its tributaries. • Expansion of the water distribution networks of the axes of the upper Guajimía Watershed and its tributaries. • Construction of urban amenities in the strips of intervened areas. • Exploitation of loan material. • Management of waste products from the cleaning of the channel of the Canal and its tributaries and demolitions of the affected houses. • Transportation and traffic. • Work force.	• Increased water consumption. • Increased consumption of electricity and fuels. • Increased consumption of loan materials.	Nature: Negative Importance: Moderate Probability of impact occurrence: High	Nature: Negative Importance: Minor Probability of impact occurrence: High

Table B. Summary of Potential and Residual Impacts during the Operation Phase

VESC	Sources of impact	Impact	Potential impacts	Residual impacts
Physical environment VESC				
Air quality and climate change	• Maintenance of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks. • Maintenance of urban structures. • Transportation/circulation	• Slight degradation of air quality at the local level. • Contribution to climate change due to potential greenhouse gas emissions.	Nature: Negative Importance: Minor Probability of impact occurrence: Medium	Nature: Negative Importance: Minor Probability of impact occurrence: Low
Noise and vibrations	• Maintenance of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks. • Maintenance of urban structures. • Transportation/circulation. • Presence of workers	• Increase in noise and vibration levels due to maintenance activities.	Nature: Negative Importance: Minor Probability of impact occurrence: Medium	Nature: Negative Importance: Minor Probability of impact occurrence: Low
Soil	• Maintenance of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks. • Maintenance of urban structures. • Solid waste handling and management. • Transportation/circulation.	• Soil contamination due to maintenance activities.	Nature: Negative Importance: Minor Probability of impact occurrence: Low	Nature: Negative Importance: Minor Probability of impact occurrence: Low
Water Resources	• Presence and operation of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks. • Presence and operation of the homes of the resettlement plan and urban structures. • Solid waste handling and management.	• Pollutant load reduction in surface waters due to the elimination of accumulated garbage in the Canals. • Flood reduction of floods. • Improvement of surface runoff by rectifying the wet section in Canals and channels.	Nature: Positive Importance: Major Probability of impact occurrence: High	Nature: Positive Importance: Major Probability of impact occurrence: High

VESC	Sources of impact	Impact	Potential impacts	Residual impacts
Biological environment VESC				
Terrestrial Habitat, Vegetation and Flora	• Maintenance of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks. • Maintenance of urban structures.	• Deterioration of green spaces and gardens created by maintenance activities of the structures for rainwater and sanitary drainage, drinking water supply and urban construction. • Possible introduction of invasive alien species (IAS).	Nature: Negative Importance: Moderate Probability of impact occurrence: High	Nature: Negative Importance: Minor Probability of impact occurrence: Low
Terrestrial habitats and fauna		• No negative impact is expected during the Operation Phase.		
Aquatic Habitats and Fauna	• Presence and operation of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks.	• Improvement of the quality of aquatic habitats in the Guajimía Canal in the section from Autopista 6 Noviembre to the Haina River.	Nature: Positive Importance: Moderate Probability of impact occurrence: Medium	Nature: Negative Importance: Major Probability of impact occurrence: High
Critical Habitats	No critical habitats were identified that could be affected by the project's actions in the pre-construction and construction phases.	N/A	N/A	N/A
Human Environment VESC				
Land planning and use	• Presence and operation of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks. • Presence and operation of the homes of the resettlement plan and urban structures.	• Illegal occupation of the spaces where the structures for rainwater and sanitary drainage, drinking water supply and urban construction are located.	Nature: Negative Importance: Major Probability of impact occurrence: High	Nature: Negative Importance: Major Probability of impact occurrence: Low
Existing Infrastructure	• Presence and operation of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks. • Presence and operation of the homes of the resettlement plan and urban structures.	• Destruction of rainwater and sanitary drainage, drinking water supply and urban structures due to vandalism.	Nature: Negative Importance: Moderate Probability of impact	Nature: Negative Importance: Moderate Probability of impact occurrence: Low

VESC	Sources of impact	Impact	Potential impacts	Residual impacts
			occurrence: Medium	
Economy, employment and livelihoods	• Maintenance of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks. • Maintenance of urban structures.	• Creation of jobs for maintenance work.	Nature: Positive Importance: Major Probability of impact occurrence: Medium	Nature: Positive Importance: Major Probability of impact occurrence: High
Quality of life, health and safety	• Presence and operation of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks. • Presence and operation of the homes of the resettlement plan and urban structures. • Maintenance of urban structures. • Solid waste handling and management.	• Reduction of the threat of floods and vulnerability of the resident population in the surroundings of the Guajimía Canal and its tributaries. • Reduction of the spread of diseases transmitted by water and vectors (mosquitoes, flies, rats and mice) in the resident population around the Guajimía Canal and its tributaries. • Improvement in the quality of life of the population of the neighborhoods under direct and indirect impact from the project. and of the resettled population. • Improvement of the conditions for the management of urban solid waste. • Creation of spaces for recreation and sports activities for the	Nature: Positive Importance: Major Probability of impact occurrence: Medium	Nature: Positive Importance: Major Probability of impact occurrence: High

VESC	Sources of impact	Impact	Potential impacts	Residual impacts
		community, especially children and youth.		
Social cohesion and gender	• Presence and operation of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks. • Presence and operation of the homes of the resettlement plan and urban structures.	• Promoting community cohesion.	Nature: Positive Importance: Major Probability of impact occurrence: Medium	Nature: Positive Importance: Major Probability of impact occurrence: High
	• Presence and operation of the homes of the resettlement plan and urban structures. • Maintenance of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks. • Maintenance of urban structures. • Presence of workers.	• Disturbances by the population that was not resettled. • Disturbance by population that consider they should be included in the RAP. • Tensions generated between residents and workers due to inadequate interaction during the structures' maintenance activities.	Nature: Negative Importance: Moderate Probability of impact occurrence: Medium	Nature: Negative Importance: Minor Probability of impact occurrence: Low
Vulnerable groups	• Presence and operation of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks. • Presence and operation of the homes of the resettlement plan and urban structures.	• Reduction of the vulnerable population in the communities in the project's area of influence.	Nature: Positive Importance: Major Probability of impact occurrence: High	Nature: Positive Importance: Major Probability of impact occurrence: High
Landscape	• Presence and operation of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks. • Presence and operation of the homes of the resettlement plan and urban structures. • Maintenance of urban structures. • Solid waste handling and management.	• Improvement of the visual landscape.	Nature: Positive Importance: Major Probability of impact occurrence: Medium	Nature: Positive Importance: Major Probability of impact occurrence: High

VESC	Sources of impact	Impact	Potential impacts	Residual impacts
Cultural and archaeological heritage		• No negative impact is expected during the Operation Phase.	N/A	N/A
Resources		• No negative impact is expected during the Operation Phase.		

Measures to be implemented during the pre-construction, construction and operation phases of the project for the prevention, minimization, compensation, mitigation of potential, residual as well as cumulative impacts, according to the valued environmental components (VEC) are identified (see annexes 11.1 to 11.5).

Environmental and Social Management Plans

This ESIA describes the management practices that will allow to avoid, mitigate, or compensate for the negative impacts from the project identified in the chapter identifying and evaluating risks and environmental and social impacts. In addition, management measures are included to enhance positive effects. As a general measure, the program will apply to the entire organization, including the main contractors and suppliers with whom the organization has control or influence, or to specific facilities, locations, or activities.

Considering the identified risks and impacts, a hierarchy of measures is outlined whose priority is prevention over mitigation. If residual impacts persist, they are restored or compensated if technically and financially feasible. Measures are arranged in the following hierarchy:

- Prevention measures
- Minimization measures
- Restoration or compensation measures
- Mitigation and performance measures

Preventive, mitigation and compensation measures organized by sub-programs to be implemented during the pre-construction, construction and operation phases of the project are presented.

Below is an overview of the main costs of implementing the Environmental and Social Management Program:

Summary Budget Estimate of the Environmental and Social Management Program

	Activities	Cost (USD$) (1 year)	Cost (USD$) (4 years)
Construction phase	Air quality monitoring	7,270.00	29,080.00
	Noise monitoring	6,970.00	27,880.00
	Water quality monitoring	16,970.00	67,880.00
	Biodiversity monitoring	33,370.00	133,480.00
	Social environment monitoring	13,460.00	53,840.00
	Sub-Total Construction Phase	**78,040.00**	**312,160.00**
Operations phase	Water quality monitoring	16,970.00	67,880.00
	Biodiversity monitoring	33,370.00	133,480.00
	Social environment monitoring	13,460.00	53,840.00
	Sub-Total Operation Phase	**63,800.00**	**255,200.00**
	TOTAL	**141,840.00**	**567,360.00**

Environmental Education Plan

The environmental education plan to be implemented has the following objectives:

- To make known to the workers of the work the measures that are part of the Program of Measures of the ESMP of the project.
- To instruct workers on how they should carry out their work in their respective jobs, so as to minimize the effects on the environment.

- Raise awareness among construction workers about the importance of their collaboration with compliance with the ESMP to avoid, mitigate or compensate for the negative impacts that the project may cause to the environment.
- To raise awareness among the population living in the sectors of the project's area of influence about the importance of their collaboration for the protection of the environment and for Phase II of the Rainwater and Sanitary Sanitation project of the Guajimía Canal and its Main Tributaries to be successful, especially in relation to the proper management of solid waste.
- Train the inhabitants of the sectors of the area of influence in different trades so that they increase their capacities and aptitudes for the possible obtaining of jobs both in the project and in future projects.
- To inform the inhabitants of the sectors of the area of influence of the project about procedures for the reporting of complaints.

Environmental Health and Safety Plan

The Environmental Health and Safety Plan (EHS) Plan identifies the principles, approach, procedures and methods that will be used to control and minimize the adverse environmental and social impacts of all construction and operational activities associated with project Assessment (ESIA) and ensure that commitments made by CAASD to minimize project related adverse environmental and social impacts are upheld throughout all project phases.

Waste Management Plan

The Waste Management Plan (WMP) describes the procedures, systems, equipment, and structures specific to waste management and disposal. Waste generation should be limited at all levels of the operation in order to decrease the volume of waste generated and make waste disposal more manageable. The WMP also defines who is responsible for developing and implementing the plan, and what records and reporting will be required.

Conclusion

This Environmental and Social Impact Assessment has been professionally carried out to the following objectives:

- Baseline Survey of the Project Area.
- Execution of an Environmental and Social Impact Assessment (ESIA) and development of Environmental and Social Management Plans (ESMP).

The investigations of impacts on the social environment are a crucial part of the study, since the project may impact the communities which reside at close proximity to the project site. The investigation of social impacts has involved the following:

- A baseline socio-economic study of the community envisaged to be impacted by the project activities in both the construction and operational phases.
- A Public Consultation undertaken to sensitize stakeholders.

Environmental impacts of the project’s activities have been identified for all phases of the project. The most significant changes are seen during the pre-construction and operation phases, since several of the activities will take place simultaneously. During the operation phase, the stud determined a decrease in negative impacts. It observed that this project will also have a positive impact, mainly on the socio-economic and historical-cultural environment, fostering the generation of jobs, the improvement of the quality of life of the inhabitants and of the visual landscape. All the impacts identified are normal for this type of project and can be prevented or mitigated by applying the environmental measures described in the Environmental and Social Management Program.

The population residing in the area may be subject to involuntary resettlement due to the objectives of the project, so this represents a turning point regarding social cohesion, which has a significant impact during compensation negotiations.

The Social and Environmental Management Program has been designed taking into account the preventive, mitigating and restorative or compensating measures of the identified impacts, as well as the provisions of the Environmental Laws and Regulations of the Dominican Republic, the Performance Standards on Environmental and Social Sustainability and the IFC Guidelines on Environment, Health and Safety.

Recommendations

- Develop a detailed Work Plan before starting construction activities, including compliance with mitigation measures for each of the components and applicable national regulations and international standards. In order to obtain efficient compliance, this plan must be disclosed to contractors and subcontractors through a formally structured communication program for this purpose.
- Coordinate in a timely and appropriate manner with the corresponding authorities the interventions in public spaces.
- Establish continuous communication between the authorities, social groups and others involved in the project, in order to maintain effective coordination during the processes involved in the development of the different activities, including the process of compensating those affected.
- Maintain channels of communication with the community, instructing them on the mechanisms for presenting claims, complaints or suggestions about the project and making them aware of the way in which they will be dealt with by the authorities or those responsible.
- Consider the recommendations obtained during the public consultation processes of this study, with the participation of residents and those potentially affected by the resettlement actions.
- Avoid initiating any activities planned for the construction phase before the families that will be directly affected by the project are relocated to their new residential units. This process must be carried out in accordance with the procedures established in the PAR.
- Maintain the established timeframe of 48 months for the development of pre-construction and construction activities, thus avoiding causing greater disturbance in the areas to be intervened.
- Establish an education program aimed at the community, with the objective of raising awareness among the population regarding the importance of good wastewater management and the benefits that these practices represent for human health and the environment.
- Maintain optimal solid waste management, including the final disposal of solid waste by the responsible entity.
- Once the construction phase is completed, perform the necessary maintenance of the project to prevent their deterioration.
- Adequately implement the ESMP and each of its programs, so identified impacts can be prevented, mitigated or eliminated.

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Annexes (Volume 2)

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ASODIFIMO	Dominican Association of Physically and Motor Handicapped
BOD_5	biochemical oxygen demand
CAASD	Santo Domingo Aqueduct and Sewerage Corporation
CAPI	Computer Assistant Personal Interview
CATHALAC	Water Center for the Humid Tropics of Latin America and the Caribbean
CCC	Canadian Commercial Corporation
CCKP	Climate Change Knowledge Portal
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CO	Carbon monoxide
COD	Chemical oxygen demand
CONAPE	National Council for the Elderly
CR	critically endangered species
CSOs	Civil society organizations
DCA	DESSAU Can-American
EDESUR	Empresa Distribuidora de Energía del Sur
EHS	Environmental, Health, and Safety
EIS	Environmental Impact Statement
EN	Endangered species
EOO	Extent of Occurrence
EP	Equator Principles
EPA	U.S. Environmental Protection Agency
EPFI	Equator Principles Financial Institution
ESIA	Environmental and social assessment Study
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
ESPS	Environmental and Social Performance Standard
GBIF	Global Biodiversity Information Facility13
GHG	Greenhouse Gas
GIIP	Good International Industry Practice
GIS	Geographic information system
GPS	Global Positioning System
HDPE	high-density polyethylene pipes
HSMP	Health & Safety Management Plan
IAH	International Association of Hydrogeologists
IFC	International Finance Corporation

ILO	International Labour Organization
INAPA	National Institute of Drinking Water and Sewerage
INFOTEP	Instituto Nacional de Formación Técnico Profesional
INSTMET	Institute of Meteorology of Cuba
INTEC	Instituto Tecnológico de Santo Domingo
INVI	National Housing Institute
IUCN	International Union for the Conservation of Nature
LED	Light-emitting diode
MIMARENA	Ministry of Environment and Natural Resources
MINERD	Ministry of Education of the Dominican Republic
NBI	Unsatisfied Basic Needs
NGOs	Non-Governmental Organizations
NHC	National Hurricane Center
NOAA	National Oceanic and Atmospheric Administration
OECD	Organization for Economic Cooperation and Development
ONAMET	Oficina Nacional de Meteorología
ONE	National Statistics Office
OSAH	Occupational Safety & Health Administration
PET	Population of working age
PM	Particulate Matter
PS	Performance Standards
PUCMM	Pontificia Universidad Católica Madre y Maestra
PVC	polyvinyl chloride
RAP	Resettlement Action Plan
RCIA	Rapid cumulative impact assessment and management
RCP	Representative Concentration Pathways
SDS	Safety data sheets
TDS	Total dissolved solid
UAPA	Universidad Abierta para Adultos
UASD	Autonomous University of Santo Domingo
UN	United Nations
UNAPEC	Universidad APEC
UNICARIBE	Universidad del Caribe
URBE	Redevelopment of Neighborhoods and the Environment
UTESA	Technological University of Santiago
VEC	Valued environmental and social components

1. INTRODUCTION

This chapter presents the background and justification of the project followed by the purpose and the category of the ESIA.

1.1 Project Background

1.1.1 Project Context

The municipality of Santo Domingo Oeste is the western part of the Dominican Republic, in the capital of Santo Domingo. Covering an area of 57,5 km^2, the municipality is crossed by numerous waterways whose banks are densely populated by inhabitants living in ramshackle households that do not benefit from basic sanitation services. Consequently, garbage is thrown into local streams and rivers, which are also used as open sewers (Photo 1-1). This garbage disrupts the water flow, which results in floods of heavily polluted waters during the rainy season. The impacts of these floods include loss of human life, a high degree of pollution, unsanitary conditions and inhuman living conditions (Photo 1-2).

Photo 1-1: Accumulation of waste in a typical canal of the project area (Picture taken on May 19, 2021)

Photo 1-2: Housing condition in the Santo Domingo Oeste (Picture taken on May 19, 2021)

In 2003, the Dominican Republic Congress unanimously approved the Guajimía Project in order to solve the flood and sanitation problems in the canals of the Guajimía Watershed. The Santo Domingo Aqueduct and Sewerage Corporation (CAASD) is the governmental authority that managed the Guajimía Project. During execution of Phase I, an environmental and social impact assessment (ESIA) and a Relocation Action Plan (RAP) were conducted for Phase II. However, after the completion of these studies, this Phase II was suspended, and no works were conducted.

On December 4, 2020, the Dominican Republic Government signed a loan agreement of USD $50 million with J.P. Morgan. With this investment, the CAASD relaunched the second phase of the Storm and Sanitary Drainage of the Guajimía Canal and signed an agreement on January 28, 2021 with the Canadian Commercial Corporation (CCC). The latter requested AECOM's services to update and improve the previous ESIA. Finally, AECOM involved the Dominican firm EMPACA as a subconsultant.

1.1.2 Project History

In 2005, the Santo Domingo Aqueduct and Sewer Corporation (CAASD) entrusted DESSAU Can-American (DCA) with the mandate to carry out the Engineering, Procurement and Construction Management (EPCM) of Phases I, II and II Addenda. This mandate also included the realization of the environmental and social assessment studies, the elaboration of the Resettlement Plan for the affected the families and its implementation, as well as the technical and environmental supervision of the construction works. The sections below present the highlights of these phases.

1.1.2.1 *Phase I*

The first phase of the Guajimía Project comprising the intervention on 8 km of tributaries was launched. The project consisted in channeling the tributaries of Buenos Aires, El Indio and Urena as well as the central part of the Guajimía Canal. Stormwater drainage, the installation of major water systems, expansion of drinking water supply systems and access roads were built. Residential complexes were built to relocate the families (see Photo 1-3).

Photo 1-3: Canal Buenos Aires Works

Works conducted during the phase I of the project can be summarized as follow:

- Building of 5.9 km of rainwater channels
- Construction of 6.5 km of drinking water networks and 12 km sanitary sewer networks
- Building of a total of 56 km of underground sewers

Furthermore, the first phase included the construction of 58 blocks, comprising 900 housing units for a total of 1,184 apartments for riverside dwellers. These units were provided with drinking water and sanitary sewer services (Photo 1-3).

Photo 1-4:Examples of residential units built in Phase 1

In May 2006, an environmental assessment study for the first phase of the project was submitted to the Secretaría de Estado de Medio Ambiente y Recursos Naturales and the environmental license was obtained in May 2007 (Environmental License No. 0103-07). This license was renewed on July 17, 2018 for a validity of 5 years (Environmental License No. 0103-07-RENEWED).

Finally, two additional studies were also carried out. The first focused on the construction of the wastewater treatment plant and the second on the construction of an underwater outfall, all planned during Phase II of the project.

1.1.2.2 *Launch of Phase II*

After the success of the Phase I, the second phase of the project was launched. The latter included storm collectors and sanitary drainage of the upper part of the Guajimía Watershed, including the principal watershed from where the Guajimia canal empties into the Haina River to where it flows under the 6 de Noviembre Highway. Also, from the convergence with the "Villa Aura" Tributary to its convergence with the Buenos Aires Tributary. Work was also needed to complete the transitional work required to ensure the interface with the storm collectors and sanitary drainage systems built in Phase I.

In 2008, an ESIA was conducted to identify and analyze the project's impacts or effects on natural resources and environmental components (physical, natural, social and visual) potentially generated by the second phase of the Project.

Impacts identified from pre-construction, construction and operation and maintenance included:

- Fire hazard from logging residues.
- Increased noise levels.
- Soil compaction and chemical contamination caused by the operation of vehicles and their petroleum supply.
- Transport-related emissions of atmospheric pollutants.
- Premature degradation and failure of existing infrastructures.
- Increased noise level associated with machinery operation.
- Risk of accidents related to excavation and earth removal.
- Dust generation.
- Life quality improvement.
- Coastal water quality improvement.

An environmental and social management plan was developed. Among its recommendations are:

- Restore degraded vegetation.
- Increase vegetation coverage.
- Recover lost elements of flora.
- Increase terrestrial, aquatic, and marine habitats for plants and conserve threatened or valuable species.

However, the works were never conducted in the field.

1.1.2.3 *Addenda of Phase II*

In 2009, an ESIA was added as an addendum to the first ESIA for assessing the impacts of the wastewater treatment plant and the underwater outfall designed in Phase I.

1.1.2.4 *Relaunch of Phase II*

In 2021, the phase II of the Storm and Sanitary Drainage of the Guajimía Canal Phase II Project was relaunched and was divided in the three following stages.

<u>Stage I</u>

Stage I includes:

1. Updating of the environmental impact assessment study (the current document).

2. Removing the garbage from the tributaries.

3. Channeling the stormwater of the Guajimía Canal and its tributaries:

- The completion of the "Buenos Aires" Tributary.
- The completion of the "El Indio" tributary.
- The completion of the "La Ureña" Tributary.
- Part of the Guajimía Canal from the convergence with the "Villa Aura" Tributary to its convergence with the "Buenos Aires" Tributary.
- Part of the "Las Caobas" Tributary.

4. Installation of sanitary drainage collectors and expansion of water main networks in the following sections:

- The "Buenos Aires" Tributary.
- The "El Indio" Tributary.
- The "La Ureña" Tributary.
- Part of the Guajimía Canal from the convergence with the "Villa Aura" Tributary to its convergence with the "Buenos Aires" Tributary.
- Part of the "Las Caobas" Tributary.

5. Installation of urban and roadway amenities: Amenities such as playgrounds, parks, lighting, and spaces for social gathering for urban integration in the sections affected by stormwater channeling.

6. Construction for affected families and compensation:

- Update of the Resettlement Action Plan (RAP).
- Construction of the necessary residential units for the relocated families to house families, as well as, on behalf of CAASD, the relocation management payment of monetary compensation to the affected families as provided in the RAP.

Stage II

Stage II includes:

1. Channeling the stormwater of the Guajimía Canal and its tributaries:

- The completion of the Guajimía Canal from the convergence with the "Villa Aura" Tributary to its convergence with the "Buenos Aires" Tributary.
- The completion of the "Las Caobas" Tributary.

2. Installation of sanitary drainage collectors and expansion of main water networks in the following sections:

- The Guajimía Canal from the convergence with the "Villa Aura" Tributary to its convergence with the "Buenos Aires" Tributary.
- The "Las Caobas" Tributary.

3. Installation of urban and roadway amenities: Amenities such as playgrounds, parks, lighting, and spaces for social gathering for urban integration in the sections affected by stormwater channeling.

4. Installation of a Wastewater Treatment System, which includes:

- Preliminary treatment plant.
- Pumping station.
- Part of the land portion of sanitary drainage to the preliminary treatment site.

Stage III

Stage III includes:

1. Channeling the stormwater of the Guajimía Canal and its tributaries in:
   - The "Villa Aura" Tributary.
   - The Guajimía Canal from where it flows under the 6 de Noviembre Highway to where it empties into the Haina River.
2. Installation of sanitary drainage collectors in:
   - The "Villa Aura" Tributary
3. Installation of urban and roadway amenities: Amenities such as playgrounds, parks, lighting, and spaces for social gathering for urban integration in the sections affected by stormwater channeling.
4. Connection to the Wastewater Treatment System and outfall, which includes:
   - Completion of the land portion of sanitary drainage to the preliminary treatment site.
   - Completion of the land portion of the wastewater outfall and the wastewater marine outfall.

The map showed in the following locations of the canals.

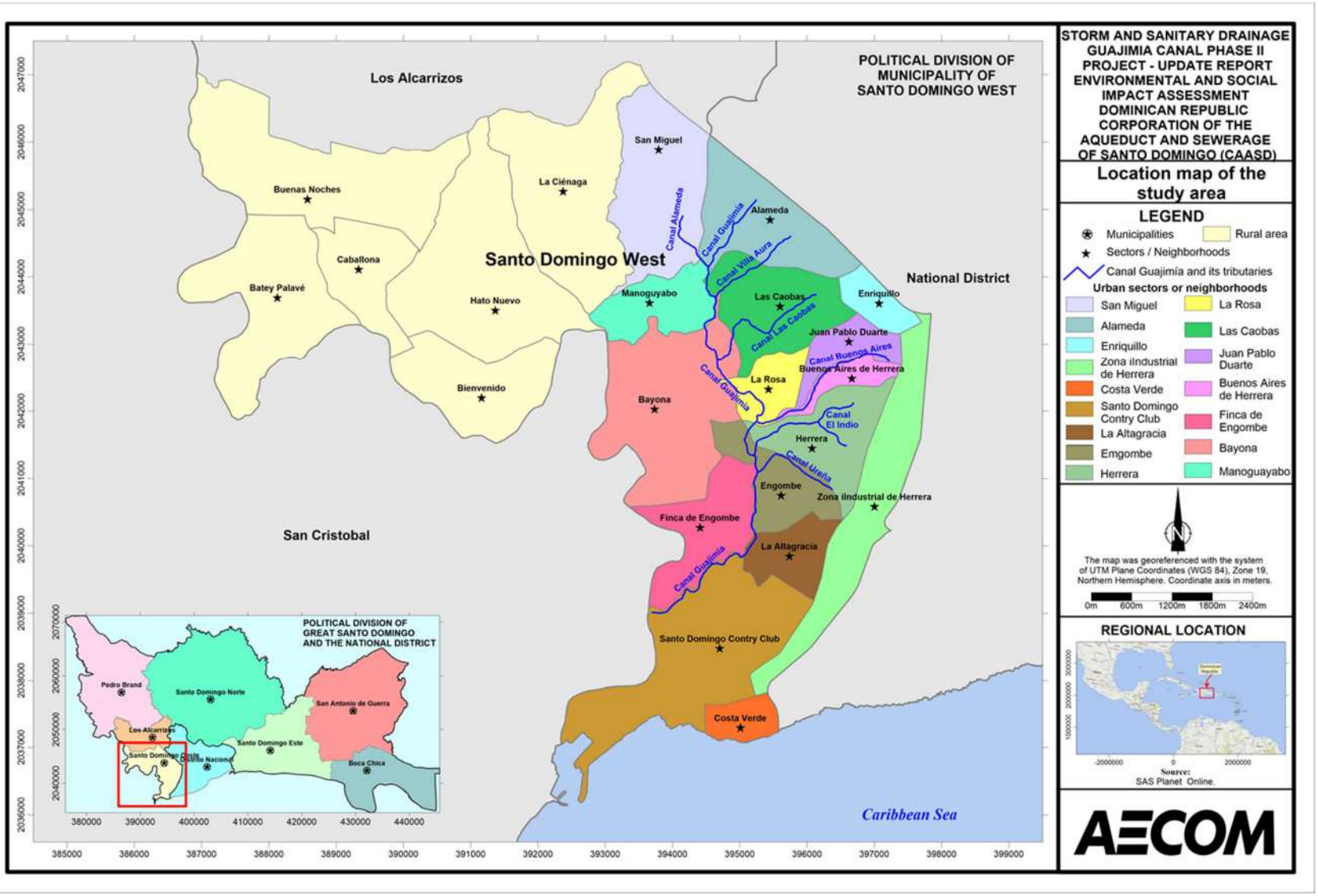


Figure 1-1: Project Location

1.2 Project Justification

In accordance with the provisions of the Santo Domingo Sanitary Sewerage Master Plan, it is necessary for project execution and compliance to address the interventions proposed in a timely manner, which are focused on meeting the needs of the affected areas.

The completion of Phase II of the Project will not only contribute to the integral sanitation of this sector of West Santo Domingo but will also have a significant impact on the generation of jobs and the economic development of the sector. In the sanitary aspect, it will allow for an increase in the quality of wastewater discharges through the efficient treatment and channeling of wastewater for a high percentage of the population and finally an integrated vision of the urban space of this sector of the city.

In addition, as a result of these actions, the environmental and sanitary risks associated with the inadequate sewage disposal , solid waste management and sanitation of the Haina River will be reduced, thus guaranteeing compliance with related environmental regulations and improving the quality of its water, which will benefit not only the local inhabitants but also the entire first city of Santo Domingo.

The Storm and Sanitary Drainage of the Guajimía Canal and its main tributaries is justified because it will make it possible to achieve the following goals:

- To extend in an integral way to the upper part of the watershed, the pluvial and sanitary sanitation of the Guajimía Canal and its main tributaries, thus improving the health conditions of families settled near the gullies and in the surroundings of the intervened sectors and therefore the substantial improvement of the population's life quality.
- To guarantee the optimal functioning of the different solutions implemented in the first execution of the present project, through the integration of storm and sanitary solutions that allow to reach the integral sanitation of the watershed.
- To provide the necessary conditions to substantially reduce the contamination of the Haina River as a result of the contributions discharged by the Guajimía Canal, through efficient wastewater collection systems.
- Increase the management capacity and efficient handling of the drinking water supply for Guajimía and sectors of the capital through the modernization of operations, training and equipment supply and materials necessary to carry out interventions and improvements.
- Decrease the level of wastewater input into the Guajimía Canal and the Haina River by providing pre-treatment and, subsequently, dispersion and dilution of the effluent through the installation of a land and submarine outfall.

1.3 Purpose, Scope and Methodology of the ESIA

1.3.1 Purpose

The purpose of the study is to identify and analyze the impacts that can be generated in the natural resources and environmental components (physical, natural, social and visual), during project development Project and to design an Environmental and Social Management Plan (ESP) that will contain specific programs to prevent, mitigate, correct or compensate the negative impacts of the Project on the environmental and social components of the area of direct and indirect influence of the project.

In addition, it will include a plan that establishes the mechanisms for the monitoring and management of the environmental and social measures adopted and to address the contingencies that may arise in the development of the Project. The Environmental and Social Impact Assessment Study of the Guajimía Canal Storm and Sanitary Sanitation Project Phase II was carried out in accordance with the provisions of Law 64-00 on the Environment and Natural Resources and its regulations; the environmental standards in force in the Dominican Republic; the international conventions to which it is a signatory and the Performance Standards (PS) on Environmental and Social Sustainability of the International Finance Corporation (IFC).

Importantly, this study is complemented by the Relocation Action Plan (PAR) of Phase II of the Project, which will present in more detail the impacts on the population of the Project's intervention bands and the relocation and monitoring strategies developed.

1.3.2 Scope

The first stage is the only one currently approved in the government budget. In that context, the present ESIA only assesses the infrastructures included in Stage 1. It will:

- Describe, characterize, and analyze the environment (physical, biotic, socioeconomic and visual) within which the project, work or activity is intended to be developed.
- Identify the areas of environmental management that should be excluded or treated in a special way during the development of the project, such as critical, sensitive or important ecosystems.
- Evaluate the supply and environmental vulnerability of the natural and social systems used or affected by the project.
- Identify and analyze the impacts produced by the project, both in its construction stage and in the operation and maintenance stages.
- Present an Environmental and Social Management Plan (ESMP) that addresses all measures of prevention, correction, compensation, and mitigation of the negative impacts generated to ensure optimal environmental management.
- Consult the public or private plans programmed in the study area, to evaluate the compatibility with the project.
- Collect the necessary information about the natural resources that will be used or affected by project construction, operation, and maintenance.
- Design the Monitoring Plan to evaluate the effectiveness of the measures designed in the ESMP.
- Prepare the Contingency Plan based on the identification and evaluation of possible accidents or risks not foreseen or unrelated to the development and normal operation of the Project and associated with each of its activities.

The CAASD plans in Stage 2 and 3 also include the construction of a Wastewater Treatment Plant and an underwater emissary for the final disposal of the treated waters. However, these are not included within the scope of this ESIA.

1.3.3 Methodology

1.3.3.1 *Data Source*

The preparation of this document is based on two data collection campaigns. The first was carried out by a multidisciplinary team of specialists of AECOM in the Dominican Republic in May 2021. This procedure allowed to carry out different meetings, collect various documents useful for the preparation of environmental studies and finally, visit the canals that are subject to the mandate.

A second information gathering campaign, also in May 2021, was carried out with local professionals from EMPACA under the supervision of AECOM’s environmental ands social experts.

1.3.3.2 *Finally, a GIS file delimiting the Project area and the number of Project Affected People was sent to AECOM by the CAASD. Overview of the Methodology*

The overall procedure used to carry out the ESIA is based on "ad hoc procedures", "checklists" and "matrices". Together with a knowledge of the study area, this method allows the identification of sources of impact and sensitive elements of the environment. It essentially consists to:

- Describe the technical components of the Project from the information provided by the project promoter.
- Characterize the components of the physical, natural and human environments from secondary sources (Atlas of Biodiversity and Natural Resources, 2012, National Population and Housing Census, 2010, among others); and from primary sources such as field trips, water, air quality, and noise level sampling, characterization of terrestrial and aquatic flora and fauna, population surveys.
- Interrelate the most significant elements of the Project and the environment to identify the impacts.
- Qualify the identified impact through a series of parameters that allow to determine its importance.
- Suggest mitigation measures for each of the identified impacts to reduce the effects of the project on the environment.
- Define the residual impacts of the Project. They are the ones that could persist after the implementation of the proposed mitigation measures.
- Finally, where justified, suggest a monitoring and follow-up program to ensure the relevance of both the identified impacts and the proposed mitigation measures.

It is important to note that specific methodologies were developed in each of the chapters of ESIA.

1.3.3.3 *Study Unfolding*

The ESIA took place from April to August 2021. During this period, various activities and missions were planned:

- Kick-off meeting on April 8, 2021 held by video conference between CAASD, CCC, J.P. Morgan and AECOM to launch the ESIA.
- Video conference on April 14, 2021 between the CAASD, EMPACA and AECOM to discuss the Requirements Application for Environmental Authorization of Project, Work or Activity needed from Application file to Ministry of Environment and Natural Resources (MIMARENA).
- CAASD certified on April 15 that the Environmental License No. 0103-07 emitted by the MIMARENA for the first ESIA was still valid, ensuring that AECOM didn't need to obtain the Terms of References from the MIMARENA to start the ESIA.
- Helios, the firm in charge of updating the design, confirmed on April 15, 2021 that the preliminary design used for the previous ESIA could be used for this ESIA without any change.
- Helios sent the CAD files of the preliminary design to AECOM on May 2, 2021
- First field mission from May 3 to 7, 2021, which consisted of:
    - Meetings with the CAASD in Santo Domingo on May 4, 2021 to discuss the Project design with its engineering department and the social department to examine the stakeholder engagement strategy, present the IFC standards and collect data and documents.
    - Field reconnaissance tour of the project alignment – Guajimía Canal Phase II with CAASD on May 5, 2021.
    - Meetings with the CAASD in Santo Domingo on May 7, 2021 for the mission debriefing including the schedule of the field activities by EMPACA, the planning of the next mission of AECOM (date and participating specialists) and potential cut-off date according to census.
- Second field mission from May 10 to May 19 to conduct field works for the baseline characterization.
- Meeting with CAASD, CCC, EMPACA in Santo Domingo and AECOM (by videoconference) on May 21, 2021 to discuss the Project area and affected people.
- Meeting with CAASD, CCC, EMPACA in Santo Domingo and AECOM (by videoconference) on May 25. to confirm the Project areas and agreement for CAASD to send a GIS file to AECOM including the inventory of project's affected people.
- The census was held from June 4 to July 5th, 2021.

- Submission of the draft report on August 6, 2021.
- Submission of the executive summary in Spanish on August 16, 2021
- Submission of the final report on August 26, 2021.

The process of the consultations is discussed in Chapter 5.

1.3.4 Structure and Content of the Report

The Phase 1 report is structured as follows:

- Non-technical executive summary that concisely discusses significant findings and recommended actions.
- 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.
- Chapter 3: Analysis of Alternatives. This chapter presents the technical description of the different variants of the proposed arrangements.
- Chapter 4: Project Description. This chapter presents the technical description of the project.
- Chapter 5: Stakeholders Participation. This section details the consultation activities held during Phase 1, as well as the main issues raised and the new expectations of the Project.
- Chapter 6: Environmental and Social Baseline. This section describes the environmental baseline of the project's study area.
- Chapter 7: Update of the Assessment of the Main Environmental and Social Impacts. This chapter presents the results of the impacts analysis.
- Chapter 8: Environmental and Social Management Program (ESMP). This section sets out the measures of prevention, correction, compensation, and mitigation of the negative impacts generated to ensure optimal environmental management.
- Chapter 9: Conclusions and Recommendations. This chapter highlights the main features of the study and reports on AECOM's observations for the continuation of the Project.
- Chapter 10: References.

1.3.5 Limitations of the Study

Several elements and situations may limit the results of this study among which is the rainy season. Indeed, due to the limited timeline of the ESIA, field missions could not be conducted during the rainy season which restricted the gathering of information.

1.4 Categorization of this ESIA

According to Equator Principles and the IFC Policy on Environmental and Social Sustainability (2012 edition), projects are classified into categories based on their risk and environmental or social impact, as detailed below:

- **Category A:** Business activities with potential significant adverse environmental or social risks and/or impacts that are diverse, irreversible, or unprecedented.
- **Category B:** Business activities with potential limited adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures.

- **Category C:** Business activities with minimal or no adverse environmental or social risks and/or impacts.
- **Category FI:** Business activities involving investments in financial institutions (FIs) or through delivery mechanisms involving financial intermediation. This category is further divided into:
    - FI–1: when an FI's existing or proposed portfolio includes, or is expected to include, substantial financial exposure to business activities with potential significant adverse environmental or social risks or impacts that are diverse, irreversible, or unprecedented.
    - FI–2: when an FI's existing or proposed portfolio is comprised of, or is expected to be comprised of, business activities that have potential limited adverse environmental or social risks or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures; or includes a very limited number of business activities with potential significant adverse environmental or social risks or impacts that are diverse, irreversible, or unprecedented.
    - FI–3: when an FI's existing or proposed portfolio includes financial exposure to business activities that predominantly have minimal or no adverse environmental or social impacts.

More information about the IFC Standards can be found in Section 2.3.4.

The Organization for Economic Cooperation and Development (OECD) classifies projects into the following categories:

Category A: A project is classified in Category A if it has the potential for 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. Category A, in principle, includes projects in sensitive sectors or located in or near sensitive areas.

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

Category C: A project is classified in Category C if it has minimal or no potential adverse environmental and/or social impacts.

Based on the provisions of the Equator Principles, IFC and OECD, the Storm and Sanitary Drainage of the Guajimía Canal Phase II Project is classified as a Category A project.

2. LEGAL FRAMEWORK

This chapter discusses the policy, legal, and administrative framework within which this ESIA is carried out, including Dominican Republic regulations, implementing obligations relevant to international social and environmental treaties, agreements, and conventions, the international standards applied to the project, as well as any additional priorities and objectives for social or environmental performance identified by the CAASD, the CCC and J.P. Morgan.

2.1 Legislation in Force in the Dominican Republic and Legal Documentation that Frames the Development of the Project

Law 1-12 National Development Strategy 2030 (NDS)

In 2012, the Dominican Republic passed Law 1-12 – National Development Strategy (NDS) 2030 establishing the objectives of the country up to 2030. This strategy lays out priorities for public investment and is framed in the four following strategic axes:

i) Social and democratic state of law (institutional axis)
ii) Society with equal rights and opportunities (social axis)
iii) Sustainable, inclusive, and competitive economy (productive axis)
iv) Society of sustainable production and consumption adapted to climate change (environmental axis)

These axes are articulated with 19 general objectives, 57 specific objectives and 460 lines of action.

The Storm and Sanitary Drainage of the Guajimía Canal Phase II Project complies with the Strategic axis II of the NDS 2030, 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".

The project complies with the **General Objective 2.5**.- "Decent housing in a healthy environment" with its specific objectives:

Specific Objective 2.5.1.- "Facilitate the population's access to affordable, safe and dignified housing, with legal security and in sustainable, socially integrated human settlements, which meet the criteria of adequate risk management and universal accessibility for people with physical motor disabilities" and its Line of Action **2.5.1.3**.- "Relocate settlements in conditions of risk to natural phenomena, sources of pollution or risks arising from human action";

Specific Objective 2.5.2.- "Guarantee universal access to drinking water and sanitation services with quality and efficiency" and its Action Line **2.5.2.3** that establishes "Develop new network infrastructures that allow the expansion of the coverage of drinking water services, sanitary and storm sewerage, wastewater treatment and protection of the subsoil, with a sustainable development approach and with priority in traditionally excluded areas".

2.2. Environmental Legislation in force in the Dominican Republic

The Environmental and Natural Resources Law No. 64-00 (the Environmental Law), enacted in 2000, establishes the basic principles of environmental protection, management and use of natural resources, and the civil and criminal liabilities and penalties. Among the 204 articles of the Environmental Law, the following ones were considered for the current ESIA.

2.1.1 Environmental Assessment

Article 38. In order to prevent, control and mitigate the possible impacts on the environment and natural resources caused by works, projects and activities, the environmental assessment process is established with the following instruments (those that are relevant to the current ESIA 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**

Article 40. Every project, work of infrastructure, industry, or any other activity which due to its characteristics could affect the environment and natural resources in one way or another, must obtain from the State Secretariat of Environment and Natural Resources, prior to its execution, the environmental permit or environmental license, according to the magnitude of the effects which it could cause.

Article 41 presents 20 activity types or projects that require the presentation of an environmental impact assessment. The most relevant for the current ESIA are the following:

1) Ports, docks, navigation ways, breakwaters, piers, canals, shipyards, drains, maritime terminals, reservoirs, dams, dikes, irrigation canals, and aqueducts.

4) Airports, bus and railroad terminals, railroad lines, highways, roads, and public roadways.

5) Urban development and human settlement projects; plans for urban regulation.

14) Importation, production, preparation, transformation, use, marketing, storing, transportation, disposal, recycling, or reuse of toxic, noxious, explosive, radioactive, inflammable, corrosive, or reactive substances or others of evident dangerousness.

Paragraph II. Projects, installations or works, both private and state, will be submitted to the environmental and social impact assessment procedure.

Paragraph VI. When the State is the promoter, executor, or is an active partner in any of the development project plans, it must hire the services of private consultants, or legal entities, in order to carry out the corresponding environmental studies and must comply with the requirements established in this Law.

Article 42. The environmental impact statement (EIS), the environmental impact study and the environmental report will be paid for by the person interested in developing the activity, work or project, and carried out by a technical, multidisciplinary team if necessary, and may be represented by one of them. 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 providers of environmental declaration, report, studies, diagnoses, evaluations and audits.

Article 44. The environmental license and permit will include the environmental management and adaptation program to be executed by the person responsible for the activity, work, or project, establishing the form of monitoring and compliance with it.

Paragraph. The environmental management and adaptation program established in this article shall be carried out based on the environmental parameters and indicators referred to in articles 78 et seq. of Chapter I, Title IV, of this Law. Until these indicators and parameters are definitively established, provisional parameters will be used, and the Secretary of State for the Environment and Natural Resources must define a minimum percentage of reduction of the polluting potential, which must be established in all environmental permits and licenses issued.

Finally, the ESIA also consulted the Compendium of Environmental Authorizations, Regulations and Procedures published by the MINERVA (Regulation No. 22, 2013). The latter contains the regulations regarding the environmental impact assessment process that aims to regulate the environmental authorizations procedure established in the Environmental Law in order to prevent, control and mitigate the possible impacts on the environment and natural resources caused by works, projects and activities, as established by the **Articles 38** to **55** of the aforementioned law.

2.1.1.1 *Water and Water Pollution*

The two following articles of the Environmental Law have been considered for waters as a Natural Resource.

Article 129. The National Plan of Territorial Planning will establish the hydrological zoning, prioritizing the areas for water production, conservation, and forest use, among others, and guaranteeing a mandatory protection strip of thirty (30) meters on both banks of the river currents.

Article 133. Prohibit the dumping of debris or garbage in riverbeds and streams.

2.1.1.2 *Soils and Soil Pollution*

As for the soils, the project will comply with the provisions of **Article 90** of the Environmental Law, which states that, in order to avoid soil contamination, it is prohibited to deposit, infiltrate or bury polluting substances, without prior compliance with the established standards.

Because the households living along the Guajimía Canal and its tributaries dump their waste into the canals indiscriminately, the General Law of Integral Management and Co-processing of Solid Waste (No. 225-20) was also consulted. The latter has been enacted on October 2, 2020 and creates the legal regime to prevent the generation of waste and establishes mechanisms for its integral management. This regime responds to the need to promote reduction, reuse, recycling, recovery, and valorization over other waste management techniques.

2.1.1.3 *Air Pollution*

Articles 92 and 93 of the Environmental Law have been considered for air pollution:

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

Article 93. The Secretary of State for the Environment and Natural Resources, in coordination with the Secretary of State for Public Works and the municipalities, shall regulate the control of emissions of harmful and polluting gases and noise caused by motor vehicles, power plants, other internal combustion engines, boilers and industrial activities.

2.1.2 Noise Pollution

In regards of noise pollution, the following articles of the Environmental Law have been consulted.

Article 93. The Secretary of State for the Environment and Natural Resources, in coordination with the Secretary of State for Public Works and the municipalities, shall regulate the control of emissions of harmful and polluting gases and noise caused by motor vehicles, power plants, other internal combustion engines, boilers and industrial activities.

Article 114. The Secretary of State for the Environment and Natural Resources, in coordination with the municipal councils and the municipal police, shall regulate noise emission that are annoying or harmful to the environment and health, in the air and in residential areas of urban and rural areas, as well as the fixed or ambulatory use of loudspeakers.

Article 115. Noise emission produced by the lack of the exhaust silencer or its malfunction, of power plants, motor vehicles, as well as the use of sirens or horns in private vehicles, which by reason of the nature of their usefulness correspond to the police services, ambulances, fire engines or sea boats, is prohibited.

2.1.3 Solid Waste Management

The **Article 107** of the Environmental Law states that the placement, throwing, and final disposal of solid or liquid wastes, whether toxic or not, is prohibited in unrecognized areas.

The standard for the Environmental Management of Non-Hazardous Solid Waste (NA-RS-001-03) raises the following aspects:

- Solid waste that is delivered or disposed in public collectors becomes the responsibility and property of the municipality.
- The management of solid waste will be subject to sanitary control to avoid soil and water (surface and groundwater) contamination of, bad odors, proliferation of disease vectors and other public nuisances.
- The management and final disposal of non-hazardous municipal solid waste is a public service. The authorities responsible for the management of solid waste are obliged to provide the service. The delegation of this responsibility must transparent and always oriented towards common good.

2.1.4 Rules for Conducting Public Consultation

The **Article 38 (point #8)** of the Environmental Law states that the public must be involved in the environmental assessment process of any project, infrastructure work, industry or activity.

2.1.5 Population Resettlement

Although there is no law in the Dominican Republic that currently governs or regulates the resettlement process for affected people who are displaced within the framework of a project of social interest, there is a legal standard of lesser scope than that of a law. This standard is the Decree 192-21, by which the Executing Unit for the Rehabilitation of Neighborhoods and Environments (URBE) is created. Its mission is to execute and put into operation civil works for the readjustment of irregular settlements located in high-risk areas.

However, due to the fact that it is a legal standard of lesser scope than that of a law, Decree 192-21 does not clearly define the resettlement procedures and policies to implement, limiting itself to defining the executing body and establishing some general guidelines, such as keeping the community informed about the available alternatives, either to solve an existing problem or to prevent new irregular settlements.

Prior to the decree, the institutions with powers related to urban relocation projects were the National Housing Institute (INVI) and National Assets. Neither of them has a regulation that can be used as a regulatory system for relocation processes carried out in the country.

Given this deficit in national regulations, the resettlement procedures that will be applied throughout the Guajimía Canal will be the operational policy 4.12 of the World Bank, in accordance with the realities of the area and will not be in contradiction with any Dominican legal precept or regulation.

2.1.6 Risk Management Regulations

The Law 147-02, on risk management, constitutes the legal framework for disaster risk reduction in the Dominican Republic. The latter will be used for the Risk Management and Prevention Plan of the current ESIA to identify the critical points of environmental and safety risks in the event of technological or natural disasters.

For the establishment of measures for the prevention of occupational accidents, the established regulations on safety and health at work were considered.

On the other hand, for the design of the fire system and the measures for prevention and action in case of fires, the provisions of the Regulations for Fire Safety and Protection of the Dominican Republic R-032 were considered.

2.1.7 Protected Areas

The **Article 34** (transitory) of the Environmental Law establishes that the National System of Protected Areas is constituted by the units and categories of conservation in different laws and decrees. Decree 183-93 that orders the creation of the Green Belt is listed, as well as its ratified limits.

Additionally, there are other legal instruments that complement the Environmental Law, such as the Sectorial Law No. 202-04 on Protected Areas that also regulate protected areas in the Dominican Republic. The Storm and Sanitary Drainage of the Guajimia Canal Phase II Project is located outside the System of Protected Areas of the Dominican Republic, declared in Article 6 of the Sectorial Law No. 202-04.

2.1.8 Biodiversity Protection

The Dominican Congress approved the Law 333-15 on Biodiversity in 2015 that creates a regulatory framework to conserve and promote sustainable use of biodiversity.

2.1.9 Environmental Regulations on Climate Change

In 2014, the Dominican Republic Government approved a resolution (no. 02-2014) introducing climate change adaptation elements in the environmental impact assessments. Climate change adaptation has since to be undertaken in the design and development of infrastructures. Thus, the Ministry of Environment and Natural Resources must 1) incorporate the considerations of adaptation to the effects of climate change in the EISA and 2) integrate the considerations for adaptation to the effects of climate change on environmental factors and aspects related to projects or activities in their environmental studies and environmental management and adaptation programs.

2.2 International Conventions adopted by the Government of the Dominican Republic

The Dominican Republic, as a member of the international community, encourages and is bound by various conventions and declarations regarding environment matters, namely:

2.2.1 Ramsar

Ramsar is the Convention on Wetlands of International Importance. Itis the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources. The convention entered into force in the Dominican Republic on September 15, 2002 (Res. No. 177-01). The country has

currently 4 sites designated as Wetlands of International Importance (Ramsar sites) but none are in the Guajimía watershed.

2.2.2 World Heritage Convention

The Convention for the Protection of the World Cultural and Natural Heritage was ratified by the Dominican Republic on February 12, 1985 and its effectiveness in the country started on May 12 of the same year.

2.2.3 Rio de Janeiro Convention on the Protection of Biological Diversity

The Convention on Biological Diversity (CBD) is a legally binding international treaty with three main objectives: 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. Its overall objective is to promote measures that lead to a sustainable future. The Dominican State signed the Convention on Biological Diversity in 1996 (Res. No. 25-96 of September 26, 1996).

2.2.4 International Convention on Trafficking and Trade in Endangered Species (CITES)

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species. The Dominican Republic is a signatory of the CITES since 1983.

2.3 International Standards used by Funding Agencies

In addition to the national requirements for environmental and social protection, the implementation of the project must follow international best practices. Thus, the ESIA, ESMP, RAP, and ESMS must be compliant with the following international standards and guidelines:

- The World Bank EHS Guidelines.
- Guidelines of Annex II and III from the Organisation for Economic Cooperation and Development, Common Approaches.
- IFC Performance Standards.
- Equator Principles guidelines including Equator Principles 4.

The following sections below describe these standards.

2.3.1 Organisation for Economic Cooperation and Development, Common Approaches

The Dominican Republic and Canada are members of the Organisation for Economic Cooperation and Development (OECD). Since the mid-1990s, Members of the OECD have been sharing information on their policies, practices, and experiences about addressing environmental and, more recently, social issues when providing officially supported export credits. The result of these discussions has been a series of agreements and OECD Recommendations relating to measures that Members should take to address the potential environmental and social impacts of projects for which official export credit support is requested.

The current agreement is the OECD Recommendation of the Council on Common Approaches for Officially Supported Export Credits and Environmental and Social Due Diligence (the “Common Approaches”), which was adopted on 28 June 2012 and revised by the OECD Council on 6 April 2016 (OECD/LEGAL/0393). This agreement sets common approaches for undertaking environmental and social due diligence to identify, consider and address the potential environmental and social impacts and risks relating to applications for officially supported export credits as an integral part of Members’ decision-making and risk management systems. While an OECD Recommendation is not legally binding, it expresses the common position or will of

the whole OECD memberships, and therefore may entail 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 commodities, with a repayment term of two years or more.

The Guidelines of Annex II and III from the Organisation for Economic Cooperation and Development, 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.

Members are expected to benchmark projects against international standards as part of their environmental and social due diligence, such as World Bank Group EHS Guidelines. The next section describes the latter.

2.3.2 World Bank EHS Guidelines

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-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 as required by their respective policies and standards. These General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines which provide guidance to users on EHS issues in specific industry sectors.

The General EHS Guidelines are organized as follows:

1. Environmental
    - Air Emissions and Ambient Air Quality
    - Energy Conservation
    - Wastewater and Ambient Water Quality
    - Water Conservation
    - Hazardous Materials Management
    - Waste Management
    - Noise
    - Contaminated Land
2. Occupational Health and Safety
    - General Facility Design and Operation
    - Communication and Training
    - Physical Hazards
    - Chemical Hazards
    - Biological Hazards
    - Radiological Hazards
    - Personal Protective Equipment (PPE)
    - Special Hazard Environments
    - Monitoring
3. Community Health and Safety
    - Water Quality and Availability
    - Structural Safety of Project Infrastructure
    - Life and Fire Safety (L&FS)
    - Traffic Safety
    - Transport of Hazardous Materials
    - Disease Prevention
    - Emergency Preparedness and Response
4. Construction and Decommissioning
    - Environment

- Occupational Health & Safety
- Community Health & Safety

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

The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each project on the basis of the results of an environmental assessment in which site-specific variables, such as host country context, assimilative capacity of the environment, and other project factors, are taken into account.

2.3.3 IFC Performance Statements

In addition to national environmental and social protection requirements, project implementation should follow international best practices.

The IFC has defined eight performance standards that set out the criteria that an IFC client 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 Potential Performance Standards (PS) to be considered in the study are as follows:

- ✓ PS 1: Assessment and Management of Environmental and Social Risks.
- ✓ PS 2: Labor and Working Conditions.
- ✓ PS 3: Resource Efficiency and Pollution Prevention.
- ✓ PS 4: Community Health, Safety and Security.
- ✓ PS 5: Land Acquisition and Involuntary Resettlement.
- ✓ PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.
- ✓ PS 7: Indigenous People.
- ✓ PS 8: Cultural Heritage.

Table 2-1: Performance Standards

Performance Standards	Objectives
PS 1: Assessment and Management of Environmental and Social Risks	• Identify and evaluate 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, compensate/offset for risks and impacts to workers, Affected Communities, and the environment. • Promote improved environmental and social performance of clients through the effective use of management systems. • Ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately. • Promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.
PS2:	• Promote the fair treatment, non-discrimination, and equal opportunity for men and women in the hiring process.

Performance Standards	Objectives
Labor and Working Conditions	• Implement working conditions ensuring the health of workers, focussing on the needs and vulnerabilities specific to women, men and workers with disabilities. • Establish, maintain, and improve the worker-management relationship. • Promote compliance with national employment and labor laws. • Protect workers. • Promote safe and healthy working conditions, and the health of workers. • Avoid the use of forced labor.
PS3: Resource Efficiency and Pollution Prevention	• Avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities. • Promote more sustainable use of resources, including energy and water. • Reduce project related GHG emissions.
PS4: Community Health, Safety and Security	• Anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances. • Ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities. • Identify and mitigate the risk of increased exposure of women from the communities to incidents of sexual harassment and assault and to implement a grievance mechanism related to this risk.
PS5: Land Acquisition and Involuntary Resettlement	• Avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs. • Avoid forced eviction. • Anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected. • Improve, or restore, the livelihoods and standards of living of displaced persons. • Improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.
PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	• Protect and conserve biodiversity. • Maintain the benefits from ecosystem services. • Promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities. • Identify men's and women's roles and involvement in the management, conservation, and efficient use of natural resources.
PS7: Indigenous People	• Ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous People. • Anticipate and avoid adverse impacts of projects on communities of Indigenous People, or when avoidance is not possible, to minimize and/or compensate for such impact. • Promote sustainable development benefits and opportunities for Indigenous People in a culturally appropriate manner. • Establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous People affected by a project throughout the project's life cycle. • Ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous People when the circumstances described in this Performance Standard are present. • Respect and preserve the culture, knowledge, and practices of Indigenous People.

Performance Standards	Objectives
PS8: Cultural Heritage	• Protect cultural heritage from the adverse impacts of project activities and support its preservation. • Promote the equitable sharing of benefits from the use of cultural heritage.

2.3.4 Equator Principles

First issued in 2003, the Equator Principles (EP) is a risk management framework, adopted by 118 financial institutions[1] (including J.P. Morgan Chase & Co.) in 37 countries to support certain investment decisions by applying environmental and social standards to determine, assess and manage environmental and social risks in projects. The EP are based on the International Finance Corporation ("IFC") Performance Standards ("PS") on social and environmental sustainability and on the World Bank Group Environmental, Health, and Safety Guidelines ("EHS Guidelines").

The EP were updated in 2006 (EP2), 2013 (EP3) and more recently on 18 November 2019 (EP4). This latest iteration of the EPs has become effective in October 2020 and is made of the following 10 core principles:

- **Principle 1** - Review and Categorization: When a Project is proposed for financing, the EPFI will, as part of its internal environmental and social review and due diligence, categorise 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 categorisation is based on the International Finance Corporation's (IFC) environmental and social categorisation process.
- **Principle 2** - Environmental and Social Assessment: For all Category A and Category B Projects, the finance institution will require the client to conduct an Assessment process to address, to the finance institution's satisfaction, the relevant environmental and social risks and impacts of the proposed Project. The Assessment Documentation should 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 should, in the first instance, address compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues.
- **Principle 4** - Environmental and Social Management System and Equator Principles Action Plan: For all Category A and Category B Projects, the finance institution will require the client to develop or maintain an Environmental and Social Management System (ESMS). Further, an Environmental and Social Management Plan (ESMP) will be prepared by the client to address issues raised in the Assessment process and incorporate actions required to comply with the applicable standards.
- **Principle 5** - Stakeholder Engagement: For all Category A and Category B Projects, the 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 Participation process. The client will tailor its consultation process to the risks and impacts of the Project; the Project's phase of 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** - For all Category A and, as appropriate, Category B Projects, the EPFI will require the client, as part of the ESMS, to establish effective grievance mechanisms which are designed for use

[1] These financial institutions are known as Equator Principles Financial Institutions (EPFIs)

by Affected Communities and Workers, as appropriate, to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance. Grievance mechanisms are required to be scaled 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, readily accessible, at no cost, and without retribution to the party that originated the issue or concern. Grievance mechanisms should not impede access to judicial or administrative remedies. The client will inform Affected Communities and Workers about the grievance mechanisms in the course of the Stakeholder Engagement process.

- **Principle 7** - Independent Review: For all Category A and, as appropriate, Category B Projects, an Independent Environmental and Social Consultant, not directly associated with the client, will carry out an Independent Review of the Assessment Documentation including the ESMPs, the ESMS, and the Stakeholder Engagement process documentation in order to assist the finance institution's due diligence, and assess Equator Principles compliance.
- **Principle 8** - Covenants: For all Projects, where a client is not in compliance with its environmental and social covenants, the EPFI will work with the client on remedial actions to bring the Project back into compliance. If the client fails to re-establish compliance within an agreed grace period, the EPFI reserves the right to exercise remedies, including calling an event of default, as considered appropriate.
- **Principle 9** - Independent Monitoring and Reporting: To assess Project compliance with the Equator Principles and ensure ongoing monitoring and reporting after Financial Close and over the life of the loan, the finance institution will, for all Category A and, as appropriate, Category B Projects, require the appointment of an Independent Environmental and Social Consultant, or require that the client retain qualified and experienced external experts to verify its monitoring information which would be shared with the finance institution.
- **Principle 10** - Reporting and Transparency: The following client reporting requirements are in addition to the disclosure requirements in Principle 5. For all Category A and, as appropriate, Category B Projects:
    - The client will ensure that, at a minimum, a summary of the ESIA is accessible and available online and that it includes a summary of Human Rights and climate change risks and impacts when relevant
    - The client will report publicly, on an annual basis, GHG emission levels during the operational phase for Projects emitting over 100,000 tonnes of CO_2 equivalent annually.
    - The EPFI will encourage the client to share commercially non-sensitive Project-specific biodiversity data with the Global Biodiversity Information Facility13 (GBIF) and relevant national and global data repositories, using formats and conditions to enable such data to be accessed and re-used in future decisions and research applications.

The table below provides a summary of the EP requirements in response to Project classification A, B or C (see section 1.4).

Table 2-2: EP Requirements in Response to Project Classification of A, B or C

Category	Requirements for Client
A	a. Prepare an environmental and social impact assessment report (ESIA). b. Conduct an alternative analysis (when GHG emission is more than 100,000 tons of CO_2 equivalent annually). c. Prepare an Action Plan (AP). d. Establish an environmental & social management system. e. Conduct a stakeholder engagement with the project-affected communities. f. Establish a grievance mechanism. g. Disclose the environmental and social impact assessment report online. h. Disclose the GHG emissions quantification (for projects emitting more than 100,000 tons of CO_2 equivalent annually). i. Require an independent expert to review on the above items a-f.
B	a. Prepare an environmental and social impact assessment report (ESIA). b. Conduct an alternative analysis (when GHG emission is more than 100,000 tons of CO_2 equivalent annually). c. Prepare an Action Plan (AP). d. Establish an environmental & social management system. e. Conduct a stakeholder engagement with the project-affected communities (Following are required, as applicable). f. Establish a grievance mechanism. g. Disclose the environmental and social impact assessment report online. h. Disclose the GHG emissions quantification (for projects emitting more than 100,000 tons of CO_2 equivalent annually). i. Require an independent expert to review on the above items a-f.
C	Conduct an alternative analysis (when GHG emission is more than 100,000 tons of CO_2 equivalent annually.

3. ANALYSIS OF ALTERNATIVES

This chapter compares reasonable alternatives to the proposed project site, technology, design, and operation in terms of their potential environmental and social impacts; the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under local conditions; and their institutional, training, and monitoring requirements.

The sections below present the analysis of the options considered for Stage 1 of Phase II including the status quo, the channeling of stormwater and the collection of sanitary sewage. Because the preliminary design presented in 2006 ESIA will not change according to Helios, AECOM didn't need to update the alternatives described in this report. Thus, the following section is largely taken from this study.

3.1 Status Quo

As stated in Chapter 1, the situation prevailing in the Guajimía Canal and its main tributaries is critical for the following features and will worsen quickly if no action is taken.

- At the hydraulic level: The initial capacity of the canals to evacuate water has noticeably decreased over the years mainly due to the accumulation of waste in the canals.
- In terms of security: Under the effect of the abundant rains that exist in the region in certain periods of the year and hydrostatic pressure, the water flowing in the canals regularly leave their canals causing flooding, devastating precarious homes located on the banks and causing loss of life.
- In terms of health: The Guajimía Canal and its tributaries serve as sewers to open sky and waste disposal site for dwellings located within its area of influence. The presence of many industries should also be noted whose number has increased over the last few years. Stagnant waters and polluted streams are a source of bad smell, they help spread diseases in the population and pollute aquifers.

For all these reasons, the status quo is not a valid option, it is essential deploy an energetic strategy to rehabilitate the environment.

3.2 Alternatives for Channeling Stormwater Drainage

The technical feasibility studies considered two alternatives for the capture and the rainwater drainage:

- Rectangular section of reinforced concrete ducts cast in place (box culvert)
- Multi-plate corrugated sheet metal ducts

3.2.1 Description of the Solutions Considered

Reinforced Concrete Box Culvert

One of the solutions initially proposed comprises ducts of reinforced concrete poured in place (Figure 3-1).

Figure 3-1: Reinforced Concrete Box Culvert
Source: https://www.doka.com/us/news/press/201101_BoxCulvert

Multi-plate Type Corrugated Sheet Metal Pipes

The second solution studied was the use of corrugated sheet pipes (Figure 3-2 and Photo 3-1) that respect the international ASTM standards of the: the A796 and A760M. The latter regulate the structural design for steel pipes, semi-arches and arches for sewerage purposes and the composition of the material respectively.

Figure 3-2 : Corrugated Metal Pipe
Source: https://www.txcorr.com/products/corrugated-metal-pipe/

Photo 3-1: Metal Pipes installed in Phase I of the Project, like those to be used in Phase II.
Source: CAASD

These structural plate pipes are made of corrugated steel sections that are bolted together to form the shape wanted. These sections are commonly referred to as plates. The shape of the structure (circular or in arc) is mainly conditioned by the roughness coefficient and the flow. For example, in the Guajimía section, flows of the order of 157 m^3 / s must circulate, and therefore arched conduits were selected. On the other hand, they will be circular in the Buenos Aires, El Indio and La Ureña canals because the rainfall flows are much lower.

3.2.2 Comparison between the Two Solutions

Both solutions are technically feasible. As the roughness coefficient of the concrete is smaller than corrugated sheet, the size of the concrete box culvert could be less than that of multi-plate pipes, which would imply less dismounts. This convenient feature of concrete box culvert is however compensated by the many advantages of the corrugated sheet pipes such as:

a) Greater ease of installation when considering the intrinsic rigidity of this type of conduit
b) Shorter duration of construction works and fewer inconveniences in the vicinity
c) Possibility of installation by unskilled workers
d) Lower cost

In view of these numerous advantages, the multi-plate solution was selected for stormwater drainage.

3.3 Alternatives for the Collection of Sanitary Drainage

In the technical feasibility studies, two alternatives have been considered for the capture sanitary water:

1) Circular reinforced concrete pipes
2) High-density polyethylene (HDPE) pipes

3.3.1 Description of the Solutions Considered

Circular Reinforced Concrete Pipes

The first solution comprises traditional pipes of concrete. According to this solution, all the sanitary networks would be carried out in situ following the exact lines of the canals. All parts, splice connections and other items would be made on site.

High-density Polyethylene Pipes

The second solution studied consists in installing high-density polyethylene pipes (HDPE) (Figure 3-3 and Photo 3-2. These pipes offer desirable features such as low weight, resistance to abrasion and corrosion, flexibility that allows for directional variations without the need for fittings, impact resistance, light weight, and ease of transport. In addition, they have a service lifetime of up to 50 years.

Figure 3-3: HDPE Pipes
Source: CAASD

Photo 3-2: HDPE Pipeline installed in Phase I of the Project, similar to those to be used in Phase II
Source: CAASD

Other types of pipes, such as polyvinyl chloride (PVC) pipes could be use when the diameters needed is less than 300 mm. However, for larger diameters the costs of this type of pipes are much higher and therefore less competitive than concrete or HDPE. Therefore, it is considered preferable to keep the same type of conduits for the entire project.

3.3.2 Comparison between the Two Solutions

Both solutions, concrete and HDPE, are technically feasible but the HDPE solution proposed by Dessau-Soprin Can-American has several advantages such as:

a) Greater ease of installation
b) Shorter duration of work and fewer inconveniences for the surroundings
c) Lower cost

For these reasons the HDPE pipe solution was chosen.

4. PROJECT DESCRIPTION

This chapter concisely describes the proposed project and its geographic, ecological, social, health and temporal context, including any additional project components that may be required.

4.1 Presentation of the Promoter

The promoter of the project is the Corporation of the Aqueduct and Sewerage of Santo Domingo (CAASD). The latter is an autonomous public service institution, whose main objective is to develop and execute for drinking water supply plan of and the collection, treatment and disposal of wastewater from the city of Santo Domingo and some surrounding towns. The CAASD is also in charge of the administration, marketing, maintaining, operation and expansion in the aqueduct and sewerage systems over its territory.

The CAASD's mission is to work with the population of the National District and the province of Santo Domingo to provide drinking water service, collection and sanitation of wastewater, covering their needs and contributing to the care of the environment, as a company committed to continuous improvement, valuing its human capital and using with transparency the resources it manages.

4.2 Objective of the Project

As stated in the first chapter, Phase II of the Project is divided into three stages as follows. The first Stage is the one currently approved in the government budget and will be assessed in this ESIA. The Stage I includes:

6) Removing the garbage from the tributaries.
7) Channeling the stormwater of the Guajimía Canal and its tributaries:
    - The completion of the "Buenos Aires" Tributary
    - The completion of the "El Indio" Tributary
    - The completion of the "La Ureña" Tributary
    - Part of the Guajimía Canal from the convergence with the "Villa Aura" Tributary to its convergence with the "Buenos Aires" Tributary
    - Part of the "Las Caobas" Tributary

AECOM added the Villa Aura and The Guajimía Canal from where it flows under the 6 de Noviembre Highway to where it flows into the Haina River.

8) Installation of sanitary drainage collectors and expansion of water main networks in the following sections:
    - The "Buenos Aires" Tributary
    - The "El Indio" Tributary
    - The "La Ureña" Tributary
    - Part of the Guajimía Canal from the convergence with the "Villa Aura" tributary to its convergence with the "Buenos Aires" Tributary
    - Part of the "Las Caobas" Tributary

AECOM added the Villa Aura and The Guajimía Canal from where it flows under the 6 de Noviembre Highway to where it flows into the Haina River.

9) Installation of urban and roadway amenities: Amenities such as playgrounds, parks, lighting, and spaces for social gathering for urban integration in the sections affected by stormwater channeling.
10) Construction for affected families and compensation:
    - Update of the Resettlement Action Plan (RAP)

- Construction of the necessary residential units for the relocated families, as well as, on behalf of CAASD, the relocation management and payment of the monetary compensation to affected families as provided in the RAP

4.3 Project Location

4.3.1 Geographic Location

The project area is in the municipality of Santo Domingo Oeste which is located in the province of Santo Domingo. The main drainage channel of this peri-urban watershed is the Guajimía Canal for which the drainage watershed covers an area of approximately 1,358 ha (13.58 km^2). Figure 4-1 presents a map of the Guajimía drainage watershed and its main tributary channels, namely Villa Aura, La Alameda, Las Caobas, Buenos Aires, El Indio and La Ureña canals.

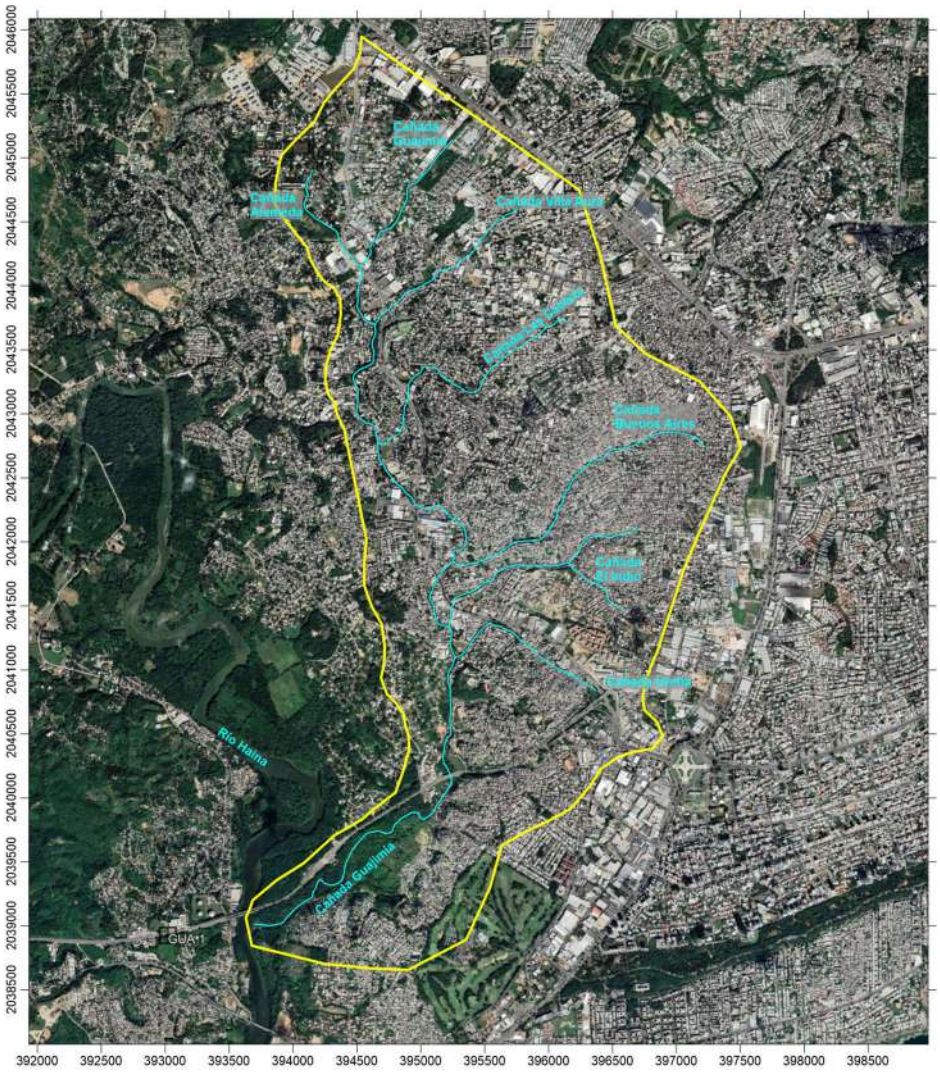


Figure 4-1: Guajimía Canal Watershed

The head of the Guajimía Canal is located in the Alameda residential area near the Duarte Highway. The canal extends over a distance of 11.35 km before reaching the Haina River, about 3.25 km upstream from its outlet in the Caribbean Sea. The course of the canal, from north to south, follows approximately the course of Avenue 27 de Febrero up to Highway 6 de Noviembre, and then turns west until it flows into the Haina River.

4.3.2 Project's Area of Influence

The area of influence corresponds, as indicated by the International Finance Corporation (IFC), to the "area *likely to be affected by both on-site impacts and external impacts arising from the activities, assets and facilities of the project, including related facilities"* [2]. This is the area where the impacts resulting from the project on any of its physical, biological, socio-economic, or historical-cultural components could be observed.

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

- **Footprint Limit:** refers to the physical space that will be occupied temporarily or permanently during the construction and operation phases of the project. It is the area within which the direct environmental and social impacts are observed,

For the definition of the limits of the project's footprint, one must include all the works required by the project (either temporary or permanent) from the execution stage (construction) to the operation and maintenance stages. For the present ESIA, this area includes:

a) Sections in both the upper and lower part of the watershed of the Guajimía Canal, specifically in certain sections of the canals Villa Aura, Las Caobas, Guajimía (from the convergence with the tributary Villa Aura to its convergence with the tributary Buenos Aires and from where it passes under the 6 de Noviembre Highway to its convergence with the Haina River), Buenos Aires, El Indio and Ureña.
b) Sites used during the execution of works for installation of amenities.
c) Lands that will be used for the construction of residential units to accommodate the households who are going to be displaced by the project.

- **Environmental Limit**: it is determined by the temporal and spatial scales impacts on the biotic and abiotic components, not limited to the area of execution of the project itself but extends beyond depending on the potential impacts that the evaluated project can generate.
- **Socio-economic Dynamics:** the area of influence in socio-economic terms is not restricted to the spatial criterion of location of the specific area of intervention of a project. In other words, it is not limited to the exact site of implementation of the project because it considers several criteria such as the impact on health and safety of the surrounding population, accessibility (roads and roads), economy, potential impacts drawn by physical or economic population resettlement.

Because the environmental limit and socioeconomic dynamics are not restrained to the direct impact of the project, an analysis was carried out to delineate the spatial scope of the physical, biological, social and cultural components (Table 4-1).

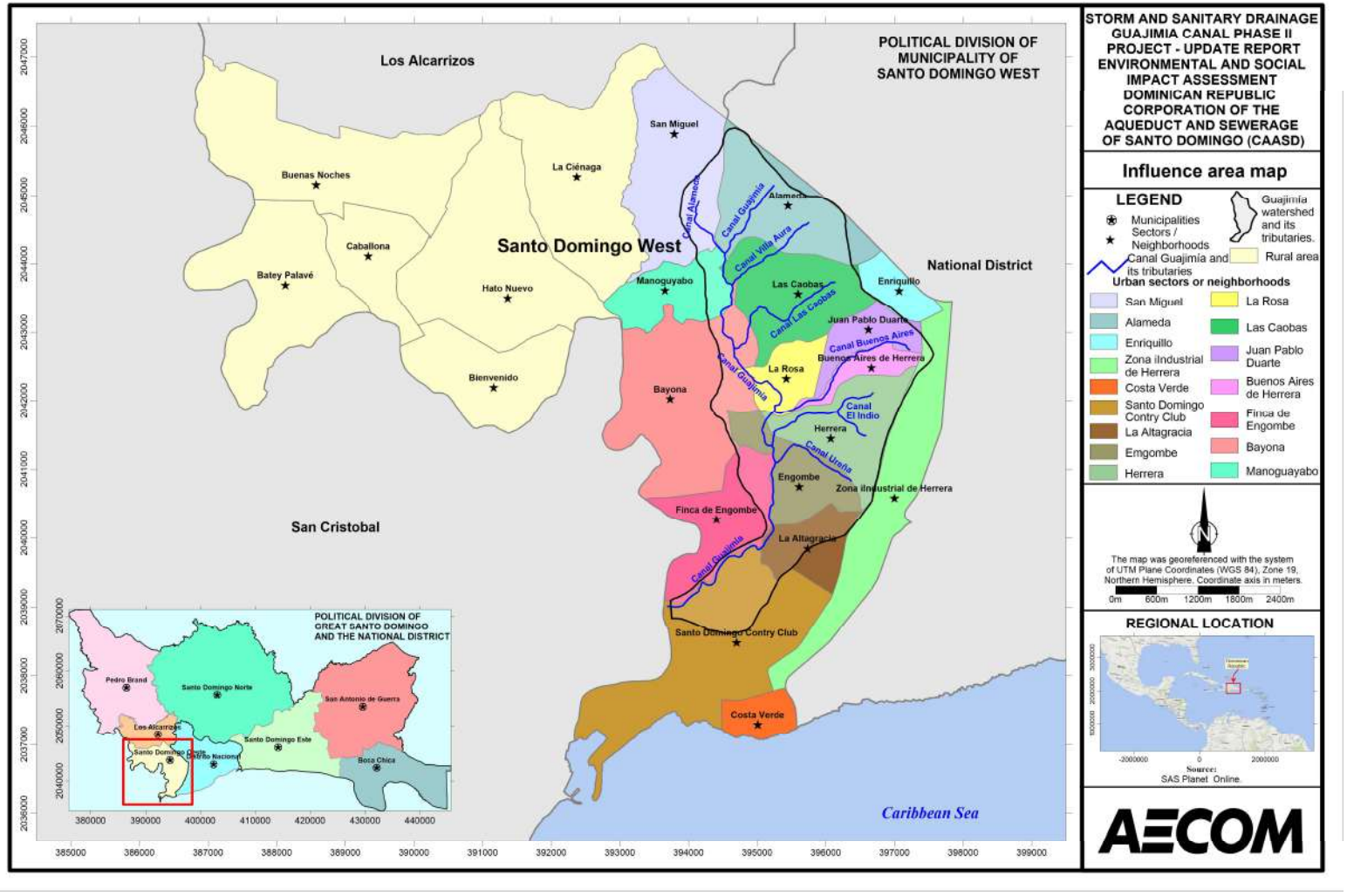
Table 4-1: Analysis of Criteria to Delimit Area of Influence

Criterion	Component	Analysis
Environmental Limit	Aquatic Habitat/Fauna and Water Quality	The diversity of aquatic species in the canals can be modified indirectly since there may be a disturbance to the downstream species due to the diversions of the watercourses by the construction activities. On the other hand, once the project enters operation, the water quality and aquatic habitat downstream of the sites where the works will be carried out will improve due the reduction of the load of pollutants. Therefore, it is considered prudent to define that there will be an incidence of these components at the watershed level.
	Air and Noise	Since the project will take place over the entire watershed, the scope of analysis for this component should be at watershed level.
	Health and Safety	Project works will have direct and indirect influences, both positive and negative, on the inhabitants who sit in the project's footprint or near it.

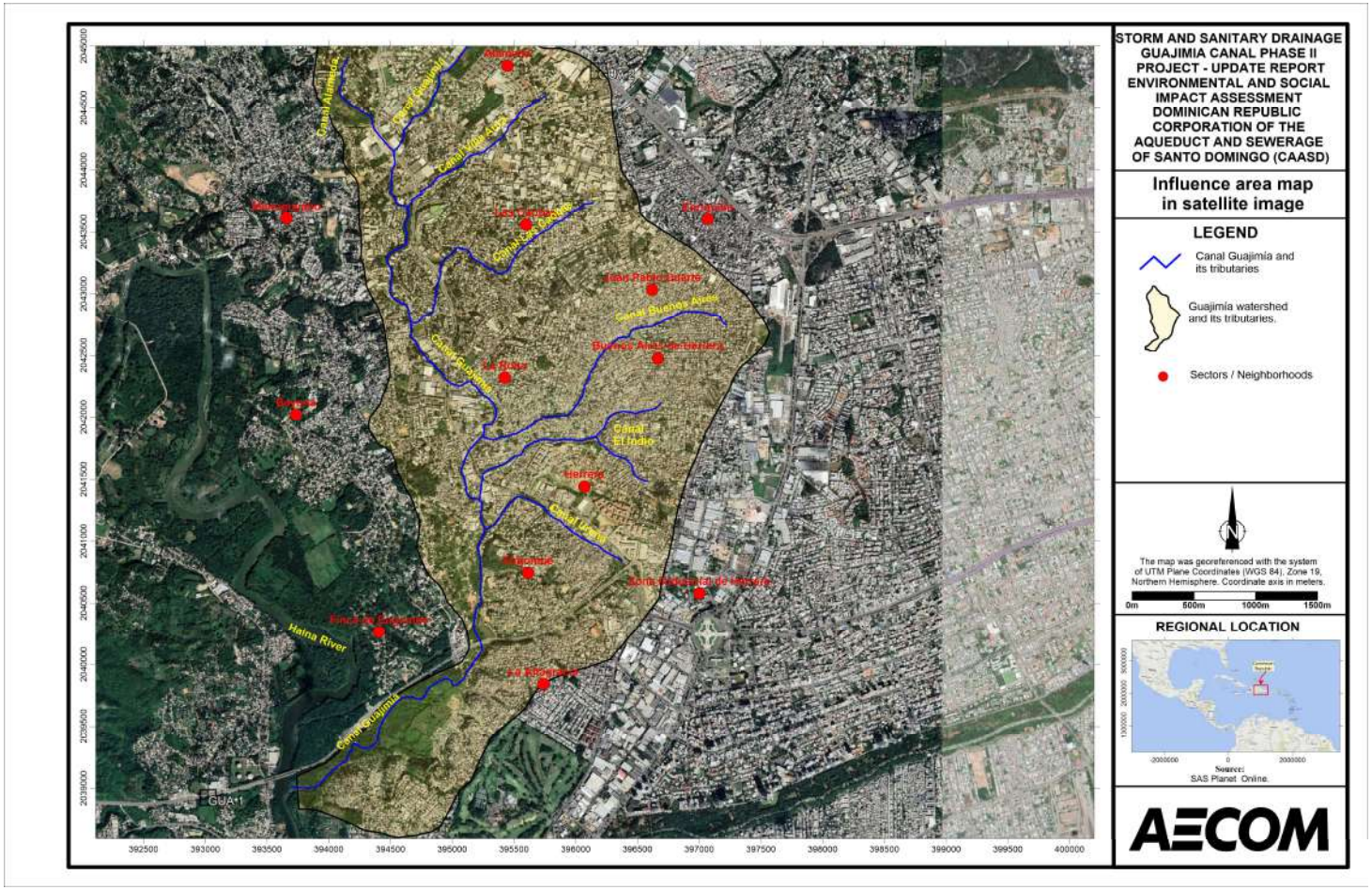
[2] Guidance Note 1 (NO21) of the IFC Performance Standard, 2012.

Criterion	Component	Analysis
Socio-economic dynamics		Several houses or structures are located along the canal in densely populated areas. This implies that, if the population remains in the area, their health and safety could be affected during construction activities such as demolition woks, machinery, presence of construction personnel and environmental noise. Other risks are brought by higher road traffic during construction for both pedestrian passers-by and vehicles who could suffer incidents or accidents. Therefore, the area of influence includes all houses and road accesses that are in the direct vicinity of the project. On the other hand, indirectly affected population, i.e. those not located in the area of direct influence, are nevertheless affected (both positively and negatively) by impacts such as noise, temporary power and water cuts, potential recipients of economic and social activities related to the presence of construction personnel in the area.
	Economy	Formal and informal businesses could be temporarily or permanently relocated. The project could also reduce or paralyze some activities Also, if roads and pedestrian accesses are disturbed, there may be displacement delays for the population. The project may also bring tangible economic benefits to local suppliers, especially during the construction phase.
	Population	The population residing within the project's footprint area and in the surrounding area might suffer from involuntary resettlement, an aspect that is relevant from the social point of view, since it affects both the living conditions of the population, as well as their social support networks and other sociocultural and demographic needs. In this sense, the area of influence considered, is the one that will be affected by physical displacement and the receiving community, i.e. the area where the new homes will be built.

In view of the importance of environmental and socio-economic considerations, the limit of the area of influence includes the entire watershed of the Guajimía Canal (Map 4-1 and Map 4-2).



Map 4-1 :Influence Area Map



Map 4-2: Influence Area Map in Satellite Image

4.4 Project Components

The Storm and Sanitary Drainage of the Guajimía Canal Phase II Project includes the following components (See General Plan Phases I and II):

1) Adequacy of the urban lot and construction of housing solutions equipped with basic services to relocate the families affected by the project, according to the results of the Resettlement Action Plan. Likewise, the payment of the corresponding indemnifications or compensations.

2) Channeling of stormwater (rainwater collectors) in the upper part of the Guajimía Canal and its tributaries, namely Villa Aura and Las Caobas and the Buenos Aires, El Indio and La Ureña tributaries in the sections that were not improved in the first phase of the Project.

3) Installation of sanitary drainage collectors in sections of the upper part of the Guajimía Canal and in sections of the tributaries of Villa Aura and Las Caobas and in the Buenos Aires, El Indio and La Ureña tributaries that were not improved during Phase I.

4) Expansion of water distribution networks of the Guajimía a Watershed, of the Villa Aura and Las Caobas tributaries and Buenos Aires, El Indio and La Ureña tributaries in the sections without intervention of Phase I of the Project.

5) Installation of urban and roadway amenities: Amenities such as playgrounds, parks, lighting, and spaces for social gathering for urban integration in the sections affected by stormwater channeling

6) Re-profile of the final portion of Guajimía Canal, between the 6 de Noviembre Highway and the mouth of the Haina River.

Table 4-2 summarizes the work planned in each of these canals.

Table 4-2: Works Planned in Each of the Canals that Affect Phase II of the Project

Canals to Intervene	Stormwater Channeling System	Distribution of Drinking Water	Interconnection with the Road Network of the Capital City	Urban Development of the Intervention Strip for the Rainwater Channeling	Wastewater Collection and Conduction System	Rehousing of the affected Population
Guajimía	×			×	×	Lots located on the Guajimía Canal.
Villa Aura	×	×	×	×	×	Lots located on the Villa Aura Canal.
Las Caobas	×	×	×	×	×	Lots located on the Las Caobas Canal.
Buenos Aires	×	×	×	×	×	Lots located on the Buenos Aires Canal in the sections that were not improved in Phase I of the project.
El Indio	×	×	×	×	×	Lots located on the El Indio Canal in the sections that were not improved in Phase I of the project.

La Ureña	×	×	×	×	×	Lots located on the La Ureña canal in the sections that were not improved in Phase I of the project.

Table 4-3 presents the activities that will carried out in the canals during Phase II of the Project.

Table 4-3: Activities to be Carried Out in Each of the Canals that attend to Phase II of the Project

Activities to be carried out	Canals								Lots where the buildings will be built
	Guajimía			Villa Aura	Las Caobas	Buenos Aires	El Indio	La Ureña	
	Section between the confluence Villa Aura-Las Caobas	Section between the confluence Las Las Caobas-Lote	Final portion of Guajimía, between the 6 de Noviembre Highway and the mouth of the Haina River						
Cleaning of the canal	×	×	×	×	×	×	×	×	
Diversion water management for stormwater channeling and re-profiling work.	×	×	×	×	×	×	×	×	
Demolitions of existing structures in the area of influence of stormwater channeling works.	×	×		×	×	×	×	×	
Channeling stormwater through pipes (length - meters).	1193	1467		1195	2194	280	300	780	
Re-profiling			×						
Collection and conduction of wastewater.	×	×		×	×	×	×	×	
Construction of the road system.				×	×	×	×	×	
Construction of the urban complex that includes the construction of buildings, social service areas and green areas. In this urban complex will be relocated the affected residents.	×	×		×	×	×	×	×	×
Land conditioning works.									×
Design and construction of public services (road system, drinking water, sewerage, and electricity).	×	×	×	×	×	×	×	×	×
Preparation of the building foundations.									×
Construction and assembly of buildings.									×

4.4.1 Actions for the Pre-construction Phase

Project actions for the pre-construction phase include land acquisition for the construction of apartment buildings.

In the Guajimía Canal there are apartments for the relocation of the families affected by the construction of the works. These lots are of named *Residential Guajimía III and Guajimía IV*.

The location of the Guajimía III Residential Lot (Lot B.1) is shown in Figure 4-2 . This lot has already been acquired by the CAASD.

Figure 4-2: Proposed Housing Lots
Source: CAASD

The location of the Guajimía IV Residential lot has not yet been defined. Once located, the CAASD will proceed with the negotiation process to acquire these lands.

4.4.2 Actions for the Construction Phase

The actions of the project for the construction phase of the work are described below.

4.4.2.1 *Installation of Temporary Facilities*

Temporary facilities will be installed on the sites where the residential units will be built and in other places that have not yet been defined. These sites will be located close to the Guajimía Canal and its tributaries. These temporary facilities will be made up of containers built in light materials so that they can be easily moved to another location in the project area. The temporary facilities of the work will comprise:

Office

The main contractor of the work, as well as the subcontractors that need it, will have office containers adapted for theirs needs. These containers will be placed on prefabricated beams, separated from the ground surface by more than 40 cm.

Figure 4-3: Enabled and Air-conditioned Containers for Use as Offices

Source: EMPACA file

Other containers for changing clothes, portable bathrooms, dining room and medical dispensary will be available for workers on the construction site.

The project does not plan for dormitories since workers will return to their residence at the end of the day.

Storage of Construction Materials: The main warehouse where the materials will be stored is the Haina Manoguayabo warehouse. This warehouse which belongs to CAASD is in Manoguayabo. Other temporary warehouses will be set up for the storage of small quantities of materials for immediate use. These warehouses will consist of containers or temporary stockrooms built with lightweight materials such as fiber cement and wood plates.

Water Supply and Consumption: Drinking water supply of will be provided through the existing CAASD networks. On site water storage tanks will be installed in the temporary facilities of the project. Bottled water will be purchased for daily consumption.

Generation and Management of Liquid Waste from the Temporary Facilities: During the construction phase, portable bathrooms will be rented to a specialized company accredited by the Ministry of Environment and Natural Resources, which will also be responsible for their periodic maintenance.

No activities that could require wastewater treatment will take place on project site, including concrete mixing, equipment cleaning. As such, no specific facilities are needed.

Supply and Consumption of Electrical Energy: Electricity supply of will overseen by the Southern Electricity Generating Company (EDESUR), through the existing electricity networks in the area. Mobile electricity generators will also be available.

Fuel Consumption and Handling: During the construction phase, the fuel supply to vehicles and trucks will be made at service stations in the area.

Fuel tanks will be installed in the temporary facilities of the construction site to supply heavy equipment and mobile electricity generators. These tanks will feature spill containment berms with a capacity of at least 10% above tank capacity.

Generation and Management of Non-Hazardous and Hazardous Solid Wastes

Non-hazardous Waste: The management of domestic solid waste during the construction phase will be made using boxes or tanks. The latter will be located according to the concentration waste generating activities. These boxes or tanks will be identified so that recyclable materials (organic, paper, cardboard, plastics, metals, among others) can be separated.

The non-recyclable and reusable domestic waste will be removed daily in trucks of the City Council of the Municipality of Santo Domingo Oeste, for transfer to the Duquesa landfill. Recyclable waste that cannot be reused on the site will be sold to an authorized manager from the Ministry of Environment and Natural Resources.

The management of waste resulting from the cleaning of the canals, debris resulting from demolition and excavation material are described in section 8.3.1 of Chapter 8.

Hazardous Waste: Hazardous waste (paint packaging, solvents, welding butts) will be generated mainly as a result of the construction activities of the new apartment buildings. The hazardous waste will be deposited in container-vans. The latter will be located on the site where the residential units will be built.

These containers will also be located more than 100 m from the canals and will be organized inside according to the types of hazardous waste that will be generated in the construction phase of the project.

A company accredited by the Ministry of Environment and Natural Resources that will be responsible for the removal of the hazardous solid waste generated by the project and its final disposal.

4.4.2.2 *Preparation of the Site where the Residential Units will be Built*

The works involved in the preparation of the site where the residential units will be built include:

- Clearing and cleaning of vegetation and topsoil of the construction area
- Strip or cut of unusable material
- Layout
- Earthmoving

The procedures for performing these activities are described below.

Clearing and Cleaning of Vegetation and Topsoil of the Construction Area

The land where the residential units will be built will be dismantled and cleaned. Clearing will be restricted to strictly necessary areas and before it starts, all specimens of flora belonging to protected or threatened species will be located in order to either keep them in their places or replant them if this is not possible.

The clearing will consist of the felling, uprooting and / or removal of the trees, shrubs, trunks and any other vegetation that there is a need to remove in order to correctly carry out the stripper or that hinders the construction of the buildings and works object of the contract.

The cleaning will consist of the removal of the materials resulting from the clearing, as well as the poles, stones, barbed wire and any other object that is in the disassembled areas and that prevents the normal development of the construction work or endangers the stability of the works or the traffic on them.

Clearing and cleaning operations shall be carried out, without distinction, by hand or by the use of mechanical equipment, but these operations shall invariably be carried out prior to the construction work and with the necessary participation so as not to hinder the normal development of the environment.

Strip or Cutting of Unusable Material

Stripper is understood as the removal of the surface layer of the natural terrain, in a sufficient thickness to remove topsoil, peat, silt, organic matter and other undesirable materials deposited in the soil.

The stripper to be implemented in the project will consist of the removal of the surface layer of the soil in a sufficient thickness to remove organic matter and other undesirable materials deposited in the soil. The stripper operation will not be limited only to the removal of the surface layers but will also include the extraction of rocks

and roots that are inconvenient for the work and that were not removed in the clearing and cleaning operation.

Earthmoving

Excavations of the site for the construction of the foundations of the works shall be carried out. In addition, the necessary cuts and fillings will be made to achieve the levels required, as provided in the drawings.

4.4.2.3 *Construction of Residential Units and their Basic Services Infrastructure*

In Phase II, relocation solutions for the affected population have been considered as a way of saving and providing housing solutions for the families affected by the project. The same three types of buildings used in Phase I will be constructed (Photo 4-1). These typologies of buildings were called type I, II and III, which have apartments of 1, 2 and 3 rooms, respectively.

Photo 4-1: Residential units Constructed for Phase I of the Project
Source: CAASD

Table 4-4 shows the preliminary number of buildings to be built by type. This number might change according to the results of the eligibility criteria for resettlement, applied to population located in the project area.

Table 4-4: Preliminary Number of Residential units per Type

Lot	Number of Buildings per Lot	Number of Buildings by Type	Building Type	Number of Apartments per Lot	Number of Apartments	Number of Rooms per Apartment	Number of Rooms
Lot Guajimía III	16	5	I	248	120	1	120
		5	II		80	2	160
		6	III		48	3	144
Lot Guajimía IV	6	2	I	96	48	1	48
		2	II		32	2	64
		2	III		16	3	48
Total	**22**	**22**	**--**	**344**	**344**	**--**	**584**

Residential areas will include parking and playgrounds for children.

Annex 1 presents examples of architectural plans of the residential units to be built.

4.4.2.4 *Population Resettlement*

According to the results of the census applied to population located in the project area, the eligibility criteria and compensation matrix categories there will be relocation of population into the new residential units. This will be made before the start of any construction activity in the canals and will be done in compliance with the procedures established in the Resettlement Action Plan (PAR).

4.4.2.5 *Payment of Compensation*

A financial compensation might be necessary for some of the physical displaced or economic displaced population, according to the compensation matrix included in the Resettlement Action Plan.

4.4.2.6 *Preparation of the Guajimía Canal and its Tributaries*

The preparation of the Guajimía Canal and its tributaries, as well as in the areas where the temporary facilities will be installed include:

4.4.2.6.1 Demolitions of existing Structures in the Area of Influence of Stormwater Channeling Works

The houses and other existing buildings in the intervention area on the banks of the Guajimía Canal (Photo 4-2) and tributaries will be pulled down either manually or mechanically using powered mobile plant such as excavators, loaders and bulldozers (Photo 4-3).

Photo 4-2: Buildings on the Banks of Canal needed to be Demolished
Source: CAASD

Photo 4-3: Demolition of Houses using Powered Mobile Plant in Phase I of the Project
Source: CAASD

The handling of demolition debris is described in subsection 8.3.1 in chapter 8.

During the demolition period, the electricity, drinking water and sanitary sewerage networks will be affected in the sectors of the area of direct influence of the project, Therefore, temporary networks will be installed after the demolition to supply the houses and other buildings located in these sectors until the construction period is completed.

4.4.2.6.2 Cleaning of the Canals

The cleaning includes the removal of the solid waste in the canals and the digging of a layer of soil beneath the waste of approximately 0.30 m thick. Cleaning will be done either manually or mechanically using powered mobile plant (Photo 4-4).

Photo 4-4: Canal Cleaning in Phase I of the Project
Source: CAASD

The management to be given to the waste resulting from the cleaning of the canals is described in subsection 8.3.1 in chapter 8.

4.4.2.6.3 Clearing and Cleaning of Vegetation and Topsoil in the Construction Area

The clearing and cleaning of vegetation, topsoil and stripper will include the areas to be intervened along the Guajimía canal and the tributaries and also over the areas where the temporary facilities will be installed.

4.4.2.7 *Diversion of Water for Stormwater Channeling and Re-profiling Work*

In the section of the Guajimía Canal or the tributaries to be treated, a diversion channel will be constructed along one of its banks in order to evacuate the water that usually flow through the canals (Photo 4-5). These channels will be made of loose materials and waterproofed with a PVC sheet. The diversion channel will be removed once the construction of the works in the canals is finished.

Photo 4-5: Diversion Channel used during Phase I of the Project
Source: CAASD

4.4.2.8 *Construction of the Works*

Before the start of the construction work, the staking will be done, covering the topography work for the layout of the works. The construction of the stormwater channels, sanitary sewerage, drinking water distribution networks will include the following main activities:

- Trench excavation and bottom conditioning (support bed)
- Placement of the pipes and pipe joints in the trench
- Filling the trench with good soil

Finally, urban and roadway amenities (roads, urban walks, playgrounds, among others) will be built over soil filled areas.

Below, the characteristics of the different works to be built are described.

4.4.2.8.1 Stormwater channeling in the upper part of the Guajimía Canal and in the Villa Aura and Las Caobas canals and in the sections that were not improved in Phase I of the Project

Stormwater conveyance along the Guajimía Canal will be carried out through the installation of metallic conduits with a Pipe-Arch and circular cross-section (Table 4-5 and Figure 4-4). In cases where land conditions limit the use of prefabricated sections, concrete hydraulic sections with metal stoppers will be used.

Table 4-5: Information on Sections to be Built

TRAZADO (Progresivas pluviales)	LONGITUD) (m)	TIPO INTERVENCION	DIMENSIONES BASE X Altura
0+000 a 0+080	80.00	Reperfilado	2.85 x variable
0+080 a 0+680	600.00	Reperfilado	2.85 x variable
0+680 a 0+880	200.00	Reperfilado	2.85 x variable
0+920 a 0+970	50.00	Reperfilado	5.21 x variable
1+090 a 1+480	390.00	Reperfilado	4.36 x variable
1+480 a 2+680	1,200.00	Reperfilado	7.29 x variable
2+680 a 4+060	1,380.00	Reperfilado	10.46 x variable
4+060 a 4+175	115.00	Reperfilado	13.05 x variable
4+215 a 4+653	438.00	Reperfilado	10.46 x variable
4+663 a 4+873	201.00	Reperfilado	13.05 x variable
6+020 a 8+180	2160.00	Reperfilado	14.00 x variable

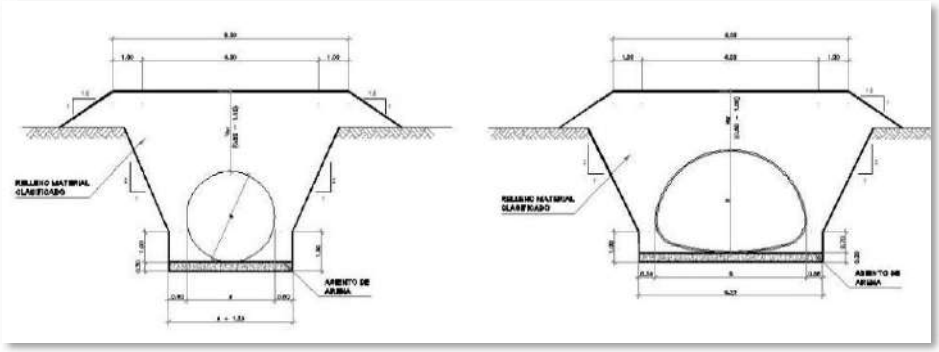


Figure 4-4: Outline of Pipes with Vaulted and Circular Section

4.4.2.8.2 Villa Aura Canal

The section that connects the Villa Aura Canal to the Guajimía Canal has a length of 1,185 meters (Table 4-7). Over this distance, two vaulted cross sections with different dimensions depending on the topography will be installed. Both sections will be able to conduct the flow of the canal for a return period of 20 years.

Table 4-6: Cross Sections Villa Aura Canal

CAÑADA VILLA AURA (L = 1,185m)						
Prog	L	Q_d	TIPO	Dimensiones		s
	m	m3/s	Conducto	Ancho	Alto	m/m
0+000						
	310.0	23.72	PA 52 N	4.727	3.071	0.005
0+310						
	520.0	32.13	PA 56 N	5.047	3.329	0.005
0+830						
	355.0	35.16	PA 56 N	5.047	3.329	0.006
1+185						

Progresiva 0+000: Inicio Canalización Pluvial
Progresiva 1+185: Confluencia Villa Aura - Guajimía

Table 4-7: Cross Sections Villa Aura Canal

CAÑADA VILLA AURA (L = 1,185m)						
Prog	L	Q_d	TIPO	Dimensiones		s
	m	m3/s	Conducto	Ancho	Alto	m/m
0+000						
	310.0	23.72	PA 52 N	4.727	3.071	0.005
0+310						
	520.0	32.13	PA 56 N	5.047	3.329	0.005
0+830						
	355.0	35.16	PA 56 N	5.047	3.329	0.006
1+185						

Progresiva 0+000: Inicio Canalización Pluvial
Progresiva 1+185: Confluencia Villa Aura - Guajimía

4.4.2.8.3 Las Caobas Canal

In this canal, the corrugated metal pipes will have either a circular or vaulted shape (Table 4-8). The circular-shaped will be use in the upper sections of the canal. The vaulted section (Pipe-Arch) will be use in the lower section of the main conduit.

Table 4-8: Sections of the Las Caobas Canal

UBICACION	LONGITUD	TIPO	DIMENSIONES
0+000.00 a 0+771.00	771.00	4N	2.588 m
0+771.00 a 1+098.00	327.00	A 56N	.365 x 2.873 m
TRAMO AFLUENTE			
0+000.00 a 0+474.00	474.00	4N	2.588 m

4.4.2.8.4 Section of the canals of Buenos Aires, El Indio and Ureña that were not improved in Phase I

Phase I did not include the installation of stormwater pipes in the three following sections:

- Buenos Aires canal: 280 m stretch
- El Indio canal: 300 m stretch
- La Ureña Canal: 780 m stretch

The stormwater channeling of these sections will be carried out using galvanized steel metal pipes.

4.4.2.8.5 Re-profile of the final portion of Guajimía Canal between the 6 de Noviembre Highway and the mouth of the Haina River.

The final portion of the Guajimía Canal will be re-profiled in the section that goes from the 6 de Noviembre Highway to the mouth of the Haina River.

The slopes will be boxed (Photo 4-9) or sowed by soil stabilizing species.

Photo 4-6: Re-profiling of the Guajimía Canal in the Section from 400 m Upstream of the Guajimía-Buenos Aires confluence to the 6 de Noviembre Highway Bridge that was executed as part of Phase I of the Project

Source: CAASD

4.4.2.8.6 Sanitary sewerage on the unfinished section of canals of Phase I

For wastewater conveyance, a sanitary sewer system is proposed using HDPE pipe.

4.4.2.8.7 Guajimía Canal

This sanitary drainage system consists of the installation of HDPE pipes having diameters ranging from 200 mm to 900 mm (Table 4-9). These pipes will be installed along the canal, on both banks and will be connected to the network designed and constructed in Phase I.

Table 4-9: Dimensions of Collectors to be Installed

LONGITUD (Aproximada) (m)	DIAMETRO (Interior) (mm)	DIAMETRO (Interior) (pulg)
248.00	200 HDPE	8 HDPE
503.00	300 HDPE	12 HDPE
91.00	375 HDPE	15 HDPE
402.00	450 HDPE	18 HDPE
1,718.00	750 HDPE	30 HDPE
911.00	900 HDPE	36 HDPE
3,873.00		

4.4.2.8.8 Villa Aura Canal

For the sanitary sewer, the system will be composed of HDPE pipes having diameters ranging from 200 mm to 450 mm as detailed in Table 4-10.

Table 4-10: Pipes for Sanitary Sewerage

LONGITUD Estimada (m)	DIAMETRO (Interior) (mm)	DIAMETRO (Interior) (pulg)
516.00	200 HDPE	8 HDPE
489.00	250 HDPE	10 HDPE
699.00	300 HDPE	12 HDPE
530.00	375 HDPE	15 HDPE
76.00	450 HDPE	18 HDPE
2310.00		

4.4.2.8.9 Las Caobas Canal

For wastewater collection, the HDPE pipes will have different diameters according to the flow requirement of each section and calculated according to the CAASD standards (Table 4-11). These pipes will collect the water along the entire canal on both sides of the river collector until it flows into the sewage collector that will be placed in the Guajimía Canal.

Table 4-11: Sanitary Sewer Pipes

UBICACION	LONGITUD	DIMENSIONES
0+000.00 a 0+800.00	1600.00 m.	375 mm HDPE
0+800.00 a 1+090.00	1020.00 m	200 mm HDPE
TRAMO AFLUENTE		
0+000.00 a 0+474.00	950.00	200 mm HDPE

4.4.2.8.10 Sections of the Buenos Aires, El Indio and La Ureña Canals that were not improved in Phase I

In the sections of the Buenos Aires, El Indio and La Ureña Canals that were not improved in Phase I (total length of 1.32 km), the sanitary sewerage networks will be installed using the same materials and methods as in the other sections of the project.

4.4.2.9 *Extension of the Water Distribution Networks*

4.4.2.9.1 Guajimía Canal

As for the expansion of the drinking water network in the intervention areas of this canal, it is only planned to implement the extensions of the networks necessary to supply the lots and buildings to be built.

4.4.2.9.2 Villa Aura Canal

As for the expansion of the drinking water network in the intervention areas of this project, it is planned to implement only the extensions of the networks necessary to supply the lots and buildings to be constructed.

For this purpose, when the infrastructures of the lots are confirmed and detail design is available, they will be included into the city's supply network.

4.4.2.9.3 Las Caobas Canal

In the Las Caobas Canal, it is planned to expand the drinking water supply networks by installing 100 m diameter SDR 21 PVC pipe (Photo 4-7), which will guarantee the water supply to the population that will not be relocated.

Photo 4-7: Pipeline for Water Supply in Phase I of the Project
Source: CAASD

4.4.2.9.4 Sections of the Buenos Aires, El Indio and La Ureña canals that were not improved in Phase I

In the sections of the Buenos Aires, El Indio and La Ureña canals that were not improved in Phase I, the water supply networks will be installed using the same materials and methods as in the other sections of the project.

4.4.2.10 *Installation of Urban and Roadway Amenities*

4.4.2.10.1 Guajimía Canal

The Guajimia project requires the incorporation of three road sections to connect to the new sites and provide access to the lots. The first section, of 203 m in length will provide access to Guajimía Lot III. Tt will be located between First and C Streets (Figure 4-5).

Figure 4-5: Proposed Road Section for Access Lot Guajimía III

Source: Environmental Effects Assessment and Risk Assessment Report (Dessau, 2008)

The second section will be located between C/Juana Encarnación and C/ Orlando Martinez with an estimated length of 276 m and will give access to lots Guajimia III and IV.

The third section consists in reconditioning the Orlando Martinez Street so that it can meet properly function for road and drainage (Figure 4-6). This section has an approximate length of 160 m (Figure 4-6).

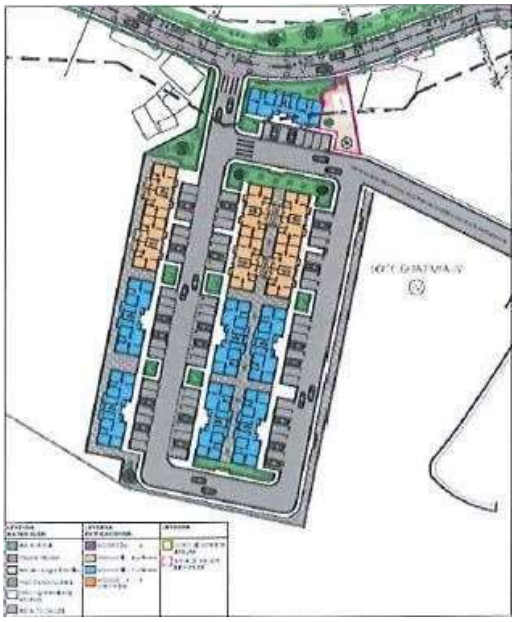


Figure 4-6: Third Road Section

Source: Environmental Effects Assessment and Risk Assessment Report (Dessau, 2008)

The sections will be composed of two lanes (3 meters wide each) and 1 m sidewalks on both sides, as shown in Figure 4-7.

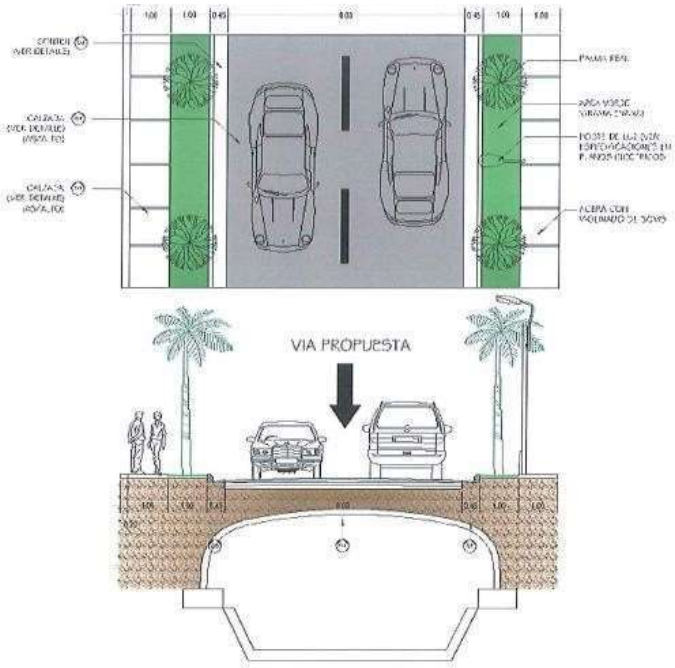


Figure 4-7: View in Plan and Cross Section of the Proposed Tracks

Source: Environmental Effects Assessment and Risk Assessment Report (Dessau, 2008)

In the upper part of the Guajira canal, the existing space is not sufficient for road development. Thus, a foot trail with of a 3 m width and green areas were suggested. This foot trail will connect rest areas, children's playgrounds, commercial premises and a playground for family recreation (Figure 4-11).

Figure 4-8: Solution between C/ Orlando Martínez and Prol. Av. February 27

Source: Environmental Effects Assessment and Risk Assessment Report (Dessau, 2008)

4.4.2.10.2 Villa Aura Canal

Given the need to connect the existing streets with the main surrounding avenues, the construction of a 774 m roadway is planned. The latter will run from Prolongación 27 de Febrero Avenue beyond the Manoguayabo highway, intercepting Maranata, Primer a, 20, Telesfgold Corre and Respaldo21 streets. This roadway will have a cross section with two 3 m lanes and a 1 m shoulder (Figure 4-9).

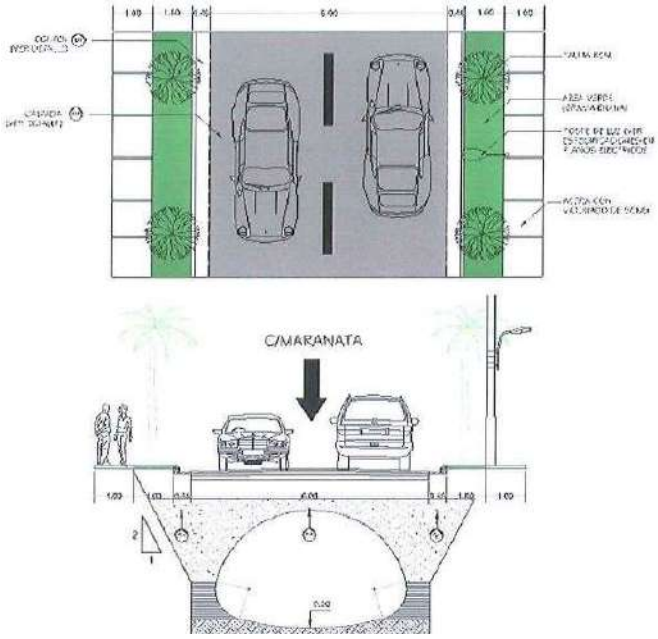


Figure 4-9: View in Plan and Cross Section of the Proposed Roads

Source: Environmental Effects Assessment and Risk Assessment Report (Dessau, 2008)

4.4.2.10.3 Las Caobas Canal

Two road sections are contemplated to interconnect the sector and provide access to other roads. The first section consists in the extension of the M17 street over an estimated total length of 94 m, located next to the Las Caobas school in order to provide access to it, replacing the pedestrian bridge that currently exists. The second section is located between Av. Prolongación 27 de Febrero and Calle Manzana 26. It is a 272 m section whose main purpose is to provide access to the proposed lot *Canal Las Caobas*.

The projected roads have the same design characteristics as those specified for the Villa Aura canal.

In the Las Caobas canal two road links have been proposed, the first will connect two existing parallel streets and the second will go from the progressive 1 +060 (Prolongation 27 de Febrero) to the 1 + 280 (internal street that borders the play) as shown in Figure 4-10 and Figure 4-11.

Figure 4-10 : First Road Link

Source: Environmental Effects Assessment and Risk Assessment Report (Dessau, 2008)

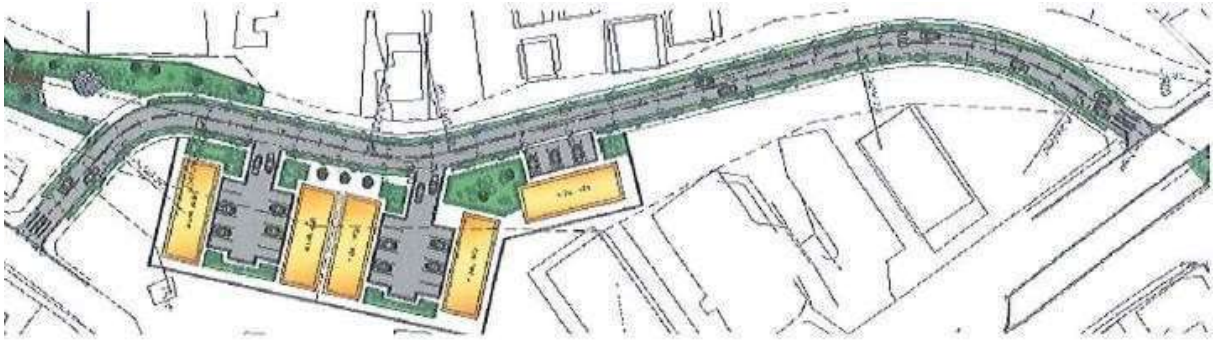


Figure 4-11 : Second Road Link

Source: Environmental Effects Assessment and Risk Assessment Report (Dessau, 2008)

4.4.2.11 *Pedestrian Walks and Recreational Areas*

On the proposed road, sidewalks will be built on both sides of the road with the introduction of a bicycle path, a foot trail, rest areas and green areas (Figure 4-12).

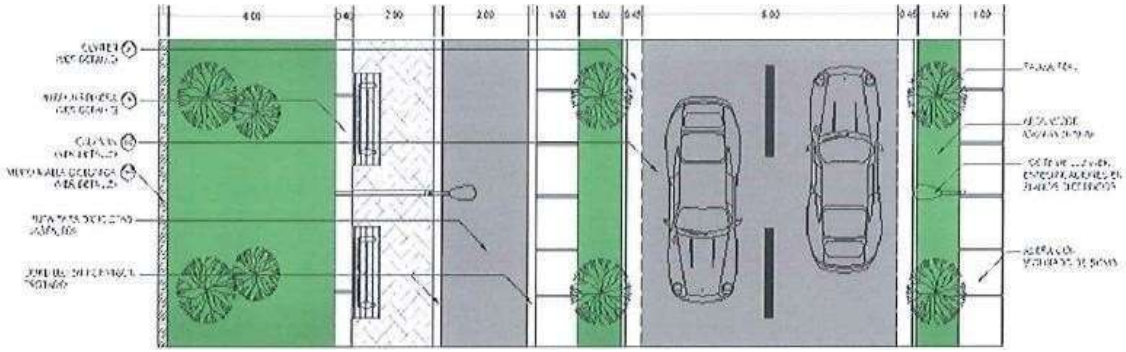


Figure 4-12: Typical Road Solution Plant on the Canal Villa Aura

Source: Environmental Effects Assessment and Risk Assessment Report (Dessau, 2008)

Furthermore, areas have been proposed for recreational use with spaces for sports fields, playgrounds for children, gazebos areas, general recreation areas and commercial premises (Figure 4-13).

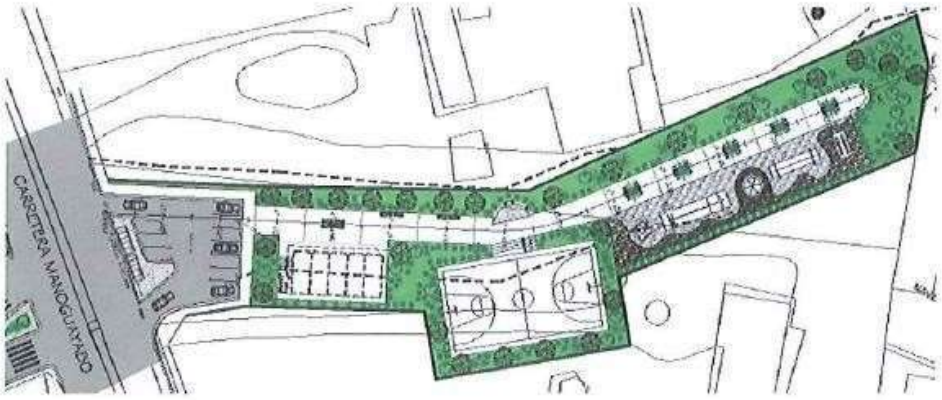


Figure 4-13: Recreation Areas

Source: Environmental Effects Assessment and Risk Assessment Report (Dessau, 2008)

4.4.2.12 *Exploitation of Loan Materials*

The filling soils will be purchased from external suppliers that have quarries that have Environmental Authorizations granted by the Ministry of Environment and Natural Resources for this purpose. The quarry (La Unión) is located in the municipality of Hatodama located at approximately 16 km from the project area. It has enough limestones and fine materials to satisfy all the loan material required for the infill works in the project.

4.4.2.13 *Waste Management resulting from the Cleaning of the Canals and Demolitions of the affected Houses*

The subsection 8.3.1 in the chapter 8 described the waste management plan.

4.4.2.14 *Transport and Traffic*

The construction activities of the project will require the use of trucks and containers for the transport of construction materials, waste and soils taken out of the canals, among others. In addition, different types of heavy equipment will circulate for the execution of the construction work.

The main access roads to the project where truck traffic will increase will be the Prolongación Av. 27 de Febrero, The Autopista 6 de Noviembre and the Manoguayabo Highway. Trucks and heavy equipment will also be affected by traffic on the inner streets of the sectors that make up the area of direct influence of project.

4.4.2.15 *Purchase of Materials, Goods and Services*

The main building materials that will be needed include:

- Loan materials and aggregates
- Galvanized steel ducts
- High density polyethylene (HDPE) pipes
- PVC pipes
- Valves, gaskets and accessories
- Rods
- Cement
- Asphalt
- Concrete
- Concrete blocks
- Finishing materials for residential units (floors, ceramics, sanitary appliances, wood, aluminum windows, paint, among others)

Materials will be purchased from local and international suppliers.

Services such as food, water and transport for workers, waste collection, fuel, among others, will also be purchased.

4.4.2.16 *Recruitment of a Workforce*

It is estimated that around 500 people will be employed during the construction works. The main contractor will be the Helios Group, which in turn will hire several subcontractors for the execution of the works. A subcontractor may be assigned for each of the sections to be intervened or a subcontractor for each activity to be carried out, whichever is more convenient. Other local companies will also be subcontracted for soil studies, surveying work, legal advice, environmental and social monitoring, among others.

Most of the work will be carried out by local companies. The type of employment to be generated shall include:

- Construction manager
- Resident engineers
- Heavy equipment operators
- Foremen
- Pawns
- Other

International participation could be related to special supervision of the installation of stormwater pipes and sanitary pipes.

4.4.2.17 *Execution Schedule*

It is planned to carry out all the activities of the pre-construction and construction phase of the project for a total time of approximately 48 months from the start date of the works. These phases will be conducted in sections to cause as little disturbance as possible to the local population (table 4-11).

Table 4-12: Schedule of Execution of the Work

month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Buildings																																																		
Basic infrastructures in the lots																																																
Implementation of the PAR																																																
Storm Sewerage																																																
Sanitary sewerage and aqueduct																																															
Urban finishes																																															

4.4.2.18 *Costs*

The total investment amount for the realisation of Stage 1 of Phase I is USD$ 50 million. The detailed budget for is presented in Annex 2.

4.4.3 Actions for the Operation Phase

The following describes the actions for the operation phase of the Project.

4.4.3.1 *Presence and Operation of Works of Channeling of the Storm Drainage, Sanitary and Drinking Water*

The proper operation of the stormwater channeling, sanitary sewerage and water supply networks will allow several benefits such as:

1) a reduction in the risk of flooding for the sectors that are directly influenced by the project
2) an improvement of the surface runoff of the canals
3) a reduction of the pollutant load of the waters of the canals due to the reduction of dumping of garbage and a smaller volume of wastewater
4) a reduction of the spread of diseases

These impacts will enhance the life quality of the population living in these sectors.

4.4.3.2 *Presence and Operation of the Housing of the Resettlement Plan and Urban Planning Works*

The new residential units will improve the life quality of the resettled population because their new homes will be of better quality than the ones they currently have. They will have greater access to basic services, such as drinking water supply, sanitary drainage, waste management, among others.

It is important to note that the CAASD will not do the administration and maintenance of these residential units once the Relocation Plan (PAR) is completed. This will be done by a board created by the residents.

4.4.3.3 *Maintenance of Works of Channeling of the Storm Drain, Sanitary and Drinking Water*

The periodic maintenance of the storm drainage, sanitary sewerage and aqueduct networks works in the operation phase will be the responsibility of the CAASD.

For these works, a maintenance program will be developed and implemented in which the procedures for carrying out inspections, preventive and corrective maintenance and the frequency in which these works must be carried out will be established to guarantee the proper functioning of these systems.

A service for leak and breakdown reporting will be available to the inhabitants of the communities of the area of influence of the project either through a telephone number, an email or in person at the offices of the CAASD.

4.4.3.4 *Maintenance of Urban and Roadway Amenities*

The maintenance of the urban and roadway amenities (roads, pedestrian walkways, children's play areas, commercial premises, gazebos, green areas, among others) will be taken in charge by the City Council of the Municipality of Santo Domingo Oeste.

4.4.3.5 *Solid Waste Management*

The collection of solid waste generated by residential units and urban and roadway amenities will be taken in charge of the City Council of the Municipality of Santo Domingo Oeste, which will be responsible for its transfer to

the Duquesa landfill. However, the CAASD will develop awareness campaigns (in coordination with the Municipality of Santo Domingo Oeste) for the population living in the surroundings of the canals on the importance of adequate solid waste management.

On its side, the CAASD will be responsible for the management of solid waste generated as a result of the maintenance work of stormwater drainage systems, sanitary sewerage system and water supply networks, such as cleaning waste from these systems, excavation waste, debris, among others.

For the management of this waste in the operation phase, the same criteria will be followed as during the construction phase of the project.

4.4.3.6 *Transport /Circulation*

The activities of periodic maintenance of the works during the operation phase will also involve the circulation of trucks, heavy equipment, and vehicles on the access roads and on the internal streets of the sectors of the project's direct influence area. However, this increase of traffic will be smaller than in the construction phase of the works.

4.4.3.7 *Purchase of Materials and Goods*

During the operation phase, the CAASD will need to use materials for the maintenance and repair of the stormwater drainage, sewerage and drinking water supply networks such as:

- Galvanized steel ducts
- High density polyethylene pipes
- PVC pipes
- Valves, gaskets and accessories

4.4.3.8 *Workforce*

During the operation phase, the personnel who will carry out the maintenance work of the stormwater, sanitary and drinking water networks will belong to the CAASD. The latter could also hire subcontractors for some works.

5. STAKEHOLDER ENGAGEMENT

This section lists and describes, according to the level and nature of their impact on the project, the institutional actors and community organizations in the study area, as well as the information and consultation activities that have been carried out.

5.1 National and International Requirements

5.1.1 National Requirements

In the Dominican Republic, the participation of the populations affected by the execution of projects is regulated by the Regulations and Procedure for Public Consultation in the Environmental Assessment Process, prepared by the Ministry of the Environment and Natural Resources, in order operationalize the mandate of Law 64-00, which has community participation in environmental protection as one of its principles (See Chapter II on Legal Framework).

The purpose of the Ministry of the Environment and Natural Resources, in preparing these regulations for public consultations, was to ensure the viability of the objective formulated in the law that originated it (Law 64-00), to promote the effective participation of interested parties and citizens in general towards the environmental evaluation process of any infrastructure, industry or activity that requires to be evaluated due to its environmental impact.

This Public Consultation process consists, in a nutshell, of a process of gathering the opinion and views of the different stakeholders regarding the implementation of a project. For this purpose, the regulation defines five methods:

1. Information and/or dissemination of the project. The promoter of the project will inform the communities of impact through a mass means of social communication, within a period of no more than fifteen (15) working days from the moment the application for authorization is submitted to the Ministry of environment and natural resources.
2. Public consultation. A public consultation will take place in influence of the project, by open invitation, which will be published in a newspaper of national circulation and by the media that are appropriate for the study area. This demand must be informed to the Directorate of Social Participation of the Ministry of Environment and Natural Resources.
3. Stakeholder analysis. The level of interest and standpoint of any person or organization regarding project implementation will be determined.
4. Observations to the environmental studies. Once a study has been carried out, it will be made available to interested parties, so that they can make observations and suggestions, granting a period of 15 working days, this period can be extended depending on the complexity and magnitude of the study. These observations will form part of the information to be considered in the decision-making process on the environmental authorization.
5. Public Hearing. It is the public consultation instrument is coordinated by the Ministry, where the broad participation of stakeholders in a project, work or activity within the environmental assessment process is allowed. This instrument is normally used in cases where a conflict arises that could not be resolved by the instruments defined previously.

5.1.2 International Requirements

International requirements for community participation are set out in the IFC Performance Standards, and their Guidance Notes, which promote the participation of the affected population in decision-making processes that affect them (see Chapter 2 on Legal Framework).

5.2 Approach

5.2.1 General Objectives

- Describe the stakeholders involved in the Stormwater and Sanitation Project of the Guajimía Canal and its tributaries.
- Determine the type and degree of interest of the stakeholders involved in the Stormwater and Sanitation Project of the Guajimía Canal and its tributaries.
- Determine the degree of influence of the stakeholders involved in the Stormwater and Sanitation Project of the Guajimía Canal and its tributaries.
- Determine the standpoint, either favorable or opposed, of the stakeholders involved in the Stormwater and Sanitation Project of the Guajimía Canal and its tributaries.

5.2.2 Methodology

In order to describe the stakeholders involved in the Project; two criteria were used.

The first criterion refers to the nature of the stakeholders, whether they are public institutions or private, such as affected people and project beneficiaries, or civil society organizations (CSOs). The second criterion takes into consideration is the level of action of these stakeholders, whether they are from the neighborhood and the municipality or whether they are public or private entities whose field of action transcends the project area.

Thus, according to the first criterion, it was determined that stakeholders such as the Ministry of the Environment, the CAASD, the City Council of the Municipality of West Santo Domingo, the National Housing Institute (INVI), the General Directorate of Territorial Planning, the URBE office, among others, fall into the category of institutional stakeholders of a public nature, while stakeholders such as neighborhood councils, mutual societies, the Community House of Justice of Las Mahogany and the Association of the Physically and Motor Disabled, among others, fall into the category of civil society organizations.

In addition, according to the second criterion, it was established that, with the exception of the Municipal Council, all institutional stakeholders of a public nature transcend the project area, both of the neighborhood and the municipality, to which some civil society organizations, such as ASODIFIMO, are added.

On the other hand, the City Council, and organizations such as neighborhood councils and mutual societies, their influence and relevance are limited to the local project area. In addition, each institution and organization were defined based on its functions and/or attributions

To determine the degree of interest, the level of influence and the position regarding the project, different stakeholders previously identified were interviewed (see Table 5-3), four (4) focus groups were held and some questions were included in the survey form applied in May, 2021.

The degree of interest in the project was established firstly from the degree to which its realization affects the stakeholders´ lives and secondly on the willingness of the stakeholders to see the project be carried out.

The level of incidence of the stakeholders was established from the degree of influence or power they exercise regarding the project's implementation, using a scale of low, medium, and high. Stakeholder standpoint with respect to the project was determined from the analysis of the answers to the questions contained in the interviews, focus groups and in the applied survey.

The standpoint of stakeholders impossible to contact or conduct interviews (President and Congressmen), was determined based on information contained in the national press (Annex 3.1. Extract of information in national newspapers on loan approval to start the project).

In other cases, when conducting formal interview was not possible, stakeholders were contacted by telephone.

5.2.3 Stakeholder Groups

Table 5 -1 shows the stakeholders, organizations or institutions interested in Project, with basic information, the degree of influence they exert or may exert, their standpoint or type of interest in the project and the degree of interest they may have in its development.

In the key stakeholders presentation, the degree of interest in the realization of the project is prioritized, which determines that it is the stakeholders most affected by the present situation of the canal, that is, the communities of the neighborhoods and their representatives, who occupy a place of first order, above the degree of influence or power that one has for the execution of the same project.

Therefore, Table 5-1 begins by presenting and describing the communities surrounding the Guajimía Canal and its tributaries, followed by a description of the neighborhood councils and other community organizations. It then moves by showing a description of the institutional actors which may have more influence.

Both the degree of interest and influence were defined as high, medium and low.

Below the table is a more detailed description of some of the actors included in it, whose relevance warrants it.

Table 5-1: Community Stakeholders, Organizations and Institutions Interested in the Guajimía Canal Storm Sanitation and Sanitary Project

Key Stakeholders	Description, Degree of Influence and Type of Interest in Project	Level of Interest
Civil Society Stakeholders		
Community stakeholders in the Guajimía Canal environment	The inhabitants of the neighborhoods around the Guajimía Canal and its tributaries are the most interested in the project. Their influence on it is carried out through the organizations that represent them and assemblies that are periodically held to discuss aspects related to the project. The creation of a "dialogue and participation roundtable" promoted by CAASD's social directorate tends to enhance community participation and, consequently, the community's influence on the project's development. Within the population of the communities surrounding the Canal de Guajimía, special attention should be paid to the population that is likely to be displaced.	High
Block of Neighborhood Councils of the Guajimía Canal and its tributaries	It is a second level organization that coordinates the work of the different neighborhood councils in the vicinity of the canal. It has been the most active organization. Its interest is high and its level of influence in the development of the project has also been high in its all phases.	High
Community stakeholders in the neighborhood or community where the population is to be displaced by the project.	The population relocated in the Guajimía I project corresponding to Phase I of the project is the receiving community of the population to be displaced in Phase II, since the land where the housing buildings will be constructed is located in an area close to this project.	High

Key Stakeholders	Description, Degree of Influence and Type of Interest in Project	Level of Interest
Neighborhood Libertador Council de Herrera	For the Storm and Sanitary Drainage of the Guajimía Canal Phase II, the neighborhood council of Libertador de Herrera is a major player, as indeed it has been, for the inhabitants of the surroundings of the canal El Indio, since it has been an interlocutor of the demands and community claims. Its level of incidence is medium.	High
Neighborhood Libertador Council de Buenos Aires	For the Storm and Sanitary Drainage of the Guajimía Canal Phase II,, the board of residents of Buenos Aires de Herrera is an actor of the first order for the inhabitants of the surroundings of the Canal Buenos Aires, since it has been an interlocutor of the demands and community claims. This neighborhood, next to the Duarte neighborhood, is affected by the Buenos Aires canal. Its level of incidence is medium.	High
Neighborhood Council Barrio Duarte	For the Storm and Sanitary Drainage of the Guajimía Canal Phase II, the neighborhood council of the Duarte neighborhood is a major stakeholder, as indeed it has been for the inhabitants of the area surrounding the canal. This neighborhood, together with the Buenos Aires neighborhood, is affected by the Buenos Aires canal. Its level of incidence is medium.	High
Engombe Neighborhood Board (El Abanico)	The neighborhood council of the Engombe (El Abanico) neighborhood is a major stakeholder for the Stormwater and Sanitation Project of the Guajimía Canal and its tributaries, since this neighborhood is located in the area of influence of the Canal Ureña. Its level of incidence is medium.	High
Las Mahogany Neighborhood Board	For the Storm and Sanitary Drainage of the Guajimía Canal Phase II, the Las Caobas neighborhood council is a major stakeholder for the inhabitants of the Las Caobas and Villa Aura canyons. Its level of influence is medium.	High
Las Mahogany Neighborhood Board (Frito Lay)	For Storm and Sanitary Drainage of the Guajimía Canal Phase II, the neighborhood council of the Las Caobas neighborhood known as Frito Lay is an actor of singular importance, because in this area converge the canals Las Mahogany and Guajimía, causing it to become an area of great vulnerability to floods, so that numerous structures have been identified in it for resettlement purposes. Their level of influence is low.	High
Agrarian City Neighborhood Board (Manoguayabo)	Although resettlement is not planned in this sector, since it is a sector with middle-class inhabitants in which the houses are not on the edge of the canal, however, the bad smell that dismisses the canal determines that the residents in this sector have a high interest in the sanitation project. They favor the project and their degree of influence is.	High

Key Stakeholders	Description, Degree of Influence and Type of Interest in Project	Level of Interest
La Rosa Neighborhood Board	For the inhabitants of the La Rosa neighborhood, the sanitary solutions of the project, specifically of the El Indio canal, represents a solution for them, because this neighborhood is located in the lower watershed of this canal. This means that the discharge of solid waste in the upper part obstructs the section of the canal already plugged in the first phase of the project, causing flooding. They favor the project and their degree of influence is low.	High
Holguín-La Rosa Neighborhood Board	As for the inhabitants of the La Rosa neighborhood, the project's sanitary solutions, specifically in the El Indio Derecho canal, represents a solution for the inhabitants of the sub-neighborhood known as Holguín, because this sub-neighborhood is located in the lower watershed of this canal. This means that the solid waste dumped in the upper part obstructs the section of the canal already covered in the first phase of the project, causing flooding. They favor the project and their degree of influence is low.	High
La Nueva Rosa Neighborhood Board	This is the same situation of the La Rosa neighborhood and the Holguin sub-neighborhood. They favor the project and their degree of influence is low.	High
La Altagracia Neighborhood Board	Although no work will be carried out in this neighborhood, since it is located in the lower watershed of the Guajimía Canal, the sanitation works carried out will have a positive impact on the quality of life of the residents of this neighborhood. They favor the project, although they have not been involved and their degree of influence is low.	Medium
El Café Neighborhood Board	Its situation is similar to that of the La Altagracia neighborhood, so it should be positively impacted in the same way. They favor the project and their degree of influence is low.	High
Dominican Association of Persons with Physical-Motor Disabilities (ASODIFIMO)	This entity supports the implementation of the project and is very interested in the inclusion and accessibility approaches for people with disabilities being considered in the project. Its degree of influence is low.	High
Relief Society El Libertador de Herrera	Mutual societies are a form of organizational of mutual support that exist in urban and rural areas of the Dominican Republic. Many of them have premises that are normally used as community halls. This is the case of the Sociedad de Socorro El Libertador de Herrera. Its degree of influence is low.	High
Relief Society Buenos Aires de Herrera	Mutual societies are a form of organizational of mutual support that exist in urban and rural areas of the Dominican Republic. Many of them have premises that are normally used as community halls. This is the case of the Sociedad de Socorro Buenos Aires de Herrera. Its degree of influence is low.	High

Key Stakeholders	Description, Degree of Influence and Type of Interest in Project	Level of Interest
United Citizens Mutual Relief Society (Duarte neighborhood)	Mutual societies are a form of organizational of mutual support that exist in urban and rural areas of the Dominican Republic. Many of them have premises that are normally used as community halls. This is the case of the Sociedad de Socorro Ciudadanos Unidos (barrio Duarte). Its degree of influence is low.	High
Church of God Buenos Aires	Churches bring together members of the communities, contributing to social cohesion. As they meet regularly, they constitute suitable information mechanisms that could be useful for communication between the management of the Stormwater and Sanitation of the Guajimía Canal and its tributaries Project, and the surrounding neighborhoods. Supports the project. Its degree of influence is low.	High
Church Rosa de Sarón	Churches bring together members of the communities, contributing to social cohesion. As they meet regularly, they constitute suitable information mechanisms that could be useful for communication between the management of the Stormwater and Sanitation Project of the Guajimía Canal and its tributaries Project, and the surrounding neighborhoods. Supports the project. Its degree of influence is low.	High
San Francisco Javier Catholic Parish (Buenos Aires de Herrera)	Churches bring together members of the communities, contributing to social cohesion. As they meet regularly, they constitute suitable information mechanisms that could be useful for communication between the management of the Stormwater and Sanitation Project of the Guajimía Canal and its tributaries Project, and the surrounding neighborhoods. Supports the project. Its degree of influence is low.	High
Living with Dignity Foundation	It is a long-standing entity in the area that does social assistance work. It supports the project, although its impact is low.	Medium
Evangelical Church, Loyola, El Abanico de Herrera	This church offers religious services to the community in several of the project's impact zones. This includes psychological services provided by the church itself. Its level of impact is low.	Medium
Catholic Church, West Vicarial Catechetical Coord.	The Catholic Church community in the area is very interested in the completion of the Guajimía project, especially in the opinion that it should begin where Phase I left off. They believe that the project should not leave any pending canals. They have little impact on the Project.	High
Catholic Church	Churches bring together members of the communities, contributing to social cohesion. As they meet regularly, they constitute suitable information mechanisms they are ideal information mechanisms that could be useful for communication between the management of the Stormwater and Sanitation Project of the Guajimía Canal and its tributaries management and the surrounding neighborhoods. Supports the project. Its degree of influence is low.	High

Key Stakeholders	Description, Degree of Influence and Type of Interest in Project	Level of Interest
Community House of Justice, Las Caobas, Gerente	High interest in the sanitation project and in being able to contribute to it from the Community House, to educate and support families in their social responsibilities and to serve in the mediation of conflicts that arise. They propose to give the houses to the family, to the couple and not to one person, to facilitate the protection of the family's property. Because of its range of action and specialized personnel, its impact on the project can be very positive. Its degree of influence is medium.	High
Public Institutional Stakeholders		
Corporation of the Aqueduct and Sewerage of Santo Domingo (CAASD))	It is the executing entity of the project and therefore has the highest level of influence.	High
City Council of the Municipality of Santo Domingo West, mayor	First-order actor given that it is the body that manages the environmental management factors that impact the quality of life of the inhabitants of the municipality in general and of the area of influence of the project in particular, as well as the strategies for the development of their social and economic life. The most important factor that makes them a first-order actor, both in terms of interest and influence or power, is the fact that they are the entity in charge of solid waste management, a variable without whose solution it is impossible to complete the project's sanitation work. Its level of influence is high.	High
Economic and Social Council Municipality Santo Domingo West	Participation mechanism established by municipal law to promote community participation in the management of municipalities. Its relevance for the Stormwater and Sanitation Project of the Guajimía Canal is given by the fact that it is a mechanism oriented towards the integral development of the municipality of Santo Domingo West, promoting the participation of the organizations of the civil society organizations. So far there has been no involvement in the project. Low level of incidence.	Low
Presidency of the Republic	The Presidency has been a major player in the project, and its interest is evident in the fact that, in addition to motivating the congressmen of the governing party to approve the loan requested, it ordered the inclusion in the national budget of the item for the initiation of the environmental impact study. The level of influence is high,	High
Vice-Ministry of Territorial Planning (VODT)	It is a unit of the Ministry of Economy, Planning and Development. Since the land use planning bill is not yet in force, its degree of influence is low; however, the experience of its technical team can be valuable, so its accompaniment is recommended.	Low
Senate of the Republic, Presdencia	The loan that will make this project possible was approved in the Senate. High level of influence.	High

Key Stakeholders	Description, Degree of Influence and Type of Interest in Project	Level of Interest
Chamber of Deputies, Presidency	The loan that will make this project possible was approved in the Chamber of Deputies. High level of influence.	High
Ministry of Environment and Natural Resources	Agency responsible for developing, implementing, and supervising national policies on the national environmental and natural resource, promoting and stimulating activities for their preservation, protection, restoration, and sustainable use. This ministry is a key stakeholder for the Stormwater and Sanitation Project of the Guajimía Canal, since according to Law 64-00 this ministry supervises compliance with standards related to the environmental impacts (physical and social) that the project will cause and the measures to prevent and mitigate them. Incidence level is high.	High
National Housing Institute (INVI)	It is the governing body for public policies related to housing. However, as far as is known, it has had no influence on the project.	Low
Executing Unit for the Rehabilitation of Neighborhoods and Environs (URBE)	It is unknown if she has been summoned as a companion in the resettlement process but having led the last resettlement processes in the country (La Barquita and Domingo Savio) is a good credential. It does not seem, however, to have any degree of influence on the project.	Low
Senate of the Republic. Senator of the Province of Santo Domingo	Currently the province's top legislator. Being interested in the development of the province, his support for the project is significant, as indicated by having assumed the submission of the World Bank loan for approval in the Senate of the Republic and his attendance at the presentation ceremony on the progress of the project carried out by the Director of the CAASD Felipe Suberbí, on June 22, 2021. Their degree of influence has been high in the approval phase.	High
Deputy Santo Domingo West	Congressman of the municipality of Santo Domingo West who assumes and supports a project that influences the improvement of the quality of life of a high percentage of the population he represents. His degree of influence has been high in the approval phase.	High

Key Stakeholders	Description, Degree of Influence and Type of Interest in Project	Level of Interest
Deputy Santo Domingo West	Congressman of the municipality of Santo Domingo West who assumes and supports a project that influences the improvement of the quality of life of a high percentage of the population he represents. His degree of influence has been high in the approval phase.	High
Deputy Santo Domingo West	Congressman of the municipality of Santo Domingo West who assumes and supports a project that influences the improvement of the quality of life of a high percentage of the population he represents. His degree of influence has been high in the approval phase.	High
Deputy Santo Domingo West	Congressman of the municipality of Santo Domingo West who assumes and supports a project that influences the improvement of the quality of life of a high percentage of the population he represents. His degree of influence has been high in the approval phase.	High
Government of the Province of Santo Domingo	The governor is the main representative of the central government in the province, and his support and assistance are important. However, in the case of Santo Domingo province, the governor's relevance is not similar to that of provinces in the interior of the country because, since the governor's functions are essentially representing of the executive power, these are often not necessary in the case of localities, such as Santo Domingo province, close to the National District, which is where the headquarters of central government is located. Supports the project, its degree of influence is low.	High
Ozama Regional Civil Defense	Its relevance is given by the fact that flooding frequently occurs in the Canal. It supports the project, its interest is high, its influence is low.	High
Santo Domingo West City Hall, Vice Mayor	Although Doña Felipa is currently Deputy Mayor, she is a legendary political and community leader of more than 50 years in the municipality. She intervened in part of the canal problem when she was a was a Member of Parliament, in a solution that is still in good condition. She proposes that one-room houses should not be built in the project because they do not constitute a solution for the families of the sector and promotes overcrowding. She also believes that empty spaces should not be left without a regulated use, to avoid invasions and privatization of public space. Her level of impact on the project is low.	High

Key Stakeholders	Description, Degree of Influence and Type of Interest in Project	Level of Interest
Pedáneo Mayor of El Libertador de Herrera	For the mayor, it is essential to finish the project, especially what was left unfinished in Phase I. The community supports the project, although there is a lot of mistrust, because there have been many years of waiting. That is why it is important to report on progress and problems, and that information is not kept in some areas. Low level of influence.	High
Juan Bosch Elementary School, Herrera, Principal	Prior to Phase I, the school was in a rented wooden building. The school is now located on the old course of the canal on Anacaona Street. However, the slopes of Phase I of the project have caused infestations of cockroaches and other vermin to invade the area and the school. The occupation of public spaces makes it difficult for children to use the few sidewalks and there are many accidents for that reason. It is important for the authorities to regulate. Their level of influence is low.	High
Vedrunas Basic School, Herrera, Director	A significant portion of the school population they serve is affected by flooding and pollution from the unfinished Phase I Project. They consider it important to preserve public spaces for community use and to avoid invasions that privatize these new spaces, making community life even more difficult. Their level of incidence is low.	High
Public Health Area VII	It is the managing body of the health policy in the municipality, so the role it can play in integral solutions linked to the project is vital. It has a low degree of incidence.	High
General Directorate of Cadastre	Its main function is to carry out the inventory of all the country's real estate in its physical, economic and legal aspects. It is a relevant actor in the real estate appraisal process. Its incidence is high.	High
Economic Stakeholders		
Herrera Industrial Association	The relevance of this association transcends the scope of the municipality; however, it is historically linked to it. Its past president is the current senator of the province of Santo Domingo. In addition, due to its proximity, a part of the workers of these industries reside in the municipality and some of the effects of the execution of the project, such as its effect on the roads, will have a positive influence. It favors the project. Its degree of influence is low	High
El Primo Companies, Buenos Aires, Herrera, President	He is very interested in the project; he believes it is very important for the community. Concerned about the amount of plastic of the so-called "fon", which appears in the canal, he understands its origin may be from companies that are in the upper part, he believes it is necessary to regulate. He understands that the project should invest in social issues, community sanitation, education. Contributes to improve the waste collection system. Helps the community generate income. His degree of impact is low.	High

Communities affected by the Current Situation of the Canal

The people affected by physical and economic displacement and the beneficiaries of the sanitation works in the communities located in the vicinity of the canals represent the most relevant stakeholders of the Guajimía Canal and its tributaries sanitation project; they are the ones who suffer from the current situation and therefore have the greatest interest in the successful implementation of the project.

As indicated, this project directly impacts the entire urban area of the municipality of Santo Domingo West, because the Guajimía Canal and its tributaries (Las Caobas, Villa Aura, Buenos Aires, El Indio and Ureña) run through the entire area, affecting different aspects (sanitation, health, education, roads, vulnerability to atmospheric phenomena, among others) of the lives of the inhabitants of the municipality.

Within the neighborhoods that are directly impacted, the project will impact population because of the need of remove land, clean the canals and relocate population. These impacts will occur in the neighborhoods of Buenos Aires, Duarte (Canal Buenos Aires), Herrera (Indio Derecho), Engombe (Canal Ureña) and Las Caobas (canals Las Caobas and Villa Aura). In other neighborhoods such as La Rosa, Ciudad Agraria, La Altagracia and Santo Domingo Country Club (El Café), there will be no direct relocation of families and economic units, but they will be directly influenced by the sanitation works.

Although the interest related to the project may be as diverse as the population that inhabits the territory, it is pertinent to distinguish some of them, especially those that have potential of generating conflicts. Among these, the following can be mentioned:

- Interests associated with family units residing in their own unitary structure housing. These are the cases of families residing in individual houses of which they are the owners.
- Interests associated with family units residing in their own apartments.
- Interests associated with family units residing as tenants, who are sometimes threatened by landlords to evict them from their homes and assume the social benefits that would otherwise go to tenant.
- Interests associated with homeowners who do not reside in their homes.
- Interest associated with business units in owned properties.
- Interest associated with economic units in leased properties.
- Interests associated with economic units within the home.
- Interests associated with persons involved in real estate inheritance litigation.

Civil Society Organizations

Civil society organizations (CSOs) are associative forms around which citizens organize themselves to achieve certain objectives, whether particular or general. This category includes both NGOs and community-based organizations.

The importance of these organizations lies in their role in strengthening the social fabric of a community. They can be issue-oriented depending on the objectives that give rise to them, including educational, scientific, sanitation, gender, generational, community development, promotion of rights, etc.

Because of their strong presence in the study area and their active involvement as key actors in the sanitation of the Guajimía Canal and its tributaries, it is pertinent to particularly describe the neighborhood councils.

Neighborhood Councils

In the Dominican Republic, neighborhood councils are the main forms of association aimed at promoting community participation in problem solving and meeting needs. Problems related to environmental quality, such

as waste disposal, pollution and the use of public places are among the issues associated with this type of organization.

They collaborate with municipal authorities in the supervision of construction sites, citizen education, environmental sanitation services, preventive health, cleaning, planning, care and use of public spaces.

Although neighborhood councils are not included in the provisions on community participation of Law No. 176-07, on the National District and the municipalities, it is through these organizations that this participation has mostly become effective in most of the municipalities of the Dominican Republic.

The first manifestations of these organizations can be found in the municipal administration of the National District, during the period 1978-1982, under the direction of the late Dr. Pedro Franco Badía, who a month after being sworn in as trustee (today mayor) of the National District, swore in the first board of directors of a neighborhood council, which was the Neighborhood Council of the Buenos Aires de Herrera neighborhood, a neighborhood that then belonged to the National District.

From that moment on, the neighborhood councils began to spread throughout the national territory, becoming interlocutors of many municipal authorities on behalf of the communities where they operate.

There are cases, such as the City Council of the National District and other localities in the country, in which the neighborhood councils have reached such a level of institutionality, that some of them have drawn up regulations assigning to the neighborhood councils powers that are contemplated in Law 176-07 on Municipalities, for instance;

In the case of the National District Regulations, its objectives include the following:

"To encourage the organized community to contribute with the municipal authorities in the supervision of the construction of works and the services of the cabildo to the sector, in the programs of citizen education, environmental and neighborhood sanitation, preventive health, hygiene, urban planning and care and use of public spaces."

“To integrate the community in the preparation of the participatory budget of the City Council, in relation to works and services of the sector.”

“That the community participates through its representatives in the activities of the Community Council of the sector". (1) Regulations of the Neighborhood Council of the National District, May 2008.

As can be seen, these are powers contemplated in the provisions on community participation contemplated in Law 176-07.”

The fact that neighborhood councils are perceived positively in the communities studied may contribute to the need for neighborhood councils to play a role beyond that of channeling community demands.

Las Caobas Community House of Justice

Although some social organisation are interested in participating in this analysis to help certain sectors, such as the disabled and others, it is important to highlight the role that the Casa Comunitaria de Justicia de Las Caobas can play in the project, due to its level of institutional development and service to the community.

This entity is dedicated to the mediation of conflicts, to the education of citizens for the proper management of their duties and citizens rights. It has offered to contribute to the education and training of families in relation to their economic rights. And, in this way, to help prevent undesirable behavior of parents who leave their family in distress, by selling the goods they receive. This is a problem that the Community House frequently handles. It offers its collaboration to the Project.

5.2.3.1 *Public Institutional Stakeholders*

In the Dominican Republic, the different public entities that provide services aimed at responding to health, education and sanitation needs are the National Health Service, the Ministry of Education, the municipal councils and the local aqueduct and sewerage corporations or, in failing that, the National Institute of Drinking Water and Sewerage (INAPA).

Both the National Health Service and the Ministry of Education report directly to the central government, while the local aqueduct and sewage corporations are decentralized bodies and the municipalities are autonomous local authorities.

The **Metropolitan Regional Health Service** is the instance of the National Health Service to which the municipality of Santo Domingo West belongs to.

To this instance are attached the Municipal Hospital of Engombe, the Municipal Hospital Las Caobas and the Regional Hospital Marcelino Vélez, located in the urban area of the municipality. There are also primary healthcare centers, located in different neighborhoods of the urban area and sections of the rural area.

Educational District 15-05 is the regional entity of the Ministry of Education that coordinates educational centers in the municipality of Santo Domingo West. It has 120 public and 272 private education centers.

The **Municipal Council of West Santo Domingo** is the public institution that is responsible for providing environmental sanitation services, especially in relation to the collection and disposal of solid waste, preventive health, sanitation, planning, care and use of public spaces throughout the urban and rural areas of the municipality of West Santo Domingo.

According to its Municipal Development Plan 2016-2020, the City council of Santo Domingo West has an administrative structure made up of 2,092 employees, being its last executed budget greater than RD$1,007 million pesos, of which approximately 30 million is dedicated to the municipal participatory budget.

In addition to fulfilling its main function related to the municipality's sanitation, the municipality develops various programs, including gender violence prevention, and has a women's assistance department with ten (10) employees.

The **Santo Domingo Aqueduct and Sewer Corporation (CAASD)** is a public service entity that constitutes, together with the municipality and the communities of the neighborhoods involved, the main actors of this project. In its digital portal, the CAASD defines itself as "... an autonomous public service institution, whose main objective is to develop and implement a drinking water supply plan and the collection, treatment and disposal of wastewater in the city of Santo Domingo and some surrounding towns, being in charge of the administration, marketing, maintenance, operation and expansion of the aqueduct and sewerage systems in its area of influence".

The **Ministry of Environment and Natural Resources** is the public entity responsible for developing, implementing and supervising national policies on environment and natural resources. It was created by General Law 64-00, of 2000, on Environment and Natural Resources.

Among the various functions assigned to it by law that gave rise to it, the following are particularly relevant to the Stormwater and Sanitation Project of the Guajimía Canal and its tributaries:

- Seek the progressive improvement of the management, administration and regulation of soil, air, and water pollution, for the conservation and improvement of environmental quality.
- Develop standards, review existing ones, and monitor the effective implementation of legislation to ensure the conservation and sustainable use of natural resources and improve the quality of the environment.
- Guide, promote and stimulate in private institutions, community and non-governmental organizations, the activities of preservation, restoration, conservation and sustainable use of the environment, as well as the

protection of natural resources, adapting their activities to the policies, objectives and goals envisaged for environment and natural resources.

- Promote the integration of civil society and community organizations into plans, programs and projects aimed at preserving and improving the environment.
- Control and prevent environmental pollution at emission sources, establish environmental standards and general environmental regulations, to which human settlements, mining, industrial, transportation and tourism activities must be subjected; and in general, any service or activity that may generate, directly or indirectly, environmental damage.
- Evaluate, monitor and supervise environmental risk factors and those that may influence the occurrence of natural disasters and directly execute or in coordination with other relevant institutions, actions aiming at them their consequences.

The **Civil Defense** is an institutional actor whose function is defined by Law 147-02 on Risk Management. Its main objective is to guarantee the safety of the population against events caused by floods, earthquakes, storms, hurricanes, fires, shortages or deficient distribution of material supplies, and others. In other words, it oversees the development of actions aimed at guaranteeing the well-being of the population, that is, the safeguarding of life and property in circumstances of disasters. Although as an institution it has a public character, it is closely linked to civil society organizations through the creation of local volunteer committees. The municipality of Santo Domingo has a structure made up of 252 volunteers, distributed in its neighborhoods, especially in those located in the surroundings of the Guajimía Canal and its tributaries, which are the most frequently exposed to flooding disasters.

The **National Housing Institute (INVI)** is the governing and regulating institution of the housing sector in the Dominican State, created by Law No. 5892 of 1962. It is autonomous, although it is subject to the provisions of this Law and the regulations issued by the Executive. Its purpose is to provide solutions for housing deficit in the country through the construction of social housing.

The **Executing Unit for the Redevelopment of Neighborhoods and the Environment (URBE)**

Having as a precedent the Decree 201-14, of 2014, which created the Executing Unit for the Readjustment of La Barquita and Surroundings, its scope of action grew with the Decree 192-21. Its main function is the resettlement of irregular human settlements that are highly overcrowded and exposed to flood risks

5.2.4 Stakeholder Information and Consultation

This section lists the activities carried out to inform the communities about the implementation of the project, as well as the consultation process (interviews and focus groups) with relevant project stakeholders.

5.3 Activities Carried Out for the Phase II Proposal

For the realization of the Environmental and Social Assessment Study and the Phase II Resettlement Action Plan , between the end of 2007 and the beginning of 2008 several consultation activities were carried out with the potentially affected population, to inform about the project and the compensation measures, in addition to responding to the concerns they had.

Part of the consultations were addressed to the general population, who resided in the canals, for which three meetings were held. Another meeting was held with community leaders from the project's area of influence.

As Phase I of the Project was ongoing, work was done through mechanisms such as the Social Office, which became a means to provide information on this new Phase II on a permanent basis.

Since then, and until the present time, the community has had no new information about the project, which is why disbelief prevails when they hear about Phase II, although it is the desire of most of the residents that the project concludes what was once started.

5.3.1 Presentation of the Project by the CAASD

The CAASD, as the entity promoting the Project, announced to the residents the resumption of the studies for Phase II in three of the critical points of the Guajimía canal, where its general director, Eng. Felipe Subervi, answered some questions from the media and the residents.

On the same day, May 5, 2021 in the afternoon, a meeting was held at the premises of the Sociedad de Socorro Ciudadanos Unidos, located in the Duarte neighborhood, in order to provide more details to the residents about the project and respond to their concerns, by CAASD and AECOM-EMPACA. A transcript of the presentation to the community in Barrio Duarte is presented in Annex 3.2.

Subsequently, another meeting was held at the Buenos Aires de Herrera Mutual Aid Society on June 17, with another group of residents and community leaders from the project's impact area. A transcript of the presentation to the community in Buenos Aires de Herrera is presented in Annex 3.3.

5.3.2 Consultation with Key Stakeholders

5.3.2.1 *Individual and Group Interviews*

For the stakeholder consultation, 30 individual interviews and 8 group interviews were conducted with key institutional and organizational stakeholders for the project, which are detailed in Table 5-2 below.

For civil society stakeholders, especially neighborhood councils in the project's area of influence and the private sector, the main concerns and suggestions are the following:

i) That housing units should be delivered to families affected by the project.
j) That the work should be continued where Phase I of the Project left off, that the unfinished canals should be completed.
k) The right of the women and children to own the property received should be guaranteed, compared to the cases of some parents who individually dispose of these assets.
l) Social investment is made in educating families about their duties and rights.
m) Improve the solid waste collection system in the municipality, to prevent some residents from breaking the canal and continue to throw garbage into it.
n) Necessary measures should be taken to avoid the occupation of the new public spaces created by the project, as seen in Phase I, privatizing the use of spaces and hindering the life of the community.
o) It is suggested to avoid the construction of one-bedroom housing, as they will contribute to overcrowding, incentivize the sale of apartments by families that do not fit in them and are counterproductive for the purposes of family development.
p) There is a high level of concern among tenants in the Project's impact area, due to the traditional behavior of some landlords to forcibly evict them to receive the benefits that would otherwise be given to them.

For the state's institutional stakeholders, the interests are diverse, although all agree on the importance of the project. The CAASD is leading this initiative. However, as in the previous experience of Phase I, without strong support from other institutions, especially the Municipality of West Santo Domingo and other institutions that can add technical and professional capacities, such as the Vice-Ministry of Territorial Planning and Development, INVI and URBE, the occupation of public spaces and other undesired consequences for the majority of the population observed previously could be repeated.

Annex 3.4 presents the Stakeholder Interview Guides.

Table 5-2: List of Annexes with Transcripts of some of the Institutional and Civil Society Stakeholders Interviewed

Annex Number	Organization/Institution	Person interviewed	Function
3.5	CAASD	Juan Francisco Campusano	Sub-director
3.6	Municipality of Santo Domingo West	José Andújar	Mayor
3.7	Municipality of Santo Domingo West	Felipa Gómez	Deputy Mayor
3.8	Vice-Ministry of Land Management	Domingo Matías	Deputy Mayor
3.9	Juan Bosch Elementary school	Antonia Castillo	Director
3.10	Básica Vedrunas School, Herrera, Principal	Belkis Hernández	Director
3.11	Public Health Area VII	Dr. Luis Espinal	Director
3.12	Block of Neighborhood Councils of the Guajimía canal and its tributaries	Ángel Fortuna, Roberto Báez	President and vice-president
3.13	Neighborhood Council Libertador de Herrera	Juan Urbáez	President
3.14	Neighborhood Council Las Caobas	Fausto Miranda	President
3.15	Neighborhood Council Ciudad Agraria (Manoguayabo)	Rubén Ramírez	President
3.16	Pedáneo Mayor of El Libertador de Herrera	Cristino Collado	Pedáneo Mayor of El Libertador de Herrera
3.17	Neighborhood Council La Rosa	David Cruz	President
3.18	Neighborhood Council Holguín-La Rosa	Esther Villanueva	President
3.19	Neighborhood Council La Nueva Rosa	Samuel Carrasco	President
3.20	Neighborhood Council El Café	Tomás Aquino	President
3.21	Dominican Association of Persons with Physical-Motor Disabilities (ASODIFIMO)	María Leonidas Recarey y Luz Manuela Reyes	Executive director
3.22	Community House of Justice, Las Caobas	Carmen Victoriano	Manager
3.23	El Primo Companies, Buenos Aires, Herrera	Teodoro Adón	President
3.24	Living with Dignity Foundation	Dra. Ana Lora	Director
3.25	Evangelical Church, Loyola, El Abanico de Herrera	Maritza Agramonte	Pastor
3.26	Catholic Church	Damaris Bonilla	--
3.27	Affected by the Guajimía Canal	Erika María Bierd Aracena	--

5.3.2.2 *Consultation through the Applied Survey*

On May 13, 14 and 15 of 2021, a survey was conducted among 393 residents living in the Project's impact area to gather their suggestions and opinions on Phase II of the Project. As expected, all of the respondents favored the project. However, some of their concerns are similar to those expressed by the social organizations:

g) That the garbage collection system in the municipality should be improved.
h) That Phase 1 should be concluded. That social investment should be made in the Project, by educating and accompanying the population.
i) That the treatment plant should be built.
j) That families located on the banks of the canal should be relocated.
k) That the spaces freed by the Project for public use should be preserved.

Most of these responsibilities correspond to both the CAASD and the Municipal Council. Therefore, a strong institutional alliance is required to meet these demands.

5.3.2.3 *Focus Groups*

As part of the consultation process, four focus groups were conducted. The first two on June 11, 2021 with families from the Guajimía I and Guajimía II housing developments, which were resettled as part of Phase I of the project. The objective was to address the experiences in the relocation process, with the aim of learning from these experiences in order to replicate the positive elements and correct the mistakes made. In Annex 3.28, the Guidelines for focus group with potential beneficiaries are presented.

Subsequently, on July 6, 2021, two more focus groups were held, this time with heads of families in the areas affected of this second project phase. One of these focus groups was held with women heads of household in the affected area of the Indio Derecho canal and the second with heads of families of both sexes, in the Buenos Aires canal. The objectives of these meetings were to determine the perception of families in the affected area about how the relocation process should be conducted, their expectations and recommendations, as well as an evaluation of the census process carried out.

Table 5-3 lists the focus groups conducted, referring to the Annexes where the respective transcripts can be found.

Table 5-3: Focus Groups Conducted as part of the Consultation Process

Focus Group	Location	Date	Annex
First focus group	Residential Guajimía I	11-6-21	3.29
Second focus group	Residential Guajimía II	11-6-21	3.30
Third focus group	Libertador de Herrera	6-7-21	3.31
Fourth focus group	Buenos Aires	6-7-21	3.32

The information obtained by means of these focus groups served mainly as a resource for triangulation of the information obtained through the interviews and surveys, highlighting the following:

- The interviewed expect the relocation will benefit families really affected by the project, demanding to apply measures to avoid that new houses are delivered with favoritism to people who do not currently reside in the affected area.
- Consider the opinions of the affected people during housing design, avoiding errors such as those found in the Guajimía I and II buildings, where balconies were built for the bedrooms and not for the living rooms.
- Avoid the construction of single-room houses.
- Concern that tenants in the affected area will be evicted by landlords so they can receive the benefits otherwise owed to the tenants.

- Need for civic education of people that will be relocated and definition of rules of coexistence in the buildings.
- Housing units should be built close to the places where they currently reside so as not to affect people who have their livelihoods in the same neighborhood.
- To provide housing units on the first floor to those heads of households who have businesses in their own homes.

6. ENVIRONMENTAL AND SOCIAL BASELINE

This chapter outline the main physical, biological, socioeconomic, health and labour characteristics of the project area.

6.1 Physical Baseline

The findings of the physical baseline of the ESIA conducted in 2008 were updated. It is important to note that climate change and GHG emissions, which were not included in the first ESIA, were added to the current ESIA.

6.1.1 General Methodology

Methodologies used for describing the physical baseline are briefly presented at the beginning of each sub-section. The specialists involved in the field surveys were equipped with is a high-sensibility GARMIN personal GPS, (model GPSMAP 64) and with a GLONASS receiver fitted with a Quadrifilar Helix antenna (Photo 9 in Annex 5). All sampling sites were georeferenced with UTM coordinates of the WGS84 system in zone 19 of the northern hemisphere. This georeferencing method was also applied to the cartographic sheets that were originally made with NAD 27 datum.

6.1.2 Geology

6.1.2.1 *Methodology*

The description of the geological characteristics of the region is based on reports from the Geothematic Mapping Program of the Dominican Republic and on geological maps from the National Geological Service (scale 1: 250,000). A stratigraphic column was drawn for the region to describe the vertical location of rock units and the tectonics.

The description of the geological characteristics of the project area was based on geological maps (scale 1:50,000) from the National Geological Service (sheets San Cristóbal 6171-II and Santo Domingo 6271-III) and their respective explanatory note. The lithological characteristics at that l scale is useful to identify active geomorphological processes in the project area.

The maps representing the regional and local geology were drawn at the 1:200,000 and 1:50,000 scale, respectively.

6.1.2.2 *Regional Geology*

Only traces of the most recent episodes of the evolution of Hispaniola are visible on the exposed rocks at the surface. Below the surface, materials dated from the origins of the island (more than 130 million years) and are related to the evolution of the Caribbean tectonics plate, from its beginning as a primitive arc of islands, to its oblique collision with the North American tectonics plate and its translation movement along transcurrent faults at the plates boundary.

The materials from the Pliocene and Pleistocene are the fundamental constituent of the Caribbean coastal plain, whose outcrops near the edges of the plain show a paleo-relief modeled on Paleogene sedimentary rocks and, especially, on igneous and metamorphic rocks that form the substratum of the intensely deformed Eastern and Central mountain ranges. The thickness of this Plio-Pleistocene massif in unknown because its base has not been found s in the project area but according to estimate, it is probably between 100 and 200 m. This massif includes three geological formations (Fm.) described as:

- Yanigua Fm. is represented by a monotonous succession of marls deposited in a lagoon environment. It covers a larger area in the northern sector of the Caribbean coastal plain. This formation is attributed to the Pliocene-Lower Pleistocene. Towards the surrounding reliefs it intercalates with detrital layers, while towards the south of the Caribbean coastal plain, there is a progressive increase in the calcareous intercalations, giving way to the reef limestones of the Los Haitises Fm.

- Los Haitises Fm. is a 3 to 4 km wide strip located at the south of the previous geological formation (Yanigua) and is also attributed to the Pliocene-Lower Pleistocene. It is a calcareous formation of reef origin, which has a very characteristic appearance due to the eustatic changes and intense chemical weathering processes active in the region.

- La Isabela Fm. has a staggered morphology and is located between the previous geological formation (Los Haitises) and the Caribbean Sea. This formation is attributed to the Pleistocene. This massif is represented by reef limestones deposited by the migration of the coastline to the south.

Regional tectonics

The morphology of the Caribbean coastal plain with its staggered continuity parallel to the coastline, maybe the result of the eustatic-sedimentation dynamics and the generalized rise of Hispaniola during the Pliocene-Quaternary, causing the consequent marine retreat. In any case, the uplift of the plain takes place without any fault activity. The uplift did not occur at the same rates in the different formations of the island. In this sense, despite the scarcity of dating in Quaternary materials, the data provided by the marine terraces associated with the formations of La Isabela and Los Haitises, gives us indication on the uplift and its elevation rates. It is estimated that the uplift the terrace south of the study area occurred at an elevation rate of 0.14 mm/year.

This uplift has been maintained since the cessation of deposition of the Los Haitises Fm., i.e., at least since the Lower Pleistocene, but the imprecision about the age of the most recent carbonates within this formation leaves estimates of uplift rates very open. The western sector of the Caribbean coastal plain in the Los Haitises Fm. has the highest elevation point at +70 m.

6.1.2.3 *Local Geology*

The watershed of the Guajimía canal lies over marls and limestones surface materials (Annex 4.18 Geological map of the study area) and have been correlated with the Yanigua Fm the Los Haitises region as described by Brouwer and Brouwer (1982) . (Photo 20 in Annex 5). These rock outcrops are restricted to the northern sector of the study area and to the valley slopes of the Guajimía canal near the 6 de Noviembre highway. The outcrops can't be easily observed due to human activities (Photo 21 in Annex 5). In addition to marls and limestones as the predominant rocks, thin layers of sands and bioclastic and coral deposits have been observed.

The calcareous content increases toward the southern part of the Los Haitises Fm. whereas the marly texture, gradually disappears. The difference between both formations in terms of surface materials changes the dynamics of surface runoff (Figure 6-1).

Figure 6-1: Boundary of the Yanigua and Los Haitises Formations in the Downstream Area of the Guajimía Canal

Petrographically, the limestone layers show bioclastic wackestones-packstones, with a highly variable proportion of allochems (30-70%), matrix (15-60%) and cement (0-45%), occasionally including quartz (<7%), glauconite (<4%) and rock fragments (<2%). Among the textural components, fossils predominate by far with a very high proportion of biomicrites (higher than 95%). Boundstones integrated by corals are occasionally found.

Despite the high degree of human activities, it is possible to observe the exposed Los Haitises Fm. in isolated excavation sites where civil works are carried out. These calcareous massifs can only be observed on the southern slope in the downstream area to the Guajimía canal watershed.

This type of outcrops is typical of this geological formation in the region of Los Haitises, as described by Brouwer and Brouwer (1982). The contrasted geomorphological characteristics of the massif in the Caribbean coastal plain and the Los Haitises region are explained by their different structural evolution and different degree of weathering processes. They appear as a monotonous group of grays to whitish limestones, in which the high fossiliferous content is visible to the naked eye. Generally, they are grouped in layers of several meters, although frequently their stratification is not easily observable. This accentuates their massive and uniform aspect, increased by the remarkable karsification that affects the rock unit at different scales (Photo 22 in Annex 5).

As the geological formation lies just below the surface, we can assume that its minimal thicknesses of 45 m.

Coral constructions, especially branching corals, are the most frequent facies. They may appear fragmented or dispersed in bioclastic sediment with a micritic matrix, or as massive colonies. In addition to corals, which are the main constituent, there is an abundance of fossiliferous species that includes red algae, Miliolids, Nummulitids, Bivalves, Gastropods, Bryozoans, Ostracods and spicules of Echinoderms. In any case, the presence of Acropora cervicornis, A. palmata and Stylophora in different locations on the massif along the Caribbean coastal plain, narrows the age to the Lower Pliocene-Pleistocene, without discarding the possibility that its base date from the Upper Miocene (Braga, 2010).

Finally, La Isabela Fm. represented by reef limestones is located on the Upper Platform and Lower Platform of the Middle-Upper Pleistocene (identified by numbers 3 and 5 in the geological map of the study area). The basic difference between the two platforms lies in their morphological arrangement. The older platform, which also presents a higher degree of karsification, is located at elevations of up to +50 m to the south of the study area, with a slight decreasetowards the east to less than +30 m, and limited to the south by a pronounced escarpment,

corresponding to a paleo-cliff that can reach 20 m in height (Photo 23 in Annex 5). In contrast, the highest elevation of the lower platform is inferior to +20 m except at the western end, being limited to the south by the present cliff, with a 5-6 m drop.

Despite the high degree of urbanization of the massif, there are numerous points where quality observations of the characteristics of the La Isabela Fm can be observed, such as the seawall for the lower level and the slope of the Mirador del Sur for the upper level (Photos 24 and 25 in Annex 5). In general, rocks are made of skeletons of coral colonies in life position or more or less overturned, at different degrees of fragmentation, stacked on top of each other. Between the colonies there is an internal sediment of bioclastic calcarenites, composed of coral fragments, algae, mollusks, echinoderms and bryozoans in a micritic matrix. The voids between the corals are not always completely fill when coral skeletons dissolve.

As the base of the La Isabela Fm. has never been observed, we can only infer that its thickness is superior to 20 m. When the formation is exposed to the surface, a certain zonation in the composition of the corals is observed, similar to what can be observed in other areas of the Dominican Republic.

Petrographically, the non-coral masses appear to be made of fossiliferous limestones (biomicrites and biosparites) at various degree of recrystallization. They present diverse textures of bioclastic nature with variable proportions of allochemicals (10-60%), matrix (10-80%) and cement (5-60%). These masses are remains of coral reefs, which are similar to present-day Caribbean reefs.

6.1.3 Geotechnical Characterization

A geotechnical study carried out in February 2005 allowed to determine the nature and bearing capacity of the soils in the restricted study area. Almost 40 exploration wells were drilled to a depth down to 8 m, along the canals of Buenos Aires, El Indio, and La Ureña. In general, the bearing capacity of soils is excellent since it is a least equal to 1.50 kg / cm^2 (about 147 kPa).

6.1.4 Geomorphology

6.1.4.1 *Methodology*

The Atlas of Biodiversity and Natural Resources (MIMARENA, 2012) was used to characterize the geomorphological zones at the regional scale the in These zones were identified by the nature rocks and sediments at the surface observed irregularities and discontinuities, relief forms, structural escarpments and sediment deposits .

The morphological analysis can be carried out from the geomorphostructural or geomorphogenetic approaches. In the geomorphostructural approach, the relief characteristics are mainly determined by the lithology and structural arrangement of the geological substratum.

The relief features in the study area derives from a reef platform established in region X Caribbean coastal plain during the Pliocene and surrounded by region XI Central Cordillera to the north and region XII Intramountain Valleys of the Central Cordillera (Figure 6-2) (Regional geomorphological map).

A morphological profile oriented from south to north, was drawn following the longitudinal axis of the Guajimía Canal. Relief forms are highlighted on this profile as well as the watershed limit and the location of tributary confluences.

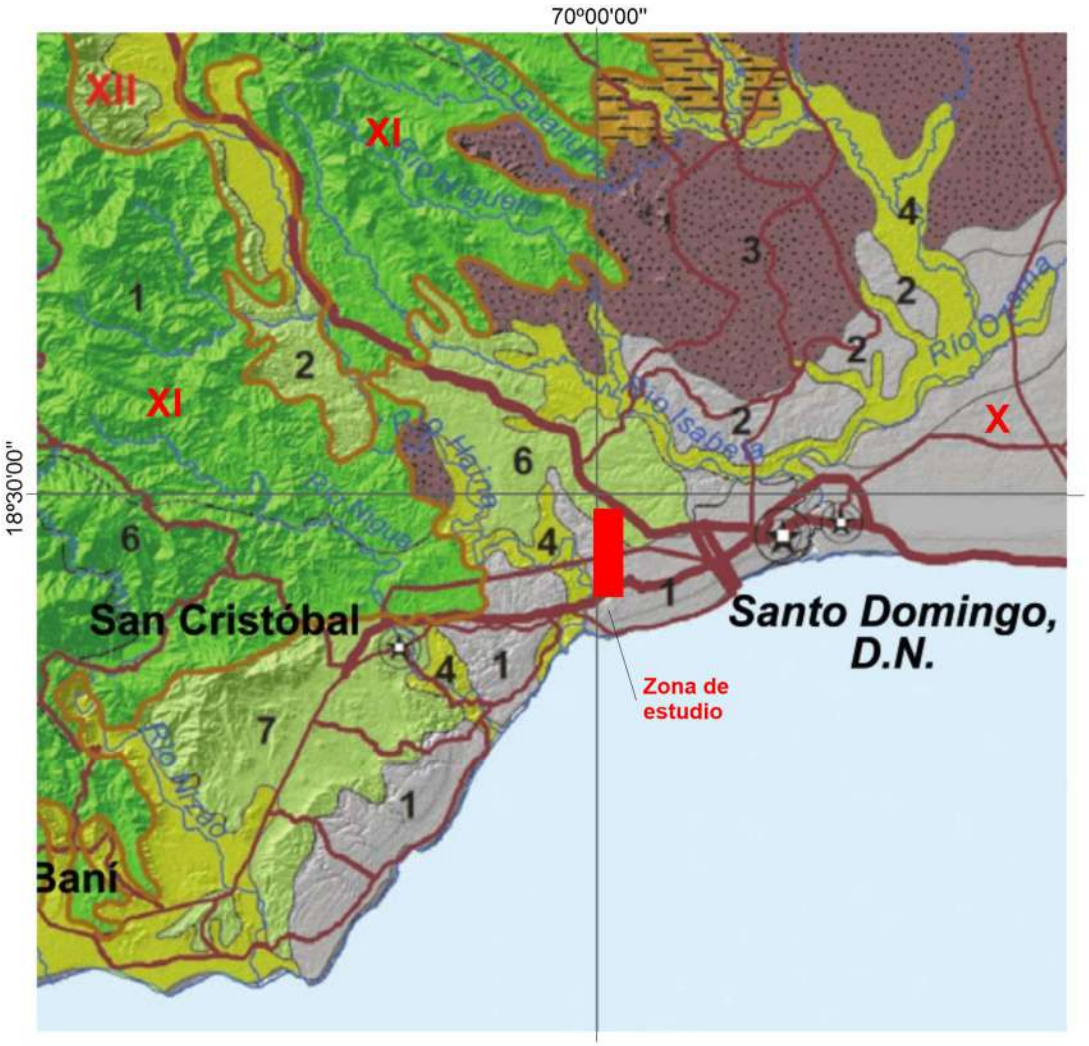
At the local scale, georeferenced markers were used at sites where indicators of erosive processes were observed (such as sedimentation and dragging), and also on escarpments, hillsides of river valleys and karst landforms.

6.1.4.2 *Regional Geomorphology*

The morphology of the area began to take shape during the Pliocene to the south of the current Central Mountain Range that was only a series of islands and islets at that time (Díaz de Neira et al., 2007). The geomorphological evolution of the area is mainly conditioned by the slow platform uplift throughout the Quaternary.

The basic characteristic of the Pliocene platform is the presence of a E-W oriented reef barrier (Los Haitises Fm.) that protected a wide lagoon (Yanigua Fm.) fed by terrigenous discharges from the incipient Central Cordillera. The uplift rate of Hispaniola slowed down during the Lower Pleistocene and at the Middle Pleistocene, the old reef structure acted as barrier between the Caribbean Sea and an inland sea or a large coastal lagoon located to the north. The subsequent marine retreat was accompanied by the southward migration of the reef structures (La Isabela Fm.).

By the Upper Pleistocene, the ancient lagoon had completely emerged, forming a large endorheic zone, while the reef structure migrated to the south forming new deposit made of staggered structures. Recent geomorphological evolution is dominated by the karsification of extensive calcareous surfaces and the erosion of the coastline.



Región X. Llanura Costera del Caribe

Zonas:
1. Calizas planas y arrecifales
2. Topografía ondulada cercana a río
3. Depósitos lacustre-marinos de arcilla
4. Aluviones
6. Calizas y margas
7. Banco de arena

Región XI. Cordillera Central

Zonas:
1. Rocas volcánicas metamorfizadas
6. Tobas y otras rocas volcánicas

Región XII. Valles intramontanos de la Cordillera Central

Zonas:
2. Colinas de granodioritas meteorizadas

Figure 6-2: Regional Geomorphological Map
(taken from the Geomorphological Map of the Atlas of Biodiversity and Natural Resources of the Dominican Republic).

This morphostructural seating was altered by external processes of various nature and intensity. In the study area, stepped surfaces were shaped by marine-fluvial processes while the extensive calcareous outcrops resulted from the karsification process

Structural Morphological Forms

These forms are concentrated on the Pliocene platform and are attributed to differential erosion. They mainly consist of degraded structural surfaces lying on top of calcareous layers from the Los Haitises Fm. and to a lesser extent the Yanigua Fm.

Littoral Marine Morphological Forms.

These coastal marine forms located south of the study area determine the physiognomy of the coastal strip up to the Upper Surface of the Caribbean coastal plain, where its most outstanding elements are the biogenic constructions belonging to the La Isabela Fm., on which elevated abrasion platforms (marine terraces) have developed in a staggered arrangement from the south to the north to the entire region, parallel to the coastline (Photos 16).

On a regional scale, five levels of terraces have been recognized at approximate elevations of +2-3 m, +6-20 m, +20-30 m, +25-50 m and +55 m, although, as already mentioned, the Upper Surface of the Caribbean Coastal Plain (+40-70 m), sculpted over the Los Haitises Fm. (r6), perhaps constitutes the oldest abrasion platform.

The second (r2) and fourth (r4) terraces extend over the entire area, constituting respectively the Lower and Intermediate Surfaces of the Caribbean Coastal Plain (Figure 6-3); while the others terraces (r1, r3 and r5) extend over a part of the area.

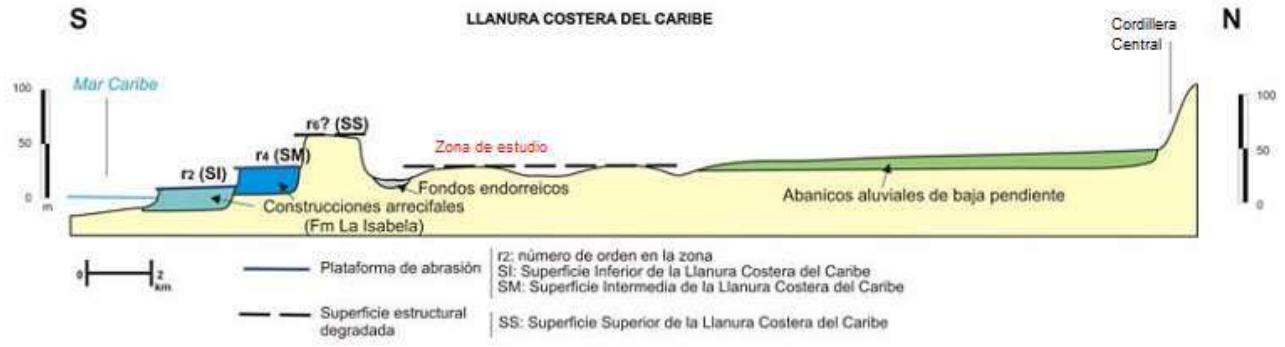


Figure 6-3: Morphological Profile Perpendicular to the Coastline (taken from the explanatory note of the geological map Santo Domingo 6271-III, 1:50,000).

At the front of some of these terrace levels (reef ridges), there are small elevations parallel to the outer edge of the platforms. The platforms are delimited by fossil cliffs, more or less degraded, which appear as vertical escarpments (Photo 17 in Annex 5). The present-day cliffs, although present throughout the area, have a more modest span, with average values close to 6 m and minimal of 2 m.

Quaternary

The Quaternary deposits accumulated after the La Isabela Fm. uplift have a very heterogeneous distribution, with a predominance of fluvial deposits in the Guajimía canal watershed, overlying the Yanigua Fm. in the fluvial plain. On the carbonate materials of the Fms. Los Haitises and La Isabela, there are very scarce deposits filling the karst forms, which together with those of coastal and anthropic origin complete the spectrum of Quaternary materials in the region.

Doline or uvala beds made of Pleistocene-Holocene decalcification clays (identified as number 4 in the geological map of the study area).The deposition of these sediments is observed in very different shapes and sizes, predominantly filling depressions with circular or elliptical karstic dolines, although uvalas are also observed, due to the union of two or more dolines (Photo 26 in Annex 5). In the regional geological map (Annex 4.18), the most relevant forms have been identified in the region, associated with the carbonate massifs of the Fms. Los Haitises and La Isabela, outside the study area. These are red clays of massive aspect generated by the decalcification of calcareous lithological layers due to karsification processes.

Their thickness varies and can exceed 3.0 m. Their lower age is bounded by that of the Los Haitises Fm., so they are framed in the Pleistocene-Holocene.

Terraces represented by Upper Pleistocene reddish gravels and sands (identified in the geological map of the study area). In the entire region, they only lie in the western surroundings of the middle and lower thirds of the Guajimia canal watershed, although their deposit is related to the hydrodynamics of the Haina River. The characteristics of the sediments can not be described in detail because there are no cuts or outcrops but only a few cases where observation was possible. Sediments basically consist of polymictic gravels in sandy and silty matrix of reddish tones, with rounded pebbles of predominant igneous-metamorphic composition, whose diameter is frequently between 5 and 10 cm. The thickness of the deposits reaches up to 15 m. Generally, these deposits are overlaid or covered with recent clayey and sandy sediments, associated with fluvial hydrodynamics. As regards to their age, depending on the degree of incision of the local fluvial network, they are attributed to the Upper Pleistocene.

Floodplain represented by Holocene gravels, sands and shales (identified on the geological map of the study area). These deposits have only been described in relation to the Guajimía Canal. They form strips of variable width where polymictic gravels lie, in a sandy matrix, although accumulations of sands and shales are frequent (Photo 27 in Annex 5). Their thickness is difficult to determine because the substrate can not be observed and because of the high degree of anthropism in these plains, but it can reach 5.0 m. Due to their current dynamics, these deposits are included in the Holocene.

Valley bottoms represented by Holocene gravels, sands and shales (identified on the geological map of the study area). In general, these deposits are the main evidence of the sedimentary activity of the current fluvial network, where clays and silts dragged from the loamy massifs predominate, and may include gravels and sands of calcareous composition whose source are Pliocene materials of the Yanigua and Los Haitises Fms. Yanigua and Los Haitises (Photo 28 in Annex 5). Although there are no cuts or excavations to determine its thickness, it undoubtedly varies considerably depending on the runoff sector, the sinuosity of the channels and the flow regime, and can reach up to 5.0 m. Due to their current dynamics, the valley bottoms are assigned to the Holocene.

From the interpretation of the morpho-alignments at regional scale, very much masked by anthropic modifications, two predominant categories were established, which respond to the main distribution of the elements (Figure 6-4). Category A where a series of morphological elements such as fluvio-marine terraces are oriented at 50-60º. The continuity of these alignments is not determinable, although they are not the most relevant in the region. These alignments mark to some extent the erosion processes active in the area and may also be related to karsification in the carbonate rock massifs. Geomorphological elements of Category B are, on the other hand, align at a 140-150º direction with a great continuity. The 90º alignments that are observed occasionally from east to west represent regional deviations of the geological structures. It is important not to discard anthropic alteration, which is important at a regional scale.

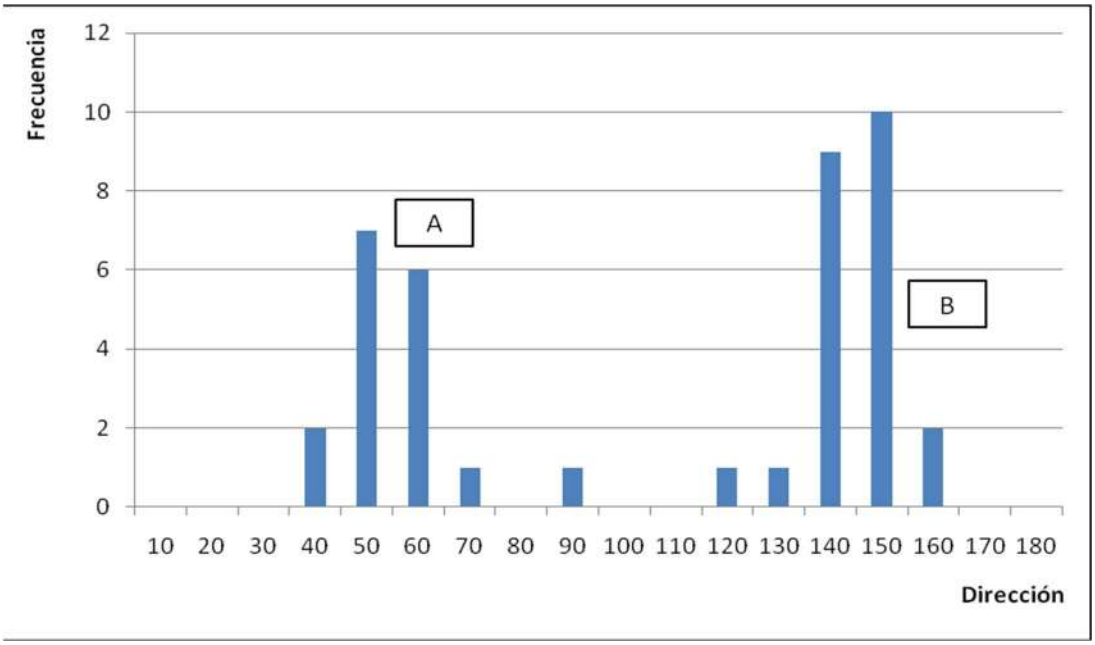


Figure 6-4: Plot of Frequency vs. Direction Morpho alignments for the Zone

6.1.4.3 *Local Geomorphology*

A morphological profile of the Guajimía canal watershed was drawn from south to north, (Annex 4.17 Longitudinal morphological profile of the Guajimía canal, from south to north).

Over the study area, the Guajimía canal has a wide flood plain that has been highly modified by human activities although shallow terraces can be recognized in the main canal with very degraded escarpments. The latter can be close to +20 m higher than the elevation of the current channel (Photo 18 in Annex 5).

The valley bottoms are the main evidence of the sedimentary activity of the current fluvial network. In the study area, they appear generally in the shape of a narrow "U" conditioned by the high anthropogenic activity and coinciding with the low water level channel. However, in the downstream part of the watershed, these valley bottoms have an open "U" shape.

The morphology derived from the Pliocene and the lithology are the main conditioning factors of the geometry of the drainage network. However, the predominant drainage in the outcrop sectors of the Fms. Los Haitises and La Isabela in the southern part is conditioned by infiltration. In the lower Pliocene plain sector, a dendritic pattern is observable.

In addition to the impacts of natural factors on the drainage network, surface runoff .is also influenced by the high level of existing anthropism

<u>Forms originated by Chemical Weathering</u>

The forms can be observed in the southern part of the study area where they developed in limestone outcrops of the Fms. Los Haitises and La Isabela. The dolines are the most outstanding forms, reaching significant dimensions. In any case, the most extended form corresponds to the lapiéz (dogtooth) field, visible throughout the area, although it is very eroded and covered by anthropic modifications.

Finally, there is evidence of a remarkable endokarst development, at the foot of the escarpment of the La Isabela Fm. (Photo 19 in Annex 5).

Quaternary

The Quaternary deposits accumulated after the La Isabela Fm. have a very heterogeneous distribution, with a predominance of fluvial deposits in the Guajimía canal watershed, overlying the Yanigua Fm. in the fluvial plain. Terraces can be observed in the western surroundings of the middle and downstream areas of the watershed of the Guajimía Canal. Floodplain deposits form strips of variable width where polymictic gravels lie in a sandy matrix, although accumulations of sands and shales are frequent (Photo 27 in Annex 5). Finally, valley bottoms are found in the low water channel or the canal of the Guajimía Canal.

6.1.5 Topography

6.1.5.1 *Methodology*

The relief of the study area is mainly a flat-bottomed plain, with hills located on the southern and eastern edges.

A relief profile of the Guajimía canal watershed was drawn using the Santo Domingo 6271-III and San Cristóbal 6171-II topographic sheets and the observations taken during the field surveys (Annexes 4.17 and 4.18). That profile helps evaluate the current topography and highlight the main discontinuities masked by the intense anthropic changes in the area.

In the downstream part of the Guajimía watershed, the profile shows two different altitude zones. The first one has elevations below +20 masl (meters above sea level) and represents the extensive flat plain found in the bottom of the fluvial valley of the Haina river and the Guajimía Canal. The second zone has elevations reaching more than 60 meters masl and plays a structural barrier that borders the river valley to the east and south. The slopes of the escarpments located at the limit of these two zones reach values of up to 20-25%. Figure 6-5 shows a diagram illustrating the difference in elevations between these two zones.

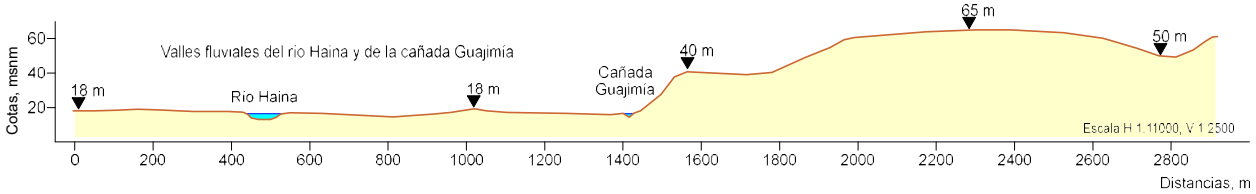


Figure 6-5: Scheme of the relief in a cross-sectional profile of the downstream part of the Guajimía watershed (taken from topographic profile 1).

In the middle of the Guajimía watershed , the general topography has the same features described above, where the fluvial plain has elevations above +20 masl , and the elevated massif to the east has elevations between + 60 and + 65 masl with an area at +73 masl. The main difference with the downstream part of the watershed is the higher presence of isolated mounds. The middle area of the Guajimía watershed has sites with pronounced scarps with slopes up to 15%.

Finally, in the upstream sector of the Guajimía watershed, the relief flattens with slopes reaching less than 3% (Annex 4.8). This zone has elevations close to +60 masl with valleys that can have elevations between + 35 and +40 masl.

In general, the topography of the watershed of the Guajimía Canal varies between slightly wavy and flat. Small peaks with slopes varying from 4 to 16% alternate with valleys whose slopes vary from 0 to 4%. The slopes of the northeast sector of the local study area vary from 0 to 4% while the southwest sector is more rugged. The watershed has slopes that vary from 16 to 32% and even slopes greater than 32% near the Guajimía Canal. The slopes of some parts of the canals have been modified overtime, either due to the construction of buildings or the accumulation of solid waste along the canals.

6.1.6 Soil Characterization

6.1.6.1 *Methodology*

The Atlas of Biodiversity and Natural Resources (MIMARENA 2012) was consulted to characterize the soils at the regional scale. Afterwards, field surveys were carried out in which in-situ analysis of physical characterization and visual description were performed using to the Cuban Standard NC 61:2000.

A total of five surface soil and sediment samples were collected on sites where semi-natural deposits were observed (Photo 10), discarding sites with accumulations of construction materials, debris or solid waste. Table 6-1 describes the reference of the soil and sediment sampling sites (Annex 4.19 Map of location of soil and sediment sampling points).

Table 6-1: Description of Sampled Soils and Sediments with Location

Point	Sampling Sites	Physical Description of Soils and Sediments	UTM Coordinates	
			X	Y
SU-1	Vacant land north of the Villa Aura canal (north of air quality sampling point P11).	Brown silty-clayey soils.	395049	2044023
SU-2	Vacant land west of Guajimía Canal (near air quality sampling point P6).	Brown silty-clayey soils.	394652	2042499
SU-3	In the channel of the Guajimía Canal, at the Orlando Martínez street bridge (near air quality sampling point P6).	Alluvial sediments of the Guajimía Canal bed.	394800	2042484
SU-4	Downstream of the Mexico Street bridge in the Guajimía canal (near water sampling point GU-7).	Alluvial sediments of the Guajimía Canal bed.	395212	2041807
SU-5	In the lower third of the Guajimía Canal watershed, in front of the Café neighborhood (near air quality sampling point P4).	Alluvial sediments of the Guajimía Canal bed.	395074	2039908

Annex 4.11 presents this information in the field sampling reference sheets.

At each site, more than 1 kg of soil/sediment was sampled and collected in a zip lock bag with a tared filter to conserve humidity. In addition to the "in situ" observations, pH, natural moisture and granulometric composition were determined for each sample following the ASTM D422-63, D4959-89 and D4972-89 standards.

6.1.6.2 *Soil Type*

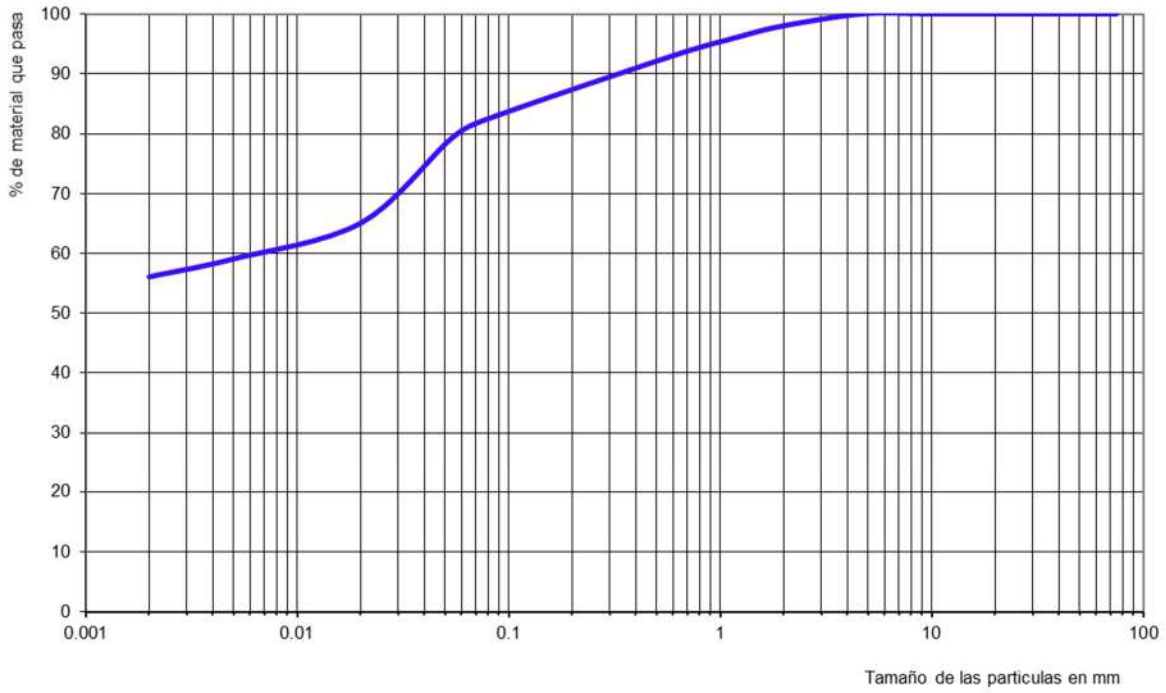
Areas with vegetation were differentiated from the other landuses, using image processing methods. because it was assumed that their growing medium is made of either f edaphic soils, alluvial sediments and/or anthropic materials. Results showed that these areas cover 36.4% of the watershed (Map of distribution of soil types and sediment coverage). The following sections describe them.

Edaphic Soils

According to the Map of Soil Association, soils in the project area are classified either as Recent Alluvial or Association Jalonga – Marmolejos - Caliche (53-70-71). Recent Alluvial soils display weak development of horizons due to the irregularity of action of the agents of the weathering, especially climate and biological factors. Due to these characteristics the formation of the soils of this association is not uniform, and the nature of the profile is determined by the nature of the sediments that were deposited over time. The texture of these soils is predominantly sandy.

Over the Guajimía Canal watershed, two edaphic formations were observed which, interpreted by their agro-productive capacity, can be summarized within classes II and IV according to the OAS classification used in the Atlas of Biodiversity and Natural Resources of the Dominican Republic (MIMARENA, 2012). The paragraphs below described these two classes.

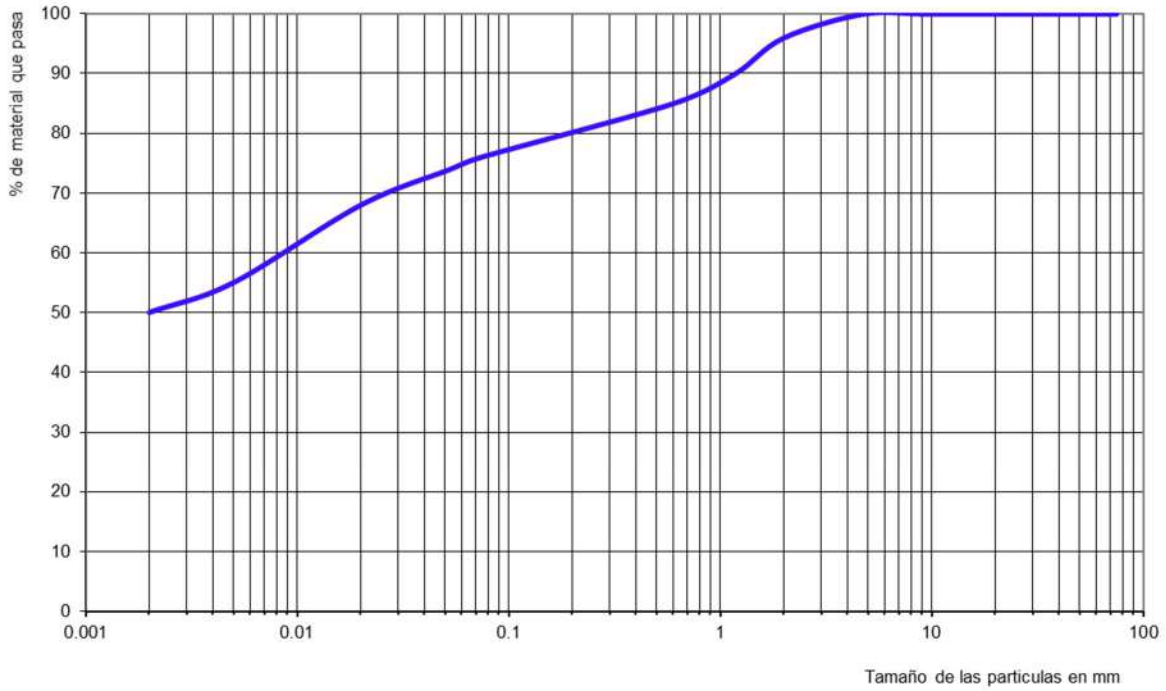
Class II soils are distributed over the intermediate plain where urbanization is intense and currently limited to intervened spaces, but not occupied by urbanization. Occasionally these soils are used for gardening or found in green areas of parks and public spaces. These soils, in several of the sites observed, can be considered as relicts of the natural soil cover in the area, with changes in several of their properties caused by urbanization. In general, the soils are brown, clayey and silty, with a low fraction of gravel in the less modified sites, neutral pH and moderate natural moisture (W). According to these physical parameters, a specific weight (Gs) between 2.68-2.70 g/cm³ is assumed. The s granulometric composition is mainly made of clays and silts with a D60 diameter of 0.007 mm, Figure 6-6 and Photo 29 in Annex 5).



Gravel: 2.00 %	Sand: 19.00 %	Silt: 20.00 %	Clay: 59.00 %
pH: 7.05	W: 18 %	Gs: 2.68-2.70 g/cm³	

Figure 6-6: Average Grain Size Composition for Brown Silty Clayey-clay Soils

Class IV soils are located in the southern and western parts of the massif, covering primary rocks that lie on the upper platform, where there is currently intense urbanization. Despite they are classified with limitations for cultivation, they are found in public spaces and green areas. In general, their physical and chemical properties are similar to those of the previous class II, although their clayey texture is more homogeneous (Figure 6-7and Photo 31 in Annex 5).

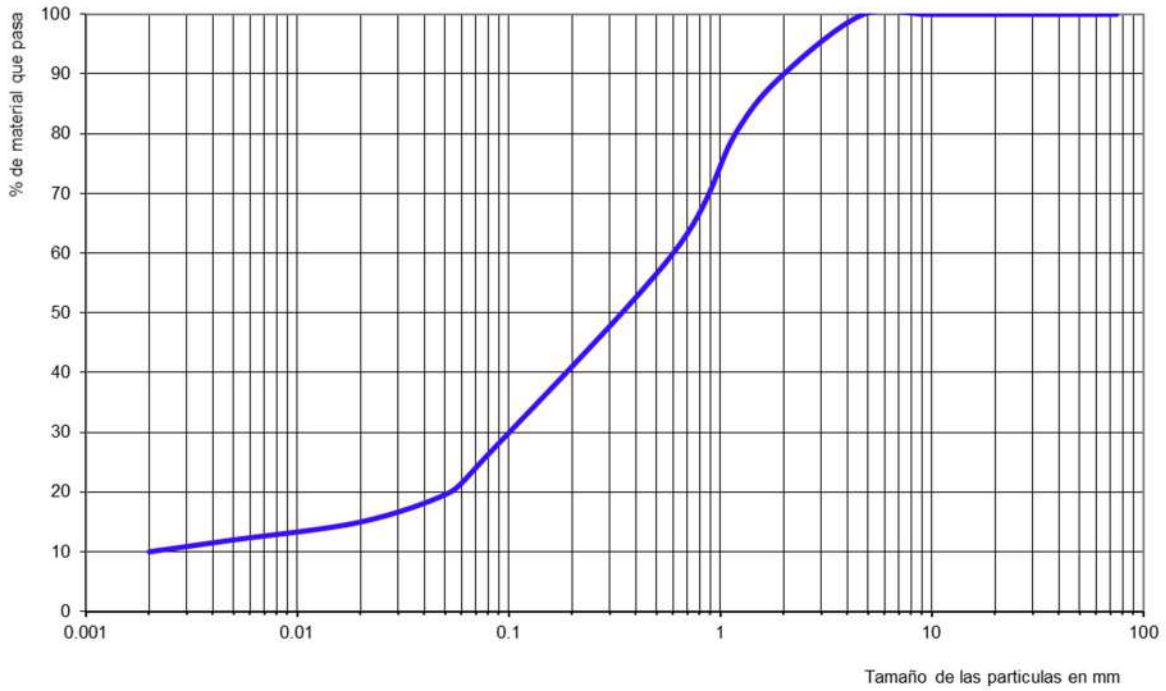


Gravel: 4.00 %	Sand: 22.00 %	Silt: 19.00 %	Clay: 55.00 %
pH: 7.20	W: 22 %	Gs: 2.72 g/cm³	

Figure 6-7: Average Grain-Size Curve of Class IV Soils, Clayey

Alluvial Sediments

Alluvial sediments are distributed in the canals and channels of the Guajimía watershed and they are highly contaminated by materials of anthropic origin. In the past, the deposition process of these sediments had an intense dynamic, but the anthropic modifications of urbanism have recovered these deposits. These sediments have mostly a granular texture and are found in the main canal (Figure 6-8, Photos 32 and 33 in Annex 5).



Gravel: 10.00 %	Sand: 70.00 %	Silt: 8.00 %	Clay: 12.00 %
D_{50}: 0.35 mm	D_{30}: 0.1 mm	D_{60}: 0.6 mm	D_{10}: 0.002 mm

Figure 6-8: Average Grain-Size Curve of Alluvial Sediments

Anthropic materials

Anthropic deposits cover several sectors in the project area such as on the banks of the canals (Photo 34 in Annex 5).

6.1.6.3 *Soil Quality*

The geotechnical study carried out during the first EISA also described the soil quality of samples taken in the materials that will eventually be excavated. No significant PAH contamination was detected but significant presence of manganese in one sample and nickel in another were measured. Finally, three samples showed significant levels of concentration of hydrocarbons derived from the oil (C10-C50).

6.1.7 General Climatology of the Region

6.1.7.1 *Methodology*

The main sources of information for wind (speed and direction), cloudiness, humidity, evaporation, hours of sunshine, and hurricane statistics were found at the ONAMET's Santo Domingo and Las Américas Airport Stations and in the Atlas of Biodiversity and Natural Resources (MIMARENA 2012). Indeed, climate and meteorology were characterized using information available from reliable data with at least 20 years of observation from two meteorological stations in the region (Engombe Station in Haina and the Las Américas Airport in Santo Domingo). These stations are located at a distance of no more than 35 km (Table 6-2).

Table 6-2: Weather Stations as Sources of Information on Meteorological Variables

Station	UTM Coordinates		Observation
	X	Y	
Engombe (3401), Haina	394195	2040291	2 km west of the study area.
Las Americas Airport	428394	2039037	33 km east of the study area.

Information on normal and maximum precipitation, as well as minimum, maximum and average temperatures were found at two closer stations, (Table 6-3).

Table 6-3: ONAMET Weather Stations as Sources of Precipitation and Temperature Data

Station	UTM Coordinates		Observation
	X	Y	
A. Herrera, DN	397934	2042089	2 km east of the study area. Altitude 61 m. Data 1984-2005
Loyola, San Cristóbal	383810	2034792	13 km west of the study area. Altitude 45 m. Data 1991-2020.

Rainfall analyses were made using models appropriate for the Caribbean islands, following the pattern of the distribution of annual averages and based on morphometric criteria. The rainfall data obtained were studied by extracting the maximum monthly and annual precipitation values for each station (Pmax), and analyzing their quality using the outlier method.

6.1.7.2 *Climate Characteristics*

6.1.7.2.1 Air Temperature

Table 6-4 shows the maximum, minimum and mean air temperature data (monthly averages) measured at the Loyola and Herrera stations. A period of 29 years was considered for the Loyola station (1991-2020) and 21 years for the Herrera station (1984-2005). Results show that the average annual temperature is almost 25º C, with minimums around 20º C in February and maximums above 31º C. Data show high correlation at both sites due to the similarity in location regarding the coast and altitude of both stations.

Table 6-4: Maximum, Minimum and Average Temperatures (Monthly Average in ºC) recorded at the Loyola and Herrera Stations.

Source: ONAMET

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Loyola Station													
T max.	29.4	29.6	30.3	30.9	31.1	31.6	32.2	32.5	32.2	31.7	30.6	29.7	30.8
T min.	20.1	20.5	20.9	21.9	22.9	23.6	23.9	23.9	23.3	22.9	22.2	21.0	22.0
T mean	24.6	23.1	25.5	25.7	26.5	26.3	26.6	27.2	26.3	27.2	24.7	24.4	25.6
Herrera Station													
T max.	29.2	29.1	29.6	30.2	30.6	31.2	31.7	31.9	31.7	31.5	30.4	29.6	30.4
T min.	20.5	20.3	20.9	21.9	22.9	23.6	23.5	23.6	23.3	23.1	22.3	21.1	22.1
T mean	24.8	24.7	25.2	26.0	26.7	27.4	27.6	27.7	27.5	27.2	26.3	25.3	26.2

These data are shown in Figure 6-9.

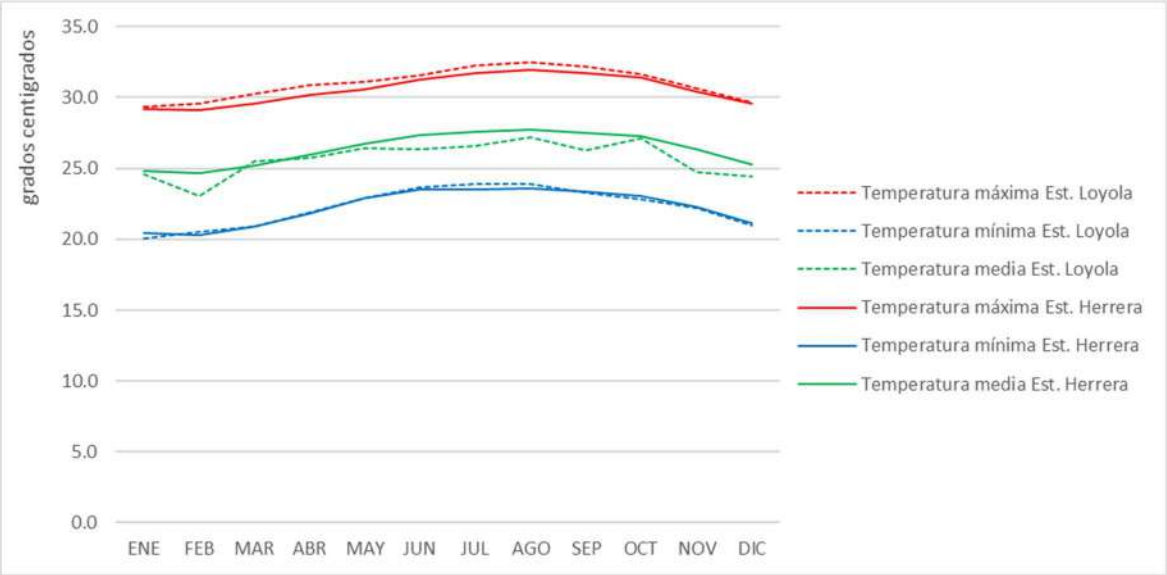


Figure 6-9: Monthly Average Behavior of Maximum, Minimum and Average Temperatures in the Study Area

6.1.7.2.2 Barometric Pressure

Table 6-5 shows the average monthly distribution of barometric pressure measured at the meteorological station of the "Las Americas" Airport in Santo Domingo, during the period 1971-2017. The barometric pressure has very little variation during the year, oscillating between minimum and maximum values in ranges of 4 hPa. According to the records, the maximum values are reported at the beginning of the year with values in the order of 1017 hPa, while the minimum values oscillate in 1013 hPa, generally occurring in the month of October. It is important to consider that these data correspond to normal meteorological conditions, since during the passage of a tropical cyclone the barometric pressure can drop to values below 1000 hPa.

Table 6-5: Average Barometric Pressure Recorded in the Region, in hPa

Months	Average values, hPa
January	1014.3
February	1014.2
March	1013.5
April	1012.3
May	1012.4
June	1013.8
July	1014.3
August	1013.0
September	1011.1
October	1011.1
November	1011.5
December	1013.6
Annual average	**1013.0**

Source: Freemeteo, ONAMET and INDRHI Water Statistics Websites.

6.1.7.2.3 Relative Humidity

Table 6-6 shows the monthly average relative humidity measured at the Santo Domingo station between 1993 and 2014. The average annual relative humidity at this station is almost 83%, with values ranging from 81.2% in March to 84.6% in October.

Table 6-6: Relative Humidity (Monthly Average in %) recorded at the Santo Domingo Station (1993-2014)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Hr	82.5	81.8	81.2	81.5	83.6	83.6	82.9	84.0	82.0	84.6	83.8	83.1	82.9

Source: ONAMET

6.1.7.2.4 Evaporation

Table 6-7 shows the monthly data of evaporation from the free water surface, as well as its annual value at the Santo Domingo station for a period of 25 years. The average evaporation over a year is 1633 mm with monthly values ranging from 104.6 mm in December to 166.3 mm in March.

Table 6-7: Recorded Evaporation, mm.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean	110.4	120.2	166.3	164.5	159.4	150.7	156.6	160.2	144.1	134.0	109.2	104.6	1633.4
Max.	141.2	160.7	195.8	198.0	205.9	192.6	192.4	186.8	175.8	157.1	155.8	154.6	
Min.	83.7	94.8	120.4	137.9	118.0	107.3	115.8	123.0	114.0	113.4	75.7	83.6	

6.1.7.2.5 Cloudiness

The cloudiness data are showed in Table 6-8 and are based on scattered data taken from the Santo Domingo station and reports from other stations in the region. The observed cloudiness barely fluctuates over a year with values ranging between 0.3 and 0.4 okta.

Table 6-8: Observed Cloudiness, Okta

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4

6.1.7.2.6 Sunshine Hours

Table 6-9 shows the hours of sunshine as a monthly total at the Santo Domingo station for the years 1984 to 1995. The total number of sunshine over a year is 2745 hours with monthly values ranging from 221.9 hours in November to 254.3 hours in March. Solar radiation was estimated as the length of the day (time the sun remains above the horizon), which ranges between 11 and 13 hours. Insolation (represented by the number of hours with the sun shining) oscillates between 6.6 and 8.0 hours, with the maximum values in the spring months (March-June).

Table 6-9: Total Monthly Hours of Sunshine recorded at Santo Domingo Station, (1984-1995)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Media	233.2	221.8	254.3	242.6	225.8	217.8	221.6	227.6	217.6	232.0	221.9	229.5	2745.0

Source: ONAMET.

6.1.7.2.7 Precipitation

The spatial distribution of average annual precipitation varies greatly from one region to another, and even within a watershed. In the project region , annual precipitation varies from 1200 to 1600 mm (Figure 6-10).

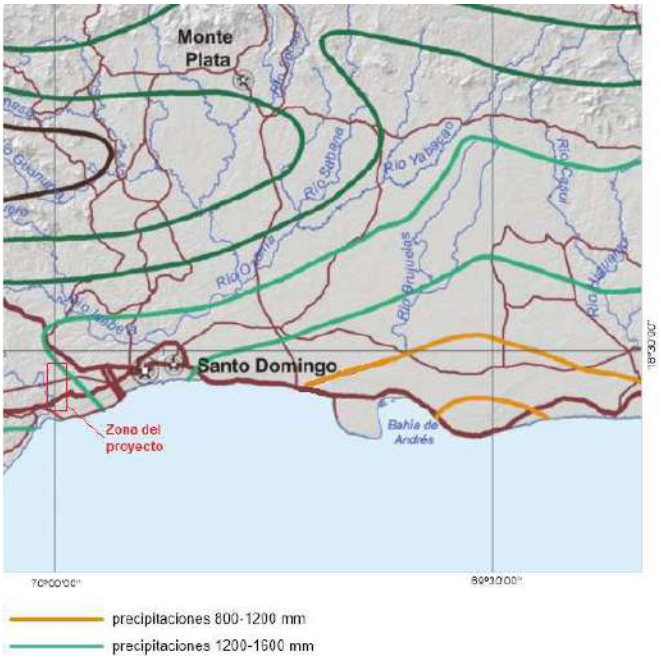


Figure 6-10: Behavior of Mean Annual Precipitation (mm) in the Area (Taken from the Annual Isoietic Map of the Dominican Republic in the Atlas of Biodiversity and Natural Resources).

Table 6-10 shows the total monthly distribution of rainfall at the Santo Domingo and San Cristóbal stations for a 21-year period (with several missing periods). According to these data, the months of August and September are the rainiest, with accumulated rainfall exceeding 200 mm, while the months of February and March have less than 60 mm of rain.

Table 6-10: Precipitation (Monthly Totals in mm) in the Region

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean	68.7	51.3	56.6	80.0	157.1	142.8	169.9	204.8	203.8	196.0	135.0	90.0	1556.1

Source: ONAMET

The number of days with precipitations within a month range from 6.5 days in April to 12.5 days in October (Table 6-11).

Table 6-11 : Days with Rain for the Region

Months	Days with Rain
January	8.3
February	6.8
March	7.0
April	6.5
May	10.5
June	9.3
July	10.8

Months	Days with Rain
August	11.5
September	12.1
October	12.5
November	10.7
December	9.1
Annual sum	**115.1**

6.1.7.2.8 Maximum Daily Rainfall

The maximum daily rainfall in the region can occur at any time of the year due to the hydroclimatic and physiographic characteristics of the territory. Indeed, extreme 24-hour rainfall values generally occur during heavy rains caused by hurricanes or extreme storms, many of which cover larger territories than the project area.

Maximum daily rainfall regime was characterised using values reported at the Loyola (years 1981-2020) and Herrera (years 1984-2005) stations. These values are shown in Table 6-12, Figure 6-11 and Table 6-13, Figure 6-12.

Table 6-12: Maximum 24-Hour Rainfall Values in mm, by Month, recorded at Loyola Station (1981-2020)

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Rain max.
1981	3.7	20.5	12.7	14.5	128.4	71.4	33.5	48.3	42.0	41.0	18.3	10.0	128.4
1982	12.5	24.3	14.3	9.4	117.0	41.3	104.9	20.0	53.5	23.7	-	9.3	117.0
1983	9.4	4.4	27.2	19.5	170.0	58.7	90.2	32.0	78.0	21.8	19.4	37.0	170.0
1984	19.2	20.2	13.3	28.5	44.2	-	-	90.2	51.1	34.7	126.5	27.6	126.5
1985	13.5	14.7	15.4	27.7	88.5	12.4	133.0	41.0	191.0	132.5	68.4	13.6	191.0
1986	15.1	3.0	44.0	57.5	109.0	108.0	28.8	78.0	54.2	-	25.2	15.5	109.0
1987	9.1	93.6	-	23.8	44.1	82.1	25.6	33.3	86.1	36.0	-	159.0	159.0
1988	16.6	18.0	23.5	44.7	18.7	58.0	37.5	80.0	100.0	28.0	73.2	33.2	100.0
1989	28.0	71.0	26.2	25.0	34.9	24.3	58.3	-	37.5	25.5	37.2	5.8	71.0
1990	32.0	25.0	24.0	22.9	7.8	23.5	33.4	18.5	18.0	124.1	36.7	46.2	124.1
1991	12.5	26.6	38.2	29.4	97.8	-	28.3	25.0	102.7	40.5	36.9	20.0	102.7
1992	40.0	23.0	34.0	43.4	47.0	57.9	63.4	50.0	43.7	12.5	34.5	65.0	65.0
1993	68.0	36.6	19.0	36.0	145.5	35.5	59.7	236.2	95.2	42.0	76.5	18.5	236.2
1994	23.0	89.0	45.7	14.5	97.0	10.7	66.0	54.2	95.0	100.0	106.0	29.1	106.0
1995	5.5	33.1	40.0	61.5	48.0	55.0	18.2	147.0	75.0	225.0	24.0	20.5	225.0
1996	10.8	27.7	21.5	75.5	90.0	-	36.2	40.5	64.3	49.5	75.5	20.3	90.0
1997	15.7	-	4.6	4.5	26.2	56.0	40.0	26.0	46.0	26.1	49.5	17.3	56.0
1998	13.0	110.0	50.0	37.6	125.0	53.5	88.0	43.7	-	34.4	43.0	32.5	125.0
1999	22.5	5.2	11.2	42.2	16.7	21.0	70.0	15.8	-	-	-	-	70.0
2000	50.0	15.5	21.0	30.2	49.2	13.8	20.0	26.5	42.8	87.5	25.3	22.5	87.5
2001	5.5	19.1	7.1	16.7	54.0	22.0	58.6	31.8	-	25.1	14.4	46.7	58.6
2002	4.0	2.0	11.0	24.2	49.7	40.0	-	39.2	67.0	55.7	50.0	40.0	67.0
2003	43.0	6.3	27.0	30.7	9.7	38.3	76.5	90.0	38.5	48.0	34.3	131.0	131.0
2004	43.0	14.3	10.0	68.5	154.5	38.7	48.0	39.3	96.2	39.1	50.6	25.1	154.5

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Rain max.
2005	30.3	1.7	4.1	14.8	67.2	74.0	138.5	69.9	30.8	86.8	12.5	12.6	138.5
2006	12.6	20.0	3.2	40.0	74.3	-	68.0	41.7	10.0	32.4	45.5	18.8	74.3
2007	22.3	2.4	9.6	54.3	22.7	13.4	49.5	53.3	52.0	94.4	20.1	124.4	124.4
2008	14.6	14.9	13.4	54.4	36.3	63.2	14.9	160.8	97.9	62.4	40.0	17.9	160.8
2009	65.1	28.3	18.1	12.1	148.5	30.0	158.2	34.8	29.8	16.2	17.9	28.3	158.2
2010	9.7	3.8	1.5	18.7	52.0	-	-	32.9	32.9	64.4	62.7	0.4	64.4
2011	1.7	38.8	7.9	27.0	63.2	30.4	-	89.5	26.6	32.1	16.0	5.3	89.5
2012	14.6	10.0	19.0	64.8	64.7	26.2	30.1	123.4	20.0	76.1	30.1	-	123.4
2013	7.8	28.0	5.3	28.0	54.0	81.0	123.0	22.0	33.0	46.0	44.0	11.0	123.0
2014	21.6	27.4	11.0	12.7	21.8	5.3	38.5	69.9	38.3	8.2	23.9	2.7	69.9
2015	60.4	21.9	13.3	12.7	13.4	26.1	7.2	33.5	19.2	66.3	34.0	62.0	66.3
2016	13.7	20.1	14.2	38.3	49.9	33.1	23.2	68.2	15.6	91.9	67.5	9.6	91.9
2017	14.7	-	-	-	-	-	-	-	-	-	29.0	-	29.0
2018	60.6	17.2	29.7	29.4	70.6	61.4	101.6	22.1	29.5	43.8	25.2	14.7	101.6
2019	12.6	15.8	52.3	42.3	38.3	5.2	23.7	32.5	68.4	20.4	15.8	49.6	68.4
2020	18.4	14.1	17.6	11.8	32.6	-	-	-	-	-	-	-	32.6

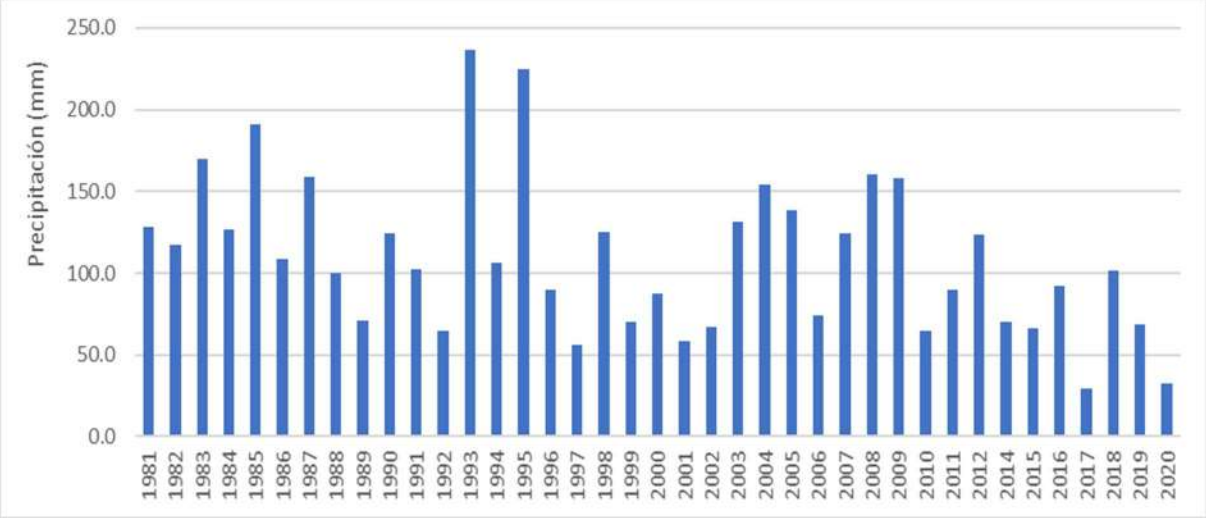


Figure 6-11: Distribution of Rainfall (24-Hour Maxima in mm) recorded at Loyola Station (1981-2020)

Table 6-13: Maximum 24-Hour Rainfall Values in mm, by Month recorded at Herrera Station (1984-2005)

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Rain max.
1984	27.8	24.1	7.8	19.2	33.8	129.5	62.6	40.6	76.7	98.4	5.6	14.3	129.5
1985	20.5	28.9	19.5	15.4	38.6	2.6	46.2	40.7	234.7	112.5	100.8	11.1	234.7
1986	78.5	8.0	26.4	49.2	95.7	115.0	13.0	93.6	48.9	19.0	35.0	24.8	115.0

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Rain max.
1987	5.5	275.4	35.5	34.5	42.5	66.3	44.2	56.1	76.1	25.2	39.6	160.8	275.4
1988	30.0	20.8	50.6	45.8	19.2	53.7	33.3	76.6	114.5	34.5	68.5	42.0	114.5
1989	25.7	136.9	33.5	12.9	29.6	19.0	63.9	47.8	75.6	28.1	46.9	9.9	136.9
1990	23.0	20.5	11.0	10.6	18.5	13.2	49.4	7.6	84.7	96.3	29.9	25.4	96.3
1991	16.8	55.6	41.4	51.0	104.1	15.4	16.6	24.1	103.9	65.7	55.2	10.5	104.1
1992	33.9	18.7	82.9	28.8	74.0	55.0	51.8	22.2	52.6	19.0	48.2	15.6	82.9
1993	86.2	53.7	29.1	20.3	136.1	32.7	43.1	148.1	29.5	41.0	40.8	11.7	148.1
1994	19.1	17.8	40.0	12.3	5.0	12.0	36.1	56.1	83.3	9.3	9.7	30.9	83.3
1995	6.0	40.0	22.3	19.3	30.1	19.3	23.0	226.0	32.6	161.7	34.5	19.8	226.0
1996	63.3	20.7	36.3	57.0	61.1	22.4	36.9	37.4	75.0	45.0	65.4	21.5	75.0
1997	15.6	17.2	33.0	37.0	16.8	44.9	15.1	26.8	35.0	50.1	37.8	17.6	50.1
1998	24.1	89.3	26.8	37.3	72.4	37.6	34.6	51.0	214.7	24.9	44.1	24.0	214.7
1999	51.5	16.4	15.0	6.1	43.3	17.2	44.3	32.9	91.2	67.9	67.4	4.5	91.2
2000	53.1	16.9	29.6	42.4	47.1	15.8	29.6	59.7	39.0	13.7	53.3	13.6	59.7
2001	28.8	21.1	12.3	48.0	78.5	27.3	64.6	57.8	40.0	61.2	5.7	53.2	78.5
2002	6.1	3.7	29.6	63.4	57.6	54.4	53.7	17.8	70.4	60.3	69.0	19.6	70.4
2003	66.2	7.5	46.0	54.5	29.1	59.2	94.6	80.2	48.0	53.4	28.2	110.6	110.6
2004	41.2	10.7	19.0	47.9	175.6	36.2	24.7	27.5	43.9	33.0	37.7	21.4	175.6
2005	25.6	-	1.0	14.4	53.0	78.3	96.2	39.0	20.4	75.5	19.0	32.7	96.2

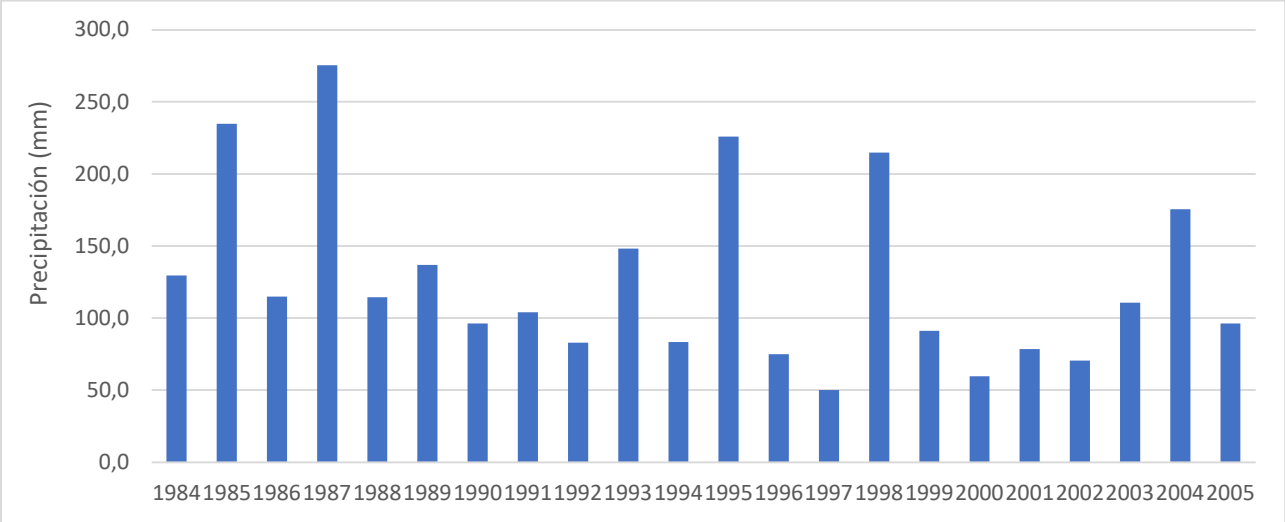


Figure 6-12: Distribution of Rainfall (24-Hour Maxima in mm) recorded at Herrera Station (1984-2005)

The maximum daily rainfall for different return periods (probabilities) over the project area was estimated by applying statistical-hydrological probability processing on data recorded at the Loyola and Herrera stations The results of this processing show that the maximum 24-hour rainfall (corresponding to a return period of 100 years) is 250 and 350 mm at these stations (Figure 6-13).

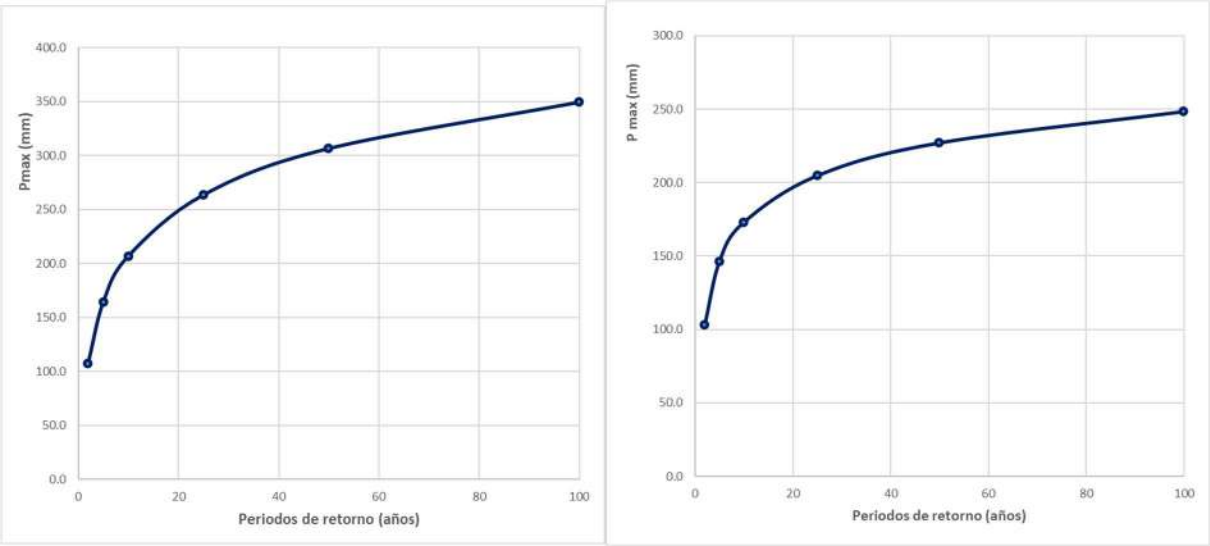


Figure 6-13: Probability Plot (%) of Daily Maximum Precipitation (Pmax) at Reference Stations

Afterwards, these distributions of rainfall recorded at the Herrera and Loyola stations were adjusted to the project area based on their distance from the study area. Finally, the maximum values that can occur for various return times at the project area were estimated (Table 6-14 and Figure 6-14). It is important to note that these maximum daily rainfall values are associated with extreme meteorological events or hurricanes that hit the Caribbean region every year.

Table 6-14: Maximum Daily Rainfall Values for Different Return Times (T) in the Study Area

Catchment	Distance, m		Pmax T= 2 años, mm	Pmax T= 10 años, mm	Pmax T= 50 años, mm	Pmax T= 100 años, mm
	A. Herrera Station	Loyola Station				
Study area (Guajimía Canal)	2467	14382	106.7	205.6	304.2	346.6

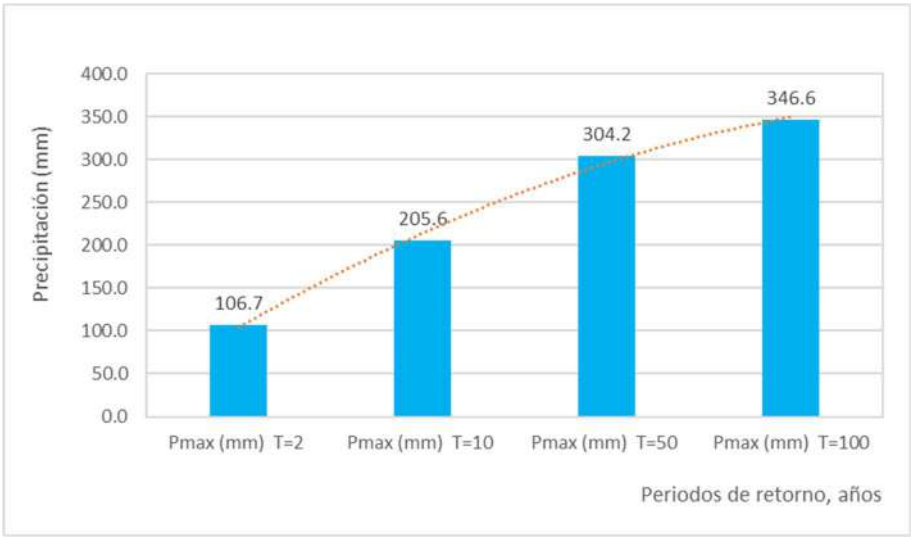


Figure 6-14: Pmax (mm) Graph for the Return Periods T considered in the Study Area

6.1.7.2.9 Wind Direction and Speed

According to various reports from the National Meteorological Office, the normal wind speed in the region ranges mostly between 7 and 11 km/h with the maximum values from November to April, and the minimum from May to October. These average speeds are not considering the conditions that are established with the presence of a tropical cyclone in the Caribbean.

Table 6-15 shows the wind speed values for the Santo Domingo station for a series of data between 1993 and 2012. The average wind speed over a year is 7.8 km/h with monthly values ranging from 7 km/h in June to 9.1 km/h in November.

Table 6-15: Monthly Averages of Wind Speed, km/h

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly mean
1993	--	6.4	6.4	6.3	6.3	6.6	5.9	5.9	5.7	--	--	6.5	--
1994	7.3	--	--	8.5	9.3	--	--	8.1	6.9	--	--	7.7	--
1995	8.5	7.2	8.1	8.8	7.4	2.0	1.7	6.4	7.2	5.2	5.2	5.9	6.1
1996	9.0	4.6	2.7	6.7	4.6	6.4	8.0	6.4	7.0	6.7	7.0	7.6	6.4
1997	7.6	8.3	8.2	7.9	9.2	8.5	7.1	7.1	7.7	7.1	6.6	6.1	7.6
1998	8.6	9.2	9.3	10.4	7.3	7.0	8.3	8.1	11.3	15.2	9.6	9.3	9.5
1999	9.6	9.6	8.3	8.5	8.3	7.6	8.9	7.2	8.5	7.2	8.0	9.3	8.4
2000	6.6	6.9	7.8	7.6	6.9	8.6	7.6	8.2	7.5	7.9	10.6	8.4	7.9
2001	8.0	8.4	7.6	7.9	7.0	7.6	7.1	7.7	7.7	8.7	30.2	8.6	9.7
2002	8.7	8.8	8.8	9.0	7.7	7.8	8.4	7.3	7.3	6.8	7.4	7.8	8.0
2003	7.6	8.2	8.5	8.6	7.7	7.6	8.5	8.7	6.9	7.1	8.5	8.8	8.1
2004	8.3	8.2	9.6	8.1	9.8	8.9	8.0	8.4	8.5	7.4	10.3	8.2	8.6
2005	8.8	9.1	7.8	7.9	7.3	6.9	6.8	5.6	6.3	6.4	7.4	6.5	7.2
2006	6.0	6.4	6.5	5.6	5.8	5.2	5.6	6.2	6.7	7.5	8.4	8.3	6.5
2007	8.5	7.3	8.1	8.3	6.0	6.4	7.0	6.8	5.9	5.9	7.4	8.1	7.1
2008	8.1	8.8	8.5	8.5	7.5	7.7	8.8	8.9	9.0	7.4	7.3	8.3	8.2
2009	8.4	9.2	9.6	7.3	7.3	7.6	8.4	7.7	7.4	7.2	6.1	7.2	7.8
2010	7.6	8.6	8.8	9.1	7.7	6.3	6.9	6.8	7.5	6.8	9.4	9.3	7.9
2011	7.4	7.8	8.7	8.7	7.2	6.8	7.4	7.8	7.1	6.2	7.8	7.8	7.6
2012	7.7	7.8	8.0	7.8	7.1	6.8	7.5	8.5	7.1	8.2	7.0	7.3	7.6
Mean	8.0	7.9	8.0	8.1	7.4	7.0	7.3	7.4	7.5	7.5	9.1	7.9	7.8

Finally, data on wind direction recorded at the Santo Domingo station shows that the predominant wind direction is from the east and north throughout the year, except from April to July where wind directions are from the SSE and SE.

6.1.8 Hydrology

6.1.8.1 *Methodology*

Surface hydrology was described using the San Cristóbal 6171-II and Santo Domingo 6271-III cartographic sheets (scale of 1:50000) as a primary base. Once the limits of the watershed were drawn using information from contour lines, adjustments were made due to the intense transformations of the relief caused by the urbanization of the territory, especially the road works that modify the surface runoff and induce it to sewage systems and bridges with areas of contribution very different from the natural conditions.

After the watershed was delineated, the main morphometric parameters such as the total area, perimeter, channel length, sinuosity, and overall slope were calculated. Using the digital cartographic base, the contribution watersheds of each tributary of interest were delimited, identified as Ureña, El Indio, Buenos Aires, Las Caobas, Villa Aura and Alameda canals, for which their morphometric parameters and the general runoff patterns spatially related to the study area were also determined.

Calculation closures were established at each confluence of the described tributaries with the main channel of the Guajimía canal. Afterwards, the rational method and the HEC HMS model software were used to calculate the hydrometric parameters of average flows and estimate hydrological probabilities of 1, 2 and 50 % (return period 2, 50 and 100 years).

Due to the general anthropism of the watershed, it was difficult to obtain the hydrometric parameters needed for the calculations, Therefore, remote sensing techniques were used to determine the runoff coefficient, using the program for Global Monitoring for Environment and Security, known as "Copernicus Program" by downloading satellite images from the Sentinel2 space mission of the study area, formed by 13 bands operating from the visible to the short wave infrared (SWIR).

Based on the consideration that urbanized areas are composed of a heterogeneous amount of materials and construction typologies, which nevertheless present a response capable of being unified in contrast with vegetated areas or water bodies, images dating from May 15, 2021 were analyzed because they were recent and free of cloud cover. From the RGB 843 false color processed image (Figure 6-15) the total representative areas of vegetation, soil and sediment areas, surfaces with concrete and asphalt cover were determined. The analysis was performed for each delimited area of the Guajimía watershed and representative runoff coefficients were determined for each area.

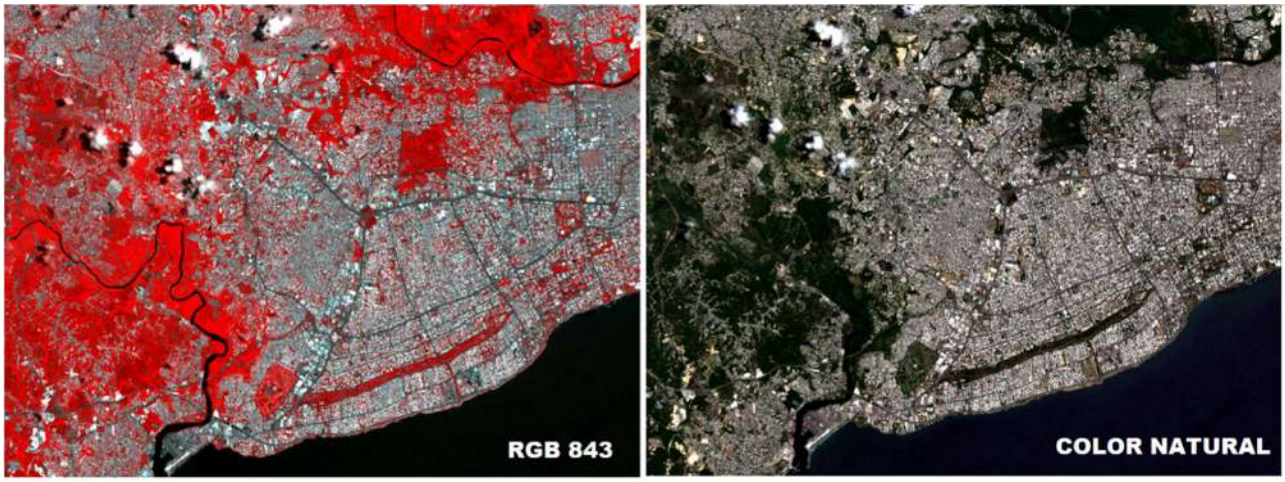


Figure 6-15: Images from Remote Sensing processing to determine Runoff Coefficient

Likewise, the final hydrometric calculations, considering the complexity of interpretation of the physical scenario due to the generalized anthropism and the structure of the runoff network, the Guajimía canal was divided into eight sub-watershed, in addition to the watersheds of each of the tributary canals (Figure 6-15).

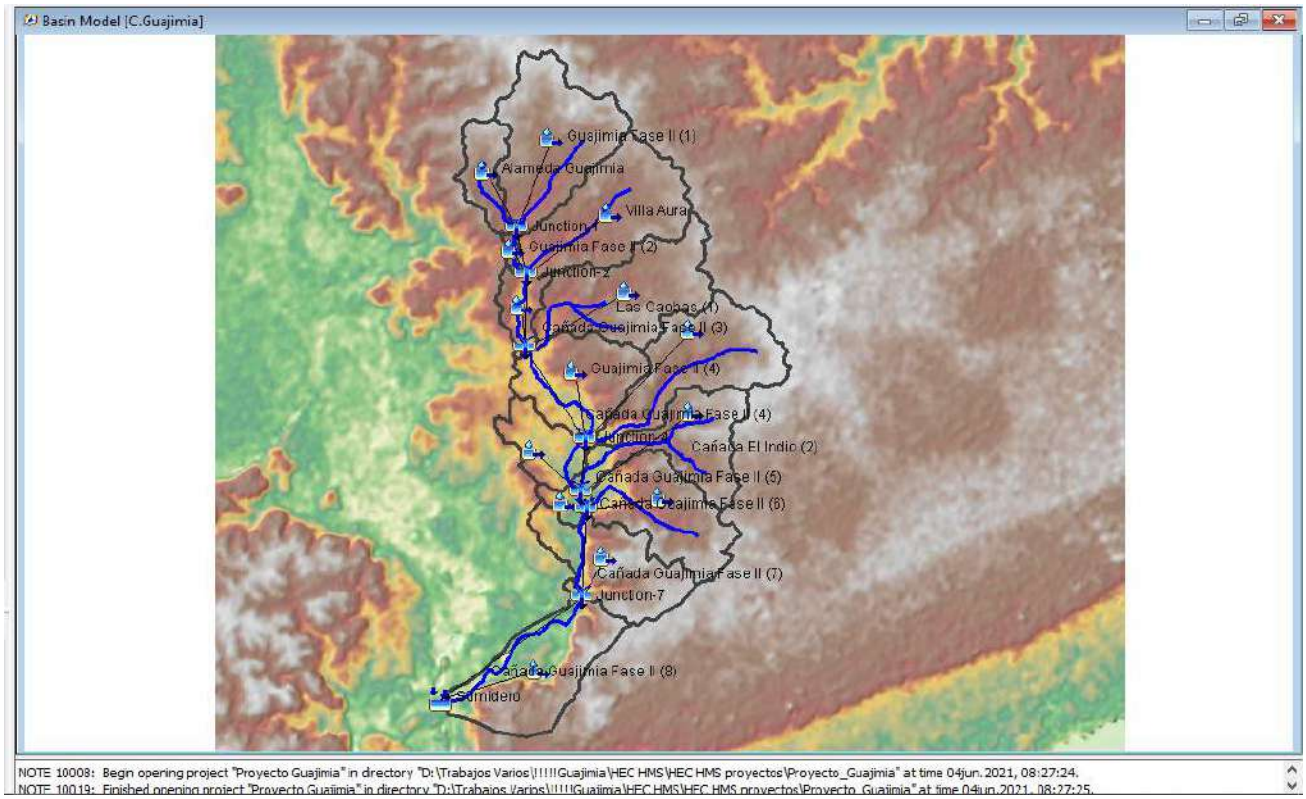


Figure 6-16: Example of Computational Node Mesh for the Calculation of Hydrometry in the Guajimía Canal

Afterwards, the IBER software was used to calculate the extent of flooding in the lower third of the watershed and at a point in the middle third, only as a reference of the extent of these hazards in the study area and with little altimetric information (Figure 6-17). The dimensions of the wetted sections of the channels and culverts were measured directly during the field survey.

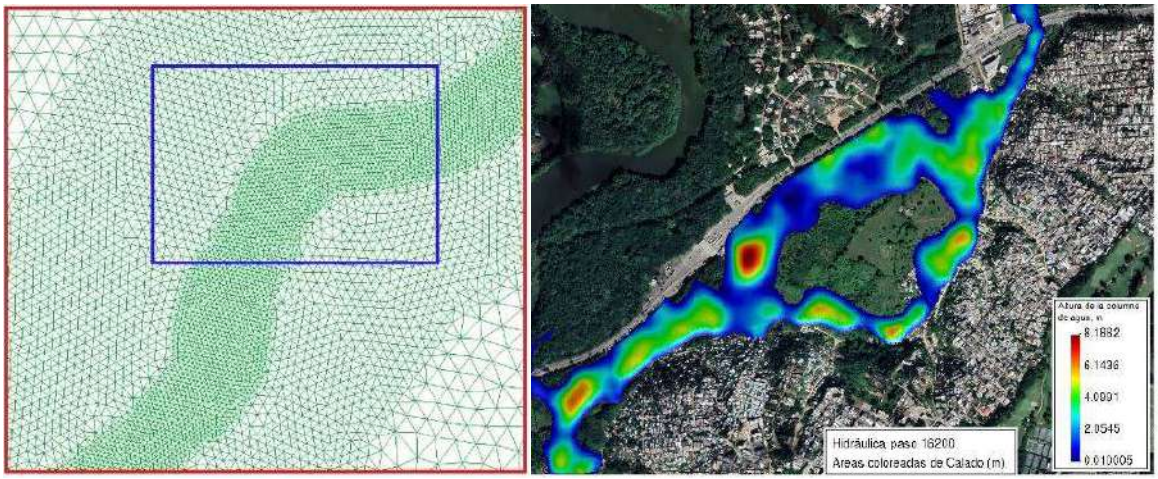


Figure 6-17: Example of Flood Reach Calculation for a Section of a Watershed

6.1.8.2 *Surface Water*

The Guajimía Canal is an important tributary of the Haina River. The hydrological map of the Guajimía Canal (Annex 4.21) and Table 6-16 describe the morphometric parameters of the watershed, which will be the reference values in the hydrological calculations.

Table 6-16: Morphometric Parameters of the Guajimía Watershed.

Area, (km^2)	**Perimeter**, (km)	**Length of main river**, (km)	**Overall slope** (%)	**Sinuosity**	**Observations**
14.1	19.5	8.11	0.5	1.18	It has been calculated that 63.6% of the watershed is occupied by urbanization.

Table 6-17 shows the morphometric parameters of the watersheds of the tributaries and the 8 sub watersheds of the main canal.

Table 6-17: Morphometric Parameters of the Tributary Catchment Areas and Sectors of the Main Channel of the Guajimía Canal

Watersheds and catchment areas	**Area,** km^2	**River length**, km	**Slope**, %
Guajimía 1 Canal	1.70	1.46	2.0
Guajimía 2 Canal	0.06	0.54	1.1
Guajimía 3 Canal	0.33	0.88	2.2
Guajimía 4 Canal	1.14	1.32	2.4
Guajimía 5 Canal	0.56	1.19	1.0
Guajimía 6 Canal	0.15	0.57	3.1
Guajimía7 Canal	1.17	0.97	0.2
Guajimía 8 Canal	1.27	2.04	0.6
Villa Aura Canal	1.67	1.90	1.2
Las Caobas Canal	1.60	2.31	1.3
Ureña Canal	1.28	1.76	2.2
El Indio Canal	1.13	2.20	1.8
Buenos Aires Canal	1.53	2.57	1.2
Alameda Canal	0.47	1.00	1.8

A scheme for analyzing the basic hydrodynamic behavior of surface runoff was established as a criterion for calculating hydrometry. The oval shape of the watershed, the distribution of the tributaries always to the east of the main channel and the hydrodynamic balance from the gauging carried out in the field surveys were taken into account (Figure 6-18).

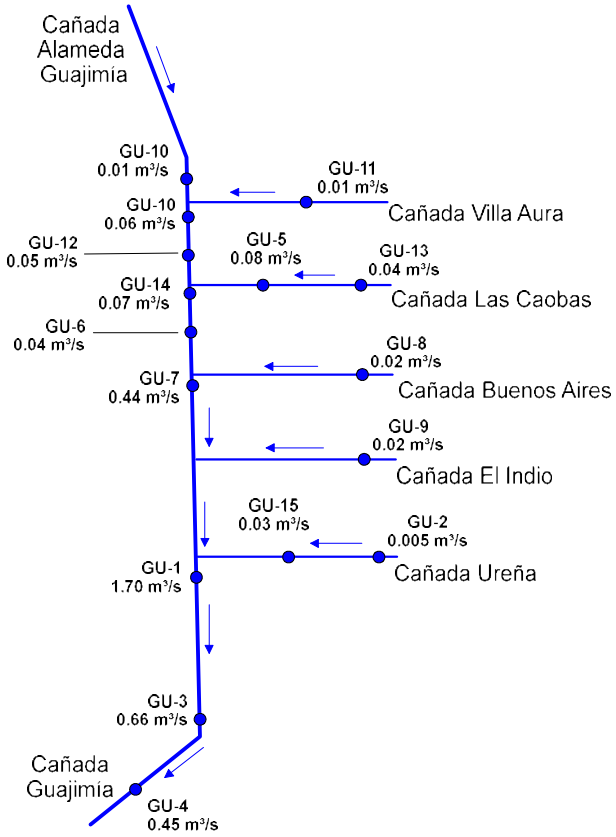


Figure 6-18: Hydrodynamic Scheme of the Guajimía Watershed

Based on the instantaneous gauging during field surveys (conducted without the occurrence of precipitation events), this hydrodynamic scheme seems to show that the main canal and its tributaries are fed by meteoric waters from precipitation. However, it was observed that the surface runoff of permanent water regime has a very high anthropic component almost over the entire fluvial network. Indeed, it was observed that throughout the territory there are innumerable discharges of domestic and industrial liquid waste (surface and underground) that flow through streets and ditches to be discharged into the canals (Photo 35 in Annex 5). In fact, it is very common to observe holes in the pavement or in concrete surfaces to facilitate the discharge of liquid waste directly into the canal (Photo 36 in Annex 5). As a general reference, during the field survey, with no history of accumulated rainfall, a flow of 0.45 m³/s was measured in the lower third of the sub-watershed, before the mouth of the Haina River (Photo 38 in Annex 5).

In that context, it was considered that the maximum flow (Qmax) of the Guajimía watershed was not the sum of the flows of its tributaries, given that these values are obtained for the maximum peak of the storm and their manifestation are of short duration with respect to the general average. This criterion of the dynamics is due to the time lag that exists between the connections of drainage ways, which establish differences in the moments of concentration of the flows, with moderate possibility of overlapping. As a solution to this effect and due to the knowledge acquired, a matrioshka scheme was established at the closure points of interest in a cumulative manner.

Therefore, maximum flows for the different probabilities at six calculation closures in the watershed were established following the hydrodynamic criteria explained above (Annex 4.21 Hydrological map of the Guajimía Canal). Figure 6-19 shows the calculation graph using the HEC MHS software and on the Digital Terrain Model.

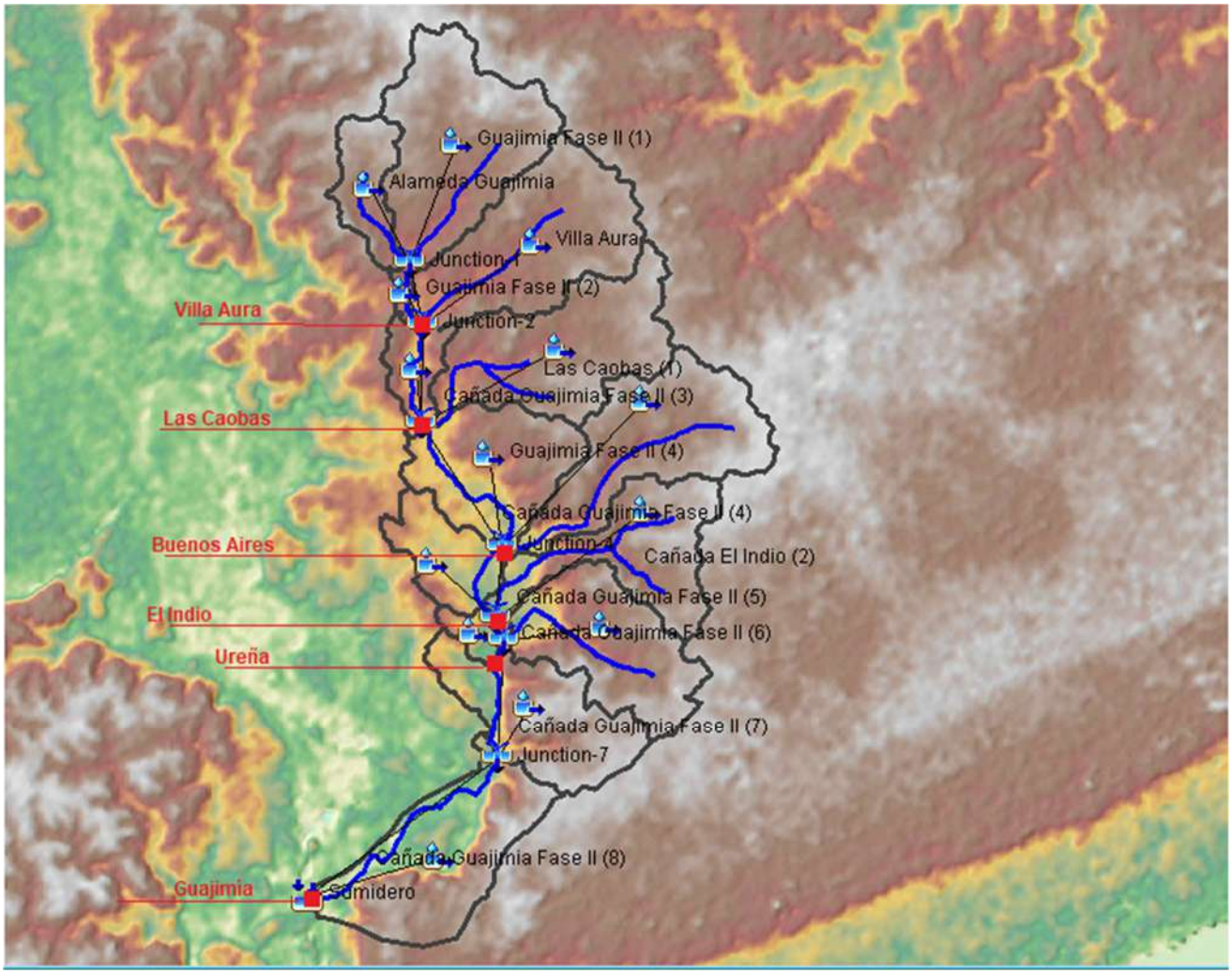


Figure 6-19: Base Calculation Graph of Hydrometry in the Hydrological Sub-watershed of the Guajimía Canal, on the Digital Terrain Model (HEC MHS software)

Table 6-18 presents the hydrometric calculation parameters with respect to the closures established in the sub-watershed and Table 6-19 presents the maximum flows for 1, 2 and 50 % hydrologic probability.

Table 6-18: Hydrometric Parameters of the Runoff Contribution Areas in the Calculation Closures

Calculation closures in the sub-watershed	UTM coordinates		Area, km²	C	tc	Imax 2 years	Imax 50 years	Imax 100 years
	X	Y						
Villa Aura	394617	2043631	3.84	0.6974	83.2	53.8	103.8	119.5
Las Caobas	394637	2042813	5.83	0.7353	110.4	46.0	88.7	102.2
Buenos Aires	395223	2041838	8.50	0.7629	140.5	40.3	77.6	89.4
El Indio	395203	2041270	10.19	0.7726	175.0	35.7	68.7	79.2

Calculation closures in the sub-watershed	UTM coordinates		Area, km²	C	tc	Imax 2 years	Imax 50 years	Imax 100 years
	X	Y						
La Ureña	395276	2041066	11.63	0.7606	180.0	35.1	67.7	78.0
Cuenca de Gaujimía	393761	2039001	14.01	0.7478	220.0	31.4	60.6	69.8

C- Runoff coefficient; tc- time of concentration, min; Imax- Maximum rainfall intensity for 2, 50 and 100 years, mm/h.

Table 6-19: Maximum Flows in the Calculation Closures

Calculation closures in the sub-watershed	Maximum flow rates (Qmax), m³/s		
	Qmax for T=2 years, P=50%	Qmax for T=50 years, P=2%	Qmax for T=100 years, P=1%
Villa Aura (CC1)	39.9	77.0	88.7
Las Caobas (CC2)	54.6	105.3	121.3
Buenos Aires (CC3)	72.3	139.5	160.6
El Indio (CC4)	87.0	167.7	193.1
La Ureña (CC5)	86.0	165.8	191.0
Cuenca de Gaujimía (CC6)	91.5	176.5	203.3

The results of the above table summarize the maximum flows that will drain in the different calculation closures, which coincide with the confluences of the main tributaries and the Gaujimía Canal. The calculated volume showed that the riverbed overflows in many places due to the lack of evacuation capacity caused by anthropic modifications or by the accumulation of solid waste that obstructs the canals. Photo 37 in Annex 5 shows the bed of the El Indio canal (point GU-9) where more than 75% of its wet section is occupied by the accumulation of solid domestic waste, which in the event of extreme rains will prevent normal drainage, causing local flooding.

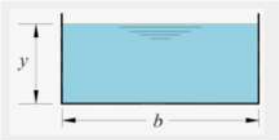
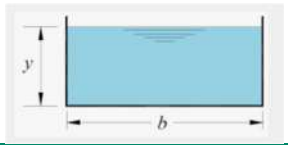
It is important to note that the measured flows and the calculated maximum flows are representative of the runoff conditions in the watershed, associated with the closures, but without considering the flow that is induced to drain by the sewage systems, which have modified the system in urbanized areas and which contribute to evacuate the maximum volumes of the flows in cases of extreme storms.

Flood Conditions for Peak Flows

Based on all the morphometric and hydrometric parameters calculated for the watershed, two sites were chosen as a reference to describe the dynamics of floods that can form as a result of fluvial floods with maximum flows. These selected sites constitute sections of riverbed with insufficient wetted section due to anthropic modifications and the progressive accumulation of sediments and solid domestic waste, which causes overflowing and flooding of the surrounding dwellings.

These two sites correspond with surface water sampling points GU-5 and GU-12 (Annex 4.22 Map of measurement points for physicochemical and bacteriological parameters of surface water) and are described in Table 6-20. During each measurement event at each of the 15 points, the flow velocity was measured using the float method, or estimated when the site had accumulation of domestic solid waste or the riverbed had a poor structure.

Table 6-20: Description of Flood Calculation Sites for Fluvial Floods with Peak Flows

Surface water sampling site (GU-5)		Surface water sampling site (GU-12)	
Las Caobas Canal in the Frito Lay neighborhood, north of the baseball field.		Guajimía Canal at the vehicular bridge east of Rogelio Roselle street.	
UTM coordinates X:394771; Y:2042773		UTM coordinates X:394521; Y:2043125	
Pedestrian bridge with a rectangular section of 7.0 m² that reduces the cross section of the canal. 		Vehicular bridge in the street, with a rectangular section of 4.2 m² that reduces the wet section of the canal 	
			
Calculated maximum flow rate for the Las Caobas Canal inflow area.	T=100 years **52.1** m³/s	Maximum flow calculated for the area with closure in the Guajimía Canal, downstream of the confluence of the Villa Aura canal.	T=100 years **106.3** m³/s
	T=50 years **45.2** m³/s		T=50 years **92.3** m³/s
	T=2 years **23.5** m³/s		T=2 years **58.1** m³/s
Excess flow	T=100 years 24.5 m³/s	Excess flow	T=100 years 84.7 m³/s
	T=50 years 19.2 m³/s		T=50 years 70.9 m³/s
	T=2 years 0.8 m³/s		T=2 years 37.9 m³/s
Evacuation capacity of the current section in front of the avenue with maximum flow	T=100 years 51 %	Evacuation capacity of the current section in front of the avenue with maximum flow.	T=100 years 20 %
	T=50 years 19 %		T=50 years 23 %
	T=2 years 97 %		T=2 years 35 %

According to the results described in Table 6-20, it is evident that the current evacuation capacity of the works described above in the event of extreme precipitation events that cause peak flows is less than the necessary capacity. However, in this result it is important to consider that currently most of the sewage works are highly affected by the accumulation of plant debris, sediments and solid domestic waste.

For instance, Figure 6-20 shows the estimated result for the flooding of the lower third of the Guajimía Canal, downstream of the November 6 highway bridge, in the event of an extreme precipitation event of regional scope that causes the formation of maximum flows with a hydrological probability of 1% (return time of 100 years). It is important to keep in mind that the spatial scope of this result should be considered as an estimate because it was based on a very general morphology of low plains, without altimetric and topographic details that would allow establishing the precise boundary conditions in the calculation models. Nevertheless, the current conditions of the physical scenario are evident, where flooding due to extreme rainfall reaches the sectors of the river valley bottom, irregularly occupied by urbanization. Through personal communication from local residents, floods that have affected these sectors appear in the results of the computational model.

Figure 6-20: Estimated Flood Conditions in the Lower Third of the Guajimía Watershed, due to the Occurrence of Extreme Regional Rainfall

6.1.9 Hydrogeology

6.1.9.1 *Methodology*

The description of hydrogeology at the regional scale was based on the classification of the hydrographic watersheds of the Dominican Republic and the nomenclature of the Hydrogeological Map of the Dominican Republic (scale of 1:250,000). The main aquifers in the region were determined, with their lithological characteristics and their hydrogeological importance considering the effects of urbanization.

The subterranean hydrodynamic was described an approximation was made to a larger scale zoning, delimiting the coastal strip corresponding to the reef limestones and differentiating the terrigenous massif of less aquiferousness and transmissivity, and highlighting the flow dynamics towards the coastline, with some very specific deviations.

At the local scale. the groundwater deposits were described using by two observation wells found in the explanatory note of the hydrogeological map.

6.1.9.2 *Regional Hydrogeology*

On a regional scale, the project area is located within the Eastern coastal plain, towards its western end, where the aquifers described are free in alluvial and eluvial sediments and in reefal limestone and marl rocks.

This regional hydrogeological zone, with a total area of more than 6,500 km^2 has a calculated recharge of 1,465 hm^3/year and a potential that exceeds 900 hm^3/year. Regional studies have determined a degree of pressure on the water resource of approximately 32%.

According to the nomenclature of the Hydrogeological Map of the Dominican Republic (scale of 1:250,000), the predominant aquifer rocks in the region are of medium to high hydrogeological importance. These aquifer formations are characterized by being represented 1) by unconsolidated sediments of low permeability associated with the river valleys and 2) by calcareous, fractured and karstified rocks of high permeability in the massifs of the high plains of the coastal plain (Annex 4.20 Hydrogeological map of the region and the study area).

6.1.9.3 *Local Hydrogeology*

In the alluvial and eluvial sediments that accumulate and form the low terraces of the Haina River flood valley and the lower third of the Guajimía Canal, groundwater has a very limited development, with depths of less than 3.0 m, and the aquifer is very affected by urbanization and transformations in the surroundings of these riverbeds. These aquifers have very low productivity and are of no hydrogeological interest.

In the coastal strip to the south, which corresponds to the reef limestone massif of the Fms. La Isabela and Los Haitises, groundwater has a dynamic flow towards the coastline, with some very specific deviations. This dynamic is through fractures and karst cavities, which, while increasing transmissivity, increases the vulnerability of these resources. This aquifer in the area is very affected by anthropic modifications, however, it acquires hydrogeological importance due to its lying in the coastal strip and its hydrodynamics in relation to the interface with marine waters.

However, in then northern part of the study area, the materials that predominate in the massif have a high terrigenous component, which conditions a medium aquosity and low hydraulic transmissivity, although there are also preferential flow paths associated with the fractures and stratification of the massif.

In both cases of the aquifers described, the relationship with the fluvial surface waters is direct, although their influence is limited to the morphometry of the valleys and urbanization. Locally, it can be described that the flow direction of the local aquifer is towards the riverbeds, although with a high flow component towards the south (towards the sea). These descriptions have a high uncertainty due to the anthropization of the surface and aquifer feeding sectors.

6.1.10 Water Quality

6.1.10.1 *Methodology*

A sampling program, based on the principle of representativeness for the entire study area, was designed following the general criteria of the Environmental Standard for surface and coastal water quality of the Dominican Republic (2012), the Standard Methods for the Examination of Water and Wastewater (APHA) and the U.S. Environmental Protection Agency (EPA). Highly anthropized and morphometrically modified flow paths were preliminarily characterized for the 15 sampling sites. These sites were georeferenced in UTM coordinates, DATUM WGS84 system, northern hemisphere, using a Personal GPS. The optimized sampling and measurement program were carried out according to the schedule at these points (Table 6-21, Annex 4.11 and Annex 4.12 Map of measurement points for physicochemical and bacteriological parameters of surface waters).

Table 6-21: Sampling and Measurements at the 15 Surface Water Characterization Points

Sampling site	day/month/year	Site description	UTM coordinates	
			X	Y
GU-1	13/05/2021	Guajimía canal, downstream of Camino de Emgombe street.	395246	2041049
GU-2		Ureña canal, 27 de Febrero street.	396266	2040902

Sampling site	day/month/year	Site description	UTM coordinates	
			X	Y
GU-3		Guajimía canal, downstream of the 6 de Noviembre highway bridge.	395210	2040082
GU-4		Guajimía canal, lower third of the watershed, in front of the Café neighborhood.	395074	2039933
GU-5	18/05/2021	Las Caobas canal, north of the baseball field in the Frito Lay sector.	394756	2042813
GU-6		Guajimía canal, at the Orlando Martínez street bridge, north of the Bohemia Brewery.	394797	2042470
GU-11		Villa Aura canal, on 9th Street.	395029	2043942
GU-12		Guajimía canal, west of Rogelio Roselle Street.	394521	2043125
GU-13		Las Caobas canal, behind the neighborhood park.	395276	2043199
GU-7	19/05/2021	Guajimía canal, Mexico Street bridge.	395207	2041803
GU-8		Buenos Aires canal, on El Sol street.	397202	2042728
GU-9		El Indio canal, west of Restauración Street.	396203	2041837
GU-10		Guaijimía canal at the entrance to Ciudad Agraria.	394647	2043696
GU-14	20/05/2021	Guajimía canal, north of Residencial Paloma María, upstream of the confluence with Las Caobas canal.	395771	2041221
GU-15		Ureña canal, upstream from the park.	394820	2039824

In addition, another point was measured outside the program (point GU-16), in the El Café neighborhood, 200 m downstream of point GU-4, near its mouth in the Haina River.

Table 6 22 (Photo 11 and 12) details the scope and general structure of the surface water sampling in the Guajimía canal and its tributaries.

Table 6-22: **Scope of the Surface Water Measurement and Sampling Program**

Generalized sampling to determine the physicochemical and bacteriological quality of surface water.	
In situ tests	Laboratory tests
• pH • water temperature • electrical conductivity • total dissolved solids • dissolved oxygen • oxygen saturation • turbidity • total suspended solids	• chloride • nitrate • sulfates • oils and fats • BOD_5 • COD • ammonia nitrogen • total phosphorus • total nitrogen • total and fecal coliforms • residual chlorine • Metals: arsenic, cadmium, copper, hexavalent chromium, iron, mercury, selenium and zinc

The 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 Environmental Management System (EMS), and the Environmental Protection Agency (EPA). (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.

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, a 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 general terms, the established procedures were followed for this sampling:

1) At all times technicians wore latex gloves and mask.

2) Sample containers were sealed and dry, and labeled prior to sample collection indicating sample name, 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. The chain of custody is presented in Annex XIV.

6) Immediately after sampling, and independent of the acidification from the laboratory, the samples were placed in a cooler with crushed ice, guaranteeing a temperature between 4-8º. The cooler was kept protected from the sun during the sampling day

After the end of the sampling day, all the fields of the chain of custody of the samples were verified and communication was established with the EqLab laboratory to establish transport times and coordinate the time of delivery (Annex 4.14 Chain of custody).

Table 6-23 below presents a summary of all the procedures performed for sample collection and 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 XXIII corresponding to the laboratory reports of the test results for each of the 15 samples.

Table 6-23: **Summary Table of Sampling, Preservation, Transfer and Processing of Samples**

Tests	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	
Residual chlorine		On-site analysis	
Chloride			
Nitrate (NO_3)	Plastic 250 ml	Cooling	EqLab
Sulfate (SO_4)		Refrigeration	
Total Nitrogen			

Tests	Type of container and volume	Preservation	Laboratory
Fats and oils	Glass 500 ml	HCL and cooling	
Metals (As, Cd, Cu, Cr VI, Fe, Se, Zn)	Plastic 250 ml	Filtration, HNO3 and cooling	
Total Mercury	Plastic 250 ml	HNO3 and cooling	
Ammoniacal nitrogen	Plastic 500 ml	H2SO4 and refrigeration	
Total phosphorus			
Total coliforms	Sterile sleeve 100 ml	Cooling	
Fecal coliforms			
Biochemical Oxygen Demand (BOD5)	Plastic 500 ml	H2SO4 and refrigeration	
Chemical oxygen demand (COD)			

In Situ Tests

All sampling and primary parameter measurements "in situ" were performed by EMPACA Environmental Quality Laboratory Division[3]. Samples for in situ analysis were taken to avoid alterations in the physicochemical parameters due to sampling and transfer to the laboratory, and were collected with a smooth, high-density polyethylene sampler with a capacity of 600 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 then rinsed (sweetened) with the surface water collected. In addition, 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 0.01 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 Hatch 2100 q portable 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 50ºC, and bases its analysis on EPA method 180.1. The resolution is 0.01 NTU and the response time is 6 seconds, which allows the determination of turbidity up 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.

Laboratory Tests

Laboratory analyses of physicochemical and bacteriological parameters were performed by Environmental Quality Laboratories S.R.L. (EqLAB[4]) 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).

An ISECI18101 probe was used in the chloride determinations, 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 an ISA Hach Nitrate reagent (1 powder bag/25 ml sample).

[3] Annex 4.11 shows the reference sheets of the in situ surface water measurements.
[4] Annex 4.12 shows the accreditation certification of the EqLab laboratory.

For residual chlorine measurements, Hach colorimeter II equipment with 10 ml glass and plastic vials was used, in high range (0.1 up to 8.00 mg/l) and low range (0.02 up to 2.0 mg/l) solutions, following the SM 4500CIB, G method.

Total and fecal coliform determinations were performed within 24 hours after sampling, at EqLab's headquarters in Santo Domingo, following the SM9221B method with a "most probable number" (MPN) result; while for BOD_5 and COD the SM 5210B and EPA 410A methods were used, also before 24 hours had elapsed.

The test certificate of the equipment manufacturer and the periodic calibration of the probes used are presented in Annex XIII.

Water Quality Standards

In 2012, the MIMARENA has developed surface and coastal water quality standard (NA-CASC). According to these standards, water bodies receiving surface waters can be classified as follows:

- Class A: water intended for the public supply of drinking water without the need for prior treatment, except simple disinfection. Waters destined for the irrigation of vegetables of raw consumption, for recreational uses with direct contact (ex. Swimming). Waters for the preservation of fauna and flora.

- Class B: water intended for the public supply of potable water with treatment. Usable waters for irrigating crops, water sports without direct contact, and industrial and livestock uses.

- Class C: waters used for navigation, refrigeration, and other uses that do not imply direct contact.

- Class D-1: surface waters to be preserved in natural conditions, due to their exceptional quality or great ecological value. The uses of these areas include scientific demonstrations and investigations, aesthetic and landscape activities, and activities related to management and conservation that do not alter the environment. For which, the discharges made (upstream in the case of rivers) should not affect the conditions of said ecosystem.

The current ESIA, the class B was use because the water in the canals will be send to a water treatment plant in the future (stages 2 and 3 of the Phase II).

6.1.10.2 *Surface Water*

In general, surface waters that show a terrestrial genesis fed by precipitation with low mineralization, which in none of the samples exceeds 1 g/l (1000 mg/l). However, there is a very important anthropic source of nourishment, by direct discharges of liquid effluents, which influence the surface water regime and the concentrations of macroconstituents in these waters analyzed. These surface waters are highly affected by turbidity and total suspended solids concentrations, with very high values at all sites sampled but not exceeding the class B for surface waters (Table 6.24).

In general, the pH values report a mean of 7.24, which shows conditions tending to be neutral, although values of 6.82 and 6.93 stand out at points GU-1 and GU-4 respectively (Guajimía canal), as a punctual effect; in addition to a value of 7.62 at point GU-8 Buenos Aires canal, where liquid effluents with dyes were observed discharging directly into the canal.

The presence of total and fecal coliforms is critical at all points, whose very high values show that the organic load to these waters is permanent, and presumably direct from anthropic sources. The concentrations of dissolved oxygen and oxygen saturation are very low, with critical values, very influenced by the intense accumulation of organic material (garbage) that is maintained for a long time and creates almost permanent leachate drainage.

Detailing this chemical characteristic of the surface water in the Guajimía canal, it can be observed that this mineralization given by the concentrations of total dissolved solids has a certain variability, within the range

explained. The graph in Figure 6-21 shows how the concentrations of dissolved solids are significantly higher at points GU-2, GU-8, GU-9, GU-13 and GU-15, which coincide with the headwaters of the main tributaries to the main channel (Ureña, El Indio Derecho, Buenos Aires and Las Caobas canals), where precisely the accumulations of solid waste are critical and the discharges of liquid waste are evident, while the runoff volumes are lower.

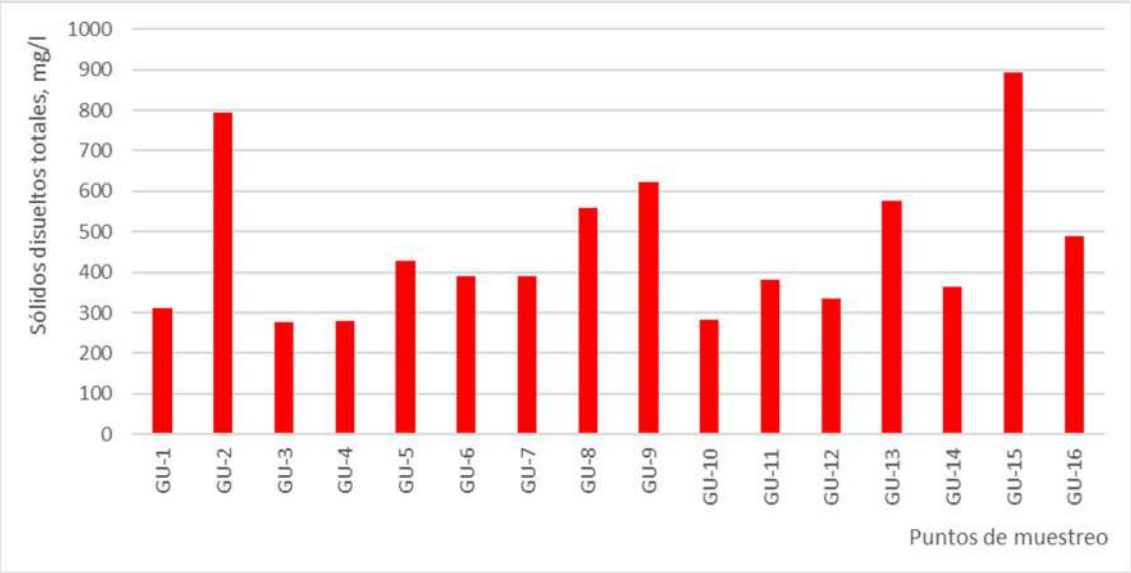


Figure 6-21:. Behavior of Total Dissolved Solids Concentrations in the Analyzed Surface Water Samples

Table 6-24: Physicochemical Parameters of Surface Water at the Measurement Points

Paramet	Unit of measurement	Environmental Standard NA-CASC-2012*	GU-1	GU-2	GU-3	GU-4	GU-5	GU-6	GU-7	GU-8	GU-9	GU-10	GU-11	GU-12	GU-13	GU-14	GU-15	GU-16
pH		6.5-8.5	6.82	7.24	7.00	6.93	7.02	7.21	7.46	7.62	7.15	7.13	7.31	7.25	7.32	7.28	7.37	7.73
Water temperature.	ºC	--	28.2	26.3	28.0	28.5	28.8	27.7	28.9	27.9	28.1	27.8	29.2	28.0	31.3	28.2	29.4	30.0
Electrical conductivity.	µS/cm	--	685	1700	610	617	944	846	860	1291	1347	612	875	736	1123	797	1954	1113
Total dissolved solids.	mg/l	1000	312	795	277	280	429	389	389	559	624	282	381	336	576	363	892	488
Dissolved oxygen.	mg/l	--	2.53	2.56	2.50	2.86	2.93	2.60	2.32	2.85	2.24	2.15	2.58	2.20	2.64	2.68	2.69	2.25
Oxygen saturation.	%	> 70	25.0	26.1	26.1	27.3	22.3	18.3	20.2	37.6	20.8	32.2	26.1	28.1	30.8	25.6	22.9	36.8
Turbidity.	NTU	--	51.6	56.3	61.7	56.3	36.5	24.7	62.7	82.3	82.7	63.2	39.1	21.1	79.9	17.6	115.0	63.1
Total suspended solids.	mg/l	--	250.0	265.3	284.0	263.8	165.2	117.0	271.8	388.0	405.0	292.3	167.2	98.5	287.0	80.2	512.0	270.0
Chlorine residual.	mg/l	--	0.02	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.02	0.01	0.01	0.00	0.01	0.02	0.02	0.00
Chloride.	mg/l	250	56.3	135.1	45.1	47.9	73.5	55.8	68.1	99.1	105.3	51.9	67.5	58.1	98.5	62.7	157.6	83.1
Total coliforms	NMP/100 ml	1000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	--
Fecal coliforms	NMP/100 ml	1000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	> 24000000	--
Nitrate	mg/l	10 (NO_3+NO_2)	8.80	30.10	9.40	6.10	17.3	10.6	10.9	30.9	5.1	6.6	11.6	8.6	11.7	8.4	48.5	9.60
Sulfate	mg/l	400	17.0	21.0	16.0	16.0	20.0	14.0	20.0	19.0	18.0	19.0	26.0	19.0	20.0	20.0	19.0	--
Fats and oils	mg/l	1.0	5.80	11.20	3.60	4.20	10.2	4.0	5.6	30.8	23.6	5.6	5.4	2.6	19.6	1.4	14.0	--
Biochemical Oxygen Demand (BOD5)	mg/l	5.0	71	152	33	28	136	36	75	172	250	35	108	69	72	59	382	--
Chemical Oxygen Demand (COD)	mg/l	--	105	368	67	71	173	86	93	340	482	44	137	81	131	92	637	--
Ammonium	mg/l	0.5	18.9	98.4	14.5	13.9	35.1	26.3	23.4	33.2	52.1	7.9	24.7	20.9	25	26.0	132.1	--
Total phosphorus	mg/l	0.025	1.0	8.07	0.40	0.40	3.0	2.5	2.1	6.8	7.4	0.7	3.2	1.9	4.0	1.8	10.5	--
Total nitrogen	mg/l	--	19.0	85.0	17.0	15.0	32.0	24.0	22.0	53.0	61.0	9.0	30.0	21.0	26	24.0	116	--
Hexavalent chromium	mg/l	0.01	0.052	0.102	0.047	0.085	0.033	0.075	0.053	0.066	0.139	0.068	0.058	0.057	0.087	0.056	0.063	--
Total arsenic	mg/l	0.05	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	--
Total cadmium	mg/l	0.005	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	--
Total copper	mg/l	0.2	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	0.0425	0.0119	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	0.0134	--
Total Iron	mg/l	0.3	0.350	0.497	0.274	0.369	0.146	0.197	0.168	0.634	1.11	0.184	0.209	0.191	0.229	0.157	0.470	--
Total selenium	mg/l	0.01	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	0.00849	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	--
Total Zinc	mg/l	0.05	0.0248	0.0434	0.0155	0.0154	0.0195	0.0194	0.0186	0.0458	0.0740	0.0113	0.0138	0.0127	0.0252	0.00882	0.0408	--
Total Mercury	mg/l	0.001	< 0.00007	< 0.00007	< 0.00007	< 0.00007	0.0000834	< 0.00007	0.0000825	< 0.00007	< 0.00007	0.0000716	< 0.00007	< 0.00007	< 0.00007	0.0000848	0.0000714	--

* Environmental quality standard for surface and coastal waters, for class B surface waters

All concentrations of biochemical oxygen demand (BOD_5) and chemical oxygen demand (COD) in surface waters were above the permissible limits established by the environmental standard of reference, and even other international regulations (Figure 6-22). This reflects the poor water quality and high contaminant inputs in the canals.

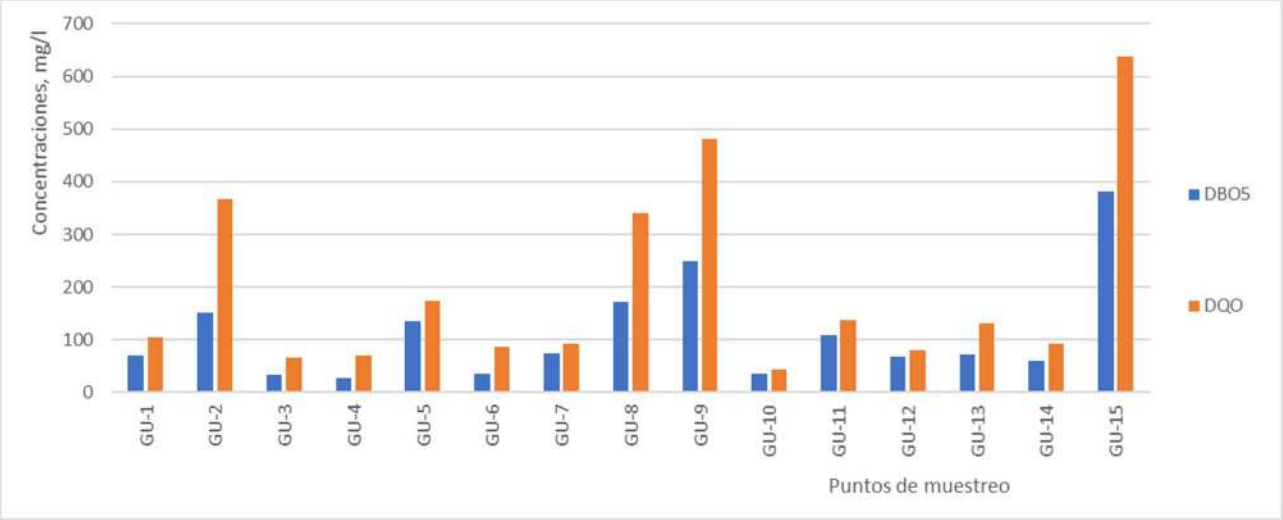


Figure 6-22: **Behavior of DBO_5 and COD Concentrations in the Analyzed Surface Water Samples**

From this previous result of DBO5 and DQO concentrations in the waters, the high values at points GU-2, GU-8, GU-9 and GU-15 stand out again, which coincide with the headwaters of the main tributaries to the main channel (Ureña, El Indio Derecho and Buenos Aires streams), where the sources of organic and inorganic contamination in the surface runoff are critical.

The concentrations of nutrients, such as nitrate, phosphorus and total nitrogen, are also reported with high values, very much in agreement with the organic pollution explained (Figure 6-23). Although total phosphorus levels exceed the limits of the standard, together with total nitrogen they are critical, and are one of the causes of the low dissolved oxygen values, the scarce aquatic fauna observed and the eutrophication.

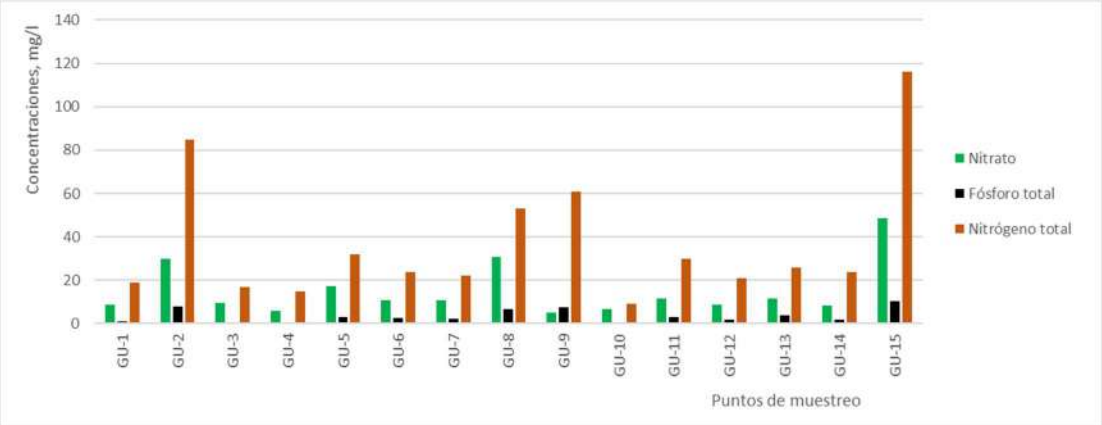


Figure 6-23: **Behavior of Nitrate, Phosphorus and Total Nitrogen Concentrations in the Analyzed Surface Water Samples**

The concentrations of microconstituents (trace metals) are reported to be low, below the permissible limits of the environmental reference standard; however, the concentrations of total iron and hexavalent chromium, with high values, are noteworthy. In the case of hexavalent chromium, this is the toxic chemical form of the element that has been shown to affect human health (Figure 6-24).

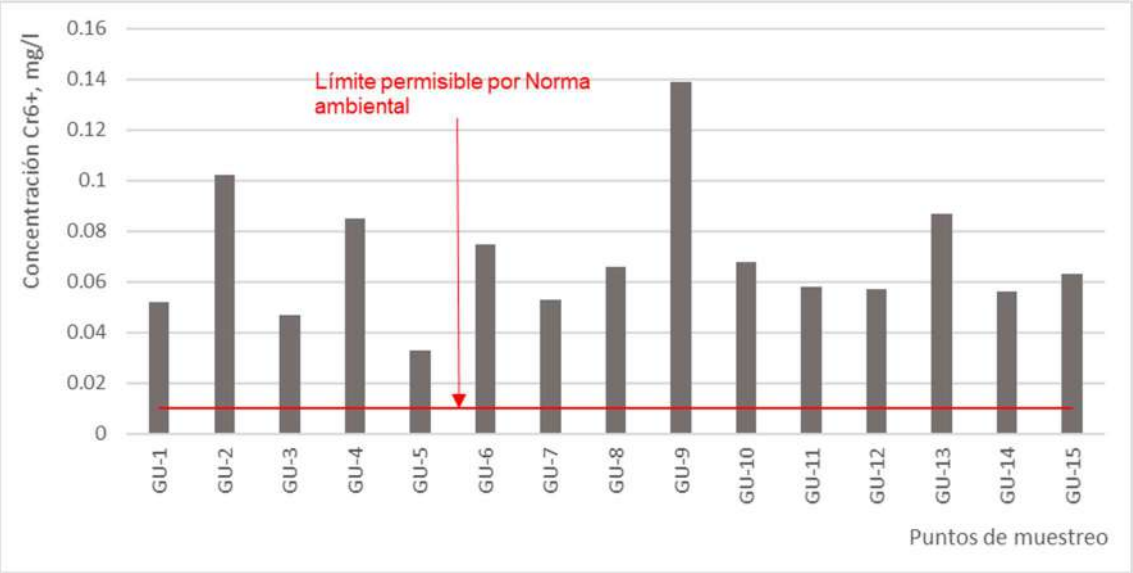


Figure 6-24. Behavior of Hexavalent Chromium Concentrations in Analyzed Surface Water Samples

In general, the surface water flowing through the Guajimía canal and its tributaries is considered to have a very poor physicochemical and bacteriological quality, with levels of various components that can cause harm to human health.

6.1.10.3 *Groundwater*

Regarding the physicochemical and bacteriological quality of groundwater, on a regional scale, there are references of oscillations in the concentration of macroconstituents as a reflection of the effects of anthropic activity developed in the territories. Values of bicarbonates are reported between 20 and 1342 mg/l, while chlorides can reach values of up to 3020 mg/l and sulfates 3756 mg/l, decreasing significantly towards the north of the territory. This hydrochemical balance makes the predominance of water types vary between sodium chloride bicarbonate and sodium chloride bicarbonate.

According to data on the hydrogeological potential of the Dominican Republic (Rodríguez, H. and Febrillet, J.F. 2006), more than 83% of the groundwater samples from this regional aquifer, taken from wells in the region, have reported the presence of coliforms and pseudomonas, while nitrate concentrations are moderate.

For the sectors closest to the coastal zone, these groundwaters have a greater influence of marine waters at the interface, and therefore their parameters do not match the groundwater patterns of the massifs in the interior of the territory.

In these intensely urbanized sectors, where impermeabilized and covered areas predominate, surface runoff is much greater than the possibility of infiltration into the massif, but at the same time the discharge of liquid waste directly into the aquifer, as a receiving body for effluents, is extremely high. Likewise, the dissolved oxygen concentration values, which are regularly considered low in urbanized or intervened sectors, suggest the presence of contaminating elements represented mainly by nutrients and organics.

By reference of hydrogeological tests carried out in boreholes to the west of the study area, towards the Haina river valley, the physical parameters of the groundwater in real time (electrical conductivity, pH and temperature), had a high similarity of more than 96% during the 24 hours of pumping. Likewise, turbidity, expressed as suspended solids, was measured and remained below 18 mg/l.

A notable feature of the urbanized areas of the city and surrounding neighborhoods is the unfavorable trend towards the drilling of wells to supply groundwater to industries and populations, while the construction of filtering wells for treated and untreated domestic liquid waste discharging directly into the aquifer is significant. This situation has compromised the quality of groundwater, where progressive deterioration has been observed.

6.1.11 Air Quality

6.1.11.1 *Methodology*

Air quality parameters were measured at 15 sampling sites covering the entire study area, including the urbanized sectors that will be affected by the project (Table 6-25). The following air quality parameters were studied : noise levels, concentrations of combustion gases under immission conditions (carbon monoxide CO, ozone O_3, nitrogen dioxide NO_2, sulfur dioxide SO_2, volatiles TVOC and formaldehyde HCHO) and concentrations of particulate matter in the air (PM 2.5, PM 10.0 and total suspended particles). Another sampling site was added (P16) to characterize the intra daily variability of particulate matter concentrations. Meteorological parameters were also measured at each sampling site concomitantly with air quality parameters.

Table 6-25: **Location of the Air Quality Parameter Sampling Sites**

Sampling site	Description	UTM coordinates	
		X	Y
P1	Camino de Engombe Street, west of the baseball field.	395211	2041206
P2	Ureña canal, 27 de Febrero Backing Street.	396266	2040902
P3	Bridge of the Highway 6 de Noviembre.	395272	2040158
P4	North side of the Guajimía canal, in a workshop by the Highway 6 de Noviembre.	395069	2039971
P5	Barrio Frito Lay, north of the baseball field.	394771	2042773
P6	On Orlando Martinez Street, north of the Bohemia Factory.	394797	2042470
P7	On Mexico Street, in the residential Guajimía I, to the north.	395298	2041994
P8	Buenos Aires canal, on El Sol Street.	397202	2042728
P9	El Indio canal, west of Restauración Street.	396203	2041837
P10	Entrance of the Residencial Ciudad Agraria.	394647	2043696
P11	Villa Aura canal, on 9th Street.	395029	2043942
P12	Guajimia canal Bridge, east of Rogelio Roselle Street.	394521	2043125
P13	Las Caobas canal, in the park.	395286	2043229
P14	Residencial Guajimía II, south of the Bohemia Brewery.	394903	2042121
P15	Vacant land plot belonging to the City Hall.	394575	2041876
P16	Near the mouth of the Guajimía canal, Café neighborhood.	395041	2039759

The following sections present the methodology for each of the air quality parameter measured.

Particulate Matter (PM)

The concentration of particulate matter was measured using three Airmetric Minivol TAS equipment set a stable flow rate of 5 lpm, over each 24 hours of continuous measurement. These devices were installed parallel to each other, two of them were fitted with PM 2.5 and PM 10 impactors, and the third for total particulate matter. Measurement were made in accordance with the specifications of the Environmental Technical Regulations for Air Quality of the Dominican Republic. Measurements were made by the Minivol TAS following a sampling technique described in the U.S. Code of Federal Regulations (40 CFR part 50, Annexes I and J). The device was thus fitted with the inlet impactor to sort particle according to their sizes , under a stable flow rate (5 lpm) closely monitoring the time elapsed between the beginning and the end of the sampling (Photo 3 in Annex 5). Concentrations of particulate matter in the air by measuring the initial weight of the dried filter install on the equipment device (before the sampling) on a precision balance and by subtracting this value to the final weight of the filter (after the sampling). The volume of air, the time elapsed and the air temperature are also taken into account in the calculation of the particle concentration express in $\mu g/m^3$. The calibration certificates of the equipment used are presented in Annex 4.6.

An Aerocet 531S device was used to characterize the intra daily variability of particulate matter concentrations at one sampling site (P16) in the study area. This device built by the firm Met One count, through a stable flow rate of 3.0 lpm, individual particles with a scattered laser light and then calculates the equivalent total concentration using a proprietary algorithm (Photo 4). The measurement cycle was programmed for 24 hours with readings at 15-minute intervals to measure the impacts of human activities and measuring the PM 2.5, PM 10 and total particulate fractions. The Aerocet 531 calibration certificate is presented in Annex 4.7.

Annex 4.4 shows the reference sheets of the field measurements and Annex 4.5 shows the data recorded at each sampling site

Combustion Gases

A smart sensor was used to measure carbon monoxide gas from immission under open space conditions at the sampling sites. The device was fitted with a stabilized electrochemical sensor and has been endorsed by the U.S. Department of Labor, Occupational Safety & Health Administration (OSHA) to measure concentration up to 1000 ppm.

Ozone gas (O_3) concentration were measured with a professional Forensics FD-90A detector fitted with electrochemical sensors and calibrated by U.S. National Institute of Standards and Technology to measure concentration ranging from 0 to 20 ppm with a resolution of 0.01 ppm (100 $\mu g/Nm^3$).

A professional FORENSICS air pollution detector was also used to measure total volatile organic compounds (TVOC[5]) and HCHO formaldehydes in the air. To measure formaldehyde, the device was fitted with an electrochemical HCHO sensor that has a double platinum catalytic electrode, while to measure the TVOC, the device is fitted with a semiconductor sensor. (Photo 5 in Annex 5). One hour long recording sessions were performed at each of the 15 sampling sites with this equipment. The reference sheets of the field measurements are presented in Annex 4.8 and the data recorded at each sampling point in Annex 4.9.

Concentration of nitrogen dioxide (NO_2) and sulfur dioxide (SO_2) gases in immission were measured with Dräger tubes. These short-range Dräger volumetric tubes indicate the number of strokes according to the gas to be determined (Photo 6 in Annex 5). Once the procedure is completed, the Dräger tubes are removed, plugs are placed at both ends to prevent additional air inflow. The reaction in the internal chemical solution happen over several minutes. The color change within the range of the tube scale determines the gas concentration, which is then used in the final calculations (Photo 7 in Annex 5). The reference sheets of the field measurements are presented in Annex 4.8.

[5] TVOC groups together volatile organic compounds of chemical pollution: benzene, toluene, xylene, aromatic hydrocarbons, aldehydes, hydrogen sulfide, etc.

In all cases, regardless of the diversity of procedures, the sampling methods and times required, the Environmental Technical Regulations on Air Quality of the Dominican Republic were applied for each air quality parameter. Annex 4.10 presents the certificates of useful life of the sensors by the manufacturer of the equipment used.

Meteorological Characteristics

As a complement to the air quality measurements, parallel measurements of meteorological characteristics, including ambient air temperature, relative humidity, and wind speed, were performed using an Extech model 45170 portable station (Table 6-26 and Photo 8 in Annex 5). Indirect methods were used to determine wind direction.

Table 6-26: **Technical Characteristics of the Extech 45170 Portable Station**

Parameter	Technical characteristics
Temperature measurement range	0 – 50 ºC
Temperature measurement resolution	± 0.1 ºC
Measuring range of relative humidity	10 – 95 %
Temperature measurement resolution	± 4 %
Measuring range of wind speed	0 – 30 m/s
Resolution of wind speed measurements	0.1 m/s

Results for the meteorological and air quality parameters measured at the sampling sites are presented below.

Air Quality Standards

In 2018, The MIMARENA has developed air quality reference values which state the concentration a pollutant shall not exceed according to different time frames (Article 6 of the Environmental Technical Regulation on Air Quality). The MIMARENA also developed in 2018 the Maximum Permissible Emission Limits of the Static Method for vehicles that use gasoline as fuel and the maximum opacity limits for emissions by diesel-powered vehicles the maximum emission limits for diesel-powered vehicles (article 8 and 11 of the Environmental technical regulation for the control of emissions of air pollutants from mobile sources)

6.1.11.2 *Results*

The results of the measurements of particulate matter concentrations, as air quality standards, are presented in Table 6 27, and in Annex 4.5, and the primary calculations are attached with the data of the measurements recorded in the field (Annex 4.15 Map of the location of air quality measurement points). In general, the concentrations of particulate matter are moderate to high, very typical of urbanized areas, where the main sources are the usual socioeconomic activity and traffic in streets and avenues, with a notable presence of trucks and trucks.

Table 6-27: Summary of Particulate Matter Concentrations (PM 2.5, PM 10 and Total Suspended Particles)

Site	Meteorological variables				Particulate matter, µg/Nm^3		
	T, ºC	Hr, %	Vv, m/s	Dv	PM 2.5	PM 10	PST
P1	27.8	71.6	0.5	E	**52.8**	**92.4**	**211.2**
P2	27.9	71.8	0.3	E	**39.6**	**79.3**	**105.7**
P3	28.5	71.1	0.8	E	**53.0**	**92.8**	**132.6**
P4	30.0	70.0	0.8	E	**19.8**	**66.1**	**145.4**
P5	30.2	63.5	2.9	E	**66.8**	**120.3**	**254.0**
P6	32.9	55.5	0.1	E	**54.1**	**121.8**	**216.6**
P7	32.3	61.8	0.2	E	**67.7**	**176.0**	**324.9**
P8	28.1	75.9	0.1	E	**52.9**	**145.7**	**251.7**
P9	29.5	67.1	0.1	E	**66.6**	**146.6**	**239.9**
P10	32.2	59.6	0.1	E	**67.5**	**135.1**	**229.7**
P11	33.9	52.6	0.9	E	**40.8**	**109.0**	**231.6**
P12	27.6	74.3	0.1	E	**52.8**	**118.8**	**224.5**
P13	31.3	59.2	0.3	E	**40.1**	**94.0**	**174.1**
P14	33.9	47.5	0.3	E	**80.4**	**147.5**	**241.3**
P15	31.5	62.9	0.2	E	**67.1**	**120.9**	**228.4**
P16	31.8	63.1	0.4	E	**15.2**	**77.4**	**156.5**
Permissible limits of the Technical Environmental Regulation on Air Quality					**65.0**	**150.0**	**230.0**

T- air temperature in ºC, Hr- relative humidity in %, Vv- wind speed in m/s, Dv- wind direction.

Figure 6-25 compares the results obtained at each sampling site with the permissible limits established by the Environmental Technical Regulations for Air Quality. The highest concentrations of particulate matter were recorded at sampling sites located in streets, neighborhoods or residential areas, where conditions of agglomerations of people, vehicles or traffic predominate (points P5, P7, P8, P9, P10, P11, P14 and P15). Likewise, the sampling sites located towards the lower third of the Guajimía Canal (P2, P3, P4 and P16), in areas with large undeveloped spaces, measured the lowest concentrations of particulate matter.

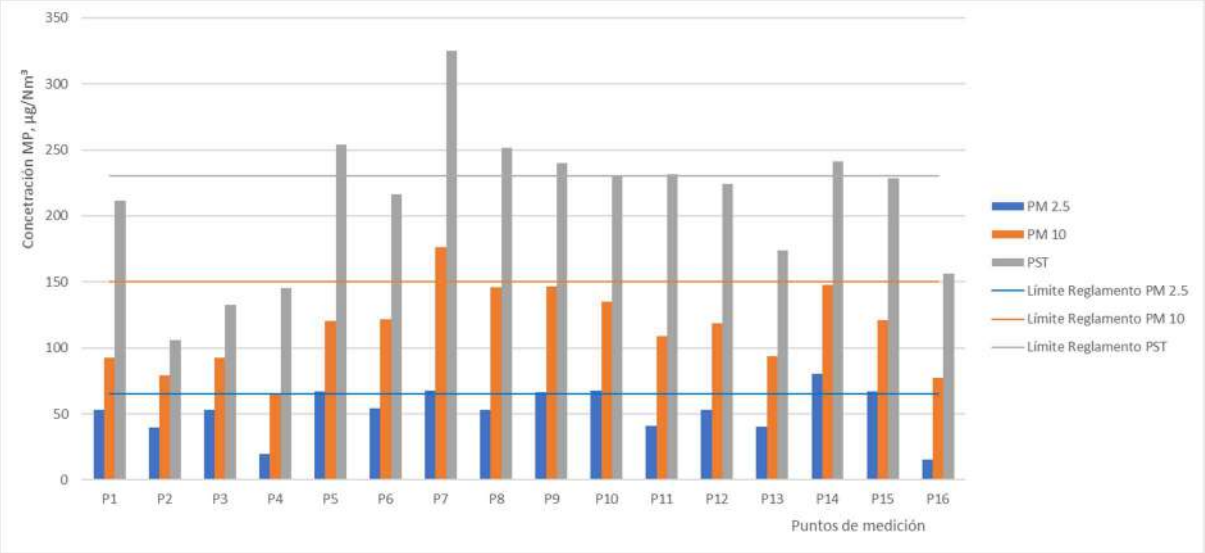


Figure 6-25: Concentration of Particulate Matter at the Measurement Points and Compared to the Permissible Limits of the Technical Regulation

Primary calculations with the data of combustion gases measured at the sampling sites are presented in Annex 4.9 (Annex 4.15 Map of the location of air quality measurement points) and results are presented in the Table 6-28. In general, all gas concentrations measured remain below the limits allowed by the reference regulation, with some minor and very specific peaks associated with local industrial activities (workshops) and vehicular traffic.

Table 6-28: Summary of Flue Gas Concentrations (CO, O3, SO2, NO2, TVOC, HCHO) at Immission Conditions

Sampling Site	Combustion gases in immission, µg/Nm³					
	CO	O_3	SO_2	NO_2	HCHO	TVOC
1	2800	< 100	< 420	< 380	14.7	64.3
2	7860	< 100	< 420	< 380	25.0	83.2
3	3110	< 100	< 420	< 380	40.8	71.5
4	7760	< 100	< 420	< 380	19.6	59.1
5	2610	< 100	< 420	< 380	16.2	37.2
6	6640	< 100	< 420	< 380	38.4	70.8
7	5830	< 100	< 420	< 380	17.0	75.7
8	2430	< 100	< 420	< 380	15.9	41.3
9	3580	< 100	< 420	< 380	28.7	51.7
10	4850	< 100	< 420	< 380	16.9	38.3
11	5040	< 100	< 420	< 380	23.2	40.2
12	2180	< 100	< 420	< 380	18.0	36.7
13	3160	< 100	< 420	< 380	16.1	42.2
14	3100	< 100	< 420	< 380	45.5	80.0
15	6250	< 100	< 420	< 380	19.5	47.7

Sampling Site	Combustion gases in immission, µg/Nm^3					
	CO	O_3	SO_2	NO_2	HCHO	TVOC
16	5480	< 100	< 420	< 380	20.0	45.8
Permissible limits of the Environmental Technical Regulation on Air Quality	**40000** (1 hour)	**250** (1 hour)	**450** (1 hour)	**400** (1 hour)	**100** (1 hour)	**(*)**

CO- carbon monoxide, **O3**- ozone, **SO2**- sulfur dioxide, **NO2**- nitrogen dioxide, **TVOC**- volatile compounds, **HCHO**- formaldehyde.
* Limits of 1000 µg/Nm3 in 30 minutes for Toluene, and 870 µg/Nm^3 per year for Xylene.

It is important to point out that these results are favorably influenced by the wind circulation conditions in the territory with a predominantly plain morphology, without significant obstacles, in addition to a location not far from the coastal strip.

6.1.12 Noise Levels

6.1.12.1 *Methodology*

Noise levels were measured at the same 16 sampling sites than those used to measures air quality. A CEM DT-8852 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 5). This device measures the maximum and minimum noise, both in dB(A) and dB (C).

General equipment data are presented in Table 6-29.

Table 6-29: 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 y Auto: 30 dB~130 dB
Response time	Fast: 125 mS y Slow: 1 s
Resolution	0.1 dB

At each sampling sites , readings were taken at a height of 1.5 m above the ground, in the direction of the source of noise during daylight hours, continuously for no less than five minutes in accordance with the procedures established in the Environmental Standard for Noise Protection of the Dominican Republic (NA-RU-001-03). The reference sheets of the field noise level measurements are presented in Annex 4.1 and in Annex 4.2.

Field calibration of the sound meter was conducted with an acoustic calibrator (pistophone) REED SC-05 class 2 IEC 60942. This device was set at the 94 and 114 dB(A) levels, 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), (Photo 2).

Annex 4.3 shows the calibration certificate of the sound level meter and the acoustic calibrator (pistophone) that fits the sound level meter in use.

Noise Standards

In Dominican Republic, the Environmental Standard for Noise Protection (NA-RU-001-03) presents the maximum permissible noise emission levels in decibels (dB) (A) and noise level allowed to vehicles by weight /cylinder capacity (Figure 2-6). In the present study, the maximum noise emission levels allowed for residential area with surrounding industries and businesses is 65 dB.

6.1.12.2 *Results*

The results of the daytime noise level measurements are shown in Table 6-30 and Annex 4.2 contains the complete data of the measurements recorded in the field (Annex 4.15 Map of the location of air quality measurement points) and the data related to the measurement. It is evident that noise levels are associated with anthropic activity in the area and traffic. For instance, the sampling sites R1, R4, R7, R10, R11, R12 and R15 were in areas with almost no traffic or with speed regulations because they are the access to residential areas. In contrast, the sampling sites R2, R3, R5, R6, R8, R9, R13, R14 and R16 were highly influenced by traffic and the usual socioeconomic activity of the neighborhoods, which contributed to exceed the permissible levels of the reference standard.

Table 6-30: Summary of Measured Noise Levels

Sampling sites	Noise level dB(A)			
	Mín.	Máx.	Prom.	Leq.
R1	52.0	76.5	59.6	**62.8**
R2	55.6	79.9	64.3	**68.7**
R3	58.4	84.7	72.0	**74.6**
R4	52.4	68.3	59.5	**61.4**
R5	51.0	86.8	60.7	**68.7**
R6	60.8	90.8	71.3	**76.4**
R7	55.4	77.8	61.1	**63.8**
R8	51.9	89.2	61.0	**69.9**
R9	55.0	78.4	64.0	**66.3**
R10	50.3	73.7	59.9	**61.9**
R11	48.0	79.5	54.7	**59.9**
R12	52.3	74.7	60.8	**63.0**
R13	54.8	85.1	63.6	**67.4**
R14	54.9	85.6	64.4	**68.2**
R15	52.1	72.6	61.1	**62.8**
R16	55.2	86.4	64.3	**70.0**

T- air temperature in ºC, Hr- relative humidity in %, Vv- wind speed in m/s, Dv- wind direction.
Standard NA-RU-001-03: Continuous Noise: 65 dB (A) for residential area with surrounding industries and businesses (Area II)

6.1.13 Vulnerability to Natural Hazards

6.1.13.1 *Seismic Activity*

The Dominican Republic is located at the junction point of the North American plate and the Caribbean plate and is characterised by the presence of regional faults. This can result in a probability of an eventual seismic event. Data indicates that at least six earthquakes reaching a magnitude 8.1 on the Richter scale were recorded in Dominican Republic.

6.1.13.2 *Floods*

In general, the watershed presents a highly branched drainage network characterized by numerous small tributaries that join the main canal at right angles. The drainage density - or water path length per unit area - is 1.36 km per square kilometer. The density of the drainage and low slopes account for the moderate response of the watershed to rainfall.

The initial drainage capacity of the Guajimía canal decreased considerably over the years due to human activities on its banks, the accumulation of waste in the channel and the insufficiency of the drainage structures under the bridges that cross it. This critical situation is expected to worsen in the next few years due to the ongoing urban development of the area and accumulation of waste.

It is important to note that the water level in the canal is high in some sections, especially downstream, due to the large number of obstruction elements lying in the canal. Therefore, the water of the canal regularly overflow the banks causing floods that destroy precarious houses on the banks and cause deaths.

6.1.13.3 *Cyclones and hurricanes*

In Dominican Republic, hurricanes are the main cause of very intense episodes of rainfall, i.e. when large accumulations are recorded with a very low return period. To express this usual behavior for the Caribbean Region, information from records related to cyclones developed in the North Atlantic from 1851 to 2020 has been 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 events, i.e., the trend towards an increase in the number of cyclones in each season, most of which cross the Caribbean region and Hispaniola (Figure 6-26).

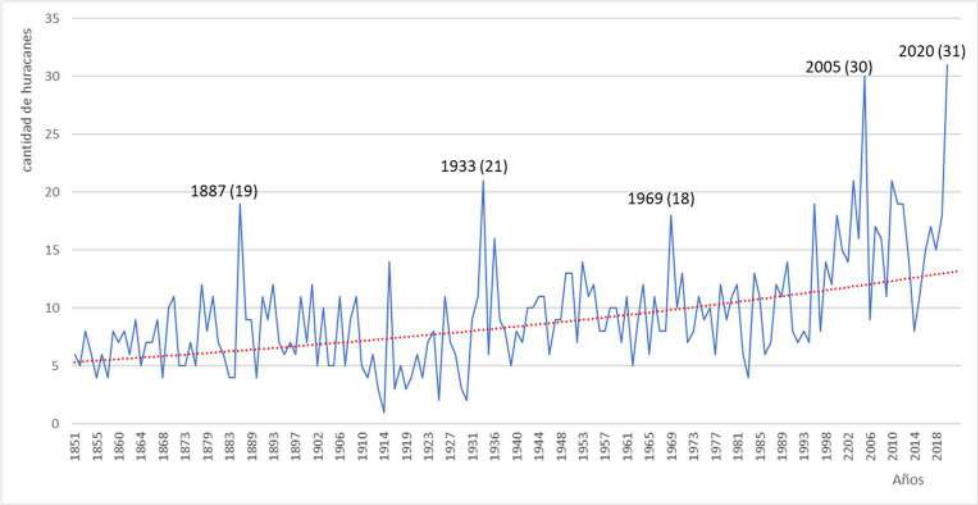


Figure 6-26: **Number of cyclones by decade from 1851 to 2020 in the North Atlantic region (named cyclones)**

As the Dominican Republic is hit every year by tropical storms it is important to understand the dynamics of these meteorological events for Western Caribbean region (according to the Caribbean Hurricane Network zoning).

Data gathered on hurricanes and storms that occurred between 1851 and 2019 in Dominican Republic show that most of these events occur in September, followed by August and October. According to archival data provided by NOAA's National Hurricane Center, the country has been hit directly by more than 40 extreme weather events over a period of 168 years (1851-2019) (Table 6-31).

Table 6-31 : Distribution of Meteorological Events by sub-region (1851-2019)

Category of events	Southern of Dominican Republic (Santo Domingo station)	Northern part of Dominican Republic (Puerto Plata station)
All events	40	43
Tropical Storms	24	30
Hurricanes of category 1	6	6
Hurricanes of category 2	5	2
Hurricanes of category 3	2	2
Hurricanes of category 4	2	2
Hurricanes of category 5	1	1

Here are the highlights of the past 15 years in terms of meteorological events:

- Even though the 2005 hurricane season was the most active since 1931 with a return period in the order of 80 years and 30 meteorological events recorded in the Caribbean region, only storm ("Alpha") affected the Dominican territory.

- the 2007 hurricane season was characterized by two events that stood out for their intense rainfall: storms "Noel" and "Olga". The former left accumulated rainfall in excess of 400 mm during the days of the event in several regions of the Dominican Republic.

- In the 2012 season, 9 hurricanes, 9 tropical storms and 1 major hurricane were reported in the Atlantic and Caribbean regions. Among these events, hurricanes "Isaac" and "Sandy" affected the southern part of Dominican Republic During the days of the "Sandy" storm (October 23 to 25, 2012), 350 mm of rainfall was reported for the northern region of Santo Domingo, which caused severe local flooding (Photo 13).

- In the 2016 season, the scourge of Hurricane "Matthew" was highlighted as it passed near f western Haiti. During these days heavy rains were recorded, reaching 234 mm in 24 hours in Santo Domingo with an additional 111 to 120 mm the following day in the same area, and a strong surge on the coast of the city of Santo Domingo (Photo 14 in Annex 5).

- During the 2018 hurricane season, 15 events were reported in the Atlantic and Caribbean regions, including 7 tropical storms, 6 hurricanes and 2 major hurricanes. The most important event for the project area was however Hurricane "Beryl", in July, which crossed the Island from south to north, as a tropical wave, with significant rainfall accumulations.

- In the 2020 season, there was a record number of 31 extreme events. In addition to these events, there were 31 tropical depressions and 30 storms, a historical record for the Caribbean region. In terms of hurricanes, 13 events were reported, 6 of which reached the hurricane category 5.

6.1.14 Climate Change

6.1.14.1 *Greenhouse Gases Emissions*

This assessment considers the seven gases defined as GHGs under the United Nations Intergovernmental Panel on Climate Change (IPCC):

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Hydrofluorocarbons (HFCs – a family of gases)
- Nitrogen trifluoride (NF_3)
- Fluorocarbons (PFCs – another family of gases) and
- Sulfur hexafluoride (SF_6)

It is assumed that small amount of GHG are currently emitted from the canals.

6.1.14.2 *Climate Change Risks*

6.1.14.2.1 Methodology

For the climate change risks analysis, the approach was based on relevant IFC standards. Elements from the “Performance Standard 4 – Community Health, Safety, and Security” (PS4) and the “Performance Standard 6-Biodiversity Conservation and Sustainable Management of Living Natural Resources” (PS6) guided the assessment.

Regarding the PS4, project activities, equipment, and infrastructure can increase community exposure to risks and impacts. Communities that are already subject to impacts from climate change may also experience an acceleration and/or intensification of impacts due to the project. The climate change risk assessment will consider the effects of climate change on community risk and vulnerability in identification and evaluation of project risks and impacts to community health, safety, and security, with particular attention to vulnerable groups.

As for the PS6, which aims to protect and conserve biodiversity, to maintain benefits from ecosystem services and to promote sustainable management of living natural resources, the climate change risk assessment will consider the effects of climate change on ecosystem services and natural habitat, and the role of each in mitigating climate risk, in identification and evaluation of project impacts on the natural environment.

Under the united nations framework, climate change is designated as a 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 period. In the last 100 years, Earth’s climate has been getting warmer and these changes in temperature can have different repercussions on weather trends in different regions. Climate change and its amplification can cause extreme weather events which could have impacts on the

population, the natural environment, structures and all types of infrastructure. In order to better plan in terms to climate change, climate change scenarios and projections have been developed and are a valuable tool for adaptation and for increasing resilience.

Climate projections are based on assumptions regarding the evolution of GHG emissions. These are referred to as Representative Concentration Pathways (RCP) and are named after their associated level of radiative forcing or difference between sunlight absorbed on Earth and what is radiated back to space. For instance, RCP 2.6, RCP 4.5, RCP 6 and RCP 8.5 correspond to 2.6, 4.5, 6 and 8.5 W/m² of radiative forcing, respectively for each scenario. Projected carbon dioxide (CO_2) concentration levels are predicted from the anticipated growth in population and energy demand (the type of energy is an important factor), as well as by the anticipated changes vegetation cover and type. High level descriptions of the RCPs are below in Table 6-32.

Table 6-32: RCPs

RCP	Description
RCP 2.6	Stringent mitigation scenario: representative of a scenario that aims to keep global warming likely below 2 degrees Celsius (°C) increase above preindustrial temperatures. Ambitious reduction of GHG emissions peak around 2020, then decline and become net negative before 2100.
RCP 4.5	Intermediate mitigation scenario consistent with relatively ambitious emissions reductions and GHG emissions increasing slightly before starting to decline ~2040. This falls short of the 2°C limit agreed upon in the Paris Agreement.
RCP 6.0	High to intermediate emissions scenario with emissions peaking in 2060 and declining for the rest of the century.
RCP 8.5	Very high GHG emissions: consistent with no policy changes to reduce emissions (current policies or business as usual).

(Source: IPCC, 2014.)[6]

The high carbon future (RCP 8.5) scenario was selected as it represents the worst-case scenario, which would overestimate the associated risk and lead to more robust adaptation measures. Historical climate information also plays a significant role in facilitating the contextualization and interpretation of future climate protection and identifying climate indicators or events that can have significant impact on a region. Historical climate trends and future climate projections were used to determine the climate-related risk.

6.1.14.2.2 Results

Currently and historically, the Dominican Republic has a tropical climate and has the general characteristics of the Caribbean coastal region. The RCP8.5 future climate projections for the Dominican Republic indicate changes in temperatures and changes in precipitation patterns varying from one region of the country to another. The World Bank Group has put forward the Climate Change Knowledge Portal (CCKP), which uses the Coupled Model Intercomparison Project, Phase 5 (CMIP5) models. The CCKP climate projections in comparison to historical data for the Dominican Republic shows certain trends for certain climate variables.

Rainfall in the Dominican Republic is highly variable depending on geography and season. In the southern part of the country, where the project will take place in the Santo Domingo area, there are to distinct season, the rainy summer, and the dry winter. Future climate scenarios based on historical climate data for the Dominican Republic provided by the National Meteorological Office (ONAMET) and analysed by experts from the Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC)[7], concluded:

- The conditions of total annual precipitation by 2050 may decrease by 15% on average throughout the national territory, aggravating the decrease to values of 17% by 2070, compared to the average of the baseline 1950–2000.

[6] IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp
[7] World Health Organization. (2021). *Health and climate change: country profile 2021: Dominican Republic* (No. WHO/HEP/ECH/CCH/21.01. 02). World Health Organization.

- The southern and western regions of the country will be the most affected by the decrease in rainfall by 2050 and 2070, while the eastern and northern regions could even show even small positive changes.
- The total monthly precipitation during the dry season may decrease drastically by 2050 and 2070.
- The beginning of the rainy season in May and June could present a sudden increase in the total accumulated rainfall.

  (World Health Organization, 2021)

These conclusions are also supported by the CCKP projections, where

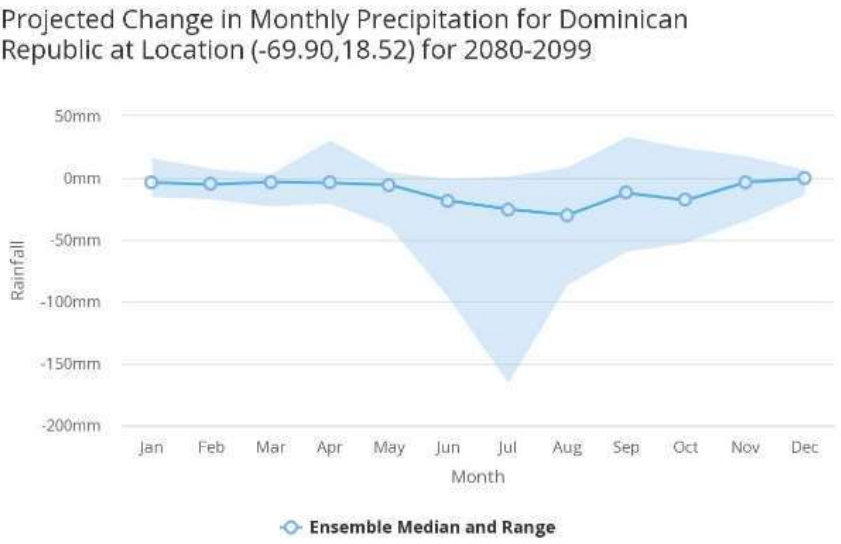


Figure 6-27: shows the projected changes in monthly precipitation for the Santo Domingo region of the Dominican Republic for the 2080-2099 projection timeframe. Overall, a decrease in monthly precipitation can be observed, especially in from June to October. The peak precipitation decrease occurs in August with a median monthly precipitation decrease of 30 mm.

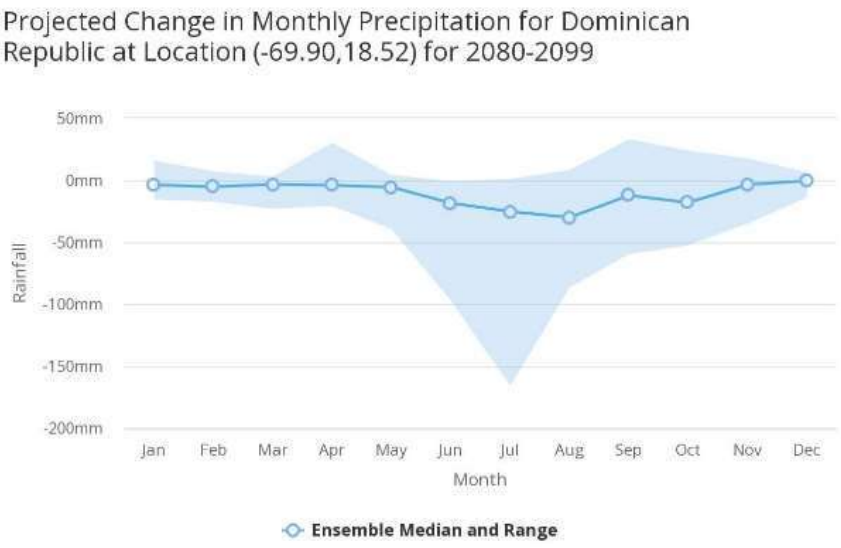
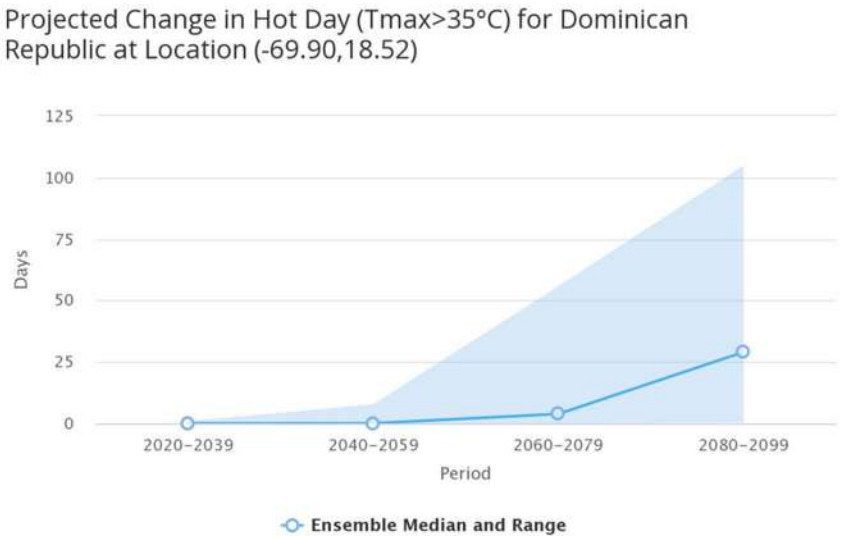


Figure 6-27: Projected Changes in Monthly Precipitation for Santo Domingo in the Dominican Republic for 2080-2099
(Source: World Bank Group, 2021a**)**[8]

Figure 6-28 and Figure 6-29 present the projected changes in hot days, where maximum temperature is over 35 degree Celsius in the Dominican Republic, in the Santo Domingo region. Figure 6-28 illustrates the changes in number of days compared to the reference period (reference period is 1986-2005 in the case of the CCKP). As shown, over the majority of the projection timeframes, an increase in number of hot days with a Tmax over 35 degrees Celsius can be observed, with a rapid increase from the 2060-2079 timeframe to the 2080-2099 timeframe. The 2080-2099 timeframe is projected to have a median increase of 29 hot days more than the reference period. Figure 6-29 shows that the increases in hot days will occur between May and November, with the peak being in August. Long-term changes in temperatures consist of a coherent increase in the coming decades, increasing water stress in arid and semi-arid areas, and also during drier months[9].



[8] World Bank Group. (2021a). Climate Change Knowledge Portal: Dominican Republic. https://climateknowledgeportal.worldbank.org/country/dominican-republic/climate-data-projections
[9] Caffrey, P., Kindberg, L., Stone, C., de Obeso, J. C., Trzaska, S., Torres, R., & Meier, G. (2013). Dominican Republic climate change vulnerability assessment report. *African and Latin American resilience to climate change (ARCC)*, 1-132.

Figure 6-28: Projected Change in Hot Days for Santo Domingo in the Dominican Republic for Different Projection Timeframes
(Source: World Bank Group, 2021a**)**

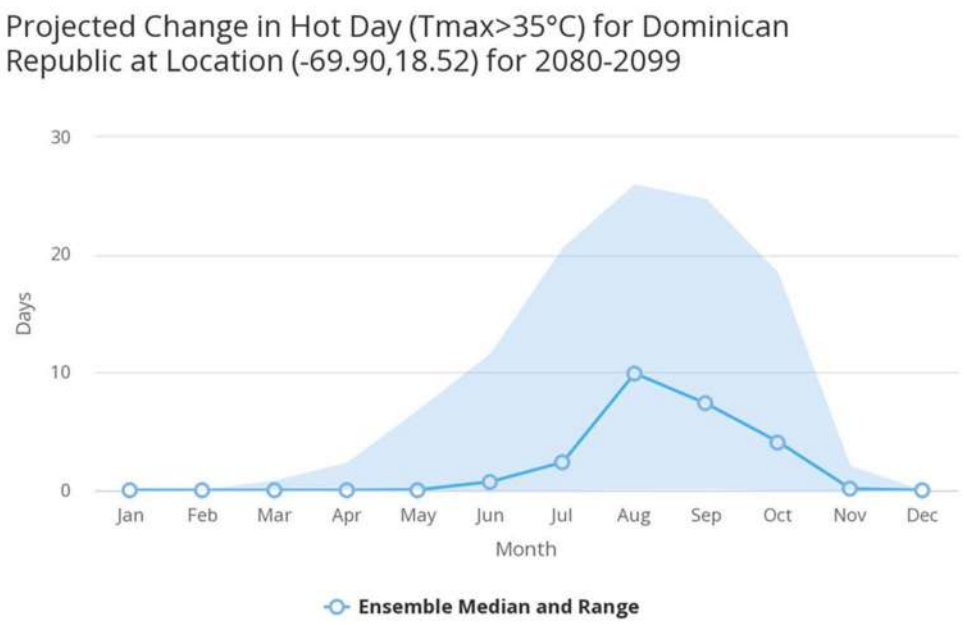


Figure 6-29: Projected Monthly Change in Hot Days for Santo Domingo in the Dominican Republic for 2080-2099
(Source: World Bank Group, 2021a**)**

Precipitation and temperatures are important climate indicators that are predicted to vary in the future. However, it is also important to look at the significant natural hazard that the Dominican Republic is currently vulnerable to, and how the changing climate may affect the occurrence and the intensity of those natural hazards. Three natural hazards are significant for the project and can be influenced by the projected change in climate: storms, floods and drought.

Historically, tropical storms in the Dominican Republic have been destructive, affecting the country's infrastructure and its population. Damages can be attributed not only to strong winds, but also to heavy precipitations. It is anticipated that the number of tropical storms may decrease towards the end of the century. However, their intensity is predicted to increase (category 4 and 5 events) due to human-induced warming. This is translated in an increase of wind speed and more intense precipitation within 100km of the storm centre. In other words, the number of storms is likely to decrease but their and their associated winds and precipitations will increase as ocean and global temperatures continue to rise. (World Health Organization, 2021)

Although precipitations are predicted to decrease in the Santo Domingo region, flood is an important natural hazard to consider for the storm and sanitary sewer project. Figure 6.4 illustrates the number of people affected by flooding in the Dominican Republic each year from 1985-2018, where it can be observed that people affected by floods has been predominant and occurrences relatively constant since 2002. With increase intensity of tropical storms, it is important that the infrastructure of the project be resilient to heavy precipitations and flooding.

Increased heat combined with decreased rainfall can exacerbate water stress, especially in the drier areas of the country and those subject to the mid-summer drought. The period of relative droughts between the months of July–August could be more intense.

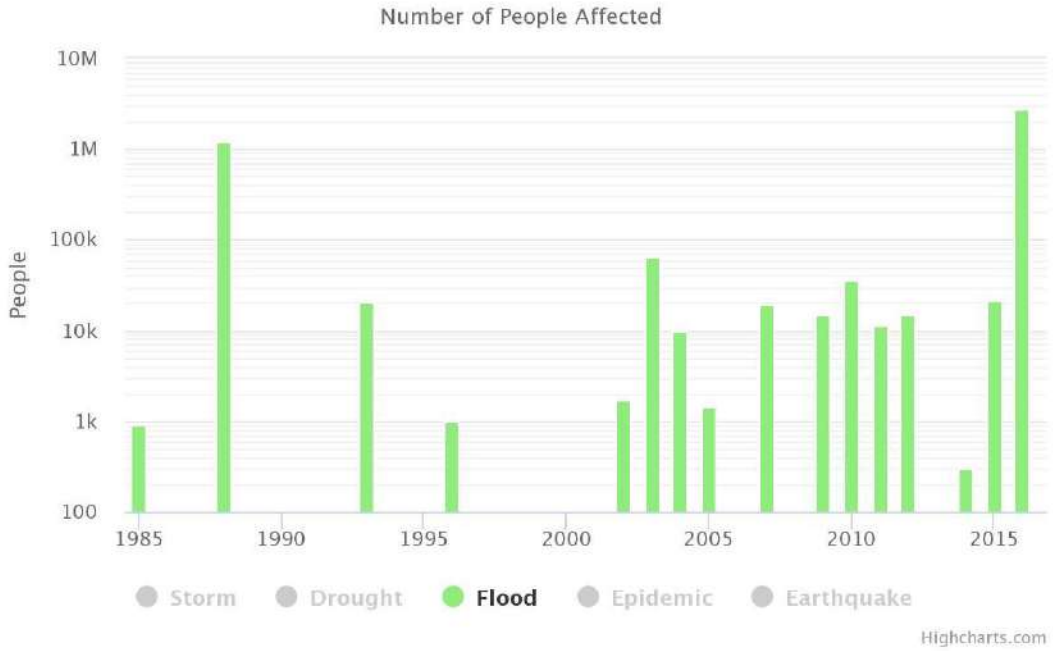


Figure 6-30: Number of People Affected by Flood Statistics for 1985-2018
(Source: World Bank Group, 2021b**)**[10]

[10] World Bank Group. (2021a). Climate Change Knowledge Portal: Dominican Republic. https://climateknowledgeportal.worldbank.org/country/dominican-republic/vulnerability

6.2 Biological Baseline

6.2.1 Methodology for the Assessment of the Biological Baseline

As background of research consulted, several documents are presented that have been carried out in the area of the Project of Stormwater and Sanitary Drainage of the Guajimía Canal Phase II, and that in general were taken as reference and comparison:

- Birds of the Dominican Republic (Stockt de Dod, 1978).
- Inventory of herpetofauna by Schwartz and Henderson (1991).
- Final Report of the Santo Domingo Green Belt (CONAU, 2000).
- Baseline inventory by Auding Latinoamericana (AL) (2003).
- Environmental Impact Assessment Report and Social Management Plan of the Rainwater and Sanitary Drainageproject of the Guajimía Canal Phase I (Dessau-Soprin-Can-American, 2006).
- Environmental Impact Assessment Report and Social Management Plan of the Rainwater and Sanitary Drainage project of the Guajimía Canal Phase II (Dessau Inc. 2008).

6.2.1.1 *Area of Influence*

Considering the geographical delimitations and levels of anthropization of the area for the project the area of influence for the biological baseline was identified as the watershed of the Guajimía canal, which occupies a total area of 13.58 km^2 (Subsection 4.2.2, Chapter 4. Description of the project).

6.2.1.2 *Selection of Sampling Points*

Prior to the beginning of the field work for the characterization of flora and fauna, 13 points were selected using the Google Earth imagery, within the boundary of the Guajimía canal watershed and its tributaries (Table 6-1), considered as the area of influence of the project. The selection of the points was influenced by the dark green spots that indicated the possible presence of vegetation.

6.2.1.2.1 Flora

Six points were discarded for the vegetation surveys (4, 5, 6,10,11 and 13) of the 13 previously selected. No vegetation of importance was found there, rather generally cleared spaces with little floristic interest. In addition, most of these areas are densely populated. Two other points were later added (14 and 15) in the canals of Ureña and Los Indios (Phase I). The points of greater estimated coverage ranged between 80 and 95%, with VT-12 showing the highest coverage. The coverage of the other points was not possible to define considering the high degree of anthropization found. All points were georeferenced using GPS, where location is expressed in coordinates UTM WG84 (Table 6-33:Annex 6.1).

6.2.1.2.2 Fauna

For fauna, 13 points were sampled (Table 6-33). Annex 6.2 displays the mapped sampling points of the terrestrial fauna in the watershed.

Table 6-33: Pre-selected Sampling Points for the Characterization of Vegetation, Flora, and Terrestrial Fauna

Vegetation Sampling (VT).	Terrestrial Fauna Sampling (FT).	UTM coordinates	
		X	and
VT-1	**FT-1**	394999.00	2043336.00
VT-2	**FT-2**	394558.00	2043375.00
VT-3	**FT-3**	394517.00	2043174.00
--	**FT-4**	395542.00	2042781.00
--	**FT-5**	394114.00	2042849.00
--	**FT-6**	394589.00	2041885.00
VT-7	**FT-7**	394714.00	2041517.00
VT-8	**FT-8**	395134.00	2041741.00
VT-9	**FT-9**	395685.00	2041298.00
--	**FT-10**	395262.00	2040790.00
--	**FT-11**	394978.00	2039919.00
VT-12	**FT-12**	394442.00	2039297.00
--	**FT-13**	393774.00	2038751.00
VT- 14	**--**	396404.21	2041852.05
VT- 15	**--**	395670.56	2041056.85

Aquatic Fauna

The sampling stations for aquatic fauna were located in the canal where the accumulation of waste allowed the existence of water (Table 6-34: Annex 6.3).

Table 6-34: UTM Coordinates of the Sampling Points of the Aquatic Fauna

Aquatic Fauna Sampling (FA).	Coordinates UTM WGS 84, zone 19Q		Canals	Date of sampling
	X	and		
FA-1	395029	2043942	Villa Aura.	May 31
FA-2	394647	2043696	Guajimía	
FA-3	394632	2042833		
FA-4	395276	2043199	Mahogany	
FA-5	397202	2042728	Buenos Aires	
FA-6	395211	2041206	Guajimía	June 2
FA-7	395074	2039933		

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6.2.1.3 *Methodology for Characterizing Vegetation Types and Associated Flora*

The field work for the characterization of the vegetation and the inventory of the flora was carried out in two field campaigns, during the month of May (2021).

Transects of 50 meters in length and 100 meters wide were sampled. The transects were selected according to the different types of vegetation present, following the Matteuci & Colma (1982) preferential method). In addition to the sites selected for the floristic inventory, collections of species located outside the transects were recorded to complement this study.

Botanists 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 in 2016, were the specialists involved the surveys.

The taxonomic identification of the species was done mostly in situ, while those that could not be identified on field were collected and identified in the National Herbarium of Santo Domingo (JBSD). Once processed and dried, the taxonomic identification of the specimens was undertaken through the use of taxonomic keys contained in the flora of Hispaniola (Liogier , 1982, 1983, 1985, 1986, 1989, 1994, 1995, 1996, 2000 and Acevedo, 2003) and by comparison with specimens from the herbarium collection.

The list of species was then drawn up with information regarding the family, scientific and common name, conservation status end estimated or relative abundance.

The International Union for the Conservation of Nature (IUCN) Red List of Vascular Flora in the Dominican Republic (2016) was consulted for the conservation status of the species. as well the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 2021).

All the fieldwork was supported by abundant photographic material, taken by the vegetation specialists. Once the field phase was completed the vegetation list with biodiversity values as well as the vegetation map were updated.

6.2.1.4 *Methodology of Sampling of Terrestrial Fauna*

Thirteen sampling points were selected for this group according to the habitats of importance, present in the study area. Presence, abundance, and diversity of the taxonomic groups of terrestrial fauna were recorded.

The conservation status of the species located in the project area was verified through the IUCN Red List (IUCN, 2021), the IUCN red list of endangered, threatened or protected species of the Dominican Republic (MIMARENA, 2011) and CITES (UNEP-CITES, 2021).

Sampling techniques proposed by Angulo et *al*. (2006) were used for the herpetofauna surveys. These consisted in unrestricted searches within a 50 m radius with a time set of 25 minutes at each sampling point. Observed individuals were counted using visual and auditory methods (Angulo et al. 2006). Special attention was given to the available microhabitats. Surveys were carried out mornings (from 8:30) and at night (from 19:30) between May 13 and 17 (2021) by specialists Jesús Mercedes Almonte and Esteban Garrido.

For the determination of the biogeographical status and conservation status of the registered species, the IUCN Red List of threatened species (IUCN, 2021), the Red List of the Species of Endangered Flora and Fauna of the Dominican Republic (MIMARENA, 2011) and the Convention for International Trade in Endangered Species of Wild Fauna and Flora (UNEPCITES, 2021) and the Caribbean Amphibian and Reptile Database (Caribherp, 2021) were taken into account.

Transects (150m) of variable width were used for direct observations of mammal species by visual and auditory means, (Birriones, 2004).

A walking pace of approximately 0.5 to 1 km per hour was maintained consistently along the transects Daytime censuses were conducted from 7:00 to 13:00 hours. Night sampling occurred from 19:00 to 1:00. The surveys took place between the 13th and 17th of May 2021 and were completed by the specialists Jesús Mercedes Almonte and Esteban Garrido.

Data for chiropters was collected using two sampling techniques: by capture, using fog nets, and by simple observation in 150 m transects. Sampling was done at points FT-5, FT-7 and FT-12 (Table 6-32) considering vegetation presence at these areas. Five fog nets of 6m long and 2m wide (Photo 77, Annex 7) were installed at

all three sampling sites (Baillie and *al*. 1986, Peach and *al*. 1991). Nets were opened in the early hours of the night at 19:00 and stayed open until 22:00 in order to cover the hours of greatest activity. Samplings were carried out between May 13 and 17 (2021) by specialists Jesús Mercedes Almonte and Esteban Garrido.

The nets were placed where frequent passages occur. When captured the individuals were identified (Photo 78, Annex 7), marked with a harmless ink, to verify recapture, and released. Observation transects were located near net placement. The numbers of individuals observed as well as flight height were recorded.

Methods from Ralph et al. (1981, 1995) and Wunderle et al. (1994) were used to collect data for birds. The sampling techniques will combine: count by fixed points, the interviews and opportunistic observations. The samplings were carried out between May 13 and 17 (2021) by specialists Jesús Mercedes Almonte and Esteban Garrido.

During **fixed points counts** the observer remains immobile during a certain time at a chosen sampling station, in order to increase the probability of bird detection and decrease disturbance generated during transect movements (Chávez-León and Velázquez, 2004).An observation radius between 25 m and 50 m was applied (Ralph et al. 1981, 1995; Wunderle, 1994; Allen, 1986; Lack, 1954, 1966; Call, 1981 and Lancia, et al. 2005) where , species and individuals observed and heard within the perimeter were identified and noted. The maximum distance between the was 200 m. Ten-minute observations were done at each sampling point (Smith et al. 1997 and Cox and Ricklefs, 1977).

For the appreciation of individuals of the same species, which are only heard in flocks, only two individuals are considered at most. In the case of mixed flocks, only one observation was noted for each species heard.

Interviews were undertaken to seek information on the history of the avifauna in the study area, (Vicente, 1998).

Opportunistic observations were made at random, providing data on other species not identified previously (Allen, 1986).

The field work was carried out at all the fauna sampling points during hours of greatest activity. Species were identified through direct observation or by chant (Allen, 1986).

Taxonomic classification followed the American Ornithological Society, (AOS, 2020) the *Guide to the Birds of the Dominican Republic and Haiti* (Latta and *al*. 2006) and *A Guide to the Birds of the West Indies* (Raffaele et al. 1998).

To define the biogeographical status of each species, the categories proposed by Raffaele and *al*. (1998) and Latta and *al*. (2006) were used, which include:

- Resident: Species of permanent presence naturally, which reproduce in the Island Hispaniola.
- Endemic: Species presence only in the Island Hispaniola, is not found elsewhere in the world.
- Migratory: Specie that reproduce outside the Island Hispaniola and occur on the island during its time of non-reproduction, usually from September to April.
- Introduced: Specie not native to The Island of Hispaniola, but for unnatural reasons such as releases and escapes, they are present in wild area where they can even reproduce.

The following categories were used for the classification of trophic guilds:

- Insectivores: Species that feed on insects
- Frugivores: Species that feed mostly on fruits and seeds
- Nectarivores: Species whose diet is based on the nectar produced by the flowers of the plants
- Piscivores: Species that feed on fish
- Raptors: Birds of prey that hunt and feed on animals including other birds (Guariguata and Kattan, 2002 and Reales and *al*. 2009)

- Scavengers: Species that feed on animal carcasses
- Omnivores: Opportunistic and generalist species that feed on seeds and insects and small vertebrates (Guariguata and Kattan, 2002; Reales and *al*. 2009)

The identification of the conservation status of species was determined according to the UICN Red list of threatened species (IUCN, 2021), the Red List of Threatened Species of Fauna and Flora in the Dominican Republic (MIMARENA, 2011), the CITES (UNEP-CITES, 2021.

6.2.1.5 *Aquatic Fauna*

This study was carried out with the aim of characterizing the existing aquatic resources in the area of influence of the Stormwater and Sanitary Drainage Project of the Guajimía Canal Phase II. Two field trips were made on May 31 and June 2, 2021. The information was gathered using different methodologies.

The techniques used were of qualitative order. Hence microscopic taxa presence was recorded using Lamella-lamella microscope (Figure 6-31) and by naked eye for macroscopic organisms.

Figure 6-31: Microscope Model used: AmScope 40x-1000

Zooplankton samples were taken at the subsurface level (0.5 m using a plankton net with a mesh opening of 20 µm, which was dragged in the water obliquely (Figure 6-32 and Photo 81, Annex 7).

Figure 6-32: Plankton Net with 20 µm Mesh Opening.

Due to the characteristics of the Canals, which have little depth and a large amount of waste, fish were captured using a jatico-type net (Figure 6-32. The collected fish were preserved in 4% formalin and labeled in plastic bags (Photo 84).

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Figure 6-33: Network Type D-Net or Jatico

6.2.2 Characteristics of the Flora

The Guajimía Canal is located within the subtropical humid forest, according to the classification of life zones of Holdridge (1947) and cited by Tasaico (1967) and Hartshon et al. (1981).

The watershed of the Guajimía Canal and its surroundings have been strongly impacted by anthropic activities since the colonial period. The colonial ruins, that testify the use of the area for sugarcane production, together with livestock, caused the first and greatest impacts to the vegetation and the local flora in the early sixteenth century. The first area impacted was the one near the mouth of the Haina River, in the Engombe sector (II Dessau Inc. 2008).

Before the area was converted into dense urban settlements, which ended up destroying the vegetation and native flora, the biggest impacts were agriculture, livestock and wood cutting.

Currently there is no primary vegetation anywhere in the environment of Gorajimia. In some areas, patches of gallery-like vegetation are observed, for instance on the edges of the Guajimía canal, in El Valle Ciudad Agraria campus of the Autonomous University in Engombe and in the vicinity of the toll located on highway 6 noviembre. In the latter subsites a forest planted by the authorities of the Ministerio de Medio ambiente and Recursos Naturales. The most abundant vegetation found in the study area is of herbaceous type, on the margins of the canal and in the courtyards of the houses. In addition, the presence of scattered trees stands out. Most of them fruit trees such as: Mango (*Mangifera indica);* Avocado *(Persea americana);* Quenepa *(Melicoccus bijugatus);* Loquat *(Manilkara sapota);* Sweet orange Citrus *sinensis);* Sour orange (Citrus *aurantium);* Lemon (Citrus*aurantifolia);* Coco *(Cocos nucifera);* Jagua *(Genipa americana);* Carambola *(Averrhoa carambola);* Soursop *(Annona muricata);* Toad *(Pouteria sapota);* Good bread (*Altocarpus altilis);* Cajuil *(Anacardium occidentale) ,*among others.

6.2.2.1 *Description of Vegetation and Flora at Sampling Points*

Point VT-1 Canal Las Mahogany: On both sides of the canal, the greatest presence of trees is in the park area, located in the North side. On the southern edge in the courtyards of the houses and some a few meters from the riverbed were observed some trees and shrubs, as well as terrestrial grasses and some aquatic plants (Table 6-35, Photo 44, Annex 7). As shown in Table 6-35, the list includes cultivated species.

Table 6-35: Flora Sampled at Point VT-1

Common Name	Scientific Name	Common Name	Scientific Name
Palma Real	*Roystonea borinquena*	Laurel	Ficus*benjamina*
Mango	*Mangifera indica*	Mahogany	*Swietenia mahagoni*
Almond	*Terminalia catappa*	Avocado	*Persea americana*
Jabilla Criolla	*Hura crepitans*	Melina	*Gmelina arbórea*
Yellow Cassia	*Senna siamea*	Quenepa	*Melicoccus bijugatus*
Flamboyant	*Delonix regia*	Soursop	*Annona muricata*
Oak	*Catalpa longissima*	Neen	*Azadirachta*indica
Creole Flax	*Leucaena leucocephala*	Guineo	Musa*sapientum*
Jina Extranjera	*Pithecellobium dulcis*	Banana	*Musa paradisiaca*
Coco	Cocos *nucifera*	Chinola	*Passiflora edulis*
Poppy	*Spathodea campanulata*	Auyama	*Cucurbita moschata*
Cayenne	Hibiscus *rosa-sinensis*	Croton	*Codiaeum variegatum*
Powerful hand	*Syngonium podophyllum*		

Point VT-2 Guajimía Canal (Agrarian City): The vegetation and flora in this area presents similar characteristics to the previous one (El Valle), except for some species not previously observed (Table 6-36: Flora Sampled at Point VT-2).

Table 6-36: Flora Sampled at Point VT-2

Common Name	Scientific Name	Common Name	Scientific Name
Tcha tcha	*Albizia lebbeck*	Loquat	*Manilkara sapota*
Soursop	*Annona muricata*	Cherry	*Malpighia punicifolia*
mamón	*Annona reticulata*	Mango	*Mangifera indica*
Carambola	*Averrhoa carambola*	Quenepa	*Melicoccus bijugatus*
Neem	*Azadirachta indica*	Noni	*Morinda citrifolia*
Gri Gri	*Bucida buceras*	Banana crops	*Musa paradisiaca*
mara	*Calophyllum calaba*	Avocado	*Persea americana*
Ilang Ilang	*Cananga odorata*	Guava	*Psidium guajaba*
Ceiba	*Ceiba pentandra*	Royal palm	*Roystonea borinquena*
Sour orange	*Citrus aurantium*	Saman	*Samanea saman*
Sweet orange	*Citrus sinensis*	Cas sia amarilla	*Senna siamea*
Coco	*Cocos nucifera*	Poppy	*Spathodea campanulata*
Flamboyant	*Delonix regia*	Tamarind	*Tamarindus indica*
Laurel	*Ficus benjamina*	Almond	*Terminalia catappa*

Common Name	Scientific Name	Common Name	Scientific Name
Jabilla Criolla	*Hura crepitans*	Cocoa	*Theobroma cacao*
Majagua	*Lonchocarpus domingensis*	Melina	*Tree Gmelina*

Point VT-3 Guajimía Canal (El Valle): At this point there is a dense strip of gallery forest formed by a mixture of native species and cultivated fruit trees (Table 6-37). Some individuals reach more than 15 m in height. It is necessary to emphasize that the vegetation of this area is cared for and valued by the neighbors of the (Photo 45 and 46, Annex 7).

Table 6-37: Flora Sampled at Point VT-3

Common Name	Scientific Name	Common Name	Scientific Name
Soursop	*Annona muricata*	Cherry	*Malpighia punicifolia*
Bambu	*Bambusavulgaris*	Loquat	*Manilkara sapota*
Cabrita	*Bunchosia glandulosa*	Quenepa	*Meliccocus bijugatus*
Casuarina	*Casuarina equisetifolia*	Noni	*Morinda citrifolia*
Yagrumo	*Cecropia schreberiana*	Tuna	*Opuntia cochinilifera*
Siltn sour	*Citrus aurantifolia*	Avocado	*Persea americana*
Sour orange	Citrus*aurantium*	Guayuyo	*Piper aduncum*
Sweet orange	Citrus*sinensis*	Foreign gina	*Pithecellobium dulcis*
Coco	*Cocos nucifera*	Sapote	*Pouteria sapota*
Higuero	*Crescentia cujete*	Guava	*Psidium guajaba*
Jagua	*Genipa americana*	Royal palm	*Roystonea borinquena*
Cuban pine nuts	*Gliricidia sepium*	Saman	*Samanea saman*
Jabilla criolla	*Hura crepitans*	Poppy	*Spathodea campanulata*
Gina creole	*Inga fagifolia*	Almond	*Terminalia catappa*
Guama	*Inga vera*	Pigeon memizo	*Trema micrantha*
Creole flax	*Leucaena leucocephala*	Joboban	*Trichillia hirta*

Point VT-7 Engombe (Marcano Forest): This sampling point was carried out near the Faculty of Agronomy and Veterinary Medicine of the Autonomous University of Santo Domingo, in an arborized area baptized as Marcano forest to honor the outstanding teacher and naturalist Eugenio de Jesús Marcano Fondeur. This area has dense vegetation with trees approximately 15 m high. Most of the trees present were planted (Table 6-38) (Photo 49 Annex 7).

Table 6-38: Flora Sampled at Point VT-7

Common Name	Scientific Name	Common Name	Scientific Name
Tcha tcha	*Albizia lebbeck*	Cuban pinion	*Gliricidia sepium*
Donkey stick	*Andira inermis*	Campeche	*Haematoxylum campechianum*
Soursop	*Annona muricata*	Jabilla criolla	*Hura crepitans*
Mamon	*Annona reticulata*	Carob	*Hymenaea courbaril*
Carambola	*Averrhoa carambola*	Sausage	*Kigelia pinnata*
Neem	*Azadirachta indica*	Creole flax	*Leucaena leucocephala*

Common Name	Scientific Name	Common Name	Scientific Name
Bamboo	*Bambusa vulgaris*	Mango	*Mangifera indica*
Wasp stick	*Casearia guianensis*	Quenepa	*Melicoccus bijugatus*
Yagrumo	*Cecropia schreberiana*	Foreign gina	*Pithecellobium dulcis*
Cedar	*Cedrela odorata*	Royal palm	*Roystonea borinquena*
Penda	*Citharexylum fruticosum*	Saman	*Samanea saman*
Beach grape	*Coccoloba uvifera*	Cassia rosada	*Senna javanica*
Pigeon heart	*Colubrina arborescens*	Cassia amarilla	*Senna siamea*
Doll	*Cordia collococca*	Olive tree	*Simarouba berteroana*
Flamboyant	*Delonix regia*	John first	*Simarouba glauca*
Rubber	elastic*Castile*	Poppy	*Spathodea campanulata*
Ficus	*Ficus lyrata*	Palo de leche	*Tabernaemontana citrifolia*
Jagua	*Genipa americana*	Almond	*Terminalia catappa*

Point VT-8 Guajimía Canal (near the Pollera): At this sampling point, there no dense tree areas are found, rather only scattered individuals with numerous herbaceous, vegetation, climbing on the margins of the canal. The few tree species observed are mostly cultivated in the courtyards of houses (Table 6-39) (Photos 52 and 53, Annex 7).

Table 6-39: Flora Sampled at Point VT-7

Common Name	Scientific Name	Common Name	Scientific Name
Bleo	*Amaranthus viridis*	Mango	*Mangifera indica*
Guanabana	*Annona muricata*	Quenepa	*Melicoccus bijugatus*
Roble	*Catalpa longissima*	Yerba de guinea	*Panicum maximun*
Sour orange	Citrus*aurauntium*	Avocado	*Persea americana*
Sweet orange	Citrus*sinensis*	Guayaba	*Psidium guajava*
Cereza	*Malpighia punicifolia*	Almendra	*Terminalia catappa*

Point VT-9 West Hills: This area is completely cleared finding only grasses and some trees on the southwest portion (Table 6-40) (Photo 55, Annex 7).

Table 6-40: Flora Sampled at Point VT-9

Common Name	Scientific Name	Common Name	Scientific Name
Buen pan	*Altocarpus altilis*	Mango	*Mangifera indica*
Roble	*Catalpa longissima*	Aguacate	*Persea americana*
Agrumo	*Cecropia scheberiana*	Gina extranjera	*Pithecellobium dulcis*
Flamboyant	*Delonix regia*	Preal soul	*Roystonea borinquena*
Laurel	Ficus*benjamina*	Anacahuita	*Sterculia apetala*
Psoul	*Livistona chinensis*	Lino criollo and Roble amarillo	*Tabebuia aurea*

Point VT-12 Guajimía Canal (stretch from 6 Noviembre Highway and the Haina River mouth): It is the area that has the greatest vegetation coverage along the entire Guajimía canal (Photos 56 and 57, Annex 7). This forest was planted under the coordination of the Ministry of Environment and Natural Resources (2008-2011).

The area has a coverage of more than 80% and some of the trees are more than 15 m high. This place has no primary vegetation, although there are native trees not planted as: Jabilla criolla (*Hura crepitans)*; Andagrumo, *(Cecropia scheberiana)* and Royal Palm *(Roystonea borinquena),* among others (Table 6-41).

Table 6-41: Flora Sampled at Point VT-12

Common Name	Scientific Name	Common Name	Scientific Name
Oak	*Catalpa longissima*	Royal palm	*Roystonea borinquena*
Andagrumo	*Cecropia scheberiana*	Saman	*Samanea saman*
Cedar	*Cedrela odorata*	Cassia rosada	Senna*javanica*
Ceiba	*Ceiba pentandra*	Ribbing	*Serjania polyphylla*
Bejuco caro	*Cissusverticillata*	Olive tree	*Simarouba berteroana*
Penda	*Citharexylum fruticosum*	John first	*Simarouba glauca*
Beach grape	*Coccoloba uvifera*	Anacahuita	*Sterculia apetala*
Crotos	*Croton lobatus*	Foreign gina	*Sweet Pithecellobium*
Gratey	*Dalechampia scandens*	Creole mahogany	*Swietenia mahagoni*
Flamboyant	*Delonix regia*	Mpowerful anus	*Syngonium podophyllum*
Guazuma	*Guazuma tomentosa*	Pink oak	*Tabebuia heterophylla*
Jabilla criolla	*Hura crepitans*	Milk stick	*Tabernemontaana citrifolia*
African mahogany	Kaya*senegalensis*	Tamarind	Tamarind*indica*
Mango	*Mangifera indica*	Almond	*Terminalia catappa*
Quenepa	*Melicoccus bijugatus*	Melina	*Tree Gmelina*
Andguinean erba	*Panicum maximun*	Pringamosa	*Urera baccifera*
Ebitter scoba	*Parthenium hysterophorus*	Aroma	*Vachellia macracanth*
Caimonicillo	*Rivina humilis*	Tits pine	*Zanthoxylum martinicensis*

Point VT-14 Soto Mayor School: This point is completely cleared, leaving only a few trees on the edge of a wall and in the bordering courtyards (Table 6-42) (Photos 50 and 51, Annex 7).

Observed species**:** Gina extranjera, *(Pithecellobium dulcis);* Mango, (*Mangifera indica)*; Quenepa, *(Melicoccus bijugatus);* Creole flax, *(Leucaena leucocephala);* Neem, (*Azadirachta indica)*; Tamarind, (*Tamarindus indica)*; Avocado, (*Persea americana)*; Carambola, *(Averrhoa carambola);* Beach grape, (*Coccoloba uvifera)*; Mamon, (*Annona reticulata);* and cultivated banana and guinea pig plants.

Table 6-42: Flora Sampled at Point VT-14

Common Name	Scientific Name	Common Name	Scientific Name
Gina extranjera	*Pithecellobium dulcis*	Avocado	*Persea americana*
Mango	*Mangifera indica*	Carambola	*Averrhoa carambola*
Quenepa	*Melicoccus bijugatus*	Beach grape	*Coccoloba uvifera*
Creole flax	*Leucaena leucocephala*	Mamon	*Annona reticulata*
Neem	*Azadirachta indica*	Cultivated banana	Musa paradisiaca
Tamarind	*Tamarindus indica*		

Point VT-15 Next to the Canal Ureña: The vegetation corresponds to scattered trees, mostly fruit trees, planted in the courtyards of the houses (Table 6-43) (Photo 54, Annex 7).

Table 6-43: Flora Sampled at Point VT-14

Common Name	Scientific Name	Common Name	Scientific Name
Breadfruit	*Altocarpus altilis*	Mango	*Mangifera indica*
Neem	*Azadirachtaindica*	Níspero	*Manilkara sapota*
Cabrita	*Bunchosia glandulosa*	Quenepa	*Melicoccus bijugatus*
Roble	*Catalpa longissima*	Noni	*Moringa citrifolia*
Limón agrio	Citrus*aurantifolia*	Moringa	*Moringa oleifera*
Arrayan	*Eugenia monticola*	Avocado	*Persea americana*
Cubaniñón P	*Gliricidia sepium*	Sapote	*Pouteria sapota*
Lino criollo	*Leucaena leucocephala*	Guayaba	*Psidium guajaba*
Cereza	*Malpighia punisifolia*	Hog plum	*Spondias mombin*

6.2.2.2 *Floristic Composition*

In the watershed of the Guajimía Canal and its tributaries, 389 species of vascular plants were identified, distributed in 90 families and 306 genera (see Annex 6.4). These include 237 native species, 6 that are endemic to the Island and 146 are introduced. Of these, 45 are naturalized and 101 are cultivated.

Biological forms include 102 trees, 72 shrubs, one is a succulent tree, 40 are climbing and creeping plants, 161 are terrestrial herbs, 2 are epiphytic herbs, 7 are stypites and 2 are parasites.

6.2.2.3 *Impacts on Flora*

The flora of the Guajimía canal watershed and its tributaries has long been impacted with the establishment of housing, totally removing the original vegetation and with it most of its native and endemic species. With the anthropogenic changes free areas were repopulated by exotic plants. Many of them introduced as ornamentals in the gardens, or fruit trees. Today many herbs such as *Panicum maximun,* are very abundant in the area and supplant the native and endemic herbaceous species.

Fruit trees as well as ornamental and medicinal plants have replaced the native and endemic trees. Flora and vegetation management does not allow the native flora to recover, since they are usually eliminated to maintain the preferred species in place. However, there are native and endemic species in areas that very close to the edge of the canal, such as the sandbox tree *(Hura crepitans);* Royal Palm, (*Roystonea borinquena)* and Cuban mahogany (*Swietenia mahagoni*) which are abundant.

Exotic species, and especially those that become invasive, have Indisputably generated a strong impact on the local flora, but also on the fauna who depend on natural habitats.

For some of the species present, seed dispersal is relatively fast, favoring the invasion of new areas. Their control is difficult. This is the case of *Leucaena leucocephala,* where different varieties were introduced as fodder, that have invaded canal. The Indian Siris *(Albizia lebbeck)* and the Neem *(Azadirachta indica),* have become invasive income areas.

Finally, in the project area, near 146 introduced species were identified, including timber trees, a considerable number of fruit trees, but mostly ornamental species.

6.2.2.4 *Rare and/or Threatened Species*

Within the project's study area, 14 threatened species according to the IUCN National Red List and the International Convention on Trafficking and Trade in Endangered Species (CITES), and others included in the National Red List were identified (Table 6-44). The Dominican Republic is a signatory of the cities' convention since 1983.

Table 6-44: List of Threatened Plant Species Recorded in the Study Area

Family	Scientific Name	IUCN Red list Status - Global (National)
Annonaceae	*Annona reticulata*	LC (EN)
Araucariaceae	*Araucaria heterophylla*	VU
Arecaceae	*Chrysalidocarpus lutescens*	NT
Arecaceae	*Roystonea hispaniolana*	VU
Arecaceae	*Sabal domingensis*	VU
Arecaceae	*Veitchia merrillii*	VU
Bombacaceae	*Ceiba pentandra*	LC (EN)
Cactaceae	*Opuntia cochinilifera*	CITES
Combretaceae	*Bucida buceras*	(VU)
Meliaceae	*Cedrela odorata*	VU (EN)
Meliaceae	*Swietenia mahagoni*	NT (VU)
Orchidaceae	*Oeceoclades maculata*	CITES, LC
Rubiaceae	*Genipa americana*	(EN)
Simaroubaceae	*Simarouba berteroana*	(VU)

6.2.3 Characteristics of Terrestrial Fauna

6.2.3.1 *Herpetofauna*

6.2.3.1.1 Amphibians

During the present study, 7 species from 4 families and genera were registered for a total of 201 individuals. The species with highest representation were: *Eleutherodactylus abbotti* with 128 individuals and the *Rhinella marina* with 43 individuals. The latter is considered introduced in Hispaniola (Table 6-45 and Table 6-46).

Table 6-45: List of Amphibian and Reptile Species Identified in the Project Study Area

Family	Scientific Name	Common Name	Biogeographical Status
Amphibians			
Bufonidae	*Rhinella marina*	Cane toad	Introduced
Eleutherodactylidae	*Eleutherodactylus abbotti*	Common Chirping Frog	endemic
Eleutherodactylidae	*Eleutherodactylus flavescens*	Yellow Split-toed Frog	endemic
Eleutherodactylidae	*Eleutherodactylus inoptatus*	Hispaniolan Giant Frog	endemic

Family	Scientific Name	Common Name	Biogeographical Status
Eleutherodactylidae	*Eleutherodactylus weinlandi*	-	endemic
Hylidae	*Osteopilus dominicesis*	=	endemic
Ranidae	*Lithobates catesbeianus*	American Bullfrog	Introduced
Reptiles			
Boidae	*Chilabothrus striatus*	Hispaniola Boa	endemic
Dactyloidae	*Anolis callainus*	Dominican Green Anole	endemic
Dactyloidae	*Anolis distichus*	Bark anoli	Native
Dactyloidae	*Anolis hispaniolae*	Anolis Cabezón	endemic
Dactyloidae	*Anolis porcatus*	Cuban Green Anole	Introduced
Dactyloidae	*Anolis semilineatus*	Half-lined Hispaniolan Grass Anole	endemic
Dipsadidae	*Hypsirhynchus parvifrons*	Cope's Antilles Snake	endemic
Dipsadidae	*Uromacer catesbyi*	Catesby's Pointed Snake	endemic
Emydidae	*Trachemys stejnegeri*	Puerto Rican Slider	Native
Gekkonidae	*Hemidactylus angulatus*	House Gecko	Introduced
Iguanidae	*Iguana iguana*	Common Green Iguana	Introduced
Leiocephalidae	*Leiocephalus personatus*	Haitian Curlytail Lizard	endemic
Teiidae	*Pholidoscelis chrysolaemus*	Common Ameiva	endemic
Sphaerodactylidae	*Sphaerodactylus difficilis*	Spotted Eye gecko	endemic

Of the 7 species recorded, two (*Rhinella marina* and *Lithobates catesbeianus*) are introduced, representing 29% of records. Five are endemic to the island, constituting 71% of records (Caribherp, 2020) (Table 6-46).

The points where the largest number of species were recorded were: FT-7 corresponding, to the Engombe sector, where 6 species were recorded with a representation of 24 individuals. At FT-5, 4 species were recorded for a total of 86 individuals from which 67 were the species *Eleutherodactylus abbotti*. This is due mainly to the presence of a small body of water in the area. At point FT-12 (Between Autopista 6 November and mouth of the River Haina), 4 species were found for a total of 20 individuals. At points FT-13 and FT-3 (Between Autopista 6 November and mouth of the River Haina). 3 species were recorded, with 41 and 12 individuals respectively. The other points recorded a presence of less than two species and 12 individuals (Table 6-46).

Table 6-46:. Quantitative Composition of the Amphibian and Reptile Species Surveyed

Scientific Name	IUCN Red List Status - Global (National)[1]	Sampling Points (FT)													Total
		1	2	3	4	5	6	7	8	9	10	11	12	13	
Amphibians															
Rhinella marina	LC	3	5	4		12		4		5		1	4	5	**43**
Eleutherodactylus abbotti	LC			6		67		10					12	33	**128**
Eleutherodactylus flavescens	NT							3							**3**
Eleutherodactylus inoptatus	LC							2							**2**
Eleutherodactylus weinlandi	LC							2							**2**
Osteopilus dominicensis	LC		2			3		3		2			2		**12**

Scientific Name	IUCN Red List Status - Global (National)[1]	Sampling Points (FT)													Total
		1	2	3	4	5	6	7	8	9	10	11	12	13	
Lithobates catesbeianus	LC			2		4							2	3	**11**
Total individuals		**3**	**7**	**12**	**0**	**86**	**0**	**24**	**0**	**7**		**1**	**20**	**41**	**201**
Total species		**1**	**2**	**3**	**0**	**4**	**0**	**6**	**0**	**2**		**1**	**4**	**3**	**-**
Reptiles															
Chilabothrus striatus	LC					1		1							**2**
Anolis callainus	LC	2	4	3	2	5		5	2	2	1	2	5	6	**39**
Anolis distichus	NE	12	24	12	7	23	2	17	20	10	5	8	12	22	**174**
Anolis hispaniolae	NE	8	12	6	3	13	1	9	11	6	2	2	4	8	**85**
Anolis porcatus	LC	4	3	2		3		2	2		1				**17**
Anolis semilineatus	LC					2		1				1			**4**
Hypsirhynchus parvifrons	LC					1		1							**2**
Uromacer catesbyi	LC					1		1							**2**
Trachemys stejnegeri	NT (VU)					3									**3**
Hemidactylus angulatus	NE		2	2	3	4		4	3	2	4	2	1		**27**
Iguana iguana	LC							2							**2**
Leiocephalus personatus	LC					2		2						2	**6**
Pholidoscelis chrysolaemus	LC			2		3	1	3						3	**12**
Sphaerodactylus difficilis	LC					2		1				1			**4**
Total individuals		**26**	**45**	**27**	**15**	**63**	**4**	**49**	**38**	**20**	**13**	**16**	**22**	**41**	**379**
Total species		**4**	**5**	**6**	**4**	**13**	**3**	**13**	**5**	**4**	**5**	**6**	**4**	**5**	-

[1]: **Vulnerable (VU):** When the best available evidence indicates that it faces a moderate risk of extinction or population deterioration in the medium term (IUCN, 2020 and MIMARENA, 2011).

Near Threatened (NT): When it has been evaluated according to the criteria and does not meet them for the above categories, but is close to qualifying as "Vulnerable", or could enter that category in the near future (IUCN, 2020).

Least Concern (LC): When evaluated, it does not meet any of the criteria that define the categories set out above. It is equivalent to out of danger (IUCN, 2020).

Not Evaluated (NE): Species that were not taken into account in the evaluation of the Red List of Threatened Species of the Dominican Republic, because their populations are stable (MIMARENA, 2011).

6.2.3.1.2 Reptiles

For this group, 14 species, from 8 families and9 genera, for a total of 379 individuals were recorded. The family showing the highest abundance was *Dactyloidae* with 5 species; represented by arboreal lizards of the genus Anolis, mostly endemic lizards. Two species of the *Dipsadidae* family, were observed; small arboreal (*Hypsirhynchus parvifrons)* and terrestrial (*Uromacer catesbyis)* snakes, both endemic to the island.

The remaining 6 families are represented by single species, either endemic, native, or introduced species, (Photo 69, Annexe 7). Nine of the species recorded are endemic ones representing 64%, of total species recorded. Three introduced species were also observed, constituting 22% overall; Native species have only two representatives (Table 6-41).

The 3 species best represented and with the largest number of individuals recorded were Anolis *distichus* with 174 individuals, *Anolis hispaniolae* with 85 individuals and *Anolis callainus* with 39 individuals (Photo 70, Annexe 7). The sampling points where a greater number of species and individuals were recorded were: FT-5 and FT-7

(Engombe sector) with each 13 species and comprising 63 and 49 individuals at FT-5 and FT-7 respectively (Table 6-46).

6.2.3.1.3 Threatened Species for Herpetofauna

According to the global IUCN Red List of threatened species (IUCN, 2020) as well as the IUCN Red List of Threatened Species in the Dominican Republic (MIMARENA, 2011), none of the amphibian species identified in the study area are threatened

However, the Puerto Rican Slider (*Trachemys stejnegeri)* is considered near-threatened (NT) according to the global IUCN red list and vulnerable (VU) according the national red list MIMARENA (2011). This turtle is a native species belonging to the family *Emydidae*) In the Dominican Republic their populations have decreased significantly, mainly due to trade and the destruction of their habitats (Table 6-43).

6.2.3.2 *Mammals*

6.2.3.2.1 Terrestrial Mammals

Only 2 endemic mammals, the Cuvier's Hutia *(Plagiodontia aedium)* and the Hispaniolan Solenodon *(Solenodon paradoxus),* can today be found on the Island of Hispaniola from a list of 25 species that previously existed. These species (Reeder, 2005).

Both species are classified as endangered (EN) according to the IUCN lists (IUCN, 2021 and MIMARENA, 2011) The study area is however located outside the distribution range of these mammals.

During the field work 7 species were identified (6 families, 6 genera) for a total of 157 individuals. These are all introduced species (Photos 72 and 73, Annexe 7)). The Brown rat (*Rattus norvegicus)* was recorded 60 times. Dogs, cats, mice, pigs and cows compose the rest of the mammals identified (Table 6-47).

Table 6-47: Quantitative Composition of the Species of Terrestrial Mammals Recorded

Scientific Name	English Name	UICN Red List Status - Global (National)[1]	Sampling Points (FT)													Total
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Rattus norvegicus	Brown rat	LC	1	9	3	6	8	3	4	3	12	2	1	3	5	**60**
Rattus rattus	House rat	LC		3	1	3	2	2	1		3			3	3	**21**
Herpestes javanicus	Javan Mongoose	LC					3		1					1		**5**
FelNs silvestris	Wild Cat	LC	1	2	2	2	4	2	2		2	1		1	2	**21**
Canis familiaris	Domestic dog	na	3	4	3	4	3	1	3	1	3	1		2	3	**31**
Its domesticus	Domestic porc	na					10								3	**13**
Bos primigenius taurus	Chinese Yakow	na					2								4	**6**
Total individuals			**5**	**18**	**9**	**15**	**121**	**8**	**46**	**4**	**20**	**4**	**1**	**23**	**20**	**294**
Total species			**4**	**4**	**4**	**4**	**11**	**4**	**9**	**2**	**4**	**3**	**1**	**8**	**6**	**-**

[1]: LC: Least concern, NA: not applicable

None of the mammal species recorded are listed as threatened according to the IUCN red lists (IUCN,2020 and MIMARENA, 2011).

6.2.3.2.2 Flying Mammals (Bats)

In the Greater Antilles, most of the present mammals are bats and represent 73% of the species (Silva-Taboada, 1979).

In Hispaniola, bats constitute more than 90% of mammals, distributed in 6 families, 17 genera and 20 species (Núñez-Novas y León, 2011 and Soto-Centeno and *al.*, 2017).

In the project area, 4 native species from 2 families were identified. A total of 411 individuals were counted, of which 173 were captured using fog nets. The remaining 274 were observed using the flight observation method, at an average flight height of 5m (Table 6-48).

Table 6-48: Number of Bat Species and Individuals Caught and Observed in the Project Area

Family	Scientific Name	English Name	UICN Red List Status - Global (National)[1]	FT-5	FT- 7	FT-12	Total
Phyllostomidae	*Artibeus jamaicensis*	Jamaican Fruit-eating Bat	LC (ne)	64	22	8	94
	Macrotus waterhousii	*Waterhouse's Leaf-nosed Bat*	LC (ne)	8	4	1	13
	Phyllops falcatus	Cuban Fig-eating Bat	LC (ne)	14	6	4	24
Vespertilionidae	*Lasiurus borealis*	Eastern Red Bat	LC (EN)	3	3	-	6
Captured individuals				**89**	**35**	**13**	**137**
Observed individuals				**134**	**86**	**54**	**274**
Total species				**4**	**4**	**3**	**-**

[1]: LC: Least Concern, ne: not evaluated, EN: Endangered

All species recorded are designated as least concern (LC) by the IUCN global red list of threatened species.

The Eastern Red Bat (*Lasiurus borealis,* (Photo 76, Annexe 7), identified in the watershed of the Guajimía Canal and its tributaries, is considered endangered (EN) according to the IUCN national red list (MIMARENA, 2011).

The Eastern Red Bat is a resident insectivorous species of medium size, which catch its prey during flight. The decrease of its population is mainly attributed to the destruction of their habitats, such as caves and the interiors of tree hollows, and the species fragility (Hickey, et al., 1996 and Fenton, 1985).

6.2.3.3 *Birds*

The avifauna fieldwork undertaken of the watershed of the Guajimía Canal and its tributaries showed a total of 1219 individuals. Forty-nine species from 31 different families were recorded**Error! Reference source not found.**.

The bird community in this area is characterized by a high dominance of the family *Columbidae,* with 6 species. This family is composed of frugivorous resident species. All species breed in the watershed of the Guajimía Canal and its tributaries. Its largest representation was centered on the FT-5 point, for which a total of 152 individuals was recorded.

Five species of the *Ardeidae* family were recorded. These are resident species that feed on insects, fish, and small invertebrates. Some largely depend on aquatic environments and have colony-forming behavior, although in the

sampled areas no congregations were observed. Its main representation was centered at point FT-13, between the 6 Noviembre Highway and the Haina River mouth. A total of 23 individuals were recorded during the sampling.

Of the 3 species recorded for the *Cuculidae* family 2, are residents and one is endemic. Two of them are insectivores and one is mostly frugivorous; all reproduce in the project area. Their largest representation was centered at point FT-13. During the sampling, a total of 51 individuals were observed.

Two species of each of the families *Phasianidae, Apodidae, Trochilidae, Psittacidae, Tyrannidae, Estrildidae, Icteridae, and Thraupidae,* were recorded, some resident, some endemic, either insectivorous, omnivorous, frugivorous, nectivorous. A few raptor species were present. All very well distributed throughout the project area, many of which breed in it.

The remaining 19 families are formed by species of the watershed of the Guajimía Canal and its tributaries. These families are composed by endemic and resident species, either frugivorous, insectivorous, nectivorous. Some are raptors and scavengers. Many of these species reproduce in the area. During sampling, some active nests were found.

Species of the watershed of the Guajimía Canal and its tributaries are either resident, endemic or introduced. The best represented group are residents with 33 species, reaching 67% of total species. Seven endemic species are found (14%), 2 of which are considered threatened. Of the introduced species, 9 occupy the area, representing 18% of the total species recorded in the project area (Figure 6-34).

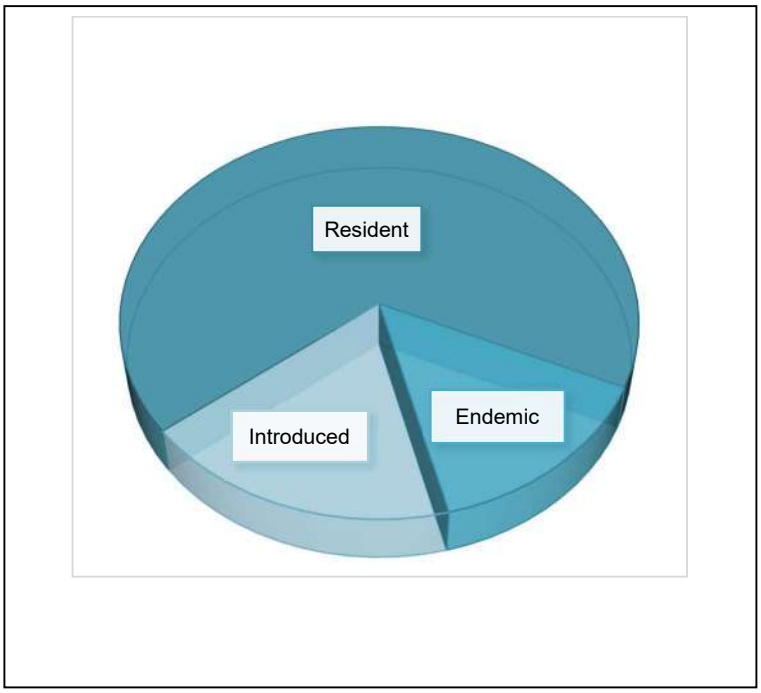


Figure 6-34: Biogeographical Status of Bird Species Found in the Watershed of the Guajimía Canal and its Tributaries

It should be emphasized that some of the species observed are considered as domestic. All were, however, observed in the wild (Table 6-49).

Table 6-49: List of Bird Species Located in the Guajimía Canal Watershed and its Tributaries

	Scientific Name	English Name	Biogeographical Status	Trophic Guild	UICN Red list Status -Global (National)[1]	UNEP CITES, 2021
Numididae	*Numida meleagris*	Helmeted Guineafowl	Introduced	Omnivore	LC (ne)	-
Odontophoridae	*Colinus virginianus*	Northern Bobwhite	Introduced	Omnivore	NT (ne)	-
Phasianidae	*Gallus gallus*	Red Junglefowl	Introduced	Omnivore	LC (ne)	-
	Turkey cristatus	Peacock	Introduced	Omnivore	LC (ne)	-
Columbidae	*Columba livia*	Rock Dove	Resident	Frugivore	LC (ne)	-
	Columbina passerina	Common Ground-dove	Resident	Frugivore	LC (ne)	-
	Zenaida aurita	Zenaida Dove	Resident	Frugivore	LC (ne)	-
	Zenaida asiatica	White-winged Dove	Resident	Frugivore	LC (ne)	-
	Zenaida macroura	Mourning Dove	Resident	Frugivore	LC (ne)	-
	Streptopelia decaocto	Eurasian Collared-dove	Introduced	Frugivore	LC (ne)	-
Cuculidae	*Coccyzus americanus*	Yellow-billed Cuckoo	Resident	Insectivore	LC (ne)	-
	Coccyzus longirostris	Hispaniolan Lizard-cuckoo	Endemic	Insectivore	LC (ne)	-
	Crotophaga ani	Smooth-billed Ani	Resident	Frugivore	LC (ne)	-
Caprimulgidae	*Chordeiles gundlachii*	Antillean Nighthawk	Resident	Insectivore	LC (ne)	-
Apodidae	*Streptoprocne zonaris*	White-collared Swift	Resident	Insectivore	LC (ne)	-
	Tachornis phoenicobia	Antillean Palm-swift	Resident	Insectivore	LC (ne)	-
Trochilidae	*Anthracothorax dominicus*	Hispaniolan Mango	Resident	Nectarivore	LC (ne)	Annex II
	Mellisuga minima	Vervain Hummingbird	Resident	Nectarivore	LC (ne)	Annex II
Rallidae	*Gallinula galeata*	Common Gallinule	Resident	Insectivore	LC (ne)	-
Aramidae	*Aramus guarauna*	Limpkin	Resident	Insectivore	LC (ne)	-
Charadriidae	*Charadrius vociferus*	Killdeer	Resident	Insectivore	LC (ne)	-
Ardeidae	*Ardea alba*	Great White Egret	Resident	Insectivore	LC (ne)	-
	Butorides virescens	Green-backed Heron	Resident	Insectivore	LC (ne)	-
	Bubulcus ibis	Cattle Egret	Resident	Insectivore	LC (ne)	-
	Nycticorax nycticorax	Black-crowned Night-heron	Resident	Insectivore	LC (ne)	-
	Nyctanassa violacea	Yellow-crowned Night-heron	Resident	Insectivore	LC (ne)	-

	Scientific Name	English Name	Biogeographical Status	Trophic Guild	UICN Red list Status -Global (National)[1]	UNEP CITES, 2021
Cathartidae	*Cathartes aura*	Turkey Vulture	Resident	Scavenger	LC (ne)	-
Accipitridae	*Buteo jamaicensis*	Red-tailed Hawk	Resident	Raptor	LC (ne)	Annex II
Tytonidae	*Tyto alba*	Common Barn-owl	Resident	Raptor	LC (ne)	Annex II
Todidae	*Todus subulatus*	Broad-billed Tody	Endemic	Insectivore	LC (ne)	-
Picidae	*Melanerpes striatus*	Hispaniolan Woodpecker	Endemic	Insectivore	LC (ne)	-
Falconidae	*Falco sparverius*	American Kestrel	Resident	Raptor	LC (ne)	Annex II
Psittacidae	*Amazona ventralis*	Hispaniolan Amazon	Endemic	Frugivore	VU(EN)	Annex II
	Psittacara chloropterus	Hispaniolan Parakeet	Endemic	Frugivore	VU (EN)	Annex II
Tyrannidae	*Myiarchus stolidus*	Stolid Flycatcher	Resident	Insectivore	LC (ne)	-
	Tyrannus dominicensis	Grey Kingbird	Resident	Insectivore	LC (ne)	-
Vireonidae	*Vireo altiloquus*	Black-whiskered Vireo	Resident	Insectivore	LC (ne)	-
Turdidae	*Turdus plumbeus*	Northern Red-legged Thrush	Resident	Insectivore	LC (ne)	-
Mimidae	*Mimus polyglottos*	Northern Mockingbird	Resident	Insectivore	LC (ne)	-
Dulidae	*Dulus dominicus*	Palmchat	Endemic	Frugivore	LC (ne)	-
Ploceidae	*Ploceus cucullatus*	Village Weaver	Introduced	Frugivore	LC (ne)	-
Estrildidae	*Lonchura punctulata*	Scaly-breasted Munia	Introduced	Frugivore	LC (ne)	-
	Lonchura malacca	Tricoloured Munia	Introduced	Frugivore	LC (ne)	-
Passeridae	*Passer domesticus*	Passer domesticus	Introduced	Omnivore	LC (ne)	-
Phaenicophilidae	*Phaenicophilus palmarum*	Black-crowned Palm-tanager	Endemic	Insectivore	LC (ne)	-
Icteridae	*Molothrus bonariensis*	Shiny Cowbird	Resident	Insectivore	LC (ne)	-
I	*Quiscalus niger*	Greater Antillean Grackle	Resident	Insectivore	LC (ne)	-
Thraupidae	*Coereba flaveola*	Bananaquit	Resident	Nectarivore	LC (ne)	-
	Tiaris olivaceus	Yellow-faced Grassquit	Resident	Frugivore	LC (ne)	-

[1]: LC: Least concern, ne: not evaluated, VU: vulnerable, EN critically endangered

Within the area of influence of the project, 23 insectivorous species were observed, representing 47% of the total species found. Twenty-nine percent were frugivorous species, with 14 species. Most are from the *Columbidae* family, with a total of 6 species and 152 individuals.

Nectarivores are represented by 3 species; he Vervain Hummingbird, the Hispaniolan Mango and the Bananaquit which constitute 6% of total species.

Of the group of raptors, a total of 3 species were reported, corresponding to 6% of total species identified. These species are permanently encountered.

The Turkey Vulture is the only scavenger specie observed (see Figure 6-35 and Table 6-49:).

Non of the surveyed species are considered of restricted range (Latta and *al*., 2006 and Raffaele and *al*. 1998).

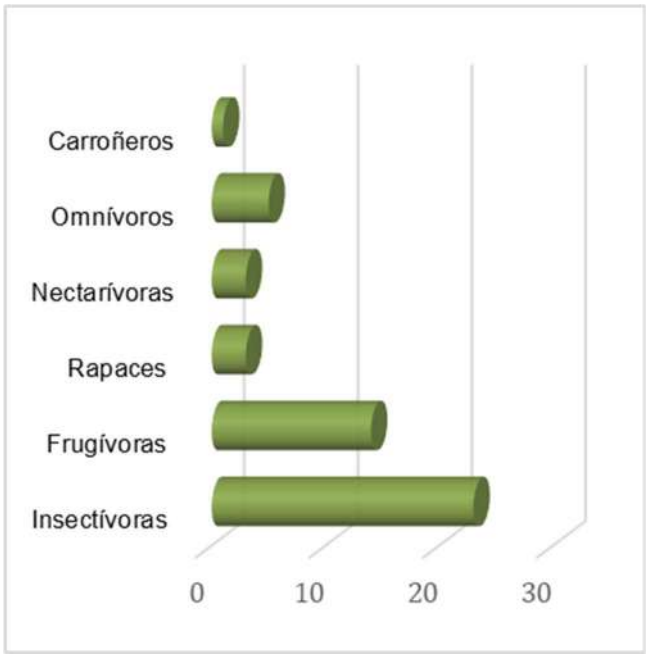


Figure 6-35: Trophic Guilds located in the Watershed of the Guajimía Canal and its Tributaries

The four following species were frequently encountered:

- House Sparrow *(Passer domesticus)*: Species very well adapted to urban environments. It is considered an introduced species. It has a very broad eating habit and can be considered as an omnivorous species.
- Palmchat *(Dulus dominicus*): Endemic frugivorous species considered as the national bird. During the sampling, some 233 individuals were observed, distributed between all sampling areas, but mostly at point FT-7 (Photos 79 and 80, Annex 7).
- Hispaniolan Woodpecker (*Melanerpes striatus)*: Endemic insectivorous specie, that nests in tree cavities. During the study, 65 individuals were registered with greater representation at point FT-12, with 12 individuals.
- Bananaquit (*Coereba flaveola)*: Resident, nectivorous specie of the Island of Hispaniola. A total of 55 individuals as well as 4 active nests were recorded. The species was especially encountered at points FT-2, FT-3 and FT-13 with 6 individuals observed at each sampling site (Table 6-50).

Table 6-50: Quantitative Composition of the Bird Species recorded in the Watershed of the Guajimía Canal and its Tributaries

Scientific Name	Sampling Points (FT)													Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	
Numida meleagris					3		2							5
Colinus virginianus							5							5
Gallus gallus		4	5		2		4		6					21
Turkey cristatus														2
Columba livia					5	6						4		15
Columbine passerina			1	4	4		2	3	4		2		8	28
Zenaida aurita				3	2		3	2	2		1	2	3	18
Zenaida asiatica	2				2		4		3				2	13
Zenaida macroura	5		2	4	6	7	6	4	13		4	12	10	73
Streptopelia decaocto					1				2				2	5
Coccyzus americanus													2	2
Coccyzus longirostris					3		5		5		3	3	5	24
Crotophaga ani					7		6		5	1	2		4	25
Chordeiles gundlachii	2				2		3	1		2				10
Streptoprocne zonaris					5		3			7		4		19
Tachornis phoenicobia					12	3			6			9		30
Anthracothorax dominicus				2	2		1			1	2	2	1	11
Mellisuga minima			2	2	3		3			1	1	2	1	15
Gallinula galeata					2							2	1	5
Aramus guarauna												1	1	2
Charadrius vociferus												2		2
Ardea alba												2	1	3
Butorides virescens		2	1		1								1	5
Bubulcus ibis					2								2	4
Nycticorax nycticorax					1				1			2	2	6
Nycticorax violacea									2				3	5
Cathartes aura												1	2	3
Buteo jamaicensis													1	1
Tyto alba					1		2						1	4
Todus subulatus		1			4								2	7
Melanerpes striatus	3	4	3	4	6	3	4	5	4	3	4	12	10	65
Falco sparverius					2		2			1			2	7
Amazona ventralis					2		2							4
Psittacara chloropterus					6		8					7		21
Myiarchus stolidus					2								1	3
Tyrannus dominicensis		2			3				4				3	12
Vireo altiloquus					2		2		2	2		3	2	13
Turdus plumbeus				2	3						2		2	9
Mimus polyglottos					2							3	2	7

Scientific Name	Sampling Points (FT)													Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	
Dulus dominicus	23	18	14	8	24	4	57		7	12	8	13	45	233
Ploceus cucullatus	5				4				4			7		20
Lonchura punctulata					9							10	3	22
Lonchura malacca					4							6		10
Passer domesticus	7	10	12	25	8	155	12	14	8	5	25	10	11	302
Phaenicophilus palmarum		2		3	2				2		3	5	3	20
Molothrus bonariensis					6									6
Quiscalus niger		3		3	5		4			3	3			21
Coereba flaveola	4	6	6	4	5	4	5		5	2	4	4	6	55
Tiaris olivaceus					7							5	9	21
Total individuals	**51**	**52**	**46**	**64**	**172**	**182**	**145**	**29**	**85**	**40**	**64**	**133**	**156**	**1219**
Total species	**8**	**10**	**9**	**12**	**40**	**7**	**23**	**6**	**19**	**12**	**14**	**30**	**34**	**-**

Most species are listed as LC according to the IUCN global red list, for the exception of the Hispaniolan Amazon (*Amazona ventralis)* and the Hispaniolan Parakeet (*Psittacara chloropterus)* who are designated as VU (IUCN, 2021).

The national red list has however designated these same species as EN (MIMARENA, 2011), Table 6-49.

Seven species are included in Annex II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (UNEP CITES, 2021) Table 6-49:

During the work of characterizing the terrestrial fauna in the watershed of the Guajimía Canal and its tributaries, no migratory species were recorded, simple because the sampling period did not coincide with the migratory period for this group. According to CONAU (2000) and Stockt de Dood (1978) 5 to 6 migratory species are present.

6.2.4 Characteristics of Aquatic Fauna

This report generates a diagnosis of the state of knowledge of the aquatic biodiversity present in the Guajimía canal and its tributaries within the framework of the Project of Pluvial and Sanitary Drainage of the Guajimía Canal Phase II.

6.2.4.1 *Zooplankton Results*

No species of this group has been observed during the sampling. This may be due to the high degree of contamination of the sampled sites (Photo 83, Annex 7).

6.2.4.2 *Macroscopic Aquatic Fauna Results*

The macroscopic aquatic fauna was composed mainly of insects (mosquito larvae) and fish.

Table 6-51 shows the results obtained at the sampling points with type D (jaticos) nets. The results indicate the presence of the family *Poeceliidae* with abundant individuals in the canal Villa Aura (FA-1) and Guajimía (FA-3 and FA-7), while it is scarce at points FA-2 and FA-6 (Guajimía Canal) and FA-4 (Canal Las Maobas). At point FA-5 (Canal Buenos Aires) this family was not detected. No identification at species level was achieved.

In the case of insects, the presence of the family *Culicidae* was recorded with few individuals at points FA-1 (Canal Villa Aura), FA-3 and FA-6 (Guajimía Canal) (Photos, 81-92, Annex 7).

Table 6-51: Results of Sampling of Macroscopic Aquatic Fauna

Group	Family	Stations						
		1	2	3	4	5	6	7
Fish	*Poeceliidae (unidentified)*	xx	X	xx	X		X	xx
Insects	*Culicidae*	X		X			X	
X - SCARCE XX - ABUNDANT XXX- VERY ABUNDANT								

6.2.4.3 *Conservation Status of Nationally protected Species considered in CITES and IUCN*

During the inventories carried out in the Guajimía canal and its tributaries, no threatened aquatic fauna was encountered.

6.3 Protected Areas

According to the National System of Protected Areas of the Ministry of Environment and Natural Resources that include those declared by Sectoral Law No. 202-04 on Protected Areas and Decree No. 571-09 and the Metropolitan Protected Areas, created by Presidential Decree No. 207-02, no protected areas overlap the study area (see map at Annex 6.5).

Four urban parks and a national park intended for the environmental protection of the less intervened areas of the Green Belt were created in 2002 under the presidential decree No. 207-02. Among the parks created is the Parque Mirador Oeste, which is the closest protected area of the project. This park has an approximate surface area of 4.45 km², which provides special protection to the watercourses of the Haina estuary, the historical ruins of Engombe and Palavé (see Photos 127 to 132, Annex 7), and to the forests that serve as a refuge for waterfowl and other species of great value.

Figure 6-36, the Guajimía Canal Watershed in its lower third, where it flows into the Haina River, is approaching the limit of this metropolitan protected area, where the historical ruins of Engombe are located.

In this section of the canal the works that will be carried out will not have any influence on this metropolitan protected area, since the 6 Noviembre Highway serves as a limit for the works that will be carried out.

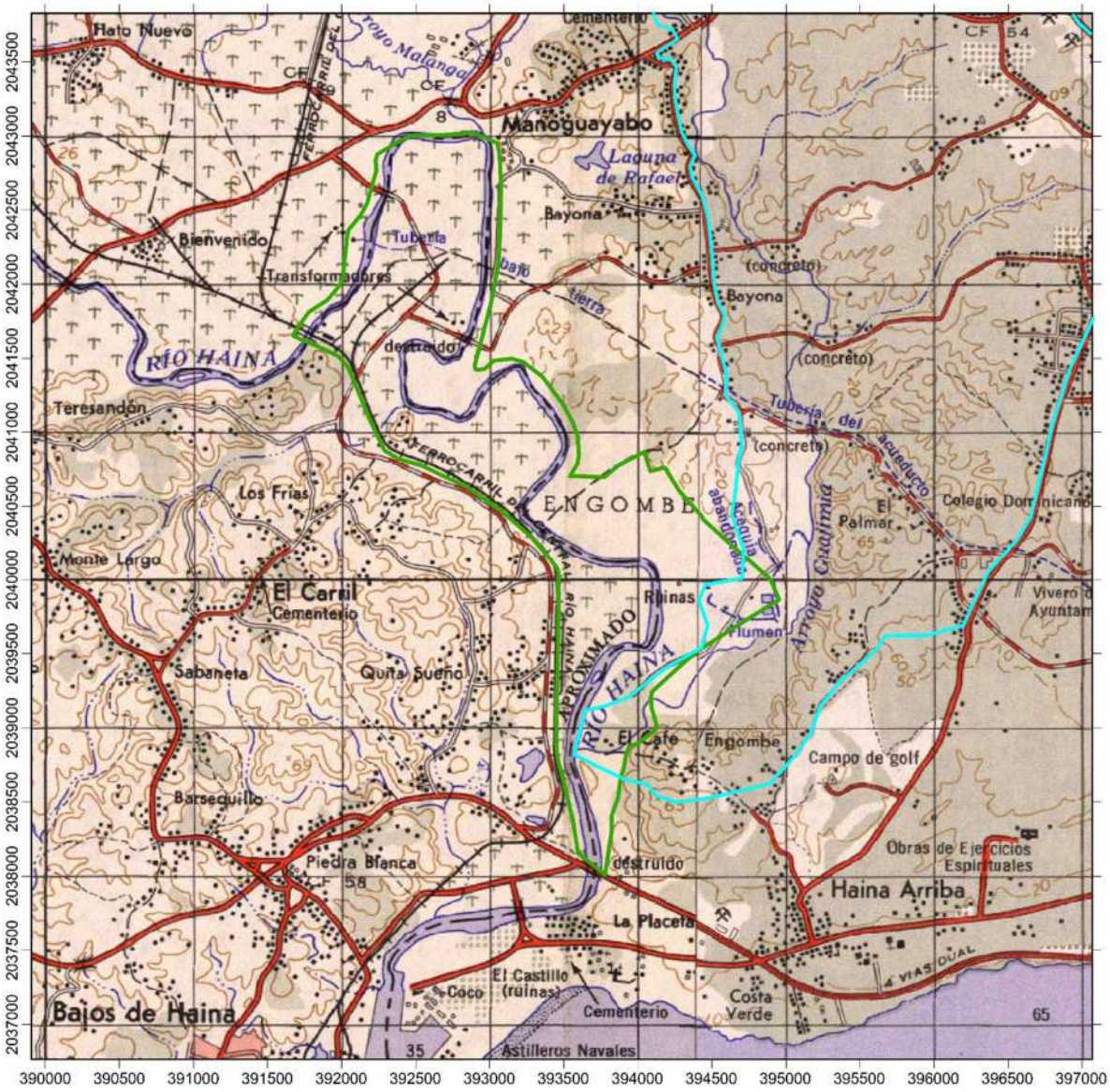


Figure 6-36: Location Map of the Mirador Oeste Park and the Guajimia Canal Watershed

Source: Ministry of Environment and Natural Resources. Edition March 2011

legend:

Limit Parque Mirador Oeste (Surface of 4.8 km²).

Guajimía watershed.

symbology:

Rivers and streams.

Section Municipal.

Paved road, passable all year round.

6.4 Habitat Classification

For the characterization of the types of habitats, the concepts of modified, natural, and critical habitats of the Performance Standard No. 6 of the International Finance Corporation (IFC), on the Conservation of biodiversity and sustainable management of natural resources were considered.

6.4.1 Criteria 1 to 3 - Endangered (EN), Critically Endangered (CR), endemic and migratory species

Criteria 1 to 3 refer to threatened species, i.e. endangered (EN) and critically endangered (CR) (criterion 1), endemic species (criterion 2) and migratory species (criterion 3). The sub-criteria proposed in the guidance notes for PS6 are presented in Table 6-52.

Table 6-52: Sub-criteria proposed in the Guidance Notes for PS6

Criterion	Sub-Criterion	Description
1) Critically Endangered (CR) and/or Endangered (EN) species	1a	Areas that support globally important concentrations of an IUCN Red-listed EN or CR species (≥ 0.5% of the global population AND ≥ 5 reproductive units of a CR or EN species)
	1b	Areas that support globally important concentrations of an IUCN Red-listed Vulnerable (VU) species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in 1a)
	1c	As appropriate, areas containing important concentrations of a nationally or regionally listed EN or CR species
2) Endemic or Restricted-Range Species	none	Areas that regularly hold ≥10% of the global population size AND ≥10 reproductive units of a species: • For terrestrial vertebrates and plants, restricted-range species are defined as those species that have an EOO less than 50,000 square kilometers (km2). • For marine systems, restricted-range species are provisionally being considered those with an EOO of less than 100,000 m2. • For coastal, riverine, and other aquatic species in habitats that do not exceed 200 km width at any point (for example, rivers), restricted range is defined as having a global range of less than or equal to 500 km linear geographic span (i.e., the distance between occupied locations furthest apart).
3) Migratory or Congregatory Species	3a	Areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle.
	3b	Areas that predictably support ≥10 percent of the global population of a species during periods of environmental stress.

Source: IFC, 2019

In the area occupied by the Canal Guajimía Phase II Pluvial and Sanitary Drainage project, no habitat was identified that, according to the criteria established by IFC Performance Standard No. 6, can be considered critical. The area is very anthropized and contains no vegetation of high biodiversity value.

In some sites, plant species included in the IUCN National Red List and others in CITES, but these species are scattered within the study are, never concentrated in a particular valued habitat. Most of the protected species cited in this report are represented by only a few individuals or small non-natural populations. The arboreal vegetation surveyed in Engombe (VT-7) and around the toll of the 6 Noviembre Highway (VT-12), was planted by local residents and reforestation planned by the Ministry of Environment and Natural Resources (See map in Annex 6.6).

The same conclusion applies for fauna. Although some species of interest were observed, none meet the threatened species criterions (1-3) described in the NP6.

6.4.2 Fragile Ecosystems (Criterion 4 and 5)

Criterion 4 of PS6 includes unique and highly threatened ecosystems. The sub-criteria proposed in the guidance notes of the standard are as follows:

- Criterion 4a: Areas representing ≥ 5% of the global extent of an ecosystem type meeting the criterion for the IUCN CR or EN
- Criterion 4b: Other areas, not assessed so far by IUCN but identified or recognized as a priority for conservation by regional or national conservation planning

Criterion 4a refers to the IUCN Red List of Ecosystem Categories and Criteria. It is a global standard for assessing the state of ecosystems, applicable at local, national, regional and global levels. Criterion 4b refers to areas recognized as priority for conservation by regional or national conservation planning.

Criterion 5 of PS6 requires the identification of landscapes showing significant spatial heterogeneity, ecotones, edaphic interfaces, biological corridors or even areas whose importance for adaptation to climate change has been demonstrated.

This is a criterion which generally applies to areas which have already been investigated and which are already known or suspected to be associated with unique evolutionary processes.

No such ecosystems were identified within the Project area.

6.5 Socio-Economic Baseline

The analysis of stakeholders and the evaluation of the socio-economic impacts is very crucial for the characterization of the socio-economic aspect of the project. As a result, the *Guide for the realization of Social Impact Assessments of the Ministry of Environment and Natural Resources* was used as our departure guide.

6.5.1 Survey Methodology for the Socio-Economic Baseline

This section describes the methodology used for the development of the social baseline for the area of direct and indirect influence of the Storm and Sanitary Drainage of the Guajimía Canal Phase II Project.

6.5.1.1 *Areas of Influence of the Project*

The population residing within the footprint area of the project and in the surrounding area may be subject to involuntary resettlement, an aspect that is relevant from the social point of view, since it affects both the living conditions of the population as well as their social support networks and other sociocultural and demographic aspects. In this sense, the area of influence is the area that will be affected by physical displacement and the receiving community. This area is also understood as the area where the new homes of the population to be resettled will be established within the limit of the area of influence, which is close to the watershed of the Guajimía Canal (Figure 6-41).

6.5.1.2 *Identification and Analysis of Socio-Economic Conditions in the Area*

The general methodology applied for the development of the social baseline includes the collection of information from primary and secondary sources.

The primary information was collected through the application of:

- Population survey; and
- Photographic survey.

This survey also allowed to obtain information about various aspects related to the Guajimía Canal, such as perceptions about the current situation of the canal, the impact on their daily lives, the expectations of the project, and suggestions, among other aspects.

The survey was applied using electronic devices, specifically the CAPI (Computer Assistant Personal Interview) method of the CsPro Software, which allows the agile implementation of a data entry to both mobile

devices and computers. This method allows a better performance in its application by the pollsters and a better-quality control of themes by the supervisors.

The application of the survey allowed to obtain data on different social and economic variables: sex, age range, levels of education schooling, residency time, condition of economic activity, and occupational category.

The survey was applied with the aim of collecting information on certain socioeconomic characteristics of the population located in the nine municipalities neighboring from the urban area of the municipality of Santo Domingo Oeste. It is important to note that all these municipalities are located nearby the Guajimía Canal.

It is valid to note that in this study the neighborhoods were determined based on the Territorial Division of the Dominican Republic, defined by the General Directorate of Territorial Planning, which often differs from the divisions by neighborhoods. The latter is carried out by municipal councils, as is the case of the Santo Domingo Oeste Municipal Council. It is pertinent to note that, when the survey was applied, there was a significant change in the preliminary distribution by sex of the sample. The reason for that is that it was more common to find females in the house since their male spouses had to leave the house to find a job to support their families.

The methodology used to define the number of surveys was based on the number of inhabitants of the neighborhoods to be surveyed. That number was already recorded in the National Population and Housing Census, 2010 (the most recent one).

All the fieldwork was documented through photographic images referring to the different neighborhoods where the survey was applied (Annex 8).

The survey was applied to 393 heads of households in the aforementioned neighborhoods. Please mention if this number is statistically representative.

6.5.1.3 *Variables Studied*

The variables addressed in this social baseline were as follows:

- Demographics;
- Characteristics of the house;
- Economic aspects;
- Access to basic services (education, sanitation, water, electricity, internet, health, etc.).;
- Areas of cultural and/or historical interest;
- Gender aspects; and
- Vulnerable groups

6.5.1.4 *Information Processing*

The processing of the data obtained in the survey was carried out in a computerized way, using the CsPro program (Short for Data Processing System for Censuses and Surveys).

CsPro, is a comprehensive computer program for the design of censuses and surveys. Among other attributes, this software allows:

- Add, modify and verify questionnaires;
- Easily build dynamic arrays;
- Perform quick crossings of variables and frequencies’
- Analyze data using uni- or multi-variable statistical techniques; and
- General thematic maps based on the elaborated crosses

The information obtained through the open questions of the survey was processed and analyzed with the support of qualitative data analysis techniques and then later was used as triangulation instruments to confirm results of closed questions.

6.5.1.5 *Difficulties in Implementing the Survey*

The main difficulty faced in the fieldwork was caused by the restrictions implemented by the health authorities stemming from the social distancing and curfew measures in place in these areas due to the Covid-19 pandemic. Social distancing measures caused some people to be reluctant to be surveyed, while the curfew from 6 P.M., caused the sex distribution of the sample to be unfulfilled, because, as explained above, many male residents in these neighborhoods were outside their residences at the time of the survey.

6.5.2 Introduction

The Dominican Republic is part of the Greater Antilles. It is located in the Caribbean Sea and occupies the eastern part of the island of Santo Domingo, which it shares with the Republic of Haiti. It is bordered on the north by the Atlantic Ocean, on the east by the Canal de la Mona, on the south by the Caribbean Sea and on the west by Haiti. Its territory has an area of 48,448 km², where 9,445,281 people live, according to the 2010 Census.

6.5.2.1 *Political Context of the Guajimía Canal Sanitation Project*

The Corporation of the Aqueduct and Sewerage of Santo Domingo (CAASD is in charge of all work done in the first phase, mainly the sanitation of the Guajimía Canal in the urban area of the municipality of Santo Domingo Oeste. CAASD is an autonomous entity responsible for the management of aqueducts and wastewater in the metropolitan area of Santo Domingo, which includes the National District and the municipalities that arise from it, except for the municipality of Boca Chica (which has its own aqueduct and sewerage corporation).

This second phase of the project of rainwater and residual sanitation of the Guajimía Canal is raised based on the strong health and economic impacts of Covid 19 on the Dominican society. Due to this reality, a new government product of the presidential and congressional elections was held in the middle of this pandemic, in order to respond to demands raised by the communities around this canal, so that the work begun more than a decade ago can be continued and completed without major interruptions.

While the management of policies aimed at the management and disposal of solid waste oversees the municipal councils, the one related to wastewater management is in charge of aqueduct and sewerage corporations that provide this service in the main cities of the country.

Public sanitation policies in the Dominican Republic involve different institutional actors, such as the Ministry of Environment and Natural Resources, the Ministry of Public Health and Social Assistance, aqueduct and sewerage corporations, and municipal councils, among others. In addition, the neighborhood councils play an important role, due to the presence of representatives of the communities that affect the management of the territory, so they constitute social actors that must be counted on in any action aimed at the implementation of public sanitation policies. Politically speaking, the country is divided into 1 National District, 31 provinces, 154 municipalities, 232 municipal districts, 1,182 sections, 9,965 places, 2,621 neighborhoods, and 4,954 sub-neighborhoods.

Neighborhoods and sub-neighborhoods are the territorial units into which the urban areas of municipalities and municipal districts are divided. Municipalities and municipal districts are the basic political-administrative entities of the territory in which the communities carry out their activities, represented by the municipalities or mayors' offices and the district boards, respectively.

The implementation of the Guajimía Canal Sanitation Project has involved the implementation of a communication and consultation process in which various categories of social and political actors have participated. (Figure 6-37)

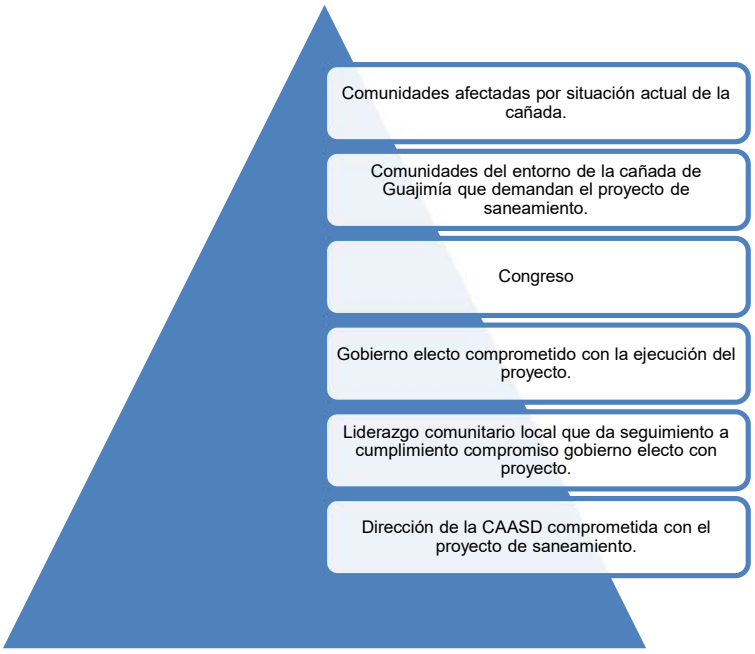


Figure 6-37: Categories of Social Actors Relevant to the Guajimía Sanitation Project

Source: Prepared by EMPACA

Communities affected by the Current Situation of the Canal

This Project directly impacts the entire urban area of the municipality of Santo Domingo Oeste. In fact, the Guajimía Canal and its tributaries (Las Caobas, Villa Aura, Buenos Aires, El Indio, and Ureña) run through this entire area, affecting different aspects (sanitation, health, education, roads, vulnerability to atmospheric phenomena, and others) of the lives of the inhabitants (Photo 93). The solution of the problem represented by the current situation of the Guajimía Canal has a great effect due to the level of positive impact it will have on the quality of life of a significant portion of the inhabitants of the urban area of the municipality of Santo Domingo Oeste.

In the communities located in the surroundings of the Guajimía Canal, there are social actors representing different political, social, and cultural sectors that have played an important role in the decision-making that has led to the formulation of this Project.

Photo 6-1: Community Members of Neighborhoods in the Guajimía Canal and its Tributaries before starting assembly to discuss the Sanitation Project

, As noted above, the project directly impacts the entire urban area of the municipality. The community organizations of these neighborhoods, especially their neighborhood councils are important actors because they have the potential to involve the communities around the Guajimía Canal and its tributaries, ensuring the successful execution of this project Figure 6-37.

Approval at the Congress of the Sanitation Project

The project to clean up the Guajimía Canal was approved with the support of all political sectors represented in the Chamber of Deputies on April 22, 2021 and in the Senate of the Republic on June 1, 2021.

Central Government committed to the Implementation of the Project

The central government has shown its interest in the implementation of the project, motivating its approval by the Congress, as well as having budgeted and awarded the necessary appropriations for the realization of the previous studies.

Local Community Leadership that follows up on Government-elect's commitment to the Project

In addition to the neighborhood councils, other relevant actors at the communities around the Guajimía Canal have been actively involved in the process, such as church pastors, school directors, directors of mutual societies, among others (Photo 6-2).

In the Dominican Republic, particularly in its urban areas, neighborhood boards play an important role in representing communities and actively engaging with municipalities and aqueduct and sewer corporations in sanitation policies.

Photo 6-2: Leaders of the Block of Neighborhood Councils of the neighborhoods surrounding the Guajimía Canal and its Tributaries

Strong Management: The CAASD committed to the Sanitation Project

CAASD, as promoter of the Stormwater and Sanitary Drainage of the Guajimia Canal Phase II Project I, has used a large part of its most valuable human resources in tasks aimed to achieving a successful implementation of this project (Photo 6-3).

Photo 6-3: CAASD Director and Deputy Director together with AECOM representative announcing the start of the Studies for the Sanitation Project of the Guajimía Canal and its Tributaries

Other Actors to Consider

It is valid to indicate that, although the nature of the project is mainly sanitation, it also refers to public housing and resettlement policies, so other institutional actors must be considered for the purposes of accompaniment and support, due to the functions that the central government's organizational chart defines and assigns to them, such as the National Housing Institute (INVI) and the Executing Unit for the Readaptation of Neighborhoods and Environments (URBE).

Other important actors to consider are international financing entities that, like the World Bank Group, seek compliance with standards aimed to protect the environment and respect the rights of vulnerable groups in the projects they finance.

6.5.3 Demography

This section describes the demographic aspects of the municipality of Santo Domingo Oeste, especially the eleven (11) neighborhoods that are part of its urban area and are the most directly impacted by the current situation of the Guajimía Canal and its tributaries (Villa Aura, Las Caobas, Ureña, Buenos Aires and El Indio Derecho). For the description of the demographic aspects, data are presented from the demarcations considered for this study, as well as from the province of Santo Domingo and the Dominican Republic as a whole, of which data is extracted from the National Population and Housing Census, 2010,. This allows to establish relevant comparisons.

Likewise, through the data obtained in the survey applied by Empaca SRL in May 2021, changes can be established over time of various demographic aspects considered in the study.

The demographic aspects considered are:

- Population
- Sex of the population
- Description of the population by age group
- Nationality
- Residency time

6.5.3.1 *Population*

Table 6-53 shows the data of the population, area and population density of the Dominican Republic, the province of Santo Domingo, the municipality of Santo Domingo Oeste and the eleven (11) neighborhoods that are part of the object of study.

The municipality of Santo Domingo Oeste is made up of an urban area of 18.6 km² and a rural area of 37 km². As can be seen in Table 6-53, except for the Manoguayabo neighborhood, the population density of the study area is significantly higher than the national average and that of the Santo Domingo province, with the Herrera, Duarte, La Altagracia, Buenos Aires and Santo Domingo Country Club neighborhoods having population densities greater than 30,000 inhabitants/km².

Table 6-53: Population, Area in km² and Population Density of the Studied Area

Territorial division (*)		Population (inhabitants)	Area (km²)	Density Inhabitant/km²
country	Dominican Republic	9,445,281	48,448	195
province	Santo Domingo	2,374,370	1,302.20	1,823
municipality	Santo Domingo Oeste	363,321	55.6 Km²	6,728
Neighborhoods	Santo Domingo Country Club	29,784	0.9	33,093
	The Altagracia	26,313	0.8	32,891
	Engombe	28,729	1.3	22,099
	The Rose	13,085	1.1	11,895
	Mahogany	23,244	3.0	7,748
	poplar grove	14,290	2.5	5,716
Buenos Aires	19,015	0.6	31,691	
blacksmith	43,119	1.2	35,932	
Duarte	31,394	0.8	39,242	
Bayonne	29,526	2.0	14,763	
Manoguayabo	16,215	25.5	636	

Source: IX National Population and Housing Census, 2010

(*) In all the tables, the territorial division includes the data of the neighborhoods of the area of incidence of the project. For example, Manoguayabo is included in the territorial division since it has a rural part.

Table 6-54 also highlights the similarity between the population growth of the municipality of Santo Domingo Oeste (3.7%) and that of the province of Santo Domingo (3.8%). This means that the neighborhoods of La Altagracia, Buenos Aires, and Duarte are the ones with the lowest population growth in the period considered, quite possibly because they are some of the neighborhoods with the highest population density and the least available spaces.

It is remarkable that the population growth of the province of Santo Domingo is higher than the population growth of the country, which explains the fact that this province is one of the main national migratory destinations.

The population decrease of the Las Mahogany neighborhood can find its reasons in several factors. Among these factors, we note the fact of being middle class and the implication it has on birth rates (i.e. lower birth rate), and the departure of part of the younger population from their homes (for instance, children leaving their parents alone or with the company of another relative to reside in other areas of the city)

The demographic growth of the Herrera neighborhood, compared to other neighborhoods impacted by the project, maybe due to the growth of investment in residential buildings and the withdrawal from industries and companies, which have freed up territory that has been used for these purposes.

Table 6-54: Demographic Evolution of the Area of Influence of the Project

Territorial division	Population Census 2002 (inhabitants)	Population Census 2010 (inhabitants)	Annual growth rate (%)	Projection to 2020
Dominican Republic	8,562,541	9,445,281	1.28	10,448,499
Santo Domingo Province	1,817,754	2,374,370	3.8	2,906,003
Municipality of Santo Domingo Oeste	280,912	363,321	3.7	--
Santo Domingo Country Club	24,681	29,784	2.6	--
The Altagracia	24,358	26,313	0.9	--
Engombe	24,783	28,729	1.9	--
The Rose	11,998	13,085	1.1	--
Mahogany	28,075	23,244	-2.1	--
poplar grove	10,910	14,290	3.9	--
Buenos Aires	18,742	19,015	0.2	--
blacksmith	30,328	43,119	5.2	--
Duarte	30,139	31,394	0.5	--
Bayonne	11,663	29,526	19.1	--
Manoguayabo	8,439	16,215	11.5	--

Source: ONE: IX National Population and Housing Census, 2010,
VIII National Population and Housing Census 2002 and Statistical projections

6.5.3.2 *Sex of the Population*

Data from the 2010 Population and Housing Census clearly show that the female population predominates in the territories studied.

Thus, it can be observed that, while in the Dominican Republic there is a slight predominance of male population (50.17%), in the province of Santo Domingo, in the municipality of Santo Domingo Oeste and in each of the neighborhoods of the urban area of this municipality, which are the objects of this study, the predominance of the female population is manifested. This trend is also shown in the Alameda, La Rosa and Las Mahogany neighborhoods, a difference of up to 6 percentage points between the female population and the male population (Table 6-55).

Table 6-55: Distribution of the Population by Sex

Territorial division	Men		Women		Total
	Quantity	%	Quantity	%	
Dominican Republic	4,739,038	50.17	4,706,243	49.83	9,445,281
Santo Domingo Province	1,163,957	49.02	1,210,413	50.98	2, 374,370
Municipality of Santo Domingo Oeste	176,532	48.59	186,789	51.41	363,321
Santo Domingo Country Club	14,338	48.14	15,546	51.86	29,784
The Altagracia	12,803	48.66	13,510	51.34	26,313
Engombe	14,110	49.11	14,619	50.89	28,729
The Rose	6,163	46.79	6,922	53.21	13,085
Mahogany	10,934	47.04	12,310	52.96	23,244
poplar grove	6,681	46.75	7,609	53.25	14,290
Buenos Aires	9,351	49.18	9,664	50.82	19,015

Territorial division	Men		Women		Total
	Quantity	%	Quantity	%	
blacksmith	20.963	48.62	22,156	51.38	43,119
Duarte	15,070	48.00	16,324	52.00	31,394
Bayonne	14,379	48.70	15,147	51.30	29,526
Manoguayabo	7,784	48.00	8,431	52.00	16,215

Source: IX National Population and Housing Census, 2010

Figure 6-38 presents the results of the survey applied by Empaca, S.R.L. in nine (9) neighborhoods of the urban area of the municipality of Santo Domingo Oeste, in May 2021, which show a higher proportion of females (58%) in relation to males, who only account for 42%.

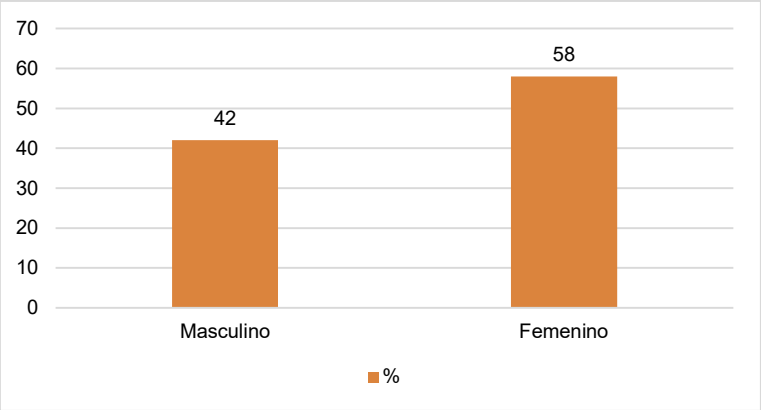


Figure 6-38: Sex of Respondents

Source: Survey applied by Empaca, S.R.L., in nine neighborhoods of the Santo Domingo Oeste urban zone, May 2021

It is important to note that these data only reflect a higher proportion of females surveyed, which explains the fact that, having been applied the surveys on weekdays, when mostly women are home, due to their traditional role of housewife that still manifests itself in societies such as the Dominican Republic, especially in its popular sectors.

To the above could be added as an explanatory factor, which is the fact that the survey is of heads of households, establishing methodologically that they should be applied in the houses. In the popular neighborhoods of the Dominican Republic, stereotypes still gravitate according to which "the man is from the street and the woman is from the house."

6.5.3.3 *Description of the Population by Age Group*

The data of the Population and Housing Census (2010) shows that there are no significant differences between the demarcations of the study area with respect to the province of Santo Domingo and the rest of the country with respect to the predominant age groups. This is due to the fact that the young population of less than 30 years predominates, representing, as in the country as a whole, between 58% and 59% of the total population.

It is noteworthy to mention that in neighborhoods such as Engombe and Santo Domingo Country Club (El Café), the population under 30 years of age exceeds 60%, while the population under 30 years in the neighborhoods of Alameda and Mahogany represents 55% and 53%, respectively. In fact, the population under 30 years of age is lower where a population with social characteristics of middle-class lives. (Table 6-56).

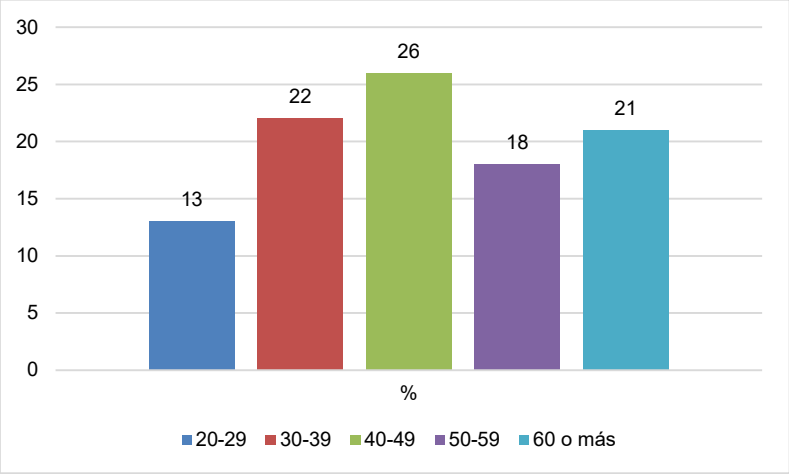
Table 6-56: Percentages (%) of Age Groups in the Study Area

Territorial Demarcation	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80 or more
Dominican Republic	19.43	20.72	17.40	14.29	11.43	7.67	4.82	2.76	1.48
Santo Domingo Province	20.30	20.66	18.28	15.06	11.47	7.29	4.05	1.96	0.94
Santo Domingo Oeste	20.14	19.60	19.17	16.11	11.37	7.01	3.90	1.86	0.83
The Altagracia	19.77	18.85	20.45	16.00	10.89	7.45	3.89	1.82	0.88
Anguiano	19.26	20.56	18.14	15.93	12.23	7.49	3.84	1.73	0.82
poplar grove	19.47	17.73	17.93	17.65	12.11	7.77	4.39	2.16	0.76
Bayonne	18.94	20.14	18.99	15.96	12.15	7.42	3.78	1.81	0.82
Mahogany	17.29	17.73	18.21	15.89	12.76	8.31	5.46	2.99	1.38
The Rose	18.36	20.09	19.48	15.77	11.69	8.21	3.90	1.57	0.92
Engombe	20.69	19.49	20.96	16.46	10.44	6.67	3.23	1.43	0.63
blacksmith	19.78	19.00	20.12	16.63	10.95	7.00	3.85	1.87	0.80
Santo Domingo Country Club	20.82	20.19	20.30	15.32	11.48	6.66	3.24	1.36	0.63
Duarte	20.29	18.97	19.17	16.69	11.07	6.28	4.48	2.16	0.89
Buenos Aires	20.46	19.20	18.94	16.26	11.06	6.61	4.24	2.30	0.94

Source: IX National Population and Housing Census, 2010.

In the survey applied by Empaca, S.R.L. in May 2021 in nine neighborhoods of the urban area of the municipality of Santo Domingo Oeste, the composition by age of the respondents reflects the following results: 13% are in the age group of 20-29 years; 22% aged 30-39; 26 per cent between the ages of 40 and 49; 18% aged 50-59 and 21% over 60 years of age (Figure 6-39).

Figure 6-39: Population Surveyed by Age Range



Source: Survey applied by Empaca, S.R.L., in nine neighborhoods of the urban area of the Municipality of Santo Domingo Oeste, May 2021

6.5.3.4 *Nationality*

The National Census of Population and Housing, 2010 shows that the proportion of the analyzed population that indicated that it was born in the neighboring country of Haiti is similar to the average of the distribution of the country. However, it is lower when compared with the average of Santo Domingo.

It can be seen that the percentage of distribution of the population that was born in Haiti represents 3.30% in the country and 2.61% in the province of Santo Domingo, while in the municipality of Santo Domingo Oeste this value reaches 3.27%.

These proportions vary in the different neighborhoods of the study area. For example, in the neighborhoods Engombe (4.47%), La Altagracia (3.97%), Buenos Aires (3.78%) and Santo Domingo Country Club (3.65%) these proportions are higher than the average of the country and municipality, while in Las Caobas (0.68%), La Rosa (1.15%) and Manoguayabo (1.85%), among others, the proportion of Haitian nationals is lower (Table 6-57).

Table 6-57: Percentages (%) of the Distribution of the Population by Country of Birth

Territorial Demarcation	Dominican Republic	Haiti	In another country	Undeclared
Dominican Republic	95.81	3.30	0.70	0.10
Santo Domingo Province	96.73	2.61	0.59	0.07
Santo Domingo Oeste	96.02	3.27	0.62	0.09
The Altagracia	95.45	3.97	0.52	0.06
Manoguayabo	97.27	1.85	0.84	0.04
poplar grove	95.86	2.56	1.49	0.09
Bayonne	96.05	3.09	0.78	0.08
Mahogany	98.10	0.68	1.28	0.4
The Rose	97.74	1.15	1.04	0.07
Engombe	94.97	4.47	0.47	0.09
blacksmith	96.38	3.15	0.32	0.15
Santo Domingo Country Club	95.88	3.65	0.37	0.10
Duarte	97.13	2.49	0.34	0.04
Buenos Aires	95.74	3.78	0.35	0.13

Source: National Population and Housing Census 2010.

6.5.3.5 *Migration*

The Dominican Republic has historically been a country expelling its population, mainly to the United States and some countries in Europe. As can be seen in Table 6-58 the migratory destination of 83% of the Dominican migrant population has been the United States.

Table 6-58: Main Dominican Migration Destinations

Migration Destination	Quantity	%
United States	1,865,987	83.1
Spain	160,913	7.2
Another country in Europe	84,764	3.7
Another country in America	69,020	3.1
Puerto Rico	64,782	2.9
total	2,245,466	100.00

Source: Table prepared by Empaca from data from the Report of the National Institute of Migration: Dominican Population Abroad: Demographic and Economic Characteristics[11]

The Dominican Republic has also been a host of foreign migrant population, mainly Haitians, who in the past worked in the sugar industry and now do so mainly in the agricultural and construction sectors. As can be seen

[11] Report of the National Institute of Migration: Dominican Population Abroad: Demographic and Economic Characteristics, Santo Domingo, 2016.

in Table 6-59, the foreign-born population from Haiti represents more than thirty-three (33) times the total resident population in the country born in the United States, which is the nearest country of origin.

Table 6-59:. Main origins of Population of the Dominican Republic Born Abroad

Country	Foreign Population
Haiti	458,233
United States	13,514
Spain	6,720
Puerto Rico	4,416
China	3,643
Venezuela	3,434
Cuba	3,145

Source: National Bureau of Statistics, First National Survey of Immigrants in the Dominican Republic (ENI-2012), Santo Domingo, 2013

It is worth noting that, unlike the first migratory movements that were established in rural communities around sugar mills and later around coffee, banana, and rice farms, a significant part of the most recent waves of Haitian migrants have been established in the urban areas of the National District and the main provinces (Santo Domingo and Santiago)., while tourist enclaves chose to establish in Punta Cana, Puerto Plata and Las Terrenas.

In addition, during the last decade, as a result of the political and economic crisis in Venezuela, the country has also been a recipient of a significant part of migrants from that country, who have settled in the main cities, as well as tourist enclaves.

This part of the Haitian migrant population residing in urban areas is mainly occupied in the construction sector and a part of it in recent years has come to represent a significant proportion of informal trade, progressively displacing Dominican nationals.

6.5.4 Housing Characteristics

This section is part of the social diagnosis for the area of direct and indirect influence of the Stormwater and Sanitary Drainage of the Guajimia Canal Phase II Project. Housing is understood in this study of any built structure used for that purpose. It is made up of one or more rooms and their dependencies, which constitute a building or are part of it, and within its characteristics are:

- They have at least a bedroom, kitchen and bathroom (either outside or inside the house).
- It has one or more entries.
- Unconventional structures such as "multipurpose" rooms with or without separations of spaces (room, kitchen, bathroom, etc.) are also considered as housing.

Among the topics addressed in this section are:

- Number of homes in the study area.
- Quality of housing.
- Housing tenure.
- Predominant building materials in the house.
- •Sanitary service of the houses.

6.5.4.1 *Number of Dwellings in the Study Area*

According to the data provided by the 2010 National Population and Housing Census, the total number of households registered in the Dominican Republic is 3,077,353 distributed across 2,278,246 homes located in urban areas and 799,246 in rural areas. In the province of Santo Domingo were registered 756,579 homes distributed in its different municipalities, of which 114,898 are in the municipality of Santo Domingo Oeste,

being nearby the neighborhoods with the highest number of homes: Herrera, Duarte, Santo Domingo Country Club and Bayona, followed by La Altagracia and Engombe, as shown in Table 6-60.

Table 6-60: Number of Homes in the Study Area

Demarcation	Number of dwellings	Population	Population/housing ratio
Dominican Republic	3,077,353	9,445,281	3.06
Santo Domingo Province	756,579	2,374,370	3.13
Municipality of Santo Domingo Oeste	114,898	363,321	3.16
Santo Domingo Country Club	9,356	29,784	3.18
The Altagracia	8,291	26,313	3.17
Engombe	8,925	28,729	3.21
The Rose	4,141	13,085	3.15
Mahogany	7,554	23,244	3.07
poplar grove	4,746	14,290	3.01
Buenos Aires Neighborhood	6,051	19,015	3.14
Herrera Neighborhood	13,609	43,119	3.16
Duarte	10,052	31,394	3.12
Bayonne	9,051	29,526	3.26
Manoguayabo (neighborhood)	5,089	16,215	3.19

Source: IX National Population and Housing Census, 2010.

Table 6-60 above shows data on the population/housing ratio. It is worth noting that, while the 2010 Census reports a greater number of dwellings (3,077,353), than households (2,671,979), that is, a difference of 405,374 more dwellings than households. This difference can be explained both in the existence of homes that were not occupied by households at that time, as well as those of a collective nature, such as hospitals, convents, boarding houses, barracks, correctional facilities, hotels, pensions, and many others.

6.5.4.2 *Structural Quality of Housing*

Table 6-61 shows the results of the National Population and Housing Census (2010) in relation to the quality of housing in the territorial demarcations that are part of the studied area.

It is observed that there is a higher proportion of housing with high structural quality in the municipality of Santo Domingo Oeste than in the average of the country and the province of Santo Domingo as a whole. Also, between the different neighborhoods, there are significant differences. For example, while in neighborhoods of Las Caobas, Alameda, La Rosa, Bayona and Manoguayabo (Photographs 96 and 97 in Annex 8), there is a higher proportion of homes with high structural quality than the remaining neighborhoods, where housing of medium structural quality predominates.

Also noteworthy is the low proportion of low-quality structural housing in the municipality of Santo Domingo Oeste as a whole and in each of the neighborhoods studied.

Table 6-61: Percentages (%) of the Structural Quality of the House

Territorial Demarcation	High Quality	Medium Quality	Low Quality	Total
Dominican Republic	30.10	69.17	0.73	100.00
Santo Domingo Province	38.91	59.64	0.55	100.00
Municipality of Santo Domingo Oeste	45.68	54.23	0.09	100.00
Santo Domingo Country Club	41.26	58.66	0.08	100.00
The Altagracia	39.70	60.26	0.04	100.00
Engombe	35.18	64.80	0.02	100.00
The Rose	72.93	27.04	0.03	100.00

Territorial Demarcation	High Quality	Medium Quality	Low Quality	Total
Mahogany	81.37	18.61	0.01	100.00
poplar grove	71.07	28.86	0.07	100.00
Buenos Aires	37.73	62.27	--	100.00
Blacksmith	41.22	58.74	0.04	100.00
Duarte	40.69	59.30	0.01	100.00
Bayonne	60.46	39.52	0.02	100.00
Manoguayabo	53.54	46.38	0.09	100.00

Source: IX National Population and Housing Census, 2010.

At this point it is worth noting that the high, medium or low quality ratings used in the National Population and Housing Census, seem not to be based exclusively on characteristics associated with the material used, but also seem to affect the assessments of each registrar at the time of the census, depending on the level of deterioration in the different parts of the house (walls, ceiling, floor).

6.5.4.3 *Housing Tenure*

Data from the 2010 National Population and Housing Census show that, unlike the data reported for the country and the province of Santo Domingo as a whole, in the municipality of Santo Domingo Oeste and most of the neighborhoods considered in this study, the predominant form of housing tenure is rented. Only in the Bayonne neighborhood, house ownership (fully paid for) slightly predominates as form of tenure , as can be seen in Table 6-62.

Table 6-62: Percentages (%) of the Possession of the Dwelling

Territorial Demarcation	Own, already fully paid	Own, still paying it	Rented	Ceded or borrowed	Other
Dominican Republic	54.36	2.61	32.84	9.81	0.39
Santo Domingo Province	47.42	3.29	41.64	7.36	0.29
Municipality of Santo Domingo Oeste	38.97	3.48	52.36	4.98	0.20
Santo Domingo Country Club	45.33	2.41	47.85	4.19	0.22
The Altagracia	33.84	1.83	60.24	3.97	0.12
Engombe	33.52	2.05	60.78	3.48	0.17
The Rose	35.82	2.70	51.71	3.63	0.14
Mahogany	40.52	3.83	50.82	4.56	0.27
poplar grove	35.50	11.90	47.38	5.03	0.19
Buenos Aires	32.43	0.95	60.53	6.00	0.09
blacksmith	31.58	1.34	61.95	4.83	0.31
Duarte	30.85	1.13	62.77	5.19	0.07
Bayonne	44.62	6.67	43.66	4.97	0.09
Manoguayabo	41.09	8.07	46.05	4.59	0.20

Source: National Population and Housing Census 2010.

6.5.4.4 *Predominant Building Materials in the House*

This section deals with the type of building materials of different parts of the houses in the study area, this includes exterior walls, ceiling and floor.

The Dominican Republic is a country located in a region that, like the Caribbean, is frequently exposed to the occurrence of hurricanes. The historical experience of the Dominican population in the face of these meteorological phenomena has taught that the use of materials such as cement in the construction of the

exterior walls and the ceiling provides greater protection than other materials such as wood. Therefore, there is a propensity to use these materials when resources are available.

6.5.4.4.1 Material of the Exterior Walls of the Houses

Data from the national census of population and housing(2010) show that block or concrete is the material of the exterior walls is predominant in the municipality Santo Domingo Oeste (89.26%) and in all the neighborhoods included in this study is the block or concrete. This percentage is higher than the one found in the data reported for the country and for the province of Santo Domingo (Photographs 98 and 99 in Annex 8).

In the case of the neighborhoods included in the study, apart from Santo Domingo Country Club and Manoguayabo, the percentage of homes with exterior walls of block or concrete exceeds 90%, as shown in Table 6-63.

Table 6-63: Percentages (%) of the Building Material of the Exterior Walls of the Houses

Territorial Demarcation	Block or Concrete	Wood	Palm Table	Other
Dominican Republic	74.69	18.66	3.94	2.72
Santo Domingo Province	82.15	14.24	0.59	3.02
Municipality of Santo Domingo Oeste	89.26	9.93	0.11	0.70
Santo Domingo Country Club	84.14	15.43	0.13	0.30
The Altagracia	93.33	6.37	0.5	0.5
Engombe	93.29	6.32	0.08	0.31
The Rose	98.87	0.97	0.02	0.14
Mahogany	99.11	0.70	0.05	0.13
poplar grove	97.72	1.96	0.02	0.29
Buenos Aires	94.07	5.59	0.02	0.33
Blacksmit	96.10	3.49	0.07	0.34
Duarte	97.53	2.21	0.05	0.21
Bayonne	93.67	5.92	0.07	0.34
Manoguayabo	87.38	11.60	0.24	0.79

Source: National Population and Housing Census 2010.

6.5.4.4.2 Roof Construction Material

Data from the National Population and Housing Census (2010) show that in the municipality of Santo Domingo Oeste 64.28% of homes have a block or concrete roof, which represents 22 percentage points higher than the country's average and five percentage points higher than the average for the province of Santo Domingo. A similar trend is manifested in each of the neighborhoods in the area of influence of the project, reaching in the cases of neighborhoods of Buenos Aires, Las Caobas, La Rosa and Alameda to represent this difference between 35 and 45 percentage points, as seen in Table 6-64.

Table 6-64: Percentages (%) of the Roofing Construction Material

Territorial Demarcation	Block or Concrete	Zinc	Asbestos Cement	Other
Dominican Republic	42.27	55.26	0.78	1.30
Santo Domingo Province	59.07	39.53	0.70	0.70
Municipality of Santo Domingo Oeste	64.28	30.43	1.09	0.30
Santo Domingo Country Club	66.79	32.54	0.32	0.36
The Altagracia	69.75	28.09	1.97	0.19

Territorial Demarcation	Block or Concrete	Zinc	Asbestos Cement	Other
Engombe	64.25	32.88	2.75	0.12
The Rose	89.13	9.66	0.94	0.6
Mahogany	93.12	6.09	0.69	0.10
poplar grove	84.60	14.94	0.34	0.13
Buenos Aires	94.07	5.59	0.02	0.33
Herrera Neighborhood	69.37	29.19	1.27	0.16
Duarte	69.23	29.73	0.79	0.25
Bayonne	77.24	20.35	2.33	0.08
Manoguayabo	69.66	29.53	0.16	0.37

Source: National Population and Housing Census 2010

6.5.4.4.3 Construction Material of the Floor of the Houses

Cement is the predominant floor material in the municipality of Santo Domingo Oeste and in most of the neighborhoods considered in the study, with percentages below the country's average and like those of the province of Santo Domingo (Photo 100).

Photo 6-4: Zinc-Roofed Housing in the Area of Influence of the Project

Only in neighborhoods of Las Caobas, La Rosa, Alameda and to a lesser extent Bayona, the percentage of homes with cement floor is significantly lower than the average of the province and the same municipality Santo Domingo Oeste (Photo 6-5), as seen in Table 6-65.

Photo 6-5: Sanitary Toilet Service in the Engombe Neighborhood, in the Area affected by the La Ureña Canal

Table 6-65: Percentages of the Construction Material Floor

Territorial Demarcation	*Mosaic*	*Cement*	*Granite, marble, ceramics*	*Earth*	Other
Dominican Republic	13.43	65.38	17.05	3.72	0.43
Santo Domingo Province	17.36	57.86	23.74	1.74	0.30
Municipality of Santo Domingo Oeste	17.81	53.07	28.04	0.78	0.31
Santo Domingo Country Club	21.09	56.25	20.42	1.40	0.84
The Altagracia	22.62	58.94	17.25	0.37	0.82
Engombe	10.41	64.03	24.86	0.40	0.29
The Rose	23.82	26.74	47.19	0.16	0.8
Mahogany	34.87	18.27	46.58	0.13	0.17
poplar grove	23.04	28.60	48.10	0.12	0.14
Buenos Aires Neighborhood	16.53	61.84	21.31	0.16	0.16
Herrera Neighborhood	15.02	58.28	26.20	0.18	0.21
Duarte	17.62	59.07	23.15	0.12	0.4
Bayonne	19.13	38.70	41.46	0.53	0.19
Manoguayabo	20.12	45.26	33.68	0.68	0.26

Source: National Population and Housing Census 2010.

6.5.4.5 *Housing Health Service*

The data of the IX National Census of Population and Housing (2010) shows that, in the area of influence of the project, the use of toilet is predominant in a significantly higher proportion both than the country and the province of Santo Domingo, reaching in the neighborhoods of Las Caobas, La Rosa and Alameda a value above 98%. The use of latrines only in the Buenos Aires neighborhood passes 5%, as seen in Table 6-66.

Table 6-66: Percentages of the Type of Health Service of the House

Territorial Demarcation	Toilet	Latrine	You don't have
Dominican Republic	69.71	24.28	6.01
Santo Domingo Province	88.12	8.40	3.48
Municipality of Santo Domingo Oeste	94.12	4.26	1.62
Santo Domingo Country Club	94.02	3.64	2.34
The Altagracia	95.54	3.81	0.65
Engombe	96.69	2.78	0.53
The Rose	99.26	0.44	0.30
Mahogany	99.55	0.24	0.21
poplar grove	98.44	0.96	0.60
Buenos Aires	92.87	6.02	1.11
Herrera Neighborhood	95.71	3.68	0.61
Duarte	96.07	3.27	0.67
Bayonne	97.44	1.46	1.09
Manoguayabo	94.91	3.69	1.40

Source: National Population and Housing Census 2010.

The National Census of Population and Housing (2010) reports data showing that in the municipality of Santo Domingo Oeste 11.51% of households share the health service with other households, which although it is lower than the national average (14.27%), is higher than the average of the province of Santo Domingo (10.74%).

The high percentage of households that share the health service is influenced by the social characteristic of the neighborhood, so that neighborhoods where households with low social extracts predominate, such as Buenos Aires (17.13%), La Altagracia (15.09%) Engombe (15.16%) and Herrera (13.82%), tend to share in a greater proportion toilets, compared to where middle-class households predominate, such as Las Caobas (1.83%) and La Rosa (2.14%), as shown in Table 6-67.

Table 6-67: Percentage (%) of Households that Share the Health Service

Territorial Demarcation	Used only by household people	Shared with other households
Dominican Republic	85.73	14.27
Santo Domingo Province	89.26	10.74
Municipality of Santo Domingo Oeste	88.49	11.51
Santo Domingo Country Club	89.79	10.21
The Altagracia	84.91	15.09
Engombe	84.84	15.16
The Rose	97.86	2.14
Mahogany	98.17	1.83
poplar grove	92.93	7.07
Buenos Aires	82.87	17.13
blacksmith	86.18	13.82
Duarte	88.73	11.27
Bayonne	93.81	6.19
Manoguayabo	91.07	8.93

Source: National Population and Housing Census 2010.

6.5.4.6 *Articles or services owned by dwellings*

Table 6-68 presents the results of the 2010 National Population and Housing Census in relation to the articles that have the census of the municipality of Santo Domingo Oeste, and in comparison, to the average of the country and the province of Santo Domingo.

It can be observed that there are significant differences in the availability of household items and services between the country and the municipality of Santo Domingo Oeste, manifesting greater availability in the latter, which is consistent with the fact that this is one of the municipalities with the lowest level of poverty in the country.

On the other hand, there are not many differences between the municipality of Santo Domingo Oeste and the province of Santo Domingo, with some differences in favor of the municipality in some cases and others that are favorable to the province.

Table 6-68: Percentage (%) of Items Owned by the Household

Items/services	Dominican Republic	Santo Domingo Province	Santo Domingo Oeste Municipality
Stove	86.4	92.1	93.2
Fridge	69.9	77.3	81.3
Washing machine	68.8	75.9	77.3

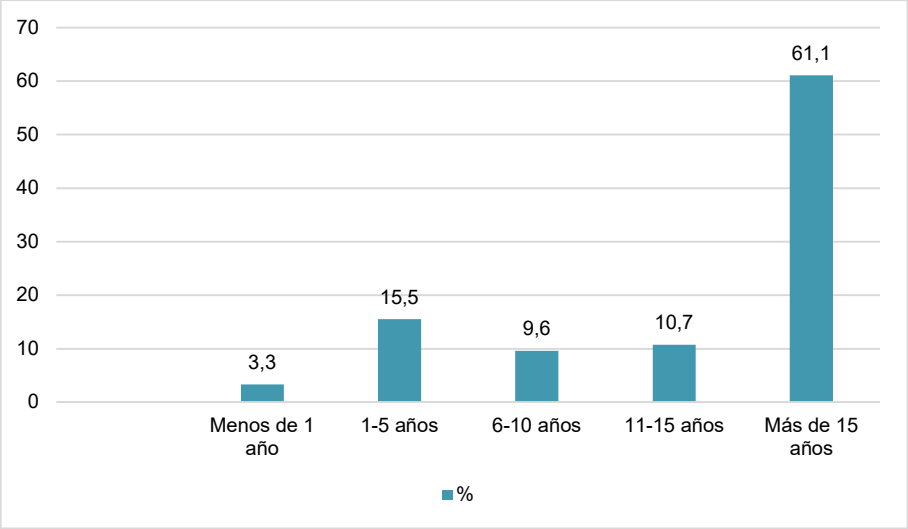
Items/services	Dominican Republic	Santo Domingo Province	Santo Domingo Oeste Municipality
Television	78.9	84.7	86.6
Radio/stereo	50.2	53.1	52.2
Cistern	18.8	29.8	30.1
Tinaco	25.1	31.8	30.1
Computer	20.2	25.1	27.9
Internet	13.8	17.2	19.6
Investor	23.2	29.4	29.3
Power plant	4.0	3.6	3.4
Home/landline telephone	24.1	33.0	34.1
Cell phone	76.5	81.8	83.5
Motorcycles	24.0	11.5	10.3
Private car	18.8	24.1	25.5
Air conditioner	8.8	10.4	12.5

Source: National Population and Housing Census 2010.

6.5.4.7 *Years of residence in the Home*

In the survey applied in May 2021, the people interviewed were questioned about the time they have residing in their homes, being able to determine that the households established in the neighborhood for more than 15 years are the predominant ones, with a total of 240 households, representing 61.1%. In addition, there are households established between 1 and 5 years, which have a frequency of 61 households and represent 15.5%, while households who have been residing for 11 to 15 years in the area are 41, for a percentage of 10.4%. Households who have been residing for 6 to 10 years account for 37 households, representing a percentage of 9.7%, and those of less than one year account for 13 households with a percentage of 3.3% (Figure 6-40).

Figure 6-40: Years residing in the home



Source: Survey applied by Empaca, S.R.L., in nine neighborhoods of the urban area of the Municipality of Santo Domingo Oeste, May 2021.

6.5.5 Economy

This section presents aspects related to the economy of the municipality of Santo Domingo Oeste and the neighborhoods considered in the study. Among the topics addressed are:

- Economic activities
- Level of employment
- Type of occupation and branch of economic activity
- Poverty situation

6.5.5.1 *Economic Activities*

The municipality of Santo Domingo Oeste has one of the main industrial parks of the country, the industrial zone of Herrera, whose origin dates back to the 60s, with the installation of the Industries Pinturas Popular and Aluminios Dominicanos. Later, with the promulgation of Law 299 in 1968, by means of which the Dominican State gave tax concessions for the installation of other companies, such as Plastimold Dominicana, Espumas del Caribe and Electroquímica Dominicana, among others.

Currently, the industrial area of Herrera is home to around 170 companies, including large, medium and small oriented to the production of various industrial goods, among which pharmaceuticals, plastics, aluminum and paints stand out.

Trade is another important economic activity in the municipality of Santo Domingo Oeste, which is enhanced by the fact that it is the gateway from the South and Cibao regions to the city of Santo Domingo. The main commercial activities are developed mostly along the Avenues Isabel Aguiar, Mexico and Las Palmas, although increasingly, they acquire this characteristic road such as the Prolongación 27 de Febrero and the Avenida de Los Beisbolistas.

Until the end of the last century, the cultivation of sugar cane was an important economic activity in the rural area of the municipality of Santo Domingo Oeste. In fact, in this area, the Palavé and Hato Nuevo sections were cane fields of the defunct Rio Haina Sugar Mill, which was until the moment of its dismantling, the largest sugar mill in the Dominican Republic. Since then, most of the land that was previously dedicated to the cultivation of sugarcane has become land with a residential and commercial vocation, given the trend of urban expansion of the municipality.

Other relevant economic data consist of the fact that, according to the same document cited, in the municipality there are 568 landholders in peasant settlements, who are capable of cultivating 1,397 hectares. In addition, there are 1,778 grocery stores or small stores of provisions scattered through different neighborhoods of the urban area and other places in the rural area.

6.5.5.2 *Level of Employment in the Case Study*

In the last decade, the Dominican Republic has reached a level of average income, however, the labor market continues to be characterized by a high percentage of workers in vulnerable and precarious situations, stagnant wages and insufficient investment in training, which hinders the creation of quality jobs.

According to the data of the National Census of Population and Housing (2010), cited in the document “Tu Municipio en Cifras”, of the National Statistics Office, in the municipality of Santo Domingo Oeste the population of working age (PET) is made up of 290,150 people, of which 139,516 are male and 150,634 are female, while the Economically Active Population (EAP) is made of 78,990 male and 56,492 females for a total of 135,482. The employed population accounts for 125,990 people, for an employment rate of 43.4%, of which 74,505 is male and 51,485 is female, while the inactive population represents 147,991people, of which 57,183 is male and 90,808 is female (Table 6-69).

The official definition of unemployment in the Dominican Republic differs from international statistical standards, as it includes among the unemployed a large part of the so-called discouraged workers, that is, people who do not have a job, or who are available to work, but did not take any special steps to look for it in the week in which the inspection of the labor force, , which was carried out in the form of an interview.

Since 2020, this condition has worsened as a result of the impact of the Covid-19 pandemic on the national economy and, therefore, on the employment situation, causing numerous suspensions of employment contracts, many of which are still in effect, although the recovery process of the labor market has been remarkable in the recent months.

Table 6-69: Employment and Unemployment in the Municipality of Santo Domingo Oeste

Indicators	Men	Women	Total
Working-age population (PET)	139,516	150,634	290,150
Economically Active Population (EAP)	78,990	56,492	135,482
Employed population	74,505	51,485	125,990
Inactive population	57,183	90,808	147,991
Unemployment Rate	5.7	8.9	7.0

Source: National Population and Housing Census 2010.

On the other hand, the survey applied by Empaca in May 2021 yields results according to which 215 of 393 people surveyed stated that they were currently working, representing 54.70%. 21.88% are in inactive working condition, 9% are unemployed or stopped working, 7.37% said they work occasionally, 2.5% are pensioners or retired, 2.29% have never worked and 1.5% work seasonally (Figure 6-41: Level of Occupation in Nine Neighborhoods of the Urban Area). One of the last ones carried out (October-December 2020) yields data according to which the employed population is composed of 4,414,601 people, which represented a reduction of 301,588 people (6.4%) compared to the same period of the previous year, that is, the pre-pandemic period.

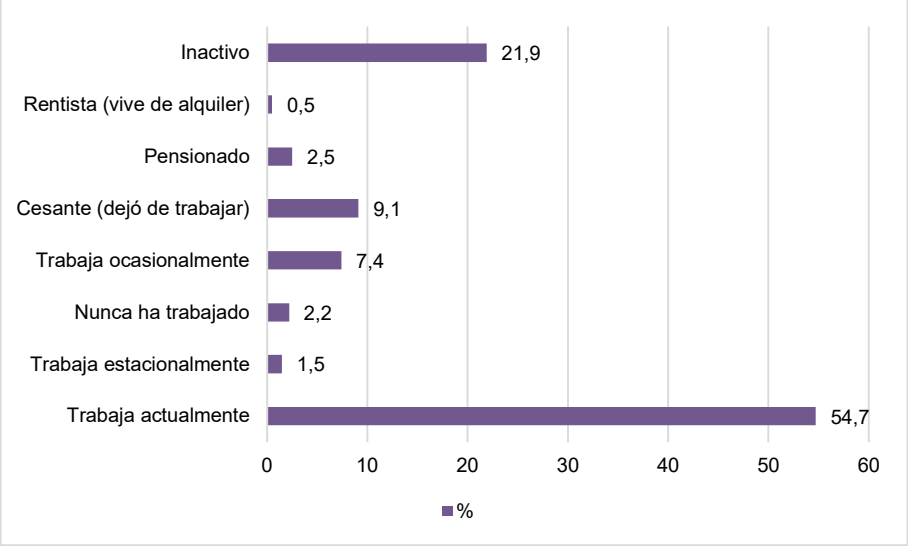


Figure 6-41: Level of Occupation in Nine Neighborhoods of the Urban Area of the Municipality of Santo Domingo Oeste

Source: Survey applied by Empaca, S.R.L., in nine neighborhoods of the urban area of the municipality of Santo Domingo Oeste.

6.5.5.3 *Category of occupation and branch of economic activity*

The predominant occupation category in the municipality of Santo Domingo Oeste is that of the employee with hire or salary, representing 73.17%, which is significantly higher than the average of the country (68.45%) and Santo Domingo province (71.14%). It is followed by the category of a self-employed worker, which represents 16.87%, which is lower than both the average of the country (19.58%) and the province (18.72%) (Table 6-70).

Table 6-70: Percentages (%) by Occupational Category

Occupation Category	Dominican Republic	Santo Domingo Province	Santo Domingo Oeste Municipality
Employee for hire or salary	68.45	71.14%	73.17%
Employer or employer	5.73	4.66%	4.65%
Family or non-family worker without effective pay (who may receive other benefits)	1.80	1.23%	1.13%
Self-employed worker	19.58	18.72%	16.87%
other	1.34	1.19%	1.16%
Undeclared	3.10	3.06%	3.02%

Source: National Population and Housing Census 2010.

On the other hand, according to the data of the IX Census of 2010 for the study area, in the municipality of Santo Domingo Oeste, the predominant branch of economic activity is commerce, representing 26% of the total, followed by manufacturing industry (Photographs 102,103 and 104 in Annex 8), which represents 11.44%. Private households with domestic service reach 8%, transport and storage reach 7.72% and construction reaches 6.70% (Table 6-71).

Table 6-71: Percentages (%) of Economic Activity.

Economic activity	Dominican Republic	Santo Domingo Province	Santo Domingo Oeste Municipality
Agriculture, livestock, hunting and forestry	8.98	1.28	0.59
Fishing	0.12	0.03	0.01
Mining and quarrying	0.2	0.06	0.07
Manufacturing	11.97	11.68	11.44
Electricity, gas and water supply	0.86	0.90	0.87
Construction	6.26	6.30	6.70
Wholesale and retail trade; repair of motor vehicles, motorcycles, personal effects and household goods	22.79	25.21	26.07
Hotels and restaurants	4.53	3.68	3.49
Transport, storage and communications	5.89	7.13	7.72
Financial intermediation	1.82	2.21	2.50
Real estate, business and rental activities	3.95	4.83	4.96
Public administration and defense, social security schemes with compulsory membership	4.60	6.32	5.29
Teaching	4.63	4.86	5.10
Health and social services	3.07	3.30	3.13
Other community, social and personal service activities	6.80	7.52	8.00
Private households with domestic service	8.16	8.31	8.18
Extraterritorial organizations and bodies	0.04	0.05	0.04
Undeclared	5.34	6.34	5.84

Source: National Population and Housing Census 2010.

Data from the survey applied by Empaca in May 2021 indicate that 24.2% of the people surveyed are employed as employees in the private sector, 30% are employed independently, 21.4% do not exercise any activity, 10.9% work in the public sector, 4.3% are self-employed or as a day laborer, while 2.5% work under the category of an employer or an active partner of a certain company (Table 6-72).

Table 6-72: Percentages (%) by type of occupation.

Type of occupation	Percentage (%)
Salaried private sector	24.2
Independent	30.0
Own account (day laborer)	4.3
Employer (active partner company)	2.5
Not active	21.4
Public employee	10.9
Unpaid worker	1.5
Family worker	3.1
Non-family worker	2.0

Source: Survey applied by Empaca, S.R.L., in nine neighborhoods of the urban area of the municipality of Santo Domingo Oeste, May 2021.

6.5.5.4 *Poverty Situation*

To determine the situation of poverty in the Dominican Republic, the method of Unsatisfied Basic Needs (NBI) has been used, since the last decade of the last century, which consists of the identification of deficiencies or deprivations related to goods, services, resources and opportunities that make subsistence and human development possible.

Precisely, the different variables addressed in the chapters of Housing and Service Structures refer to basic needs whose lack or precariousness is directly related to the condition of poverty. These variables are as follows:

- Floor
- Roof
- Wall
- Liquefied petroleum gas (LPG)
- Drinking water
- Health service
- Electricity
- Garbage collection
- Basic equipment
- Home schooling
- School attendance
- Housing
- Housing extension
- Means of transportation
- Tics

The 2014 poverty map, based on data from the 2010 National Population and Housing Census, shows that the province of Santo Domingo, with an index of unsatisfied basic needs of 29.6%, occupies the 3rd position (tied with the province of Monsignor Noel) with the lowest rate of dissatisfaction with basic needs, among the 32 provinces of the Dominican Republic.

Table 6-73 below shows the index of unsatisfied basic needs in the province of Santo Domingo and its comparison with the country, which shows that there is a lower rate of dissatisfaction in most of the indicators considered.

Table 6-73: Index of unsatisfied basic needs province Santo Domingo

Unsatisfied basic needs	Percentage of households Province of Santo Domingo(%)	Percentage of R.D. Households (%)
Floor	1.7	3.7
Roof	0.3	1.0
Wall	2.8	2.6
Liquefied petroleum gas	3.2	11.5
Drinking water	30.2	32.8
Health service	8.8	17.7
Electrical energy	0.7	4.2
Garbage collection	11.6	9.6
Equipment	19.3	26.8
Adult schooling	19.5	25.4
School attendance	2.8	3.1
Housing	8.4	7.8
Housing expansion	11.0	11.6
Own transport	64.7	59.2
Tic	12.2	17.8
NBI Index	**29.6**	**36.9**

Source: ONE, Poverty Map, 2014

These data, which reflect a higher rate of satisfaction of needs compared to the national average, translate, as we will see now, into lower levels of poverty, both in the province of Santo Domingo and the municipality of Santo Domingo Oeste and the neighborhoods considered in the study.

Indeed, the 2014 Poverty Map states that the province of Santo Domingo (36.6%) has an overall poverty rate, four points lower than those of the country, while the municipality of Santo Domingo Oeste (25.8%) has eight (8) points below the province and almost fifteen (15) below the country average (Photo 6-6).

Photo 6-6: Person looking for valuables in the middle of solid waste thrown in Canal El Indio Derecho, in the Libertador de Herrera neighborhood

It is notable that neighborhoods such as Santo Domingo Country (35.0%), Buenos Aires (35.7%) and Engombe (31.3%) have poverty levels similar to those of the province, while neighborhoods such as Las Caobas (9.8%) and La Rosa (13.3%) have significantly lower levels of poverty, as shown in Table 6-74.

Table 6-74: Percentage of households living in poverty.

place	General Poverty	Extreme Poverty
Dominican Republic	40.4%	10.4%
Santo Domingo	33.6.%	6.9%
Santo Domingo Oeste	25.8	3.6
Santo Domingo Country Club	35.0	7.1
The Altagracia	29.8	4.6
Engombe	31.3	3.5
The Rose	13.3	1.2
Mahogany	9.8	0.9
poplar grove	15.2	1.1
Buenos Aires	35.7	5.8
blacksmith	29.2	3.4
Duarte	28.6	2.9
Bayonne	19.9	3.1
Manoguayabo	23.6	4.0

Source: ONE, Poverty Map, 2014.

It is important to note that, in the most recent reports of official entities- such as the Ministry of Economy, Planning and Development (Bulletin of Official Statistics of Monetary Poverty, year V, number 7, of February 2021, page 6), it has been established that poverty levels in the country have been reduced in recent years to reach around 21%, so it can be inferred that poverty levels in the study area have been reduced, at least at levels proportionally equivalent to those of the country as a whole.

However, it should also be added that, as a result of the negative impact of the Covid-19 pandemic on the Dominican economy, it is normal to foresee a setback in the ground gained in the fight against poverty.

6.5.6 Land Use Planning

6.5.6.1 *The Growth of Urban Sprawl: between Planned and Spontaneous Occupations*

Between 1982 and 1986, the State urbanized and built the Agrarian City, while the private sector did the same with the Alameda urbanization, fundamentally dedicated to the upper-middle and upper-class sectors and encouraged by the accessibility it provided to the 27 de Febrero Avenue.

Furthermore, in the 90s, the area of El Café was made from irregular occupations when some private developers began their urbanization by creating urbanized areas such as Mirador del Oeste, which today along with several precarious settlements, is part of the Santo Domingo Country Club neighborhood.

The area under study is the urban part of the municipality of Santo Domingo Oeste. This part was previously a rural area until the second half of the twentieth century. In comparison to its undeveloped area, this area which is urban now is large and possesses the potential for urban sprawl within the municipality.

The management began in 1966. It consisted of the relocation of those evicted from other urban areas (for new buildings), on land in Engombe, to the Autonomous University of Santo Domingo (UASD),. In this way, a dynamic of urbanization was promoted that encouraged a continuous migration from rural areas, as well as from other human settlements in the rest of the country, which was previously prohibited (since it was governed by dictators).

6.5.6.2 *Role of public institutions, the private sector and residents*

As mentioned earlier in the previous point, the initiatives of the institutions of the central government, the private sector and the residents, have been key actors who help define the land use of the different sectors of the municipality.

It is noteworthy to mention that the municipal government or city council was absent during this process. It is necessary to indicate that until 2001, and with the approval of Law 163, this entire area was part of the National District and was managed, like other municipalities of the new province of Santo Domingo, by the City Council of the National District, which concentrated its action in the smallest part, that we know today as the National District, by carrying out only specific actions in the rest of the municipality.

As this new legislation provides the Municipality of Santo Domingo Oeste with some municipal investment in the area, including the improvement of local services such land use planning and citizen participation.

The proper coordination between the institution promoting the project, the Corporation of the Aqueduct and Sewerage of Santo Domingo (CAASD), the City of Santo Domingo Oeste and the neighborhood organizations of the sector, is fundamental for the good development of this initiative. This will change the land use of an important part of the municipality, which are currently open canals and solid waste dumps.

6.5.6.3 *Land use*

According to the same source, in the municipality there are 11,445 fixed commercial establishments, with a place for those purposes. 592 are semi-fixed or mobile, consisting of street vendors of raw and cooked food, fruits, and others, and 1,846 commercial establishments shared with the house, that is to say, that they occupy part of the family's home. The latter is a common survival strategy in the advocacy sectors of the project.

However, the informal occupation of the territory remains a great challenge for the authorities, this is how existing green areas in neighborhoods such as Las Caobas, El Café, and Manoguayabo, among others, continue to be occupied informally, subtracting spaces for community use from the inhabitants.

An important aspect related to land use in the municipality is related to industrial use, which, historically, influenced the process of expansion of the city of Santo Domingo and gave rise to the municipality.

Despite being a common modality of occupation of the territory, the private sector has developed urban areas such as Alameda, and the central government, in turn, has developed others such as Ciudad Agraria and Las Caobas, which have urban planning for their development, with the minimum equipment required.

Education is coordinated by Educational District 15-05, which is responsible for overseeing 120 public schools and 272 private schools, according to the National Bureau of Statistics, in the bulletin "Your municipality in figures".

6.5.7 Access to basic services

This section presents information on Service Structures, which are associated with housing characteristics, household socioeconomic status, and public policies. The issue of services is cross-cutting in most sections of this study; however, it is analyzed independently due to its greater importance.

Among the topics addressed in this subsection are:

- Electricity.
- Aqueduct and sanitation.
- Hospitals and health centers.
- Education.
- Solid waste collection and disposal system.
- Transport.
- Fire Department, Civil Defense and 9-1-1 System.
- National Police; and
- Roads

6.5.7.1 *Electricity*

The Empresa Distribuidora de Energía del Sur (EDESUR) is in charge of the distribution of electricity in the municipality of Santo Domingo Oeste, which extends its networks throughout the Southern region and part of the province of Santo Domingo (Photo 6-7).

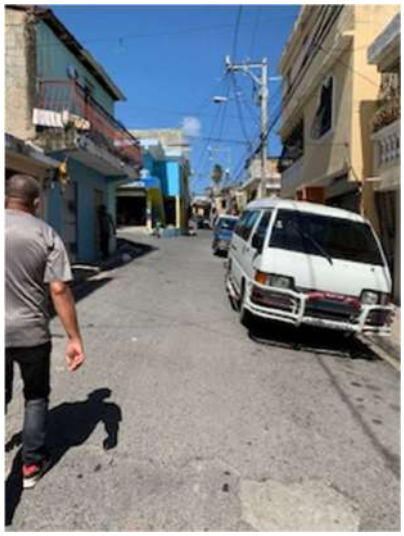


Photo 6-7: Public lighting network in the Herrera neighborhood, in the vicinity of the El Indio Derecho canal

Data from the 2010 National Population and Housing Census reveal that the level of access to electricity from public power lines in the study area is higher than in the country, representing more than 99% throughout the municipality and the neighborhoods of the study, as can be seen in Table 6-75.

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Table 6-75: Level of access to electricity from the public power line

Territorial demarcation	Power of the public line	Propane gas lamp	Kerosene gas lamp	Own power plant	other
Dominican Republic	95.63	0.52	1.72	0.13	1.98
Santo Domingo Province	99.23	0.09	0.09	0,04	0.56
Municipality of Santo Domingo Oeste	99.66	0.03	0.01	0.01	0.18
Santo Domingo Country Club	99.70	0.06	--	--	0.15
The Altagracia	99.87	0.04	0.03	0.03	0.04
Engombe	99.83	005	002	0.01	0.08
The Rose	99.78	--	0.03	0.08	0.11
Mahogany	99.88	--	--	0.01	0.10
Poplar grove	99.83	--	--	--	0.17
Buenos Aires	99.86	0.02	0.02	--	0.10
Herrera Neighborhood	99.67	0.02	0.01	--	0.27
Duarte	99.91	--	--	--	0.09
Bayonne	99.83	0.01	0.02	0.01	0.12
Manoguayabo	99.83	0.02	--	--	0.15

Source: IX National Population and Housing Census, 2010.

6.5.7.2 *Aqueduct*

The Corporation of the Aqueduct and Sewerage of Santo Domingo (CAASD) if responsible for the management of aqueducts water sources in the communities of the province of Santo Domingo (Photo 6-8).

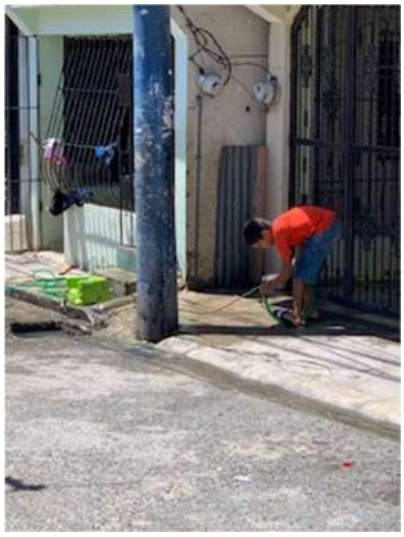


Photo 6-8: Child fetching Water from a Street Pipe

The poor drinking water service has historically been one of the problems faced by communities in the Dominican Republic, especially the popular neighborhoods of the urban area. This problem particularly affects the inhabitants of the study area, where according to the National Population and Housing Census (2010), only 64% of households had this service within the housing. This deficit is even more noticeable in neighborhoods of Buenos Aires (55.26%), Herrera (59.69%), Duarte (53.50%) and La Altagracia (60.76%) (Table 6-76).

Table 6-76: Source of water supply in the households surveyed (part one)

Source of water supply	Santo Domingo Oeste Municipality	Santo Domingo Country Club	The Altagracia	Engombe	The Rose	Mahogany
From the aqueduct inside the house	64.03%	62.82%	60.76%	72.71%	69.51%	80.07%
From the aqueduct in the courtyard of the house	15.35%	12.42%	14.29%	10.42%	10.89%	4.71%
From a key to another house	5.43%	6.12%	5.28%	3.08%	3.44%	1.88%
From a public key	2.84%	2.17%	3.58%	4.56%	1.91%	2.35%
From a street tube	6.90%	4.51%	9.37%	9.04%	1.88%	3.96%
Spring, river, stream	0.11%	0.82%	0.03%	0.05%	--	--
Rain	0.03%	0.08%	0.01%	--	0.03%	0.01%
Well	2.68%	8.51%	1.02%	--	5.54%	3.66%
Tank truck	2.06%	1.93%	4.70%	0.07%	3.74%	3.20%
Others	0.59%	0.62%	0.96%	0.07%	3.06%	0.15%
	poplar grove	Buenos Aires	blacksmith	Duarte	Bayonne	Manoguayabo
From the aqueduct inside the house	76.89%	55.26%	59.69%	53.50%	77.61	76.52%

Source of water supply	Santo Domingo Oeste Municipality	Santo Domingo Country Club	The Altagracia	Engombe	The Rose	Mahogany
From the aqueduct in the courtyard of the house	7.74%	22.62%	21.04%	17.12%	8.20	11.78%
From a key to another house	3.58%	7.96%	6.49%	7.30%	3.13	3.23%
From a public key	2.24%	2.26%	2.13%	4.38%	2.13	1.11%
From a street tube	7.26%	8.32%	6.65%	7.03%	7.52	5.20%
Spring, river, stream	--	0.07%	0.07%	0.03%	--	--
Rain	--	0.02%	0.03%	0.04%	--	0.04%
Well	1.73%	0.65%	0.88%	7.77%	0.25	1.62%
Tank truck	0.43%	2.58%	1.39%	2.54%	0.92	0.33%
Others	0.12%	0.27%	1.62%	0.28%	0.25	0.15

Source: IX National Population and Housing Census, 2010.

6.5.7.3 *Sanitation*

In the metropolitan area of the city of Santo Domingo, consisting of the National District and the province of Santo Domingo, which is the most inhabited area of the country, around 913,503 cubic meters of wastewater is generated per day, according to the statistics of the Corporation of the Aqueduct and Sewerage of Santo Domingo (CAASD) (contained in its quarterly bulletin corresponding to the April-June 2021 quarter).

Of this total, the CAASD collects 244,819 m^3/day, which represents 26.8%, and of these 24.1% of wastewater is treated , which means that of the total only 6.5% of wastewater is treated (Table 6-77).

Table 6-77: Statistics on Wastewater Province Santo Domingo April -June 2021 (*)

Concept	Quantity	Percentage
Wastewater produced	913,503 m^3/day	--
Wastewater collected in sewerage system	244,819 m^3 /day	26.8
Treated wastewater	59,089	24.1

Source: CAASD, Statistical Bulletin April-June 2021.

This reality of the province of Santo Domingo extends to the municipality of Santo Domingo Oeste, which does not have a sewage system in most of its neighborhoods. This deficiency means that much of the wastewater ends up in the subsoil through individual solutions from filter wells that contaminate groundwater. In other cases, the wastewater reaches the canals that run through the urban area of the municipality.

6.5.7.4 *Hospitals and Health Centers*

The public health system of the province of Santo Domingo is administered by the Ministry of Public Health and Social Welfare and Medical Services of the Armed Forces and National Police. The health infrastructure of the province consists of 3 hospitals, the Marcelino Vélez Regional Hospital (Photo 6-9), the Municipal Hospital of Engombe, and the Municipal Hospital Las Caobas, as well as 37 primary care centers, distributed in both urban and rural areas. The municipality also has seventeen (17) private health centers (Table 6-78).

Photo 6-9: Marcelino Vélez Hospital, in the municipality of Santo Domingo West

Table 6-78: Public sector health resources in the study area

Health Resources	Santo Domingo Province	Santo Domingo Oeste Municipality
Hospitals or specialized centers	28	3
Primary care centres	142	37
Beds	1741	184

Source: Prepared by Empaca from the Santo Domingo province and your municipality in figures statistical profile of the National Statistics Office (ONE).

The Marcelino Vélez Regional Hospital provides services in epidemiology, critical care, maxillo-facial and dentistry, clinical and specialty services in blood bank, diagnostic imaging and laboratory. In an extraordinary way, due to the pandemic caused by the Covid-19, currently this hospital has dedicated much of its physical infrastructure to the treatment of this disease.

6.5.7.5 *Main diseases affecting the population*

According to the SIUBEN ESH-2012 Database, certified in September 2018 and cited in the document "Your Municipality in Figures", published by the National Statistics Office in October 2019, hypertension is among the main diseases identified for the municipality of Santo Domingo Oeste , which reaches a total of 12,044 cases in the municipality (Table 6-79).

It is then followed by diabetes with 4,630 cases, asthma (3,882 cases), heart disease (3,336 cases), kidney disease (2,281 cases), mental illness (710 cases), epilepsy (528 cases) and cancer (467 cases).

Table 6-79: Main diseases that affect the population of the municipality of Santo Domingo Oeste.

Diseases	Frequency
Hepatitis	217
HIV/AIDS	86
Kidney diseases	2,281
Heart disease	3,336
Mental illness	710
Cancer	467
Asthma	3,882
Hypertension	12,044
Epilepsy	528
Tuberculosis	61

Source: Database of the Single System of Beneficiaries (SIUBEN) certified to 2018, cited by the National Office of statistics in Your Municipality in Figures.

Apart from the Covid-19 pandemic, the epidemiological diseases with the highest incidence in the Dominican Republic and particularly in the province of Santo Domingo are dengue, malaria and leptospirosis (Table 6-80).

Table 6-80: Epidemiological diseases Province Santo Domingo January 2020-June 2021

Epidemiological disease	Dominican Republic		Santo Domingo Province	
	Cases	Deaths	Cases	Deaths
Dengue fever	4,118	37	769	5
Malaria	775	1	461	1
Leptospirosis	219	30	36	6
Diphtheria	15	12	--	--
Pertussis	5	1	--	--

Source: Directorate General of Epidemiology, Bulletin week 26, corresponding to July 3, 2021.

The epidemiological report for week 26 dated July 3, 2021, indicates that both the frequency of acute diarrheal disease and foodborne diseases are below expectations during that period, with an epidemic index (EI) of 0.61 for the first and 0.82 for the second, which reflects that there has been no significant variation when compared to the same period in the last five years.

Meanwhile, the incidence of Covid-19 in the Dominican Republic as of July 27, 2021 has totaled 340,230 cases, of which 269,326 had recovered, with a positive rate of 15.9 and a total cumulative death of 3,937.

6.5.7.6 *Education*

Education is regulated by the Ministry of Education of the Dominican Republic (MINERD), in accordance with the General Education Law 66-97, which guarantees the right of all inhabitants of the country to this important service. In recent years, progress has been made regarding access to education through the allocation of 4% of the Gross Domestic Product to this line.

The municipality of Santo Domingo Oeste belongs to the School District 15-05 (Photographs1 09 and 110 in Annex 8), which is part of regional no.15 of the Ministry of Education. It has 120 public schools, and 272 private schools. At the basic level of education, here are 29,052 students enrolled in the public sector and 19,948 in the private sector, for a total of 49,000. At the middle or secondary level, there are 27,329 students enrolled in the public sector and 10,933 students in the private sector, for a total of 38,262. At the adult educational level, there are 454 students who are enrolled in semi-official schools (Table 6-81).

The municipality has the Dominican Dental University and the Federico Henríquez y Carvajal University, as well as the Faculty of Agronomy and Veterinary Medicine of the Autonomous University of Santo Domingo (UASD). In addition, in the municipality we can also find an extension of the Technological University of Santiago (UTESA) and the Instituto Politécnico Madre Rafaela Ybarra. Most of the university student population attends the UASD central campus, which is the public university.

Table 6-81: Educational indicators of the municipality of Santo Domingo Oeste

Indicator	Public	Private	Semiofficial	Total
Initial Education	4,307	11,947	-	16,254
basic education	29,052	19,948	-	49,000
Secondary Education	27,329	10,933	-	38,262
Adult education	6,802	1,241	454	8,947
total	67,490	44,069	454	112,013

Source: National Statistics Office: Your Municipality in Figures, 2014.

This university is located in the National District and it is reached through different means of transport such as the Santo Domingo metro and different bus lines, as well as cars that offer the transport service and are popularly known as "conchos".

Other universities attended by students in this municipality are O&M, Universidad Abierta para Adultos (UAPA) and, and to a lesser extent the Pontificia Universidad Católica Madre y Maestra (PUCMM), Instituto Tecnológico de Santo Domingo (INTEC), Universidad APEC (UNAPEC), Universidad del Caribe (UNICARIBE), and that is due to their higher enrollment costs .

In addition, the National Institute of Vocational Technical Training (INFOTEP) is important for young people in this municipality. The INFOTEPis a public entity oriented to technical training that defines its training programs according to the demands of the labor market.

6.5.7.6.1 Literacy Level

According to data from the IX Census of 2010, reading and writing deficiencies were high, yielding high illiteracy values that nationwide reached 18% and hovering around 15% in the municipality of Santo Domingo Oeste . In general, in each of the neighborhoods that are part of this study, illiteracy levels are lower than those of the country and similar to those of the province (Table 6-82).

Table 6-82: Percentage (%) literacy

Territorial demarcation	He can read and write	He cannot read or write
Dominican Republic	81.66	18.34
Santo Domingo Province	84.42	15.58
Municipality of Santo Domingo Oeste	84.84	15.16
Santo Domingo Country Club	82.17	17.83
The Altagracia	86.23	13.77
Engombe	85.90	14.10
The Rose	85.75	14.25
Mahogany	87.53	12.47
poplar grove	87.73	12.27
Buenos Aires	82.76	17.24
Herrera Neighborhood	84.38	15.62
Duarte	85.12	14.88
Bayonne	85.89	14.11
Manoguayabo	88.32	11.68

Source: *IX National Population and Housing Census, 2010.*

In 2013, a literacy plan called "Quisqueya Aprende Contigo" was launched in the Dominican Republic, which has been effective in considerably reducing illiteracy levels, and it is estimated at the moment to lower illiteracy levels below 8%, although there are still no conclusive figures.

6.5.7.6.2 Level of Study

Regarding the level of study reached by the people registered in 2010, it was found that 9.51% of people in the municipality of Santo Domingo Oeste reached the level of pre-primary, 37.94% reached the level of primary, 32.25% reached secondary or middle school, and 20.31% reached university or higher education.

There are notable variations in terms of the level of study achieved depending on the social characteristics of the different neighborhoods of the study. Thus, it can be observed that neighborhoods in which a middle-class population predominates, such as Alameda, Las Caobas and La Rosa, the level of higher education study achieved by the census population is higher than in neighborhoods with a predominance of a population of popular extraction, such as Buenos Aires, La Altagracia, Santo Domingo Country Club and Duarte, among others, as shown in Table 6-83.

Table 6-83: Percentages (%) of the highest level of study studied

Territorial demarcation	Pre-primary	Primary or basic	high school or medium	Higher or University
Dominican Republic	9.05	47.00	28.59	15.36
Santo Domingo Province	9.36	41.09	31.48	18.07
Municipality of Santo Domingo Oeste	9.51	37.94	32.25	20.31
Santo Domingo Country Club	11.60	38.58	30.53	19.29
The Altagracia	8.32	39.56	32.42	19.69
Engombe	7.90	42.61	33.17	16.32
The Rose	10.51	28.93	30.88	29.67
Mahogany	8.80	27.77	30.99	32.44
poplar grove	8.17	30.36	28.85	32.62
Buenos Aires Neighborhood	10.26	41.30	33.07	15.37
Herrera Neighborhood	10.49	38.86	34.13	18.52
Duarte	9.38	38.67	34.10	17.84
Bayonne	9.20	34.47	31.02	25.26
Manoguayabo	6.65	36.26	32.78	24.31

Source: *IX National Population and Housing Census, 2010.*

In the case of the results obtained in the survey applied in May 2021, the category of people who did not reach any educational level is 4.43%, those who reached the primary educational level represents 32%, the secondary level represents 41%, the university level represents15%, the pre-primary level represents 10% and technical education represents 2% (Figure 6-42).

If the survey data are compared with the results of the 2010 census, it is remarkable that there is consistency between the two, although there is evidence of a change in the sense that there is a higher portion of people who reached the level of secondary education. This increase is aligned with the reduction in the percentage of people who only reached the primary level.

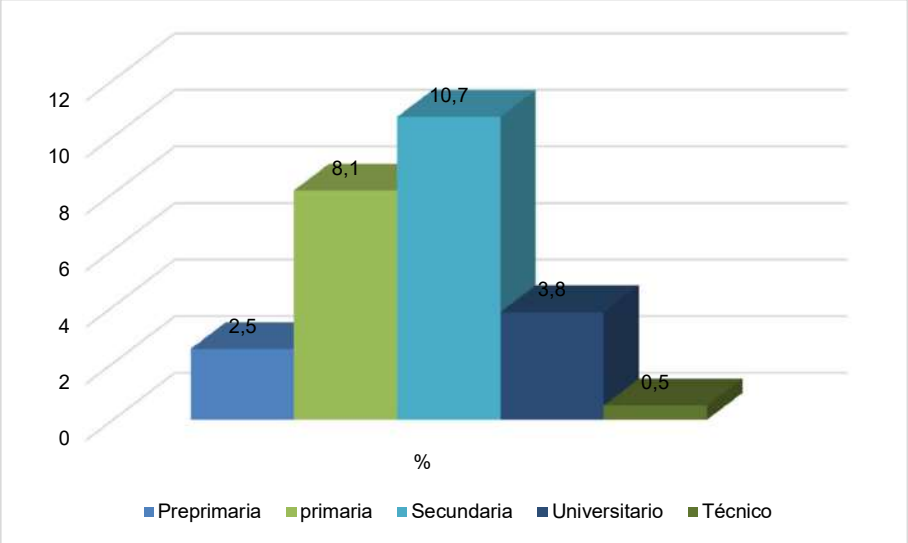


Figure 6-42: Percentage of the highest level of schooling that respondents attended

Source: Survey applied by Empaca, S.R.L., in the urban area santo domingo oeste, May 2021.

6.5.7.7 *Solid Waste Collection and Disposal System*

The data of the National Census of Population and Housing of 2010, indicate that the houses that dispose the garbage through the truck of the city council correspond to the 90.89% in the municipality of Santo Domingo Oeste, manifesting significant differences between the different neighborhoods considered in the study with respect to the percentages of households that dispose of the garbage through the City Council, such as the Alameda, Las Caobas and La Rosa neighborhoods (Photographs 111 and 112 in Annex 8), where more than 98% of the households dispose of the garbage through the city council, while in the Herrera neighborhood only 87% do it, as seen in Table 6-84.

Table 6-84: Percentages (%) of garbage disposal

Territorial demarcation	It is picked up by the city council	It is picked up by a private company	They burn it	They throw it in the courtyard or plot	They throw it in a landfill	They throw it into a river or canal	Other
Dominican Republic	73.19	1.74	15.42	3.31	2.97	2.32	1.05
Santo Domingo Province	78.31	1.70	8.43	2.07	4.67	2.88	1.94
Municipality of Santo Domingo Oeste	90.89	0.26	1.69	0.91	2.01	3.53	0.70
Santo Domingo Country Club	90.07	0.27	1.21	1.21	1.88	4.34	1.01
The Altagracia	90.15	0.27	0.21	0.79	1.80	5.86	0.92
Engombe	90.51	0.18	0.18	0.65	3.16	4.88	0.43
The Rose	98.55	0.16	0.05	0.03	0.41	0.27	0.52
Mahogany	98.76	0.31	0.04	0.12	0.28	0.37	0.10
poplar grove	98.24	0.10	0.12	0.05	0.05	0.38	1.15
Buenos Aires	94.00	0.38	0.02	0.18	0.52	4.52	0.39
Herrera Neighborhood	87.51	0.26	0.08	0.84	2.82	7.21	0.28
Duarte	92.99	0.15	0.01	0.12	0.23	6.29	0.21
Bayonne	93.71	0.10	1.89	0.29	1.44	2.03	0.54
Manoguayabo	96.70	0.26	0.79	0.46	0.52	1.05	0.22

Source: IX National Population and Housing Census, 2010.

The final disposal of solid waste from the municipality of Santo Domingo Oeste is carried out at the Duquesa Landfill, located in the municipality of Santo Domingo Norte.

6.5.7.8 *Roads and Transport*

The main roads of the municipality of Santo Domingo Oeste are:

- Duarte Highway (Route #1), which borders to the north with the National District and the municipality los Alcarrizos, communicating with the provinces of the northern region or Cibao and with John F. Kennedy Avenue towards the National District.
- Autopista 6 de Noviembre (Ruta #6), which connects with the Carretera Sánchez (Ruta #2) to the provinces of the South region and with avenida Prolongación 27 de Febrero.
- Sánchez Highway (Route #2), which connects with the municipality of Haina, the province of San Cristóbal and other provinces of the Southern region.
- Luperón Avenue, which borders the municipality with the National District.
- Isabel Aguiar Avenue, which runs through the urban area of the municipality from north to south (Photo 6-10).
- Extension February 27.
- Mexico Avenue.
- Las Palmas Avenue.
- Anacaona Avenue.
- Baseball Avenue.

Photo 6-10: View of the important Isabel Aguiar Avenue in a stretch near the entrance to the Duarte neighborhood.

6.5.7.8.1 Means of Transport

The use of public transport is related to the socio-economic conditions of users. Mostly middle-lower and poor classes use these means to carry out their daily activities.

There are different types of transport used by the inhabitants of the urban area of the municipality of Santo Domingo Oeste, being the so-called public buses (buses), being the predominant mean, followed by the mobilization in public cars or "conchos" and in "motoconchos" or motorcycles that offer the transport service, when the displacement is within the same municipality (Photo 6-11).

Photo 6-11: Starting point for means of transportation known as "motoconcho" in the project's area of influence

The Santo Domingo Metro is another mean of transport that every day gains more users among people who commute for work or study. The people taking the metro line usually have to move to the National District or to other municipalities of the province of Santo Domingo.

6.5.7.9 *Fire Departments, Civil Defense and 9-1-1 System*

The emergency and disaster assistance structure in the municipality of Santo Domingo Oeste is made up of the Fire Department, the Civil Defense and the 9-1-1 system.

The Fire Department of the municipality of Santo Domingo Oeste depends on the Municipal Council. It has a headquarters in the urban area, specifically in the Industrial Zone of Herrera, and a station in the Hato Nuevo area. This body is connected to the 9-1-1 system, which operates from a centralized dispatch center from its headquarters in the National District.

In the case of the Civil Defense, it has volunteering social servants in all the communities of the municipality of Santo Domingo Oeste, including in the Santo Domingo Oeste urban area, who are actively prepared to face emergency cases and natural phenomena, especially during the cyclonic season, when frequent floods occur in the surroundings of the canals of the municipality.

6.5.7.10 *National Police*

The National Police is in charge of the public security of the municipality. In the urban area of the municipality there are two detachments. One in the Buenos Aires neighborhood of Herrera and another one located at 12 km from the Sánchez Highway.

In addition, the City Council has at its disposal a body of municipal police, who provides services to enforce municipal regulations, protect public spaces, traffic services and internal security in the Municipal Council building.

6.5.8 Gender aspects

6.5.8.1 *Gender equity*

Unlike what the Dominican Constitution establishes on equal rights and specific laws relating to this subject, such as Law 339-68, of 1968, which defines as a family property the housing that the Dominican State transfers in property to individuals in the Dominican Republic. Despite the latter, , a social practice still prevails that tends to award the titles of ownership of the real estate in greater proportion to man, being able, as indeed happens, to incur this in fraudulent acts of sale of the family property.

Although the Dominican Constitution guarantees gender equity, it should be pointed out that many women in working-class neighborhoods, as an important part of those considered in this study, continue to suffer from conditions of inequality arising from the traditional roles assigned to women from an early ages, which is related to the care of the home and the performance of domestic tasks without financial compensation. This practice occurred in some cases of Phase I of the project, according to most women interviewed for this study, there is a need for the Project to take preventive measures, including educating and informing the community about what constitutes a family asset, handing over the assets in the name of the couple and not in the name of one of them, and offering advice and accompaniment to the women and children who have this problem or are at risk of having it.

In this regard, it is worth noting that, according to the data from the National Statistics Office, 86% of mothers who gave birth in the Dominican Republic during 2018, were registered as single in the category of their marital status, which, although probably overestimated. This indicator shows the severity of a problem that, as has been pointed out, becomes an obstacle to the development and fulfillment of women, especially when 16 %of them were under the age of 19.

Resettlement Action Plan will need to take into consideration these aspects.

6.5.8.2 *Sexual Diversity*

Although in recent years there have been advances in attitudes of tolerance towards sexual diversity, in the Dominican society, influenced by fundamentalist religious currents, there are still strong attitudes of rejection of approaches that promote the acceptance of people regardless of their sexual orientation.

These attitudes of rejection towards sexual diversity have recently found a boost in the approval in the Chamber of Deputies of a bill that leaves the room, under the premise of conscientious objection, for discrimination against people with different sexual orientations.

6.5.8.3 *Gender-based Violence*

A dramatic case of gender-based violence in 2021 occurred in one of the neighborhoods of this study, the Duarte neighborhood, where a 17-year-old girl was murdered by her 39 years old partner. This tragedy illustrates the seriousness of another problem derived from the condition of inequality in which many of the women of the popular neighborhoods live, consisting in that they are socially conditioned to be married at a very young age with men who are often twice the age, as in the cited case. Another dramatic case that illustrates this form of gender violence is the case of a pregnant teenager who died of leukemia in 2012, a case that has become a symbol of struggle for such cause.

6.5.9 Vulnerable Groups

Vulnerable groups are defined as those social groups that are disadvantaged in relation to other people or social structures, which prevent or hinder them from properly exercising their rights , which leads them to a life of high risks in many aspects of their life such as social, economic, health, and many other others. As a result, these vulnerable groups are the subjects of priority attention of public policies.

6.5.9.1 *Haitian and Venezuelan Migrants*

The status of economic migrants creates vulnerability in people because their installation in a new environment often meets resistance from part of the native population due to cultural or economic factors. Added to this is the fact that migrants do not have the social capital of their country, which is aggravated by the irregular status of their immigration status, which exposes them to abuses and violations of rights against them.

As has been pointed out in the section on migration, the Dominican Republic has historically been a country expelling its population mainly to the United States and some European countries, although it has also been a recipient of Haitian migrant population, which in the past worked in the sugar industry and currently does so mainly in the sectors of agricultural and of construction.

During the last decade, as a result of the political and economic crisis in Venezuela, the country has also been a recipient of a significant part of migrants from that country, who have settled in the main cities, as well as tourist enclaves.

The municipality of Santo Domingo Oeste, as part of Greater Santo Domingo, has been one of the places where migrants from Haiti and Venezuela have settled, a phenomenon to which the fact that the cost of rental housing in this municipality is lower than that of the National District has contributed.

Almost all the homes of Haitians and Venezuelans that are in the municipality of Santo Domingo Oeste, especially in the neighborhoods around the Guajimía Canal and its tributaries, are under the status of tenants. Since these migrants often lack documents, some landlords may try to ignore their tenant rights. This condition adds to the general disadvantages faced by all migrants to make them more vulnerable to the project's compensation or resettlement processes.

6.5.9.2 *Tenants*

When a project arrives in a neighborhood that involves compensations such as housing, because it is necessary to resets part of the families, some homeowners take measures against their tenants, who seek to deny their rights and appropriate the compensation that would correspond to them.

Therefore, the census of households affected by the project is a key instrument for guaranteeing tenants' rights to compensation. However, this should not be the only case. Unfortunately, some of the interviewees for this study reported how some tenants could not claim their rights in Phase I of the project, due to the conditions of symbolic and physical violence, generated by some owners.

Although the consultancy does not have the evidence of these cases, it happens as with the gender-based violence described above. The cases against tenants are so common that it is not possible to deny this reality

and therefore it is necessary to take social, legal and other measures that contribute to the families impacted by the project, so they can be able to fully exercise their rights and receive the established compensations.

6.5.9.3 *Elderly People*

Older people make up another group that universally falls into the category of vulnerable groups. In the Dominican Republic, Law 352-98 of 1998 created the National Council for the Elderly (CONAPE) and enshrined a series of rights and affirmative actions regarding the vulnerable population. This Act defines an elderly person as any person over the age of 65, regardless of another condition.

In the municipality of Santo Domingo Oeste, according to the National Population and Housing Census (2010), 15,225 people are aged 65 and over . A considerable percentage of these people reside in the neighborhoods around the Guajimía Canal and its tributaries, being exposed to risks of the floods that periodically affect these neighborhoods, as well as to the unsanitary conditions that prevail in them. It is therefore important that, in cases that require the relocation of some of them, the project prioritizes the relocation of these people to the ground floors of the buildings. Likewise, relocating them with their actual neighbors, as possible, keeps their social networks intact.

6.5.9.4 *Persons with Disabilities*

Similar to the elderly, disabled people, whether physical-motor, sensory or mental, constitute a vulnerable group of universal recognition.

In fact, article 58 of the Dominican Constitution of 2010 recognizes the protection of persons with disabilities, and through Law 5-13 of 2013, the Dominican State defines the rules aimed at making the protection of the rights of persons with disabilities more effective.

The National Population and Housing Census shows data on certain levels of disability of the people surveyed. Results showed that in the municipality of Santo Domingo Oeste there are 26,994 people with difficulty seeing, even if they wear glasses, which represents 7.43% of the population. Also, that 8,618 people have difficulty walking or climbing steps, representing 2.37% of the total population, 4,087 are missing one or both arms, 521 people are missing one or both legs, and 1,751 people have mental problems (Table 6-85).

Table 6-85: Levels of Disability in the Municipality of Santo Domingo Oeste

Disability	Frequency	(%)
Difficulty seeing, even if you wear glasses	26,994	7.43
Difficulty walking or climbing steps	8,618	2.37
Difficulty walking, missing one or both legs	521	0.14
Difficulty performing tasks, missing one or both arms This number differs from the number that appears at the beginning of this ESIA	4,087	1.12
Social and work difficulty, has mental problems	1,751	0.48

Source: IX National Population and Housing Census, 2010.

The municipality of Santo Domingo Oeste has the particularity of being in the headquarters of the Dominican Association of Physically and Motor Handicapped (ASODIFIMO). This non-governmental organization has highlighted the need for people with physical and motor disabilities to be addressed in a special way, as part of the solutions contemplated in the sanitation project of the Guajimía Canal, by taking accessibility and inclusion measures for people with disabilities.

6.6 Landscape

6.6.1 Landscape assessment methodology

The landscape was evaluated through its qualities of visibility, fragility, and quality.

Visibility: All possible direct observation points on site are considered.

Fragility: Set of characteristics of the territory related to its ability to respond to the change of its landscape properties.

Normally, the factors that influence 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 made from the contemplation of the entire landscape according to the resources it has.

The type of landscape identified in the area occupied by the project and its area of direct influence was evaluated in a matrix where they are valued according to the parameters of quality, visibility, fragility and quality or beauty.

Categories were given to each of these qualities and are summarized in Table 6-86.

Table 6-86: Categories of Each of the Qualities

Qualities	Categories
Visibility	Loud
	Stocking
	Casualty
	Null
Fragility	Loud
	Stocking
	Little
Quality	Excellent
	Very good
	Good
	Regular
	Poor- very poor

6.6.2 Types of landscape

In the study area, two types of landscape were determined.

6.6.2.1 *Very anthropized High Plain*

This landscape unit is represented by most of the watershed of the Guajimía Canal, with an area of 13.6 km². Acarbonate plain morphology constitutes the eroded structural surface and is greatly transformed by anthropism. Throughout the extension of this landscape unit lie pleistocane-holocene reef deposits that cover the structural surface degraded to a roof of calcareous levels, as part of the Caribbean Coastal Plain and where the elevations between +10 and +40 m are observed (Photo 6-12).

Photo 6-12: Landscape of high plain very anthropized
Location: Guajimía Canal Watershed

In this type of landscape, there is an intense anthropization, which covers more than 63% of the extension of the watershed, with a very low coverage of brown soils of little thickness and alluvial sediments in the channels of the surface drainage canals.

Vegetation develops in some sections of the banks of the canals, in the courtyards of the houses, in the parks, and green areas of the environment as described below:

Sections of canal margins: In these margins, we were able to identify the presence of herbaceous vegetation.

Patios of the houses: They are characterized by the presence herbaceous vegetation and scattered trees, most of them are fruit trees cultivated in the patios of the houses, such as : Mango, (*Mangifera indica);* Avocado, (*American Persea);* Quenepa, (*Melicoccus bijugatus);* Loquat, (*Manilkara sapota);* Sweet orange, (*Citrus sinensis);* Sour orange, (*Citrus aurantium);* Lemon, (*Citrus aurantifolia);* Coco, (*Cocos nucifera);* Jagua, (*Genipa americana);* Carambola, (*Averrhoa carambola);* Soursop, (*Annona muricata);* Sapote, (*Pouteria sapota);* Good bread, (*Altocarpus altilis);* Cajuil,*(Anacardium occidentale),*among others.

Parks and green areas of the environment: In these areas, the following species could be identified: Palma Real, (*Roystonea borinquena;* Almond, *Terminalia catappa;* Jabilla Criolla, *Hura crepitans;* Casia Amarilla, *Senna siamea;* Flamboyant, *Delonix regia;* Oak, *Catalpa longissima;* Coco, Cocos *nucifera;* Poppy, *Spathodea campanulata;* Laurel, *Ficus benjamina;* Mahogany, *Swietenia mahagoni; among others.*

From the intense anthropization throughout the area, and the quality of the buildings and urbanization parameters, two areas have been identified with landscape features that differentiate it:

- Very anthropized high plain, where acceptable urban parameters are observed with architecture of moderate quality (Photo 6-13); and
- High plain very anthropized, with a low quality of the buildings, few urban and road parameters (Photo 6-14).

Photo 6-13: Landscape area of high plain very anthropized, with acceptable urbanization
Location: Guajimía Canal Watershed.

Photo 6-14: Landscape area of high plain very anthropized, with few urban parameters.
Location: Guajimía Canal Watershed.

6.6.2.2 *Little modified high river plain*

This landscape unit is distributed in the lower third part of the Guajimía watershed, in a river section of almost 4.0 km before meeting the mouth of the Haina River ((Photo 126 in Annex 9).

Photo 6-15: Landscape of high river plain little modified.
Location: Guajimía Canal Watershed

In this area, there is a greater vegetation cover along the entire canal of Guajimía. A forest was planted under the coordination of the Ministry of Environment and Natural Resources (2008-2011). The area has more than 80% coverage and some of the trees are more than 15 m high. This place has no primary vegetation, although there are native trees that are not planted such as Jabilla criolla, *(Hura crepitans)*, Yagrumo, *(Cecropia scheberiana),* and Palma Real (Roystonea*borinquena)*.

The planted species are: Cedar *(Cedrela odorata),* Saman (*Samanea saman),* Creole mahogany (*Swietenia mahagoni)* Olive tree (*Simarouba berteroana),* Oak (*Catalpa longissima),* Penda (*Citharexylum fruticosum),* John first (*Simarouba glauca),* Beach grape (*Coccoloba uvifera),* Anacahuita (*Sterculia apetala)*, Tamarind, (*Tamarind indicates),* Melina (*Tree Gmelina),* Ceiba (*Ceiba pentandra),* Almond (*Terminalia catappa),* and Pink oak (*Tabebuia heterophylla)*.

6.6.2.3 *Landscape Assessment*

The results of the landscape assessment matrix are presented below (Table 6-87):

Table 6-87: Assessment of Landscape Types

Landscape type		Visibility	Fragility	Quality or beauty
Landscape of high plain very anthropized	Landscape area of high plain very anthropized, with acceptable urbanization	Loud	Little	Good
	Landscape area of high plain very anthropized, with few urbanistic parameters	Loud	Little	Very bad
Landscape of high river plain little modified		Loud	Stocking	Good

6.7 Historical, Archeological and Cultural Area

The Engombe ruins are the only historically interesting place in the Santo Domingo west neighborhood. They are located outside the study area on the farm of the same name and are in no way threatened by the project.

6.7.1 Pre-Columbian History of Santo Domingo Oeste

The island of Santo Domingo, which historically has been referred to as Quisqueya or Haiti, was discovered by Europeans on December 5, 1492 and has been baptized by Christopher Columbus as Hispaniola.

At that time, the island, which today is shared by the Dominican Republic and the Republic of Haiti, was populated by the Taínos, an ethnic group whose presence has spread majoratively throughout the Greater Antilles and to some extent to the Lesser Antilles.

The Taínos came from the branch of the Arahuacos, who inhabited the Atlantic coast of South America, in what is now recognized as Venezuela, in the region where the Orinoco River flows.

Until that time, the island was politically organized into five (5) chiefdoms: Marién, Maguá, Maguana, Jaragua and Higüey, which were ruled by caciques, which is a word of Taíno origin.

Of these five chiefdoms and for the purpose of this study, the chiefdom of Higüey is relevant, since it extends throughout the southeast of the island of Santo Domingo, bordering to the west with the Haina River that separated it back then from the chiefdom of Maguana, so that its territory encompassed everything that is now called the province of Santo Domingo and the National District.

Among the manifestations of the material culture of the pre-Columbian inhabitants of the island, pottery occupies a central place, characterized by the adoption of zoomorphic and anthropomorphic figures in the manufacture of different utensils. One of its main characteristics is the complete absence of painting.

One of the pre-Columbian archaeological sites discovered closest to the area of interest of this study is the archaeological site of La Caleta, which, although within the same province of Santo Domingo, is located at a considerable distance, since they are at the opposite end of the kind of arch or semicircle that forms the province of Santo Domingo around the National District, in the municipality of Boca Chica, at 33.8 kilometers.

This archaeological site became a center of interest for the studies of Antillean archaeology in 1972 when numerous rocks belonging to pre-Columbian indigenous groups that inhabited the island of Santo Domingo were discovered. The importance of this finding lies in its association with three cultural forms that manifested themselves on the island. These cultural forms are: ostionoid, late elenoid and late Taino, which date back no less than 700 years.

It is worth noting that some years before these findings, in 1968, there was a controversy over the authenticity of some pieces found in the same area, specifically in the place known as Los Paredones de La Caleta, since some locals were dedicated to carving pieces in wood and ceramics from models of the Taino culture, which they sold to tourists, under the premise that they were Taino pieces.

Another important archaeological site is the one known as Cuevas de Borbón or Pomier Anthropological Reserve, which is located in the province of San Cristóbal, at a distance of 14.17 kilometers from the area of interest of the project. These caves have a great prehistoric value, because they have manifestations of rock art.

6.7.2 History of the city of Santo Domingo

The city of Santo Domingo, which is recognized as the first city built by Europeans in the American continent, was founded on August 5, 1498 by Bartolomé Colón, brother of Admiral Christopher Columbus, on the eastern bank of the Ozama River, having the name of La Nueva Isabela later on.
Four years later (in 1502), due to a hurricane that destroyed it, it was moved to the west bank by Nicolás de Ovando, who was then the governor of the island.

The fact of being the first city founded by Europeans, it was determined that it was the place where the first institutions and service infrastructures of the continent were installed, among which the first university, the first hospital, the first cathedral, and the first layout of streets.

Throughout the social, economic and political history of the country, both in its colonial and republican past, the City of Santo Domingo has played a central role, being the main stage of its development and power struggles.

During the sixteenth and seventeenth centuries, the city suffered from the effects of power struggles between Spain and England, being invaded by the privateer Francis Drake (1586) and Admiral William Penn, in 1655.

The city of Santo Domingo was also the scene where national independence was proclaimed, on February 27, 1844.

From the year 1920, Santo Domingo began to grow outside the walled area inherited from the years of its foundation, emerging many of the neighborhoods that today are part of it.

The City of Santo Domingo was destroyed by a hurricane on September 3, 1930 and, when it was rebuilt by the dictator Rafael Trujillo, its name was changed to Ciudad Trujillo. With the fall of this dictatorship in 1961, the city' s name was changed again to Santo Domingo de Guzmán.

6.7.3 History of the municipality Santo Domingo Oeste

The first villages that settled in what is now the municipality of Santo Domingo Oeste, where the study area is located, date back to the early seventeenth century, originating from the installation of freed slaves who had left the industrial sugar manufacturing plants or Sugar Mills Engombe and Palavé.

The oldest settlements in the municipality are those of Bayona, Manoguayabo and Herrera, which originated as rural villages around the road to San Cristóbal. The name of Bayona was already known in the eighteenth century due to its ingenuity, while Manoguayabo is another community of the same period, whose name comes from indigenous roots.

The last of these three territories is that of Herrera, which consisted of a series of isolated communities scattered around tracts of land owned by a brother of dictator Rafael Trujillo. Towards the end of this dictatorship, in 1961, a process of occupation and invasion of their territories began.

One of the most important milestones in the history of the territory of what is now being recognized as the municipality of Santo Domingo Oeste, is the promulgation in 1968 of Law 299 by President Joaquín Balaguer, which gave rise to what is known as the Industrial Zone of Herrera, as part of an economic development strategy for import substitution.

The demographic dynamics created by the creation of the Industrial Zone of Herrera had a decisive impact on the growth of the demand for urbanizations, in its surroundings, to the point that in the 70s and 80s it became one of the most important poles of attraction of the city.

From this fact, numerous precarious settlements and urbanized areas influenced the need to create a new municipality.

The municipality of Santo Domingo Oeste was created on October 16, 2001 when law 163-01 divided what was then the National District, to create the province of Santo Domingo, with four original municipalities (Santo Domingo Este, Santo Domingo Oeste, Santo Domingo Norte, and Boca Chica).

The municipality of Santo Domingo Oeste included, when it was created, the then municipal districts of Los Alcarrizos and Pedro Brand, which by law 64-05, of 2005 were converted into municipalities, hence no longer belonging to the original municipality.

The first Municipal Council of Santo Domingo Oeste was established on August 16, 2002; being its first trustee Eng. Francisco Peña Tavares.

Due to the fact of being this municipality of recent creation, much of its history is linked to that of the National District or city Santo Domingo de Guzmán, with which, together with the other municipalities of the province Santo Domingo, they form the metropolitan area of Greater Santo Domingo.

6.7.4 Architectural Heritage

The architectural heritage of the municipality is linked to the history of the economic activities that developed in these territories in colonial times, that is, to the industrial activities linked to the sugar mills on the banks of the Haina River. These heritages are known as Ruins of Engombe and Casa Grande de Palavé.

6.7.4.1 *Ruins of Engombe*

This architectural monument, whose area occupies about 5.91 square kilometers, is located at 500 meters from the toll of the Autopista 6 de noviembre that connects the city of Santo Domingo and the province of San Cristóbal. This heritage was declared a protected area by decree 183-93, by president Joaquín Balaguer, in 1993. Later, in 2002, under the government of President Hipólito Mejía, it was assigned the name of Parque Mirador del Oeste, which is how it is officially called today.

These ruins are today part of the architectural riches of the Dominican Republic, being declared a National Monument and later a World Heritage Site by the United Nations.

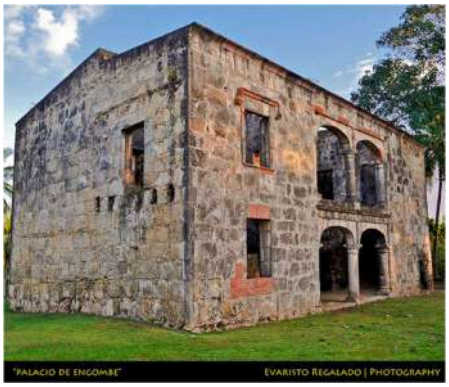
The old Palace of Engombe, called by experts in the field of architecture rather as a palace, is a colonial structure of the sixteenth century. Its name is associated with the African voice that calls /n-gombe/ cattle or oxen.

These structures were built in the sixteenth century, on the west bank of the Haina River, becoming then the first and most productive ingenuity of the colony of Santo Domingo and constituting one of the most important examples of the Dominican industrial heritage of colonial times.

The estate of Engombe, where this heritage is located, which was previously owned by Negro Trujillo, brother of the dictator Rafael Trujillo, passed in 1963 into the hands of the Autonomous University of Santo Domingo, entity that entrusted the restoration of the ruins to the engineer José Ramón Báez López-Penha.

The Ruins of Engombe are formed by four structures that consist of a palace, a church, a shed or warehouse- that was used as a stay for slaves, and the area of the mill.

The mansion is a two-story structure that measures 20 meters long, by 13 meters wide and 10 meters high. In its front, you can see 4 large entrances on the two levels finished in arches, and two large windows.



The rear of this structure has five windows and a door leading to a terrace, which gives access to the church and the courtyard. A part of the ruin is in very damaged conditions, which was probably the area intended for the mill.

Its walls or side walls lack doors, but they do have a window on each side (Photographs from 127 and 128 in Annex 9, 6-16, 6-17, 6-18, 6-19).

The church or chapel is a structure that has a small bell tower and ends in a dome next to the sacristy, becoming the most significant architectural burden of the building.

The other rectangular construction measures 8 meters wide by 31 meters long, which surely was the place where the shed and warehouse was. This structure has not been restored, leaving only a circle of stones.

The Ruins of Engombe are open to the public, being used for birthday parties, weddings, family gatherings, photo shoots, short film recording, etc., although their use must comply with strict rules, having prohibited access to street vendors. https://mapio.net/

The security in the ruins is remarkable, with the presence of security personnel 24 hours a day, solid maintenance, and periodic cleaning of the area by personnel from the Ministry of environment.

With regard to the distance of this architectural heritage from the area where the work of the Pluvial and Sanitary Drainage project of the Guajimía Canal and its main tributaries will be carried out, it was possible to establish that the area where rectification works will be carried out on the channel of the lower watershed of the Guajimía Canal, corresponds to the nearest point, being at a distance of 472 meters to the southeast, crossing the 6 de Noviembre highway.

On the other hand, it is pertinent to mention that the point of the study area closest to the Ruins of Engombe is located in the area of affectation of the Canal Ureña, near the sub-neighborhood El Abanico of the Engombe neighborhood, which, despite having the same name, is located at a distance of two kilometers from the Ruins of Engombe.

In relation to the distances of the Ruins of Engombe with respect to other points or sections to be intervened in the project of Pluvial and Sanitary Drainage of the Canal de Guajimía, it could be determined that the distances exceed two kilometers, where the section of the canal El Indio Derecho is at a distance of 2.55 kilometers. The point where the Guajimía and Las Caobas canals meet is 2.68 kilometers away, while the area to intervene of the Buenos Aires canal is 3.90 kilometers away.

Photo 6-16: View of the Santa AnaChurch
Location: Ruins of Engombe

Photo 6-17: View of the space where the mill was located
Location: Ruins of Engombe

Photo 6-18: Entrance view of the Mirador del Oeste Park, where the Ruins of Engombe are located
Location: Ruins of Engombe

Photo 6-19: View of access road to the Ruins of Engombe
Location: Ruins of Engombe.

6.7.4.2 *Casa Grande de Palavé*

Las Casa Grande de Palavé is another important architectural heritage of the municipality of Santo Domingo Oeste, which is a colonial monument that traces its origin to the colonial period in the sixteenth century, also consisting of a series of structures where Spanish families lived who dedicated themselves to the production of sugar.

Although not much information is available about this building, there are references that a sugar mill operated in it and that it was later used as a nunnery. The monument was built with bricks and clay and is composed of three large portals in the form of arches that overlook the main hall with windows at the end of it.

https://daryterrero.wordpress.com/

This heritage does not enjoy the same level of protection as the Engombe Ruins, as human settlements have been established around it and cattle are often seen grazing.

Currently, this monument is being considered by UNESCO to be declared a cultural heritage of humanity.

For the purposes of this study this building is less relevant, since it is located at a considerable distance from the area of the direct impact of the project, being in the rural area of the municipality at a distance of 5.38 kilometers from the nearest point of the area to intervene, which is the point where the Canal Las Mahogany flows into the Guajimía Canal, next to a collection center of the company Frito Lay Dominicana.

6.7.5 Culture

The fact that the urban area of the municipality of Santo Domingo Oesteis part of the main urban center of the Dominican Republic. For this reason, it is considered as a migratory destination from the various different regions of the country. As a result, this highlights that its cultural manifestations are expressions of all regions

and areas of the country, making it difficult for specific cultural features of the urban area of the municipality to be identified.

In fact, in the municipality of Santo Domingo Oeste, the various ways in which a Dominican cultural identity is expressed are manifested, which, in a dynamic way, integrates influences of modernity while retaining features that historically define it as a nation, among which can be mentioned its Hispanic heritages (language, religion, etc.). , African (music) and Tainos (food).

An element of the culture of this municipality of singular importance is constituted by its traditions, among which its carnival stands out, which integrates numerous groups and characters of folklore from different regions of the country, such as the groups "Roba la gallina", "Los Tinnaos", "La Muerte en Yipe", "El Baquiní", "Los Indios", "Se me muere Rebeca" among others (Photo 133 in Annex 9).

Inits rural area, specifically in the area of Hato Nuevo and Palavé, distinct cultural manifestations derived from the cultural influences resulting from the coexistence between groups of Dominicans and Haitians around activities linked to the sugar industry in the twentieth century can be identified.

Both Palavé and other demarcations in the rural area of the municipality were in the past bateyes belonging to what at the time was the largest sugar mill in the country, where Haitian braceros mostly lived and worked in the cutting of the cane.

These towns, when the sugar mills belonging to the Dominican state were dismantled in the last decade of the last century, became spaces where Dominicans and Haitians have lived together since then.

It is for what is noted here that in the palavé area you can find cultural manifestations influenced by the Haitian population established in the country and their descendants, such as the cultural expression known as Gagá (Photo 134 in Annex 9).

The Gagá is a musical expression and dance of magical-religious content, originated in the bateyes of the Dominican Republic and practiced mostly by Haitian migrants and their descendants, which derives from the Haitian Rara.

The Gagá is linked to religious celebrations that begin in the month of February of each year in the bateyes of the country and reach their climax from the night of Holy Thursday to Holy Sunday.

As the anthropologist Dagoberto Tejada points out, "the Gagá, as a magical-religious expression, as a cultural and folkloric manifestation, is the result of a socio-economic organization, of a system of specific social relations, of exploitation, where the cane, the sugar mill, the working conditions, the life in the bateyes, force men to interpret it, reproduce it, answer it and recreate it".

7. IDENTIFICATION AND ASSESSMENT OF ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS

This chapter presents the identification and assessment of the positive and negative impacts that the activities of the pre-construction, construction and operation stages of the Storm and Sanitary Drainage of the Guajimía Canal Phase II project will cause. The methodology used for impact identification and assessment is described as well as the potential positive and negative impacts for the different phases. The cumulative impacts assessment is also presented.

Measures to prevent, mitigate or offset the impacts identified tin this chapter are presented in Chapter 8 of this document (specifically in Table 8-3 and Table 8-4). These also include measures to maximize the effects of the positive impacts of the project.

7.1 Methodologies

This section presents the methodologies used for the identification and assessment of the possible 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 in the pre-construction, construction, and operation phases of the project.

7.1.1 Identification of environmental and social impacts

Impact identification was achieved through the Leopold Cause/Effect Matrix, which links the sources of impact generated by the activities of the project in its different phases and the environmental elements. This analysis makes it possible to identify the components likely to be affected by future activities or infrastructures.

7.1.2 Assessment of Environmental and Social Impacts

The impacts are assessed according to their magnitude which is defined using its: intensity (low, medium, high), scope (regional, local, limited) and duration (long, medium, short term). The probability of occurrence of the impact, that is, the probability that a potential impact affects a component, is also considered, although it is not used to assess magnitude. Rather, it is used to relativize impacts. The probability of occurrence can be high, moderate, or low.

7.1.2.1 *Impact Magnitude*

The impact assessment first consists in determining the magnitude of the impacts associated with the project activities in the physical, biological, socio-economic and historical-cultural environment. The impacts are either positive or negative.

The magnitude of an impact is determined by a general assessment of how one or more sources of impact affect an environmental component. This assessment considers the mitigation measures included in the project design and establishes the magnitude of the impact once the mitigation measures have been applied. Impact magnitude reflects the intensity of the impact, its scope, and its duration. Impact magnitude is classified as major, moderate, or minor (Table 7-1).

Table 7-1: Impact Magnitude Assessment Matrix

Intensity	Scope	Duration	Magnitude
High	Regional	Long term	Major
		Medium term	Major
		Short term	Major
	Local	Long term	Major
		Medium term	Major
		Short term	Moderate
	Limited	Long term	Major
		Medium term	Moderate
		Short term	Moderate
Medium	Regional	Long term	Major
		Medium term	Moderate
		Short term	Moderate
	Local	Long term	Moderate
		Medium term	Moderate
		Short term	Moderate
	Limited	Long term	Moderate
		Medium term	Moderate
		Short term	Minor
Low	Regional	Long term	Moderate
		Medium term	Moderate
		Short term	Minor
	Local	Long term	Moderate
		Medium term	Minor
		Short term	Minor
	Limited	Long term	Minor
		Medium term	Minor
		Short term	Minor

7.1.2.2 *The Intensity of the Impact*

The intensity of an impact on the environmental and human components indicates the degree to which the assessed component is disturbed. The analysis considers the properties of the component, particularly its sensitivity and its ability to adapt to change, as well as its estimated value. The intensity of the impact is divided into three levels:

- High: the impact significantly threatens or destroys the integrity of the element in question, or substantially or irreversibly changes its distribution or environmental function.
- Medium: the impact alters the quality of the component and its distribution or environmental function, without damaging its integrity.

- Low: the impact slightly alters the component in question without substantially changing its quality, environmental distribution, or function.

7.1.2.3 *Scope of the Impact*

The scope of an impact on the natural and human components refers to the extent of area influenced or the proportion of the population affected by the proposed project. Impact scope may be regional, local, or limited to the study area:

- Regional: the impact affects the entire Regional Study Area or a larger area, or most of the population of the Regional Study Area.
- Local: the impact mainly affects the footprint area or bordering population groups.
- Limited: The impact affects only a limited area or a few people in the footprint area

7.1.2.4 *Duration of the Impact*

The duration of an impact refers to the period during which the effects of the project will be felt on the environment. This parameter reflects the intermittent nature of an impact. The duration can be either long, medium, or short term:

- Long term: the impact is continuous or intermittent throughout the lifecycle of the project. The impact is usually permanent or irreversible.
- Medium term: the impact is temporary, continuous, or intermittent, throughout the construction phase.
- Short term: the impact is temporary, continuous, or intermittent for a limited period of time in any of the construction, operation, closure or rehabilitation phases of the project.

7.1.2.5 *Probability of occurrence of the Impact*

The assessment of the impact also implies determining the probability of its occurrence, that is, the probability that a predicted impact affects a component. This factor is not used to assess magnitude. Rather, it is used to relativize impacts. The probability of it happening can be high, moderate, or low:

- High probability of occurrence: the impact will certainly occur.
- Moderate probability of occurrence: the impact is likely to occur, but the occurrence cannot be determined.
- Low probability of occurrence: the impact is very unlikely to occur or could occur only by accident.

7.1.2.6 *Nature of the Impact*

It refers to the positive or negative nature of the effects of the impact.

7.1.2.7 *Residual Impact*

The residual impact is the one that persists after the application of preventive, mitigation, and restorative measures.

These impacts are assessed following the same methodology as the potential impacts. However, when assessing the intensity, scope and duration of the impact, the fact that the corresponding measures have already been applied is taken into consideration.

7.2 Sources of Impact

Project execution will require the following main activities:

Pre-construction Phase:

- Land acquisition.

Construction Phase:

- Installation of temporary facilities.
- Site preparation for the future residential units.
- Construction of the residential units and their basic infrastructures for population resettlement.
- Population resettlement and payment of corresponding compensations.
- Site preparation in the Guajimía canal and its tributaries.
- Water diversion for stormwater channeling works.
- Construction of stormwater channeling structures in the upper part of the Guajimía canal and its tributaries.
- Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía canal and its tributaries.
- Expansion of the drinking water distribution networks of the axes of the upper Guajimía Watershed and its tributaries.
- Construction of urban amenities in the strips of intervened areas.
- Exploitation of loan material.
- Waste management from the cleaning of the channel of the canal and its tributaries and demolitions of the affected houses.
- Transportation and traffic.
- Purchase of materials, goods, and services.
- Labor hiring.

Operation Phase:

- Presence and operation of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks.
- Presence and operation of the homes of the resettlement plan and urban structures.
- Maintenance of channeling works for rainwater drainage, sanitary sewerage, and drinking water distribution networks.
- Maintenance of urban structures.
- Solid waste handling and management.
- Transportation/circulation.
- Purchase of goods and materials.
- Daily employee activity.

Table 7-2 describes in greater detail the sources of impact identified by project phase.

Table 7-2: Sources of Impact by project phase

Sources of Impact	Description
Pre-construction Phase	
Land acquisition.	Acquisition of the land necessary for the construction of new residential units for the resettlement of the population and for the development of the project (system, sanitary, rainwater and urban amenities). This acquisition is achieved before the start of construction works.
Construction Phase	
Installation of temporary facilities.	Development of temporary infrastructure and work sites, including material storage areas.
Site preparation for the future residential units .	Preparation of the land where the residential units will be built: Cleaning, clearing, excavation and earthmoving.
Construction of the residential units and their basic infrastructures for population resettlement.	A number of buildings and apartments will be built to relocate affected population that are entitled for this compensation measure. It is expected that each building will be 4 stories high with 1-, 2-, or 3-bedroom apartments. These apartments will be equipped with all the basic utilities: electricity, drinking water, sanitary and rainwater sewerage.
Population resettlement and payment of corresponding compensations.	Entitlement will define the number of family units or economic units that will be relocated. Those who cannot be compensated with housing (apartments), will be paid the corresponding financial compensation or will be benefit with other measures.
Site preparation in the Guajimía canal and its tributaries.	It comprises demolitions of affected houses, cleaning of the canal and its tributaries, clearing and cleaning of the vegetation and the topsoil, and stripping.
Water diversion for stormwater channeling works.	Structures for water diversion in the Guajimía canal and its tributaries during construction work.
Construction of stormwater channeling structures in the upper part of the Guajimía canal and its tributaries.	The stormwater channeling structures will be built in the upper part of the Guajimía canal and its tributaries corresponding to phase II (Villa Aura and Las Caobas) and in the sections pending intervention in phase I (Buenos Aires, El Indio and La Ureña). Stormwater channeling will be achieved using galvanized steel lines. In cases where topographic conditions limit the use of precast sections, concrete hydraulic sections with metal tops will be used. The final portion of Guajimía will also be re-profiled, between Avenida 6 de Noviembre and the mouth of the Haina River.
Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía canal and its tributaries.	To channel wastewater, a sanitary sewer system with high-density polyethylene or HDPE pipes will be installed.
Expansion of the drinking water distribution networks of the axes of the upper Guajimía Watershed and its tributaries.	The plan is to extend the drinking water networks as necessary to supply the new buildings, as well as the population affected by the project works that will not be relocated. The drinking water supply networks will be built by installing 100 mm diameter SDR21 lines.
Construction of urban amenities in the strips of intervened areas.	The urban amenities will consist of new road sections, pedestrian walkways, children's play areas, shops, gazebos for family recreation and green spaces.
Exploitation of loan material.	Exploitation of various quarries to supply granular material for use in the project. The quarrying will be done by subcontractors, which will be accredited by the Ministry of the Environment and Natural Resources.

Sources of Impact	Description
Management of waste products from the cleaning of the channel of the canal and its tributaries and demolitions of the affected houses.	Handling and transport of solid waste and debris for its proper final disposal.
Transportation and traffic.	Street transport of workers, materials, and equipment necessary for construction on site and machinery circulation, as well as street and access maintenance.
Purchase of materials, goods and services.	Necessary purchases to undertake construction works.
Labor hiring	Hiring of labor dedicated to construction works and presence of workers on site.
Operation Phase	
Presence and operation of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks.	Presence and operation of construction structures for rainwater drainage and sanitary sewerage, as well as drinking water supply networks in the Guajimía canal and its tributaries.
Presence and operation of the homes of the resettlement plan and urban structures.	Presence and operation of residential units and urban structures (roads, pedestrian walkways, children's play areas, green spaces, and recreational areas).
Maintenance of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks.	Maintenance of channeling structures for rainwater drainage, sanitary sewerage, and drinking water supply networks.
Maintenance of urban structures.	Maintenance of roads, pedestrian walkways, playgrounds, green spaces and recreational areas. These activities will be under the care of the Santo Domingo Oeste City Hall.
Solid waste handling and management.	Handling, transportation, and final disposal of solid waste produced by maintaining the structures for rainwater channeling, sanitary drainage, drinking water supply. Solid domestic waste will also be generated in homes. Its management and final disposal will be the responsibility of the Santo Domingo Oeste City Hall
Transportation/circulation.	Transportation and circulation within the right of way, including refueling and vehicle maintenance.
Purchase of goods and materials	Necessary purchases for the maintenance of the rainwater and sanitary drainage system and the water supply network.
Daily employee activity.	Employees working in the maintenance of the structures for rainwater drainage, sanitary drainage, and the water supply system.

7.3 Environmental and Social Variables Affected

Table 7-3 shows the environmental variables (components) that could be affected during the construction and operation activities of the project.

Table 7-3: Interaction Matrix between Project Activities and Environmental Elements

Project activities		Environmental elements																
		Physical environment				Biological environment				Socioeconomic and historical-cultural environment								
		Air quality and climate change	Noise and vibration levels	Soils	Water resources	Terrestrial flora associated habitats	Terrestrial fauna and associated habitats	Critical habitats	Aquatic habitats and fauna	Land planning and use	Existing infrastructure	Economy, employment, and livelihoods	Life quality, health, and safety	Social cohesion and gender	Vulnerable groups	Cultural and archaeological heritage	Landscape	Resources
Pre-construction Phase	Land acquisition.									X				X	X			
Construction Phase	Installation of temporary facilities.	X	X							X		X	X					
	Site preparation for the future residential units.	X	X	X		X	X			X		X	X			X	X	X
	Construction of the residential units and their basic infrastructures.	X	X				X			X		X	X			X	X	X
	Population resettlement and payment of corresponding compensations.									X	X	X	X	X	X			
	Site preparation in the Guajimía canal and its tributaries.	X	X	X	X	X	X	X	X	X	X	X	X			X	X	
	Exploitation of loan material.	X	X				X					X	X			X	X	X
	Water diversion for stormwater channeling works.	X	X		X		X	X	X									

Project activities		Environmental elements																
		Physical environment				Biological environment				Socioeconomic and historical-cultural environment								
		Air quality and climate change	Noise and vibration levels	Soils	Water resources	Terrestrial flora associated habitats	Terrestrial fauna and associated habitats	Critical habitats	Aquatic habitats and fauna	Land planning and use	Existing infrastructure	Economy, employment, and livelihoods	Life quality, health, and safety	Social cohesion and gender	Vulnerable groups	Cultural and archaeological heritage	Landscape	Resources
Construction Phase	Construction of stormwater channeling structures in the upper part of the Guajimía canal and its tributaries.	X	X	X	X		X	X	X	X	X	X	X				X	X
	Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía canal and its tributaries.	X	X	X	X		X	X		X	X	X	X				X	X
	Expansion of the drinking water distribution networks of the axes of the upper Guajimía watershed and its tributaries.	X	X				X			X	X	X	X				X	X
	Construction of urban amenities in the strips of intervened areas.	X	X			X	X			X	X	X	X				X	X
	Waste management during the cleaning of the channel of the canal and its tributaries and demolitions of the affected houses.	X	X	X	X		X	X					X				X	
	Transportation and traffic.	X	X	X	X		X				X	X	X					

Project activities		Environmental elements																
		Physical environment				Biological environment				Socioeconomic and historical-cultural environment								
		Air quality and climate change	Noise and vibration levels	Soils	Water resources	Terrestrial flora associated habitats	Terrestrial fauna and associated habitats	Critical habitats	Aquatic habitats and fauna	Land planning and use	Existing infrastructure	Economy, employment, and livelihoods	Life quality, health, and safety	Social cohesion and gender	Vulnerable groups	Cultural and archaeological heritage	Landscape	Resources
	Purchase of materials, goods, and services.											X		X				
	Labor hiring.		X				X					X	X	X				
Operation Phase	Presence and operation of channeling structures for stormwater drainage, sanitary sewerage, and drinking water distribution networks.				X		X	X	X	X	X		X	X	X		X	
	Presence and operation of the homes of the resettlement plan and urban structures.				X		X			X	X		X	X	X		X	
	Maintenance of channeling structures for stormwater drainage, sanitary sewerage, and drinking water distribution networks.	X	X	X	X	X	X	X	X		X	X		X				
	Maintenance of urban structures.	X	X		X	X	X				X	X	X	X	X		X	
	Solid waste handling and management.	X		X	X								X				X	
	Transportation/circulation.	X	X	X	X		X				X							

Project activities		Environmental elements																
		Physical environment				Biological environment				Socioeconomic and historical-cultural environment								
		Air quality and climate change	Noise and vibration levels	Soils	Water resources	Terrestrial flora associated habitats	Terrestrial fauna and associated habitats	Critical habitats	Aquatic habitats and fauna	Land planning and use	Existing infrastructure	Economy, employment, and livelihoods	Life quality, health, and safety	Social cohesion and gender	Vulnerable groups	Cultural and archaeological heritage	Landscape	Resources
	Purchase of goods and materials.										X							
	Daily employee activity.		X				X				X	X	X					

7.4 Environmental Characteristics of the Area of Influence

The area of influence of a project is a concept necessary to identify the possible effects of the project on the physical, biological, socio-economic and historical-cultural environment. It is defined as the area where the impacts generated by the construction and operation activities of the project or structure. Regarding its proximity and relationship with the activities, we defined an area of influence of the project. In view of the importance of the criteria of environmental limit and socioeconomic dynamics, as well as their relationship of dependency, for this analysis, the watershed of the Guajimía canal, which has an area of 13.58 km^2, was considered as the limit of the area of influence.

Details regarding the environmental characteristics of the project's area of influence are included in Chapter 6 of this study.

7.5 Identification and Assessment of the Specific Environmental and Social Impacts of the Project

Table 7-4 and Table 7-5 present the list of potential environmental and social impacts identified for the project in the pre-construction, construction and operation phases with a description of their nature.

Table 7-4: Impacts identified for the Pre-construction and Construction Phase

VEC environment	Elements	Potential impacts	Nature
Physical	Air quality and climate change.	1. Temporary deterioration of air quality.	Negative
		2. Contribution to climate change due to greenhouse gas emissions.	Negative
	Noise and vibration levels.	3. Increase in noise and vibration levels at the local level.	Negative
	Soils.	4. Soil erosion at the edges of the canals due to the actions of reprofiling.	Negative

VEC environment	Elements	Potential impacts	Nature
		5. Soil compaction.	Negative
		6. Soil contamination	Negative
	Water resources.	7. Change in the quality of surface water in the canals under intervention.	Negative
		8. Modification of the parameters of the stormwater drainage of the canals under intervention.	Negative
Biological	Terrestrial flora and associated habitats	9. Disappearance of vegetation and loss of flora in the areas to clear.	Negative
		10. Modification of the species composition in the flora communities present in the project area.	Negative
		11. Introduction of invasive species and risk of spread.	Negative
	Terrestrial and associated habitats.	12. Fragmentation and degradation of terrestrial habitat in small cleared areas.	Negative
		13. Displacement and reduction of fauna.	Negative
		14. Modification of the species composition in the fauna communities present in the project area.	Negative
	Aquatic habitats and fauna.	15. Disturbance of the aquatic fauna present in the canals.	Negative
		16. Modification of aquatic habitats and their associated fauna.	Negative
	Critical habitats.	Unidentified	--
Socio-economic and historical-cultural	Land planning and use.	17. Impact on land properties.	Negative
		18. Nonconformity of the population to be resettled.	Negative
	Existing infrastructure.	19. Destruction of homes and other buildings located on the banks of the canals that will be intervened.	Negative
		20. Damage to existing infrastructures (roads, drinking water supply, sewage collection, among others).	Negative
		21. Increased traffic and disturbance of circulation.	Negative
	Economy, employment, and livelihoods.	22. Creation of temporary jobs.	Positive
		23. Stimulation of the local economy through the purchase of local goods and services.	Positive
		24. Disturbance of commercial and service activity.	Negative
		25. Interruption of the livelihood activities of the inhabitants in the area of influence.	Negative
		26. Changes in lifestyle habits.	Negative
	Life quality, health and safety.	27. Accidents and physical injuries involving workers and local residents.	Negative
		28. Traffic accidents involving workers and local residents.	Negative
		29. Increase in population stress due to noise, dust, air pollution and unforeseen events generated by works	Negative
	Social cohesion and gender.	30. Generation of conflicts related to compensation for tenants, homeowners, businesses, workshops, among others.	Negative
		31. Generation of tensions due to problems in the interaction of the communities with the construction workers.	Negative

VEC environment	Elements	Potential impacts	Nature
		32. Tensions generated in the neighborhoods of the project's area of influence due to the low or limited allocation of jobs and service contracts to residents, workers and professionals in said neighborhoods.	Negative
		33. Women marginalized in the compensation process for tenants, homeowners, businesses, workshops.	Negative
	Vulnerable groups.	34. Increase in marginalization and risk levels of vulnerable groups.	Negative
	Cultural and archaeological heritage.	35. Possible alteration or destruction of sites with cultural value and/or archaeological objects.	Negative
	Landscape.	36. Temporary degradation of the landscape at the site.	Negative
	Resources	37. Increased water consumption.	Negative
		38. Increased consumption of electricity and fuels.	Negative
		39. Increased consumption of loan materials.	Negative

Table 7-5: Impacts identified for the Operation Phases

VEC environment	Elements	Potential impacts and risks	Nature
Physical	Air quality and climate change.	1. Slight degradation of air quality.	Negative
		2. Contribution to climate change due to greenhouse gas emissions.	Negative
	Noise levels.	3. Increase in noise and vibration levels due to maintenance activities.	Negative
	Soils.	4. Soil contamination due to maintenance activities.	Negative
	Water resources.	5. Pollutant load reduction in surface waters due to the elimination of accumulated garbage in the canals.	Positive
		6. Flood reduction .	Positive
		7. Improvement of surface runoff by rectifying the wet section in canals and channels.	Positive
		8. Drainage stormwater contamination due to maintenance activities.	Negative
		9. Modification of the parameters of the stormwater drainage of the Guajimía canal and the tributaries under intervention.	Negative
Biological	Terrestrial flora, and associated habitats	10.Deterioration of green spaces and gardens created by maintenance activities of the stormwater and sanitary drainage structures, drinking water supply and urban construction.	Negative
		11.Possible introduction of invasive alien species (IAS).	Negative
	Terrestrial fauna and associated habitats	Unidentified.	--
	Aquatic habitats and fauna.	12.Improvement of aquatic habitat quality in the Guajimía canal in the section from Autopista 6 Noviembre to the Haina River.	Positive
	Critical habitats.	Unidentified.	--
Socioeconomic and historical-cultural	Land planning and use.	13.Illegal occupation of the areas where the structures for stormwater and sanitary drainage, drinking water supply and urban construction are located.	Negative
	Existing infrastructure.	14.Destruction of stormwater and sanitary drainage, drinking water supply and urban structures due to vandalism.	Negative
	Economy, employment, and livelihoods.	15.Creation of jobs for maintenance work.	Positive
		16.Life quality improvement for population of the project's surrounding neighborhoods and of the resettled population.	Positive
	Life quality, health and safety.	17.Reduction of flood threats and vulnerability of the resident population in the surroundings of the Guajimía canal and its tributaries.	Positive
		18.Reduction of the spread of diseases transmitted by water and vectors (mosquitoes, flies, rats, and mice) in the	Positive

VEC environment	Elements	Potential impacts and risks	Nature
		resident population around the Guajimía canal and its tributaries.	
		19.Improvement of the conditions for urban solid waste management.	Positive
		20.Creation of recreation areas for the community, especially children and youth.	Positive
	Social cohesion and gender.	21.Improvement of residents' sense of belonging to their neighborhoods.	Positive
		22.Disturbances by the population that was not resettled.	Negative
		23.Disturbances by the owners of shops, workshops, among others that were not compensated.	Negative
		24.Tensions generated between residents and workers due to inadequate interaction during the structures' maintenance activities.	Negative
	Vulnerable groups.	25.Reduction of social vulnerability	--
	Cultural and archaeological heritage.	Unidentified	--
	Landscape.	26.Improvement of the visual landscape.	Positive

7.5.1 Environmental Impacts to the Physical environment

7.5.1.1 *Air Quality and Climate Change*

Pre-construction and Construction Phase

Potential Negative Impacts

- Temporary deterioration of air quality.
- Contribution to climate change due to the generation of greenhouse gas emissions. The latter are estimated at 2,176 tCO_2eq[12] for the stormwater and sanitary works (see Annexe 10 for details).

Sources of Impact

- Installation of temporary facilities.
- Site preparation for the future residential units .
- Construction of the residential units and their basic infrastructures.
- Site preparation in the Guajimía canal and its tributaries.
- Exploitation of loan materials.
- Water diversion for stormwater channeling works.
- Construction of stormwater channeling structures in the upper part of the Guajimía canal and its tributaries.
- Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía canal and its tributaries.
- Expansion of the water distribution networks of the axes of the upper Guajimía Watershed and its tributaries.

[12] This less than the IFC threshold of 25,000 tonnes of CO_2-equivalent annually for quantify direct emissions from the facilities owned or controlled within the physical project boundary,7 as well as indirect emissions associated with the off-site production of energy used by the project (PS-3).

- Construction of urban amenities in the strips of intervened areas.
- Exploitation of loan material.
- Waste management during the cleaning of the channel of the canal and its tributaries and demolitions of the affected houses. Transportation and traffic.

Impact Description

During the construction phase, several activities carried out simultaneously (for example: site preparation: demolitions, excavations, grading/earthmoving, extraction of materials in the loan area, traffic etc.) could lead to a local increase of fine particles in the atmosphere. In addition, the use of equipment and machinery during the construction of the different works will generate exhaust emissions (including greenhouse gas emissions) that will lead to increased concentrations of atmospheric pollutants. Consequently, these activities can generate a temporary deterioration in air quality and may contribute to climate change.

The impacts on the climate are limited due to the nature and scale of the construction activities. However, with the application of general management measures, the potential deterioration of air quality during the construction phase is not expected to generate significant effects on neighboring populations.

Impact Assessment

Potential Impact on Air Quality and Climate Change – Pre-construction/Construction Phase

Intensity: Medium	Nature: Negative Magnitude: Moderate
Scope: Local	
Duration: Medium term	
Probability of occurrence: High	

Residual Impact on Air Quality and Climate Change – Pre-construction/Construction Phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Local	
Duration: Medium term	
Probability of occurrence: Medium	

<u>Operation Phase</u>

Potential negative impacts

- Slight degradation of air quality at the local level.
- Contribution to climate change due to potential greenhouse gas emissions.

Sources of Impact

- Maintenance of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks.
- Maintenance of urban structures.
- Solid waste handling and management.
- Transportation/circulation.

Impact Description

Maintenance activities of channeling structures for stormwater drainage, sanitary sewerage, water supply networks and urban structures could cause a slight degradation of air quality, limited to specific sites where these activities are being carried out.

Likewise, the circulation of equipment and vehicles necessary for these maintenance activities can cause greenhouse gas emissions, but in very low concentrations.

Potential Impact on Air Quality and Climate Change —Operation Phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Limited	
Duration: Long term	
Probability of occurrence: Medium	

Residual Impact on Air Quality and Climate Change —Operation Phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Limited	
Duration: Long term	
Probability of occurrence: Low	

7.5.1.2 *Noise and vibrations*

Pre-construction and Construction Phase

Potential negative impact

- Increase in noise and vibration levels at the local level.

Sources of Impact

- Installation of temporary facilities.
- Site preparation for the future residential units .
- Construction of the residential units and their basic infrastructures.
- Site preparation in the Guajimía canal and its tributaries.
- Water diversion for stormwater channeling works.
- Construction of stormwater channeling structures in the upper part of the Guajimía canal and its tributaries.
- Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía canal and its tributaries.
- Expansion of the water distribution networks of the axes of the upper Guajimía Watershed and its tributaries.
- Construction of urban amenities in the strips of intervened areas.
- Exploitation of loan material.
- Waste management during the cleaning of the channel of the canal and its tributaries and demolitions of the affected houses.
- Transportation and traffic.
- Labor hiring.

Impact Description

During the construction phase, traffic, and the use of construction equipment and machinery are likely to cause a temporary increase in noise levels that can disrupt neighboring communities and local wildlife. However, noise resulting from construction work will only be experienced for a limited period of time, particularly along the upper reaches of the Guajimía canal watershed and its tributaries and can be significantly reduced with the implementation of the management measures mentioned above.

At construction sites, noise levels will vary between60 dB and 70 dB, in residential areas and industrial areas. Noise emissions from construction works with associated machinery (roller, grader, concrete mixer, generators, trucks, etc.) could reach maximum noise emissions of approximately 100 dB (LHSFNA, n.d.).

Potential Impact on Noise Levels - Pre-construction/Construction Phase

Intensity: Medium	Nature: Negative Magnitude: Moderate
Scope: Local	
Duration: Medium term	
Probability of occurrence: High	

Residual Impact on Noise Levels - Pre-construction/Construction Phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Local	
Duration: Medium term	
Probability of occurrence: High	

Operation Phase

Potential negative impact

- Increase in noise and vibration levels due to maintenance activities.

Sources of Impact

- Maintenance of channeling structures for stormwater drainage, sanitary sewerage, and drinking water distribution networks.
- Maintenance of urban structures.
- Transportation/circulation.
- Daily employee activity.

Impact Description

The increase in noise and vibration levels in the operation phase is the product of maintenance activities of the structures for stormwater and sanitary drainage, drinking water supply networks and urban structures, among other components of the project. These activities usually employ tools, equipment and vehicles that generate noise and vibrations.

Impact in this phase will be of low intensity and will be limited to the sites where maintenance is being done. Its effects can be mitigated by scheduling maintenance activities during the day to affect the population of the area as little as possible and with proper maintenance of equipment.

Potential Impact on Noise Levels – Operation Phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Limited	
Duration: Long term	
Probability of occurrence: Medium	

Residual Impact Noise Levels – Operation Phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Limited	
Duration: Long term	
Probability of occurrence: Low	

7.5.1.3 *Soil*

Pre-construction and Construction Phase

Potential negative impacts

- Soil erosion of the soil at the edges of the canals due to the actions of reprofiling.
- Soil compaction.
- Soil contamination on the banks of the canals.

Sources of Impact

- Preparation of the site where the residential units will be built.
- Site preparation for the future apartment buildings.
- Site preparation in the Guajimía canal and its tributaries.
- Construction of stormwater channeling structures and the sewerage system in the upper part of the Guajimía canal and its tributaries.
- Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía canal and its tributaries.
- Waste management during the cleaning of the channel of the canal and its tributaries and demolitions of the affected houses.
- Transportation and traffic.

Impact Description

During the reprofiling works of the Guajimía canal and its tributaries slopes may experience soil erosion if the necessary mitigation measures are not taken. The soil will also be compacted in the areas where residential units and urban structures will be built.

On the other hand, soil contamination could occur if the solid waste generated is poorly managed. Soils can also be contaminated by spills of lubricants and fuel from machinery and equipment.

Potential Impact on Soils – Pre-construction/Construction Phase

Intensity: Low	Nature: Negative
Scope: Limited	Magnitude: Minor
Duration: Long term	
Probability of occurrence: Medium	

Residual Impact on Soils – Pre-construction/Construction Phase

Intensity: Low	Nature: Negative
Scope: Limited	Magnitude: Minor
Duration: Long term	
Probability of occurrence: Low	

Operation Phase

Potential negative impact

- Risk of soil contamination due to maintenance activities.

Sources of Impact

- Maintenance of channeling structures for stormwater drainage, sanitary sewerage, and drinking water distribution networks.
- Maintenance of urban structures.
- Solid waste handling and management.
- Transportation/circulation.

Impact Description

The risk of soil contamination during the operation phase is due to accidental leaks of lubricants and fuels from the equipment and vehicles used for the maintenance of the channels for stormwater drainage, sanitary drainage, drinking water systems and urban structures.

It is necessary to have an Emergency Response Plan with instructions for action in the event of a leak and to control its impact in the shortest possible time.

The soil can also be contaminated if the solid waste generated because maintenance activities (cleaning waste from the canals, debris from maintenance activities, among others) are poorly managed. Therefore, we must establish procedures for its proper handling.

Potential Impact on Soils – Operation Phase

Intensity: Low	Nature: Negative
Scope: Limited	Magnitude: Minor
Duration: Long term	
Probability of occurrence: Low	

Residual Impact Soils - Operation Phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Limited	
Duration: Short term	
Probability of occurrence: Low	

7.5.1.4 *Water Resources*

Pre-construction and Construction Phase

Potential impacts

- Change in the quality of surface water in the canals under intervention.
- Modification of the parameters of the stormwater drainage of the canals under intervention.

Sources of Impact

- Site preparation in the Guajimía canal and its tributaries.
- Water diversion for stormwater channeling works.
- Construction of stormwater channeling structures and the sewerage system in the upper part of the Guajimía canal and its tributaries.
- Waste management during the cleaning of the channel of the canal and its tributaries and demolitions of the affected houses.
- Transportation and traffic.

Impact Description

For the construction of the stormwater channeling structures in the Guajimía canal and its tributaries, the temporary diversion of its waters will be necessary, which will modify the parameters of the stormwater drainage of these surface water courses.

Additionally, site preparation works in the Guajimía canal and its tributaries and the construction of the structures, may modify the water quality parameters (mainly turbidity).

Pollution levels of surface waters could be increased by improper handling of solid waste resulting from the construction activities and by accidental leaks or spills of lubricants and fuels from equipment and vehicles used on the work.

Potential Impact on Water Resources – Pre-construction/Construction Phase

Intensity: Medium	Nature: Negative Magnitude: Moderate
Scope: Limited	
Duration: Medium term	
Probability of occurrence: Medium	

Residual Impact on Water Resources – Pre-construction/Construction Phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Limited	
Duration: Medium term	
Probability of occurrence: Medium	

Operation Phase

Potential positive impacts

- Pollutant load reduction in surface waters due to the elimination of accumulated garbage in the canals.
- Flood reduction.
- Improvement of surface runoff by rectifying the wet section in canals and channels.

Sources of Impact

- Presence and operation of channeling structures for stormwater drainage, sanitary sewerage, and drinking water distribution networks.
- Presence and operation of the homes of the resettlement plan and urban structures.
- Solid waste handling and management.

Impact Description

We expect construction of the stormwater drainage structures in the Guajimía canal and its tributary canals (Villa Aura, Las Caobas and uninterrupted sections of Buenos Aires, El Indio and La Ureña) will significantly and permanently reduce the risk of flooding on site.

Additionally, we expect that the pollution levels of the Guajimía canal and its tributaries, as well as the Haina River that they join, will decrease by building sanitary drainage systems and improving the solid waste management in the area (which cannot be dumped directly to the canals because they are channeled for the most part through pipes or covered with metal stops).

Potential Impact on Water Resources – Operation Phase

Intensity: High	Nature: Positive Magnitude: Major
Scope: Local	
Duration: Long term	
Probability of occurrence: High	

Residual Impact on Water Resources – Operation Phase

Intensity: High	Nature: Positive Magnitude: Major
Scope: Local	
Duration: Long term	
Probability of occurrence: High	

Potential negative impacts

- Drainage stormwater contamination.
- Modification of the parameters of the stormwater drainage of the Guajimía canal and the tributaries under intervention.

Sources of Impact

- Presence and operation of channeling structures for stormwater drainage, sanitary sewerage, and drinking water distribution networks.
- Presence and operation of the homes of the resettlement plan and urban structures.
- Maintenance of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks.
- Maintenance of urban structures.
- Solid waste handling and management.

- Transportation/circulation.

Impact Description

During the operation phase, contamination of the waters of the Guajimía canal and its tributaries may happen by poor handling of the solid waste resulting from the project's maintenance activities and by possible accidental spills of lubricants from the equipment used during maintenance work.

The impact can also be caused by leaks in the sanitary sewer networks built as part of the project works.

Potential Impact on Water Resources – Operation Phase

Intensity: Medium	Nature: Negative Magnitude: Moderate
Scope: Local	
Duration: Long term	
Probability of occurrence: Medium	

Residual Impact on Water Resources – Operation Phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Limited	
Duration: Long term	
Probability of occurrence: Low	

7.5.2 Impacts on the Biological Environment

7.5.2.1 *Flora and associated habitats*

Pre-construction and Construction Phase

Potential negative impacts

- Disappearance of vegetation and loss of flora in the areas to clear.
- Modification of the species composition in the flora communities present in the project area.
- Introduction of invasive species and risk of spread.

Sources of Impact

- Site preparation for the future residential units.
- Site preparation in the Guajimía canal and its tributaries.
- Construction of urban amenities in the strips of intervened areas.

Impact Description

Site preparation where the new residential units will be built, and where areas of the banks of the canal where vegetation currently exists, will require clearing, causing the modification of the species composition in the flora communities present.

This impact will be mitigated through the creation of green areas, comprised within the urban amenities included in the project. It is important that native and endemic plant species are sowed in these new green areas, thus avoiding generating the establishment of invasive species.

Potential Impact on Flora and associated habitats - Pre-construction/Construction Phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Limited	
Duration: Long term	
Probability of occurrence: High	

Residual Impact on Flora and associated habitats - Pre-construction/Construction Phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Limited	
Duration: Medium term	
Probability of occurrence: High	

Operation Phase

Potential negative impacts

- Deterioration of green areas and gardens created by maintenance activities of the stormwater and sanitary drainage structures, drinking water supply and urban construction.
- Possible introduction of invasive alien species (IAS).

Sources of Impact

- Maintenance of channeling structures for stormwater drainage, sanitary sewerage, and drinking water distribution networks.
- Maintenance of urban structures.

Impact Description

During the construction phase of the project, new green areas will be created as part of the urban development works. They might deteriorate, if not properly tended for.

Likewise, if the necessary care measures are not applied during the maintenance activities of the project's infrastructures the green areas and gardens created could deteriorate.

The establishment of invasive alien species in the green areas created may also occur.

Potential Impact on Flora and associated habitats- Operation Phase

Intensity: Medium	Nature: Negative Magnitude: Moderate
Scope: Limited	
Duration: Long term	
Probability of occurrence: High	

Residual Impact on Flora and associated habitats - Operation Phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Limited	
Duration: Long term	
Probability of occurrence: Low	

7.5.2.2 *Fauna and associated habitats*

Pre-construction and Construction Phase

Potential negative impacts

- Fragmentation and degradation of terrestrial habitat in small cleared areas.
- Modification of the species composition in the fauna communities present in the project area.
- Displacement and reduction of fauna, due to dust and noise caused by construction activities, mainly by personnel, equipment, and machinery.

Sources of Impact

- Site preparation for the future residential units.
- Construction of the residential units and their basic infrastructure
- Site preparation in the Guajimía canal and its tributaries.
- Water diversion for stormwater channeling works.
- Construction of stormwater channeling structures in the upper part of the Guajimía canal and its tributaries.
- Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía canal and its tributaries.
- Expansion of the water distribution networks of the axes of the upper Guajimía Watershed and its tributaries.
- Construction of urban amenities in the strips of intervened areas.
- Exploitation of loan material.
- Waste management during the cleaning of the channel of the canal and its tributaries and demolitions of the affected houses.
- Transportation and traffic.
- Labor hiring

Impact Description

Vegetation clearing for project site preparation and in the lots where the residential units will be built, will fragment and degrade the terrestrial habitat in these areas and will modify the composition of species therein. This impact can be mitigated by creating new green areas as part of the urban amenities of the project, which include sowing native and endemic plant species.

On the other hand, all the construction activities that generate noise and dust, cause a temporary displacement of the fauna towards other areas where there are more favorable conditions. Therefore, all the measures aimed at mitigating the impacts of increased noise and dust levels will also contribute to mitigating this impact on fauna.

Potential Impact on Fauna and associated habitats - Pre-construction/Construction Phase

<table>
<tr><td>Intensity: Low</td><td rowspan="3">Nature: Negative
Magnitude: Minor</td></tr>
<tr><td>Scope: Local</td></tr>
<tr><td>Duration: Medium term</td></tr>
<tr><td colspan="2">Probability of occurrence: Medium</td></tr>
</table>

Residual Impact on Fauna and associated habitats - Pre-construction/Construction phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Limited	
Duration: Medium term	
Probability of occurrence: Low	

7.5.2.3 *Aquatic habitats and fauna*

Pre-construction and Construction Phase

Potential negative impact

- Disturbance of the aquatic fauna present in the canals.
- Modification of aquatic habitats and their associated fauna.

Sources of Impact

- Site preparation in the Guajimía canal and its tributaries.
- Water diversion for stormwater channeling works.
- Construction of stormwater channeling structures in the upper part of the Guajimía canal and its tributaries.
- Waste management during the cleaning of the channel of the canal and its tributaries and demolitions of the affected houses.

Impact Description

The diversion of the waters of the Guajimía canal and its tributaries, for the construction of the rainwater drainage structures, will cause a disturbance for the aquatic fauna that inhabits these water courses. The study of aquatic biodiversity detected the presence of individual fish of the **Poecilidae** family, insects (mosquito larvae) and zooplankton.

This disturbance will be permanent taking into account that after the construction of the work, the aquatic habitat will not return to its original conditions.

Potential Impact on Aquatic Habitats and Fauna - Pre-construction/Construction Phase

Intensity: Medium	Nature: Negative Magnitude: Moderate
Scope: Local	
Duration: Long term	
Probability of occurrence: Medium	

Residual Impact on Aquatic Habitats and Fauna - Pre-construction/Construction Phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Local	
Duration: Long term	
Probability of occurrence: Medium	

Operation Phase

Potential positive impacts

- Improvement of the quality of aquatic habitats in the Guajimía canal in the section from Autopista 6 Noviembre to the Haina River.

Sources of Impact

- Presence and operation of channeling structures for stormwater drainage, sanitary sewerage, and drinking water distribution networks.

Impact Description

The improvement of the aquatic habitat quality is expected considering the reduction of water pollution levels in the Guajimía canal, derived from the existence of the stormwater channeling and sanitary drainage works.

The impact will be particularly limited to the section from Autopista 6 Noviembre to the mouth of the Haina River, which will be the section of the canal that will be left opened, neither piped nor covered.

Potential Impact on Aquatic Habitats and Fauna - Operation Phase

Intensity: Medium	Nature: Positive Magnitude: Moderate
Scope: Limited	
Duration: Long term	
Probability of occurrence: Medium	

Residual Impact on Aquatic Habitats and Fauna - Operation Phase

Intensity: High	Nature: Positive Magnitude: Major
Scope: Limited	
Duration: Long term	
Probability of occurrence: High	

7.5.3 Impacts on the Socio-economic and Historical-cultural Environments

7.5.3.1 *Socio-economic Environment*

7.5.3.1.1 Land planning and use

Pre-construction and Construction Phase

Potential negative impacts

- Impact on land properties.
- Nonconformity of the population to be resettled.

Sources of Impact

- Land acquisition for the construction of apartment buildings.
- Installation of temporary facilities.
- Site preparation for the future apartment buildings.

- Construction of the residential units and their basic infrastructures.
- Population resettlement and payment of corresponding compensations.
- Site preparation in the Guajimía canal and its tributaries.
- Construction of stormwater channeling structures in the upper part of the Guajimía canal and its tributaries.
- Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía canal and its tributaries.
- Expansion of the water distribution networks of the axes of the upper Guajimía Watershed and its tributaries.
- Construction of urban amenities in the strips of intervened areas.

Impact Description

For the construction of the stormwater channeling structures in the Guajimía canal and its tributaries, it will be necessary to resettle the population that resides on their banks and to economically compensate business owners so that they can resettle elsewhere.

Land use in their areas will therefore change from residential or commercial uses to public use.

On the other hand, land that is currently vacant will be acquired by the State for the construction of residential units for the resettlement of the affected population.

These changes could generate disagreements among the affected population and conflicts related to land ownership.

Potential Impact on Land Planning and Use - Pre-construction/Construction Phase

Intensity: Medium	Nature: Negative
Scope: Local	Magnitude: Moderate
Duration: Long term	
Probability of occurrence: High	

Residual Impact on Land Planning and Use - Pre-construction/Construction Phase

Intensity: Low	Nature: Negative
Scope: Local	Magnitude: Moderate
Duration: Long term	
Probability of occurrence: High	

Operation Phase

Potential negative impact

- Illegal occupation of the spaces where the structures for rainwater and sanitary drainage, drinking water supply and urban construction are located.

Sources of Impact

- Presence and operation of channeling structures for stormwater drainage, sanitary sewerage, and drinking water distribution networks.
- Presence and operation of the homes of the resettlement plan and urban structures.

Impact Description

During the operation phase, if the banks of the Guajimía canal and its tributaries and the urban construction works carried out as part of the project are not continuously monitored, there may be illegal occupation of these places after the construction works. This may also occur in other areas, such as roads, green areas, playgrounds, commercial premises, included in the project.

This situation has occurred previously in similar projects in the Dominican Republic, where people who have been resettled or financially compensated, sell their new properties and return to their former residences, occupying them illegally. It may also be the case that new settlers occupy these areas.

Potential Impact on Land Planning and Use - Operation Phase

Intensity: High	Nature: Negative Magnitude: Major
Scope: Local	
Duration: Long term	
Probability of occurrence: High	

Residual Impact on Land Planning and Use - Operation Phase

Intensity: High	Nature: Negative Magnitude: Major
Scope: Limited	
Duration: Long term	
Probability of occurrence: Low	

7.5.3.1.2 Existing Infrastructure

Pre-construction and Construction Phase

Potential negative impacts

- Destruction of homes and other buildings located on the banks of the canals that will be intervened.
- Damage to existing infrastructures (roads, drinking water supply, sewage collection, among others).
- Increased traffic and disturbance of circulation.

Sources of Impact

- Population resettlement and payment of corresponding compensations.
- Site preparation in the Guajimía canal and its tributaries.
- Construction of stormwater channeling structures in the upper part of the Guajimía canal and its tributaries.
- Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía canal and its tributaries.
- Expansion of the water distribution networks of the axes of the upper Guajimía Watershed and its tributaries.
- Construction of urban amenities in the strips of intervened areas.
- Transportation and traffic.

Impact Description

The construction works require the demolition of the houses and other buildings located on the margins of the water courses. The demolition works will also cause damage to other existing infrastructures within the project's footprint and surrounding areas (see Figure 6-4 of Chapter 6 of this study) such as roads, drinking water supply networks and wastewater collectors

To mitigate this impact, the entire affected population whose properties will be demolished will be relocated in new residential units, which will have all the necessary basic utilities including electricity, drinking water supply and sanitary sewerage, among others. New road stretches, pedestrian walkways, play areas, will also be constructed.

The urban works previously described, as well as the new residential units will be of a much higher quality than the existing infrastructure currently in place.

However, vehicular traffic during the construction phase will be affected, so mitigation measures, such as the construction of structures by sections, speed control of equipment and vehicles, will be needed.

Potential Impact on Existing Infrastructure - Pre-construction/Construction Phase

Intensity: High	Nature: Negative Magnitude: Major
Scope: Local	
Duration: Medium term	
Probability of occurrence: High	

Residual Impact on Existing Infrastructure - Pre-construction/Construction Phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Limited	
Duration: Short term	
Probability of occurrence: Low	

Operation Phase

Potential negative impact

- Destruction of stormwater and sanitary drainage, drinking water supply and urban structures due to vandalism.

Sources of Impact

- Presence and operation of channeling structures for stormwater drainage, sanitary sewerage, and drinking water distribution networks.
- Presence and operation of the homes of the resettlement plan and urban structures.

Impact Description

During the operation phase, the population might destroy the structures for stormwater and sanitary drainage, water supply networks and urban constructions included in the project, if there is no adequate surveillance and monitoring.

The impact will be limited to the structures affected by acts of vandalism. However, it can disturb the population at the local level, whose drinking water supply and sanitary drainage services, among others, may be temporarily interrupted because of acts of vandalism.

Potential Impact on Existing Infrastructure – Operation Phase

Intensity: High	Nature: Negative Magnitude: Moderate
Scope: Limited	
Duration: Short term	
Probability of occurrence: Medium	

Residual Impact on Existing Infrastructure – Operation Phase

Intensity: High	Nature: Negative Magnitude: Moderate
Scope: Limited	
Duration: Short term	
Probability of occurrence: Low	

7.5.3.1.3 Economy, employment, and livelihoods

Pre-construction and Construction Phase

Potential negative impacts

- Disturbance of commercial and service activity.
- Changes in lifestyle habits.
- interruption of the livelihood activities of the inhabitants in the area of influence of the project.

Sources of Impact

- Installation of temporary facilities.
- Site preparation for the future residential units.
- Construction of the residential units and their basic infrastructures.
- Population resettlement and payment of corresponding compensations.
- Site preparation in the Guajimía canal and its tributaries.
- Construction of stormwater channeling structures in the upper part of the Guajimía canal and its tributaries.
- Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía canal and its tributaries.
- Exploitation of loan material.
- Expansion of the water distribution networks of the axes of the upper Guajimía Watershed and its tributaries.
- Construction of urban amenities in the strips of intervened areas.
- Transportation and traffic.

Impact Description

Among the buildings that will have to be demolished for the construction of the project structures are commercial and service businesses, which must interrupt their activities. In many cases, these represent the only livelihood of their owners.

These owners will be compensated monetarily for the loss of their businesses, to avoid affecting their economic situation, their life quality and that of their families.

Site preparation, construction works, population resettlement, transportation and traffic will also disrupt commercial and service activities in the sectors within the project's footprint and surrounding areas (see Figure 6-4 of Chapter 6 of this study).

Potential Impact on the Economy, Employment, and Livelihoods - Pre-construction/Construction Phase

Intensity: High	Nature: Negative Magnitude: Major
Scope: Local	
Duration: Medium term	
Probability of occurrence: Medium	

Residual Impact on the Economy, Employment, and Livelihoods - Pre-construction/Construction Phase

Intensity: Medium	Nature: Negative Magnitude: Minor
Scope: Limited	
Duration: Short term	
Probability of occurrence: Low	

Potential positive impacts

- Creation of temporary jobs.
- Stimulation of the local economy through the purchase of local goods and services.

Sources of Impact

- Purchase of materials, goods and services.
- Labor hiring.

Impact Description

Positive opportunities for people and communities can come in the form of temporary employment and business opportunities during the construction phase, including income from the sale of food and other consumables to workers.

Jobs are expected to be available during project construction, primarily as casual workers. However, these job opportunities are expected to be temporary and benefit the community only during the construction phase. This would result in a positive impact on employment.

Potential Impact on the Economy, Employment and Livelihoods - Pre-construction/Construction Phase

Intensity: Medium	Nature: Positive Magnitude: Moderate
Scope: Local	
Duration: Medium term	
Probability of occurrence: Medium	

Residual Impact on the Economy, Employment and Livelihoods - Pre-construction/Construction Phase

Intensity: High	Nature: Positive Magnitude: Major
Scope: Local	
Duration: Medium term	
Probability of occurrence: High	

Operation Phase

Potential positive impact

- Creation of jobs for maintenance work.

Sources of Impact

- Maintenance of channeling structures for stormwater drainage, sanitary sewerage, and drinking water distribution networks.
- Maintenance of urban structures.
- Transportation/circulation.
- Purchase of goods and materials.
- Daily employee activity.

Impact Description

During the operation phase, the Santo Domingo Aqueduct and Sewer Corporation (CAASD) must hire additional personnel for maintenance work on the stormwater drainage, sanitary system, water supply networks.

Additionally, indirect jobs may be generated for the maintenance of urban amenities including roads, pedestrian walkways, children's playgrounds and green areas. These jobs will be channeled through the Santo Domingo Oeste City Hall, the Ministry of Public Works and Communications and other state institutions.

The families that own homes and businesses in the surroundings of the Guajimía canal and its tributaries, may see the value of their properties increase due to the improvement in the environmental conditions.

This could also lead to the instigation of individual improvement processes for homes and commercial buildings in the area, with the consequent demand for construction materials, labor, and technical services.

Potential Impact on the Economy, Employment, and Livelihoods – Operation Phase

Intensity: High	Nature: Positive
Scope: Local	Magnitude: Major
Duration: Long term	
Probability of occurrence: Medium	

Residual Impact on the Economy, Employment, and Livelihoods – Operation Phase

Intensity: High	Nature: Positive
Scope: Local	Magnitude: Major
Duration: Long term	
Probability of occurrence: High	

No negative impact on the economy, employment and livelihoods is expected during the operation phase.

7.5.3.1.4 Life Quality, Health and Safety

Pre-construction and Construction Phase

Potential negative impacts

- Accidents and physical injuries involving workers and local residents.
- Traffic accidents involving workers and local residents.
- Increase in population stress due to noise, dust, air pollution and unforeseen events generated by works of this magnitude in their surroundings.

Sources of Impact

- Installation of temporary facilities.
- Site preparation for the future residential units .
- Construction of the residential units and their basic service infrastructure.
- Population resettlement and payment of corresponding compensations.
- Site preparation in the Guajimía canal and its tributaries.
- Exploitation of loan material.
- Construction of stormwater channeling structures in the upper part of the Guajimía canal and its tributaries.
- Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía canal and its tributaries.
- Expansion of the water distribution networks of the axes of the upper Guajimía Watershed and its tributaries.
- Construction of urban amenities in the strips of intervened areas.
- Waste management during the cleaning of the channel of the canal and its tributaries and demolitions of the affected houses.
- Transportation and traffic.
- Labor hiring.

Impact Description

The project works could entail accidents and injuries for the workers, as well as for the population residing in the area.

Also, during the construction phase traffic accidents involving construction workers, local residents, equipment and vehicles of the contracting companies could occur.

For this reason, it is of utmost importance to take the necessary preventive measures during this phase to avoid the occurrence of accidents and injuries. These include supplying the personal protective equipment to all workers on the site, placement of necessary safety and traffic signs, speed control for the equipment and vehicles of the project, among others. We must also ensure that in the event of an accident, the resources to provide first aid and medical care to the affected population are available.

Potential Impact on Quality of Life, Health and Safety - Pre-construction/Construction Phase

<table>
<tr><td>Intensity: Medium</td><td rowspan="3">Nature: Negative
Magnitude: Moderate</td></tr>
<tr><td>Scope: Local</td></tr>
<tr><td>Duration: Medium term</td></tr>
<tr><td colspan="2">Probability of occurrence: High</td></tr>
</table>

Residual Impact on Quality of Life, Health and Safety - Pre-construction/Construction Phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Limited	
Duration: Medium term	
Probability of occurrence: Medium	

Operation Phase

Potential positive impacts

- Reduction of flood threats and vulnerability of the resident population in the surroundings of the Guajimía canal and its tributaries.
- Reduction of the spread of diseases transmitted by water and vectors (mosquitoes, flies, rats, and mice) in the resident population around the Guajimía canal and its tributaries.
- Life quality improvement for population of the project's surrounding neighborhoods and of the resettled population.
- Improvement of the conditions for urban solid waste management.
- Creation of recreation areas for the community, especially children and youth.

Sources of Impact

- Presence and operation of channeling structures for rainwater drainage, sanitary sewerage, and drinking water distribution networks.
- Presence and operation of the homes of the resettlement plan and urban structures.
- Maintenance of urban structures.
- Solid waste handling and management.
- Daily employee activity.

Impact Description

The presence of the stormwater channeling structures in the Guajimía canal and its tributaries will reduce the flood threat for the population living in the following neighborhoods: Las Caobas, Duarte, Buenos Aires, La Rosa, Herrera, Manoguayabo, Bayona, Engombe, La Altagracia and Santo Domingo Country Club.

Due to the decrease in the pollution levels of the waters in these canals and the improvement in the conditions of solid waste management on site, we expect a decrease in the spread of diseases transmitted by water, as well as by pests and rodents. This, in turn, will reduce the demand for medical and hospital services in the community.

The presence of the project structures and the new residential units will lead to an improvement in the life quality of the population both for the population residing in the vicinity of the Guajimía canal and its tributaries and for the population that will be resettled; they will live in much better environmental conditions, have higher security and access to basic services, such as drinking water supply, sanitary drainage and waste management.

The development of urban amenities including playgrounds, gazebos and green areas, constitutes new spaces for recreational and sports activities for children and youth.

Road connectivity in various areas and neighborhoods of the municipality will also improve, favoring social interactions, transportation, and more effective access for emergency vehicles.

Potential Impact on Quality of Life, Health and Safety - Operation Phase

Intensity: High	Nature: Positive Magnitude: Major
Scope: Local	
Duration: Long term	
Probability of occurrence: Medium	

Residual Impact on Quality of Life, Health and Safety - Operation Phase

Intensity: High	Nature: Positive Magnitude: Major
Scope: Local	
Duration: Long term	
Probability of occurrence: High	

No negative impacts were identified for life quality, health and safety of the population during the operation phase.

7.5.3.1.5 Social cohesion and gender

Pre-construction and Construction Phase

Potential negative impacts

- Generation of conflicts related to compensation for tenants, homeowners, businesses, workshops, among others.
- Generation of tensions due to problems in the interaction of the communities with the construction workers.
- Tensions generated in the neighborhoods of the project's area of influence due to the low or limited allocation of jobs and service contracts to residents, workers and professionals in said neighborhoods.
- Women marginalized in the compensation process for tenants, homeowners, businesses, workshops.

Sources of Impact

- Land acquisition for the construction of apartment buildings.
- Population resettlement and payment of corresponding compensations.
- Purchase of materials, goods, and services.
- Labor hiring.

Impact Description

During the construction phase, tensions could arise among the population of the local communities due to the high expectations to occupy jobs or service contracts, many of which may not be satisfied.

Disputes related to compensation could also arise and increase the risk of irregular eviction of tenants from homes in the areas directly impacted by the project, by the owners trying to benefit from the compensation owed to them.

Regarding gender, women are often excluded from compensation processes, especially single mothers. Special attention should be given to this group, and the process should be monitored to ensure that they are not left out and to guarantee that they receive the same benefits as men.

Potential Impact on Social Cohesion and Gender - Pre-construction/Construction Phase

Intensity: Medium	Nature: Negative Magnitude: Moderate
Scope: Local	
Duration: Medium term	
Probability of occurrence: Medium	

Residual Potential Impact on Social Cohesion and Gender - Pre-construction/Construction Phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Limited	
Duration: Medium term	
Probability of occurrence: Low	

Operation Phase

Potential positive impacts

- Improvement of residents' sense of belonging to their neighborhoods.

Sources of Impact

- Presence and operation of channeling structures for stormwater drainage, sanitary sewerage, and drinking water distribution networks.
- Presence and operation of the homes of the resettlement plan and urban structures.

Impact Description

Due to the presence of the project's infrastructures and the improvement of life quality of life they bring to the population, the residents will positively identify themselves with the territory they live in.

The local residents await to abandon the Guajimía canal and its tributaries., Once the project is completed, they are expected to prefer staying.

Potential Impact on Social Cohesion and Gender - Operation Phase

Intensity: High	Nature: Positive Magnitude: Major
Scope: Local	
Duration: Long term	
Probability of occurrence: Medium	

Residual Impact on Social Cohesion and Gender - Operation Phase

Intensity: High	Nature: Positive Magnitude: Major
Scope: Local	
Duration: Long term	
Probability of occurrence: High	

Potential negative impacts

- Disturbances by the population that was not resettled.
- Disturbances by the owners of shops, workshops, among others that were not compensated.
- Tensions generated between residents and workers due to inadequate interaction during the structures' maintenance activities.

Sources of Impact

- Presence and operation of the homes of the resettlement plan and urban structures.
- Maintenance of channeling structures for stormwater drainage, sanitary sewerage, and drinking water distribution networks.
- Maintenance of urban structures.
- Daily employee activity.

Impact Description

While impacts on communities and social cohesion are likely to be felt primarily during the construction phase, they may also be felt to a lesser degree during the operation phase due to the presence of maintenance employees.

On the other hand, conflicts and disturbances could arise among the resident population, as well as between business owners who consider that they should have been resettled or compensated during the construction of the project and who did not receive benefits.

It could also cause conflicts between owners and tenants of homes and commercial premises, due to the possible increase in the price of rents due to the improvement of the surrounding conditions.

Potential Impact on Social Cohesion and Gender - Operation Phase

Intensity: Medium	Nature: Negative
Scope: Local	Magnitude: Moderate
Duration: Long term	
Probability of occurrence: Average	

Residual Impact on Social Cohesion and Gender - Operation Phase

Intensity: Low	Nature: Negative
Scope: Local	Magnitude: Minor
Duration: Short term	
Probability of occurrence: Low	

7.5.3.1.6 Vulnerable groups

<u>Pre-construction and Construction Phase</u>

Potential negative impact

- Increase in marginalization and risk levels of vulnerable groups.

Sources of Impact

- Land acquisition for the construction of apartment buildings.

- Population resettlement and payment of corresponding compensations.

Impact Description

During the resettlement process, certain people could be marginalized, especially vulnerable groups, such as undocumented migrants or households whose heads are minors or very young adults.

Negative impacts can be mitigated by ensuring the collaboration of community leaders and proper monitoring of the resettlement plan in terms of distribution and management of compensation.

Potential Impact on Vulnerable Groups - Pre-construction/Construction Phase

Intensity: Medium	Nature: Negative Magnitude: Moderate
Scope: Local	
Duration: Medium term	
Probability of occurrence: Average	

Residual Impact on Vulnerable Groups - Pre-construction/Construction Phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Local	
Duration: Medium term	
Probability of occurrence: Average	

Operation Phase

Potential positive impact:

- Reduction of social vulnerability.

Sources of Impact

- Presence and operation of channeling structures for stormwater drainage, sanitary sewerage, and drinking water distribution networks.
- Presence and operation of the homes of the resettlement plan and urban structures.
- Maintenance of urban structures.

Impact Description

Vulnerable population live in the banks of the canals exposed to flood, hydro sanitary diseases and other risks associated with poverty and poor waste management. .The presence and operation of the stormwater channeling structures and the implementation of compensation measures for the affected population will reduce their vulnerability guaranteeing sanitation services and better houses.

Potential Impact on Vulnerable Groups – Operation Phase

Intensity: High	Nature: Positive Magnitude: Major
Scope: Local	
Duration: Long term	
Probability of occurrence: High	

Residual Impact on Vulnerable Groups - Operation Phase

Intensity: High	Nature: Positive Magnitude: Major
Scope: Local	
Duration: Long term	
Probability of occurrence: High	

7.5.3.1.7 Landscape

Pre-construction and Construction Phase

Potential negative impact

- Temporary degradation of the landscape at the site.

Sources of Impact

- Site preparation for the future residential units.
- Construction of the residential units and their basic infrastructures.
- Construction of stormwater channeling structures in the upper part of the Guajimía canal and its tributaries.
- Site preparation in the Guajimía canal and its tributaries.
- Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía canal and its tributaries.
- Expansion of the water distribution networks of the axes of the upper Guajimía Watershed and its tributaries.
- Construction of urban amenities in the strips of intervened areas.
- Exploitation of loan material.
- Management of waste products from the cleaning of the channel of the canal and its tributaries and demolitions of the affected houses.

Impact Description

amenities temporary deterioration of the landscape is expected to occur during the construction phase.

Insufficient management of solid waste and debris resulting from the cleaning of the canal and the demolition of houses and other buildings might also contribute do landscape deterioration.

Potential Impact on the Landscape - Pre-construction/Construction Phase

Intensity: Medium	Nature: Negative Magnitude: Moderate
Scope: Local	
Duration: Medium term	
Probability of occurrence: High	

Residual Impact on the Landscape – Pre-construction/Construction phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Local	
Duration: Medium term	
Probability of occurrence: High	

Operation Phase

Potential positive impact

- Improvement of the visual landscape.

Sources of Impact

- Presence and operation of channeling structures for stormwater drainage, sanitary sewerage, and drinking water distribution networks.
- Presence and operation of the homes of the resettlement plan and urban structures.
- Maintenance of urban structures.
- Solid waste handling and management.

Impact Description

The current landscape in the surroundings of the Guajimía canal and its tributaries is very deteriorated due to the presence of large quantities of solid waste. The existing homes and other buildings are in highly precarious conditions. The new infrastructures will contribute to the improvement of landscape quality.

Likewise, the creation of green and recreational areas amenities developed through the project will contribute to landscape improvement given they are properly cared for.

Potential Impact on the Landscape - Operation Phase

Intensity: High	Nature: Positive Magnitude: Major
Scope: Local	
Duration: Long term	
Probability of occurrence: Average	

Residual Impact on the Landscape - Operation Phase

Intensity: High	Nature: Positive Magnitude: Major
Scope: Local	
Duration: Long term	
Probability of occurrence: High	

No negative impact on the landscape is expected during the operation phase.

7.5.3.1.8 Cultural and archaeological heritage

Construction Phase

Potential negative impact

- Possible alteration or destruction of sites with cultural value and/or archaeological objects.

Sources of Impact

- Site preparation for the future residential units.
- Site preparation in the Guajimía canal and its tributaries.
- Exploitation of loan material.

Impact Description

The site preparation activities may uncover, alter or destroy cultural value and/or archaeological objects.

Within the project no sites of cultural value or archaeological objects have been identified. However, in the vicinity of the project in Santo Domingo Oeste are the Ruins of Ingenio Engombe that are part of the cultural heritage of the Dominican Republic. If archaeological objects are detected during the construction phase, the Museum of the Dominican Man must be notified, so that they can be properly managed.

Assessment of Potential Impact on the Cultural and Archaeological Heritage - Construction Phase

Intensity: Low	Nature: Negative
Scope: Limited	Magnitude: Minor
Duration: Long term	
Probability of occurrence: Low	

Assessment of Residual Impact on the Cultural and Archaeological Heritage - Construction Phase

Intensity: Low	Nature: Negative
Scope: Limited	Magnitude: Minor
Duration: Long term	
Probability of occurrence: Low	

Operation Phase

No negative impact on the cultural and archaeological heritage is expected during the operation phase.

7.5.3.1.9 Resources

Construction Phase

Potential negative impact

- Increased water consumption.
- Increased consumption of electricity and fuels.
- Increased consumption of loan materials.

Sources of Impact

- Installation of temporary facilities.
- Site preparation for future residential units.
- Construction of the residential units and their basic infrastructures.
- Population resettlement and payment of corresponding compensations.
- Site preparation in the Guajimía canal and its tributaries.
- Water diversion for stormwater channeling works.
- Construction of stormwater channeling structures in the upper part of the Guajimía canal and its tributaries.
- Construction of the sanitary sewer system for the axes of the upper watershed of the Guajimía canal and its tributaries.
- Expansion of the water distribution networks of the axes of the upper Guajimía Watershed and its tributaries.
- Construction of urban amenities in the strips of intervened areas.
- Exploitation of loan material.

- Waste management during the cleaning of the channel of the canal and its tributaries and demolitions of the affected houses.
- Transportation and traffic.
- Labor hiring.

Impact Description

During the construction phase, the demand for resources such as water (for human consumption and for construction activities), electricity, fuels and loan materials will increase for the execution of the works and for the operation of the necessary temporary facilities.

It is necessary to take measures for the efficient use of these resources in the construction phase, avoiding their waste.

Assessment of Potential Impact on Resources - Construction Phase

Intensity: Medium	Nature: Negative Magnitude: Moderate
Scope: Limited	
Duration: Medium term	
Probability of occurrence: High	

Assessment of Residual Impact on Resources - Construction Phase

Intensity: Low	Nature: Negative Magnitude: Minor
Scope: Limited	
Duration: Medium term	
Probability of occurrence: High	

Operation Phase

No negative impact on resources is expected during the operation phase.

7.6 Closure Phase

It should be noted that the impacts resulting from the project closure phase were not identified or assessed in this report. In fact, structures for stormwater drainage, sanitation, drinking water supply and urban construction are expected to be maintained and operated continuously for several decades. This long-life service makes it very difficult and potentially counterproductive to predict, at this stage, the circumstances in which project facilities might eventually be dismantled. However, a full decommissioning phase impact assessment is recommended when sufficient information on the decommissioning phase is available.

7.7 Cumulative Impact Analysis

This section is developed in order to identify and analyze the potential environmental and social impacts of the Storm and Sanitary Drainage of the Guajimia Canal Phase II 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 is considered a relevant part of environmental assessment in various standards such as Performance Standard 1 of the International Finance Corporation (IFC): Assessment and Management of Environmental and Social Risks and Impacts; the Safeguard Policy OP-4.01 Environmental Assessment issued by the World Bank; Annex II "Environmental and Social Impact Assessment Report (ESIA)" included in the Recommendation of the Council of the Organization for Economic Cooperation and Development (OECD) on Common Approaches for Officially Supported Export Credits and Environmental and Social Due Diligence (the "Common Approaches"), April 6, 2016.

In addition, the Equator Principles (November 2019) mentions these matters, in the description of the supporting information shown in Exhibit II: Illustrative list of potential environmental and social issues to be addressed in the environmental and social assessment documentation.

The Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (IFC, 2015), establishes that "*Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity (collectively referred to in this document as "developments") when added to other existing, planned, and/or reasonably anticipated future ones. For practical reasons, the identification and management of cumulative impacts are limited to those effects generally recognized as important on the basis of scientific concerns and/or concerns of affected communities.*".

Likewise, that document states that "*What is important is that during the process of identifying environmental and social impacts and risks, developers or project sponsors (a) recognize that their actions, activities, and projects—their developments —may contribute to cumulative impacts on valued environmental and social components (VECs) on which other existing or future developments may also have detrimental effects, and (b) avoid and/or minimize these impacts to the greatest extent possible.*" *Furthermore, sponsors must understand that their developments may be at risk if the cumulative effects significantly over ecosystem services the project's feasibility may depend on*". In addition, it proposes carrying out a rapid cumulative impact assessment and management (RCIA), which involves a review of the relevant documentation and some consultations with affected communities and other social agents, to determine if the activities of a project could significantly affect environmental and social aspects of interest.

Based on the descriptions included in the manual and on the information available on the design of the Storm and Sanitary Drainage of the Guajimía Canal and its Main Tributaries—Phase II Project, a cumulative impacts analysis was produced, considering the area of influence, which is defined by the limits of the Guajimía canal watershed.

7.7.1 Objectives

The main objective of this section is to identify and assess the potential environmental and social risks and impacts of the Storm and Sanitary Drainage of the Guajimia Canal Phase II Project, from the perspective of the International Finance Corporation and the Equator Principles, over time and in the context of 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:

- To identify all valued environmental and social components (VEC), which could be directly or indirectly affected by the project.
- To identify and select existing, expected and planned projects and activities and external environmental and social factors that could potentially have an effect on the identified and selected VECs.
- To identify and assess the potential environmental and social risks and impacts of the project that are the object of this study over time, in the context of potential effects that other actions, activities and projects and/or external environmental and social factors may have on the same VEC.
- To identify the interested parties that could be potentially affected by the development of the project.
- Present the environmental impacts of the project that could act cumulatively with the effects of other projects or activities and describe the type of impact expected to occur on the valued components of the ecosystem.

7.7.2 Methodology

For the development of this analysis, we applied the methodology based on the guidelines included in the Good Practice Handbook on Cumulative Impact Assessment and Management (IFC, June 2015) for an RCIA, which in turn considered the review of relevant, existing and available information, such as previous environmental impact studies, planning documents and updated baseline information.

The methodology used considered the six steps defined in the IFC Handbook, whose scope is shown in Figure 7-1.

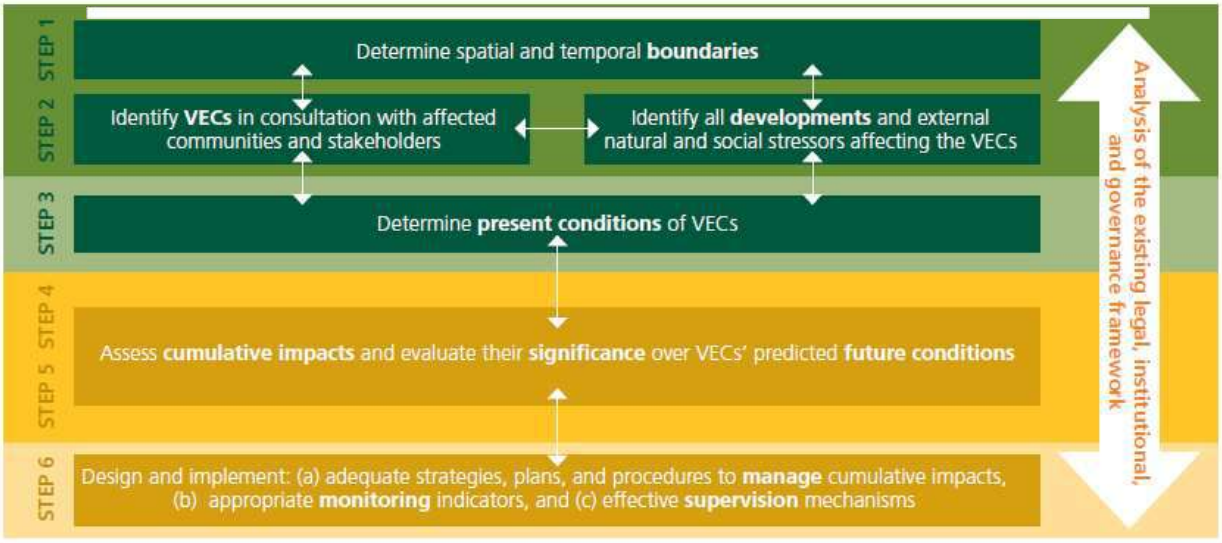


Figure 7-1: Rapid Cumulative Impact Assessment: Six-Step Process

Source: Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (IFC, 2015)

7.7.3 Determination of Spatial Limits

The geographical scope for the cumulative impact analysis was defined considering, the significant resources or VECs present within the direct area of influence, their area of influence and the potential extent that the of the cumulative impacts.

Taking the foregoing into consideration, the limit of the Guajimía canal watershed was fixed as the spatial or geographical limit, as defined in Chapter 4 on Project Description of this document.

7.7.4 Determination of Time Limits

The time scale, that is, the period of time within which the project's impacts could cumulate with others was defined as:

- The beginning and duration of the construction period (3 years starting December 2021, (see Chapter 4)
- Ten years, once construction is completed

7.7.5 Identification of Valued Environmental and Social Components (VEC)

IFC's methodological guide defines VEC as those environmental and social attributes that are considered important in the impact assessment, because they are considered relevant or of concern from a social, scientific or professional point of view. These may also be directly or indirectly affected by the cumulative impacts generated by the development of the Storm and Sanitary Drainage of the Guajimía Canal Phase II Project, as well as by the projects and activities developed in its surroundings (area of influence), natural extreme events and social stress factors.

The sources of information for the selection of the VECs 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.
- Chapter 7 - Identification of environmental and socioeconomic impacts of this Environmental and Social Assessment Study.
- Significant environmental and social conditions for potentially affected communities, based on stakeholder consultations.
- Social and environmental conditions identified as relevant during the collection of baseline information for 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 were selected based on the following criteria:

- From the identification and assessment of impacts generated by the project.
- The possible cumulative effect on the VEC with other projects or activities.

Given the nature of the potential interactions, the VECs that are analyzed are as follows:

  - Environmental quality.
  - Terrestrial habitats and flora.
  - Terrestrial habitats and fauna.
  - Aquatic habitats and fauna.
  - Economy, employment, and livelihoods.
  - Quality of life, health, and safety of the community.

Table 7-6, presents a more detailed list of the VECs identified from the aforementioned information sources.

Table 7-6: Valued Environmental and Social Components

Physical Environment VECs	
Environmental Quality	Physicochemical properties of air.
	Characteristics of noise levels.
	Physicochemical characteristics and structure of soils, sensitivity to erosion, change in runoff regime.
	Physicochemical properties of surface and groundwater.
Biological Environment VECs	
Terrestrial Habitats, Vegetation and Flora	Associations of terrestrial and riparian vegetation that form natural habitats. It includes species with a particular conservation status.
Terrestrial Habitats and Fauna	Reptiles, amphibians, birds, and mammals that inhabit the project area, permanently or seasonally.

Aquatic Habitats and Fauna	It includes species of fish (*Poeceliidae* family), insects (mosquito larvae) and zooplankton.
Socio-Economic and Historical-Cultural Environment VECs	
Economy, Employment and Livelihoods	Local and regional economic development, employability of the workforce, income, and livelihoods of affected communities.
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.

7.7.6 Identification of actions, activities, projects and social and natural stress factors that affect VECs

According to the IFC Good Practice Handbook "*The purpose of this step is to identify the totality of stresses that determine the condition of VECs selected. What is important (...) is identification of the sources of stress—past developments whose impacts persist, existing developments, and foreseeable future developments, as well as any other relevant external social and/or environmental drivers.*"

The potential sources of cumulative impacts existing in the area of influence of the Storm and Sanitary Drainage of the Guajimía Canal Phase II Project were determined considering projects and/or activities (existing or planned) located in the area of analysis and with information available. To obtain the basic information for the analysis of projects and activities, the sources used were:

- Information available on local development plans of government entities related to the development of the main existing activities in the area.
- Public information available in digital media on the development of private and public projects at the local level.
- Information from the 2008 environmental impact study of the project.

The projects and activities in the area of influence likely to generate cumulative impacts with the Storm and Sanitary Drainage of the Guajimía Canal Phase II Project are the following:

- Residential activities and projects, in the sector of the Santo Domingo Oeste municipality, which is part of the project's area of influence: these activities were generally identified in the area of influence, where there is an intense presence of structures for residential use. Several (more than ten) housing projects (building complexes) are under construction in the Municipality of Santo Domingo Oeste or at the design stage and will be constructed in the upcoming years.
- These housing projects concern the neighborhoods of Altos de Arroyo Hondo, Alameda, Manoguayabo, Herrera, Engombe and Mirador del Oeste as well as areas near the Autopista Duarte highway. Additionally, we identified land for sale for future housing projects.
- Commercial and service activities in the sector of the municipality of Santo Domingo Oeste, which is part of the project's area of influence: a wide range of businesses were identified in the area of influence, some of them converging towards shopping malls specifically designed to house various types of selling items.
- Industrial activities in the surroundings of the Santo Domingo Oeste municipality, which is part of the project's area of influence: some industrial facilities were located, including textile plants, brewery, plastics manufacture, ice cream manufacture, ice manufacture, warehouse for clinical laboratories, suppliers of

construction materials, auto repair workshops, among others. Chemical and pharmaceutical industry facilities, aluminum product factories, a clothing factory, auto repair shops and tire repair shops, woodwork and printing workshops, hardware store, carwash premises and tourist cabins are present in Avenida de los Beisbolistas. The Herrera Industrial Zone is found near the watershed limit.

- Metropolitan Office of Bus Services (OMSA): its purpose is to maintain and repair the local public transport bus fleet, manage and control bus routes, plan and organize transportation services.
- Storm and Sanitary Drainage of Guajimía Canal and its Main Tributaries Phase I (in operation): this project, which is in its operational stage, constitutes a fundamental element in the adequate management of storm and sanitary waters of part of the Guajimía canal and its tributaries.
- Construction Project of the collector, pre-treatment plant and outlet with discharge to the sea (sanitary waters): this activity is planned as part of the Storm and Sanitary Drainage of Guajimía Canal and its Main Tributaries—Phase II Project (is not part of the scope of this study) and is to develop a treatment system for the sanitary waters generated by the neighborhoods that surround the Guajimía, Villa Aura, Las Caobas, Buenos Aires, El Indio and La Ureña canals (approximately 300,000 inhabitants).

The methodology proposed by the IFC considers events of natural origin or external social pressures that can alter the existing conditions in the project development area as potential sources of cumulative impacts.

Considering the information presented in the baseline of the study area, we identified natural stress events, 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 every year by tropical storms. The region has been hit by more than 40 extreme weather events in the last 168 years (NOAA's *National Hurricane Center*).

- Floods: extreme rainfall events cause the formation of maximum water flows, especially in the lower altitude sectors. The area of influence of the project is prone to flooding due to the current limitations of the stormwater management system and the obstruction of channels generated by waste of various types. Although the Storm and Sanitary Drainage of Guajimía Canal and its Main Tributaries—Phase II Project will improve these conditions, they will remain until their construction is completed.

As a social stressor (pressures or external social forces), the following was identified:

- New settlements: the illegal set up of new settlements could occur during the operational life of the project, in the free spaces within the banks of the Guajimía canal and its tributaries.

Table 7-7 presents the potential interactions of the projects or activities likely to generate cumulative impacts with the identified VECs.

Table 7-7: Potential interactions of the projects, activities, natural events and external social pressures likely to generate cumulative impacts with the identified VECs

Sources of Impact	VEC					
	Environmental quality	Terrestrial habitats, vegetation, and flora	Terrestrial habitats and fauna	Aquatic habitats and fauna	Economy, employment, and livelihoods	Quality of life, health, and safety
Residential activities and projects, in the Santo Domingo Oeste municipality, within the project's area of influence.	x	x	x	x	x	
Commercial and service activities in the Santo Domingo Oeste municipality, within the project's area of influence.	x	x	x	x	x	
Industrial activities in the Santo Domingo Oeste municipality, within the project's area of influence.	x	x	x	x	x	
Metropolitan Office of Bus Services (OMSA).	x				x	
Storm and Sanitary Drainage of Guajimía Canal and its Main Tributaries Phase I (in operation).	x	x	x	x	x	x
Construction of the collector, pre-treatment plant and outlet with discharge to the sea of the Storm and Sanitary Drainage of Guajimía Canal and its Main Tributaries—Phase II Project.	x	x	x	x	x	x
Floods	x	x	x	x	x	x
Cyclones and hurricanes	x	x	x	x	x	x
New settlements	x					

7.7.7 Current conditions of the VECs

The current conditions of the VECs selected were presented previously in this document, in the sections related to the description of the baseline information complied in the project's area of influence.

7.7.8 Cumulative impact assessment

The cumulative impacts that are likely to be generated in the VECs are described in Table 7-8 through 7-13.

7.7.8.1 *Cumulative Impacts on Environmental Quality*

Table 7-8: Description of Cumulative Impacts. VEC: Environmental Quality

Project/Activities	Cumulative impacts on the VEC: environmental quality
Residential Construction Activities and Projects	The existing residential activities have generated and are generating effects on environmental quality in various sectors of the project's area of influence, mainly due to the high density of residential buildings and poorly planned development. The alterations to the environmental quality of this activity are related to emissions of gases such as carbon monoxide, carbon dioxide and nitrogen oxide due to the presence of vehicles. In addition, residential areas generate high levels of noise as a result of vehicular traffic, the use of audio equipment, the operation of recreation centers and the occasional construction or remodeling activities of structures. The quality of the water resource has also been affected mainly by the inadequate disposal of sewage and solid waste in the canals. Due to the future construction of several residential projects (approximately more than ten) in the area of influence (planned for the next few years), we anticipate an increase in vehicle emissions and dust generation, generating greater air pollution. Noise levels and the generation of sewage and solid waste will also increase during the construction and operation stages of these projects.
Commercial and Service Activities	Like the residential construction activities mentioned above, the operation of shops also affects air quality due to the high influx of vehicles and trucks, which in turn also alter the noise levels in the area. There may be untreated wastewater discharges into water courses in some areas, as well as and inadequate disposal of hazardous and non-hazardous waste. As the area of influence is an urban area, there is a high probability that more shops and service activities will be installed in the future, which would increase the effects previously described.
Industrial Activities	Alterations to the environmental quality of industrial activities may generate gas emissions related to production processes and influx of vehicles and trucks. In addition, these activities can generate high noise levels both due to machinery operating activities, construction or occasional structure remodeling of. There may be untreated wastewater discharges into water courses in some areas, as well as and inadequate disposal of hazardous and non-hazardous waste
Metropolitan Office of Bus Services (in operation)	The presence of a day and night flow of vehicles powered by fossil fuels implies the emission of combustion gases and high noise levels on the access routes and parking areas, where buses keep their engine running.
Storm and Sanitary Drainage of Guajimía Canal and its Main Tributaries Phase I (in operation).	The operational phase of this project, due to the maintenance activities of the structures and infrastructures, generates a slight degradation of the air quality at the local level and potential emissions of greenhouse gases. These activities also generate an increase in noise levels and the risk of soil contamination. In relation to the water resource, there is a risk of contamination of stormwater drainage.
Construction Project of the collector, Pre-treatment Plant and Outlet including Discharge to the Sea (sanitary water) (planning stages)	During its construction stage, this project will require the use of heavy machinery for earthmoving and cause gas emissions, increased noise levels and affect water and soil quality.
Floods, Cyclones and Hurricanes	Flood events brought by cyclones and hurricanes, can increase water turbidity. Chemicals and wastes maybe drained into the canal waters.

Project/Activities	Cumulative impacts on the VEC: environmental quality
New Settlements	The need for housing spaces for the low-income population may generate illegal occupations at some point during the project's life cycle. If uncontrolled, these illegal settlements, could contribute to the deterioration of water and soil resources due to inadequate solid waste and wastewater management.
Project Object of this Study	**Construction Stage:** During the construction phase of the Storm and Sanitary Drainage of Guajimía Canal and its Main Tributaries—Phase II Project, environmental quality will be affected in the area of influence (see details in Chapter 7 of this document). It is anticipated that due to the impacts generated by the project during the construction stage, **there will be a cumulative effect of the alteration on environmental quality in the area of influence**. **Operation Stage:** During the operation stage, the project will generate a slight degradation of air quality at the local level and will generate potential greenhouse gas emissions during the maintenance activities of the structures, which were assessed as being of low intensity and minor importance. However, the project will improve air quality in the area of influence due to the elimination of the accumulation of garbage in the canals and the wastewater collection and transportation system that will be developed. An increase in noise levels and risk of soil contamination are also expected due to maintenance activities, however, they were assessed as being of low intensity and minor importance. There is also a risk of contamination of stormwater drainage due to maintenance activities. this risk was assessed as being of medium intensity and moderate importance. **There is a risk of contamination of rainwater drainage due to maintenance activities. Impact was assessed as being of medium intensity and of moderate importance.**

7.7.8.2 *Cumulative Impacts on Terrestrial Habitats, Vegetation and Flora*

Table 7-9: Description of Cumulative Impacts. VEC: Terrestrial Habitats, Vegetation and Flora

Project/Activities	Cumulative Impacts on the VEC: Terrestrial Habitats, Vegetation and Flora
Residential Construction Activities and Projects	Urban growth in the project's area of influence has considerably reduced the areas occupied by vegetation, since a large part of it has been cleared for the construction of houses, commercial premises, services, and industrial use. The past, current project and future developments will continue to reduce natural terrestrial habitats and flora specie densities.
Commercial and Service Activities	
Industrial Activities	
Storm and Sanitary Drainage of Guajimía Canal and its Main Tributaries Phase I (in operation).	The vegetation in parts of the banks of the Guajimía canal and its tributaries was permanently cleared for the construction of the Storm and Sanitary Drainage of Guajimía Canal and its Main Tributaries - Phase I (currently in operation).
Construction Project of the collector, pre-treatment Plant and Outlet of the Plant with Discharge to the Sea of the Storm and Sanitary Drainage of Guajimía Canal and its Main Tributaries—Phase II (planning stages)	This project will require vegetation clearance in some areas.

Project/Activities	Cumulative Impacts on the VEC: Terrestrial Habitats, Vegetation and Flora
Floods, Cyclones and Hurricanes	These climatic events, depending on their magnitude, can affect the vegetation cover and provoke defoliation or tree and shrub uprooting. .
Project Object of this Study	**Construction Stage:** During the construction phase of the Storm and Sanitary Drainage of the Guajimía Canal Phase II Project, there will be a disappearance of vegetation and loss of flora in the areas to clear, modification of the species composition in the flora communities present and risk of introduction and eventually spread of invasive species. **Operation stage:** During the operation stage maintenance activities could possibly deteriorate the green areas and gardens created and possibly bring invasive alien species (IAS). **This impact on vegetation both in the construction and operational stages will add to the one generated by the activities and projects described above, causing a cumulative impact on this VEC.**

7.7.8.3 *Cumulative Impacts on Terrestrial Habitats and Fauna*

Table 7-10: Description of Cumulative Impacts. VEC: Terrestrial Habitats and Fauna

Project/Activities	Cumulative impacts on the VEC: Terrestrial habitats and fauna
Residential Activities and Projects	Urban growth in the project's area of influence has considerably reduced the areas occupied by vegetation, since a large part of it has been cleared for the construction of houses, commercial premises, services, and industrial use. The current project and future developments will continue to reduce natural terrestrial habitats which will in turn contribute to a considerable loss of fauna species.
Commercial and Service Activities	
Industrial Activities	
Storm and Sanitary Drainage of Guajimía Canal and its Main Tributaries Phase I (in operation).	The vegetation in parts of the banks of the Guajimía canal and its tributaries was permanently cleared for the construction of the Storm and Sanitary Drainage of Guajimía Canal and its Main Tributaries - Phase I (currently in operation) causing impacts on fauna, although no high concentration exist in those areas.
Construction Project of the collector, pre-treatment Plant and Outlet of the Plant with Discharge to the Sea of the Rainwater and Sanitary Drainage of Guajimía Canal and its Main Tributaries—Phase II (planning stages)	This project will require vegetation clearance in some areas. This will impact terrestrial fauna habitat and species.
Floods, Cyclones and Hurricanes	These climatic events, depending on their magnitude, can flood and modify terrestrial habitats and its fauna, especially small mammals, by dragging or drowning.
Project Object of this Study	**Construction Stage:** During the construction phase of the Storm and Sanitary Drainage of the Guajimía Canal Phase II Project, terrestrial habitat will deteriorate in small cleared areas causing modifications in species composition, fauna displacement and reduction of densities. **Operation Stage:**

Project/Activities	Cumulative impacts on the VEC: Terrestrial habitats and fauna
	During the operation stage some modification of the terrestrial habitats and its associated fauna is expected. **With the development of the project (construction and operation) there will be an impact on the habitats and consequently on the terrestrial fauna that remains in some sections of the Guajimía canal, causing a cumulative impact.**

7.7.8.4 *Cumulative impacts on aquatic habitats and fauna*

Table 7-11: Description of cumulative impacts. VEC: Aquatic habitats and fauna

Project/Activities	Cumulative impacts on the VEC: Aquatic habitats and fauna
Residential activities and projects	The anthropic activity in the surroundings of the Guajimía canal and its tributaries has considerably affected the aquatic habitat with the high contamination of the surface waters of these canals. The high pollutant load of these waters does not create favorable conditions for the adequate development of the aquatic fauna.
Commercial activities	
Industrial activities	
Storm and Sanitary Drainage of Guajimía Canal and its Main Tributaries Phase I (in operation).	The construction of Phase I of the Storm and Sanitary Drainage of Guajimía Canal project significantly modified the aquatic habitat since water courses have been channeled.
Construction Project of the collector, pre-treatment plant and outlet with discharge to the sea of the Storm and Sanitary Drainage of Guajimía Canal and its Main Tributaries—Phase II (planning stages)	The construction activities of this project may affect nearby water bodies.
Floods, cyclones and hurricanes	Flood events occurring in the project's area of influence, may affect water quality (increased turbidity, dragging of wastes and chemical substances into water courses), adding up to the potential impacts brought by the project's construction activities. .
Project object of this study	**Construction stage:** During the construction stage of the Storm and Sanitary Drainage of the Guajimía Canal Phase II Project, there will be a disturbance of the aquatic fauna present in the canals. **Operation stage:** During the operation stage although the project will improve aquatic habitat quality in the Guajimía canal, particularly in the section from Autopista 6 de Noviembre until it flows into the Haina River, the certain modifications of the aquatic habitats and their associated fauna due to the presence, operation and maintenance of the structures may occur.

Project/Activities	Cumulative impacts on the VEC: Aquatic habitats and fauna
	If the existing activities, future projects and natural environmental factors described above coincide with the construction and operation activities of the Storm and Sanitary Drainage of the Guajimía Canal Phase II Project, there could be cumulative impacts on this VEC.

7.7.8.5 *Cumulative impacts on the economy, employment, and livelihoods*

Table 7-12: Description of cumulative impacts. VEC: Economy, employment and livelihoods

Project/Activities	Cumulative impacts on the VEC: Economy, employment and livelihoods
Residential activities and projects	Residential activities, as well as commercial, industrial and bus service activities existing in the area of influence positively contribute to the local and regional economy, generating employment and improvement for the community's livelihoods. The residential projects to be built in the area will increase benefits to the local and regional economy, create jobs, and improve the community's livelihoods.
Commercial activities	
Industrial activities	
Metropolitan Office of Bus Services	
Storm and Sanitary Drainage of Guajimía Canal and its Main Tributaries Phase I (in operation)	The maintenance activities of this project contribute to the local and regional economy, generates employment and improves the community's livelihoods.
Construction Project of the collector, pre-treatment plant and outlet with discharge to the sea of the Storm and Sanitary Drainage of Guajimía Canal and its Main Tributaries—Phase II (planning stages)	This project, during its construction and operation phases (due to maintenance work), will create employment and therefore contribute to the economic activity in the area. These benefits will be added to those generated by Phase II.
Floods, cyclones and hurricanes	These climatic events could temporarily and negatively affect local economy, since, by rendering sections of some roads and access to shops and shop structures inoperable.
Project object of this study	The project should generate positive impacts associated to job creation during construction and maintenance work in the operation phase. It will also contribute to stimulating the local economy by the purchase of the necessary goods and services required for the project. These benefits will be added to those created

7.7.8.6 *Cumulative Impacts on Life quality, Health and Safety of the Community*

Table 7-13: Description of Cumulative Impacts. VEC: Life Quality, Health and Safety of the Community

Project/Activities	Cumulative impacts on VEC: life quality, health and safety of the community
Storm and Sanitary Drainage of Guajimía Canal and its Main Tributaries Phase I (in operation).	The benefits obtained by the population as a consequence of the construction of Phase I of the project, which included the channeling of a section of the Guajimía canal and the Buenos Aires, El Indio and La Ureña tributaries and the resettlement of 1,184 families in apartment buildings, constitute a significant improvement of life quality, as well as in the health and safety conditions of the community of the Santo Domingo Oeste municipality.
Construction Project of the collector, pre-treatment plant and outlet with discharge to the sea of the Storm and Sanitary Drainage of Guajimía Canal and its Main Tributaries—Phase II (planning stages)	Once this project goes into operation, it will complement the sanitary water treatment system in the area, ensuring that the population lives in adequate health conditions which has direct impact on their life quality. However, especially during construction, this project increase traffic flow in the area, and disturb population movement and thereby increase accident risk.
Floods, cyclones and hurricanes	These climatic events may affect structures and vehicular traffic and thereby increase accident risk.
Project object of this study	Once the construction phase is complete, the threat floods, population vulnerability and water transmitted disease spread will be reduced. Solid waste management will be improved, and new recreational and sporting areas will be created. Hence, general life quality, health and safety will be improved. Families and economic units affected by the project and entitled for the Resettlement Action Plan measures, will be adequately compensated. Those entitled for resettlement in housing units will be granted apartments that will have better construction quality than the homes where they currently reside, with better access to basic drinking water and sanitation services. the other projects described above will also provide life quality health and safety improvements for the population. However, negative cumulative impacts on population safety may be perceived with the "Construction Project of the collector, pre-treatment plant and outlet with discharge to the sea with the increase in vehicular traffic and circulation disturbance, if the construction activities coincide with the construction stage or certain situations during the operational phase. Natural events (floods, cyclones, and hurricanes), may cause negative cumulative impacts on population safety if combined with the construction phase of the Storm and Sanitary Drainage of the Guajimía Canal Phase II Project.

8. ENVIRONMENTAL AND SOCIAL MANAGEMENT PROGRAM

This chapter presents a set of mitigation and management measures to be taken during the implementation of the project to avoid, reduce, mitigate, or remedy the adverse social and environmental impacts, by order of priority, and according to their timelines. This includes multiple policies, procedures, practices, management plans and other necessary actions. In addition, the chapter describes the desired outcomes as measurable events to the possible extent, such as performance indicators, targets or acceptance criteria. that can be tracked over defined periods of time periods. It also indicates the necessary resources, including budget and responsibilities that are required for the implementation phase. That being said, it is important to note that the buyer/project sponsor should identify crucial measures and actions in compliance with applicable laws and regulations in order to meet the international standards that are applied to the project. Further, the management program includes an Action Plan, which is subject to on-going reporting and updating and to community disclosure by the people affected by the project.

The Environmental and Social Management Program (ESMP) is composed of preventive, mitigation and restoration measures or compensation for the environmental and social impacts identified for the Stormwater and Sanitary Drainage of the Guajimía Canal Phase II Project.

This ESMP is integrated and aligned with the project's Environmental and Social Management Policy.

The ESMP 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 Guidelines on Environment, Health and Safety.

Table 8-1: IFC Performance Standards on Environmental and Social Sustainability

Performance Standard Number	Content
PS 1	Evaluation and management of environmental and social risks and impacts.
PS 2	Work 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	Conservation of biodiversity and sustainable management of living natural resources.
PS 7	Indigenous peoples (*).
PS 8	Cultural heritage.

Note: The PS 7 performance standard 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 ESMP are presented in Table 8-2:

Table 8-2: Program and plans that are part of the ESMP

Subsection	Program/Plan
8.1	Program of preventive, mitigation and compensation measures
8.2	Monitoring program
8.3	Resettlement Action Plan
8.4	Stakeholder engagement plan
8.5	Complaints mechanism
8.6	Environmental education plan
8.7	Health and safety management plan
8.8	Community Safety and Health Plan
8.9	Emergency preparedness and response plan
8.10	Decommissioning plan

These ESMP programs or plans are divided into several subprograms. Each subprogram includes the following:

- Impacts addressed by the subprogram
- Objective.
- Measures to be implemented.
- Performance indicators.
- Goals.
- Stakeholders responsible for the execution of tasks.
- Supervisor(s).
- Place of implementation of the measures.
- Frequency of follow-up.
- Deployment time.
- Associated costs.

The specific and/or detailed targets for the established indicators will be established during the planning of the project activities and may be modified as the construction and operation stages of the project progress.

The subprograms of the Monitoring Plan include the following:

- Impacts addressed by the subprogram objective.
- Measures to be implemented.
- Indicators or parameters to be measured goals.
- Important stakeholders for the execution of tasks.
- Supervisor(s).
- Methodology and technology used.
- Monitoring sites
- Monitoring frequency.
- Deployment time.
- Associated costs.

The Settlement Management Plan contemplates:

- Brief description of the process.

The Stakeholder Engagement Plan includes the following:

- Objectives.
- Stakeholder participation program.
- Resources and responsibilities.
- Implementation costs.

The Complaints Mechanism includes:

- Personalized mediation.
- Courts of law.

The Environmental Education Plan includes:

- Existing programs, strategies, policies and guidelines.
- Types of training required.
- Development of the training package.
- Appropriate instructional methods.
- Training records.
- Evaluation of the effectiveness of training.

The Health and Safety Management Plan includes:

- Objectives.
- Legislation and procedures.

- Health and safety management policy.
- Responsibilities.
- Monitoring and supervision.
- Health and safety education plan.
- Risk prevention and protection plan.

The Safety and Health Plan for the community contemplates:

- Objectives.
- methodology.
- Safety and health management policy for the community.
- Responsibilities.
- Monitoring and supervision.
- Health and safety education plan for the community.
- Plan of prevention and protection of risks for the community.

The Emergency Preparedness and Response Plan includes:

- Main objectives of the emergency preparedness and response plan.
- Emergency preparedness and response plan strategy.
- General measures of the emergency preparedness and response plan.
- Measures for action in the face of accidents.
- Measures for natural disasters.
- Measures for technological disasters.

The Decommissioning Plan includes:

- Summary of the content.
- Decommissioning activities.

Environmental and social policy

The environmental and social policy of the Stormwater and Sanitary Drainage of the Guajimía Canal Phase II Project, is described below:

- Systematic compliance with the environmental legislation enforced by the Dominican Republic and by the international environmental agreements and conventions to which the country is a signatory.
- Rational and sustainable use of natural resources.
- Minimize the environmental impacts and risks for the population and workers caused by the development of the project through the application of the Environmental and Social Management Program (ESMP).
- Development of actions regarding education, dissemination and environmental information for the workers of the project and the surrounding community.
- Establish mutual commitments with the community, related to the minimization of the effects on the environment.
- Implementation of measures to promote sustainable development and adaptation to climate change.
- Ensure that the different contracting companies participating in the project comply with Dominican environmental and labor legislation as well as the project's ESMS.
- Continuous evaluation of the ESMP in order to identify environmental impacts or risks not previously identified and apply measures for their mitigation or correction.

Organizational and competence capacity

The organizational chart of the Stormwater and Sanitary Drainage of the Guajimia Canal Phase II Project is presented in Figure 8-1.

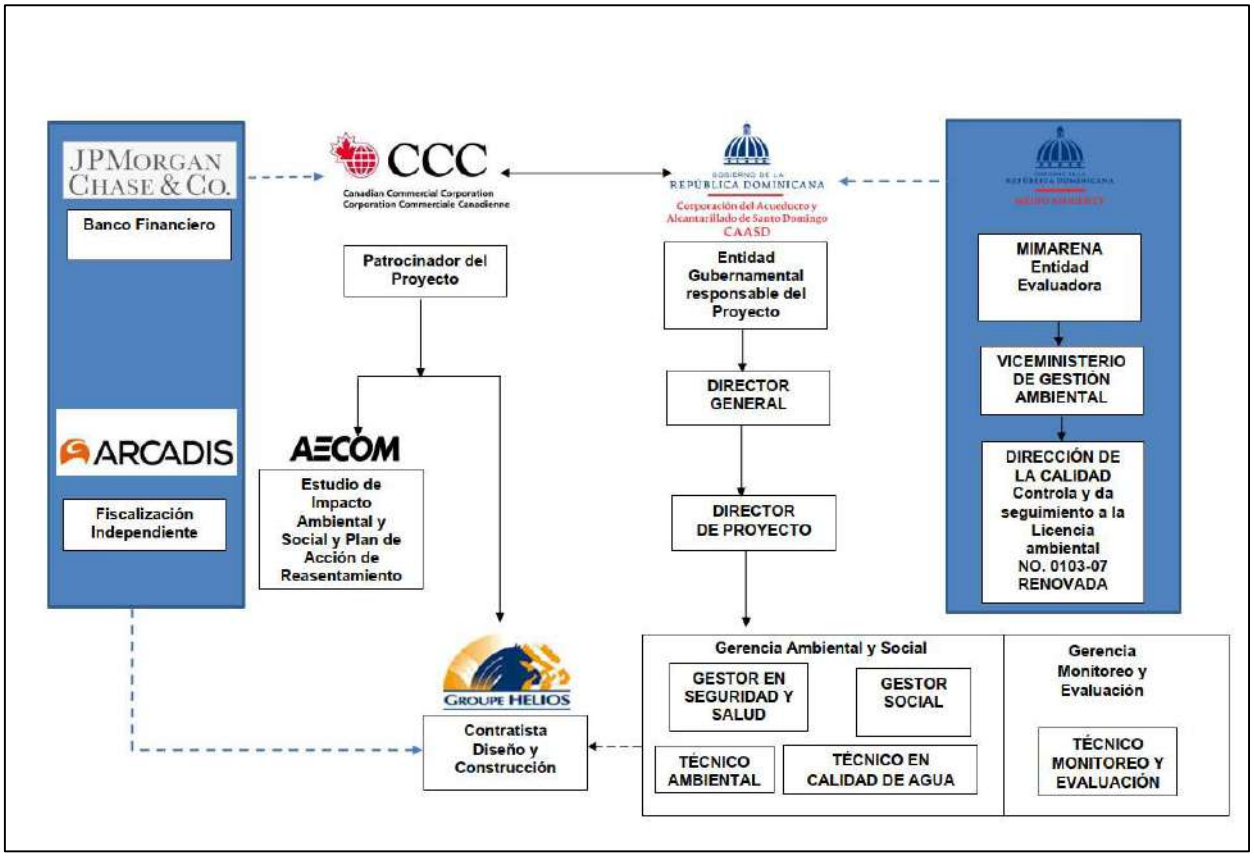


Figure 8-1: Organizational chart of the Stormwater and Sanitary Drainage of the Guajimía Canal Phase II Project.

Responsibilities

Responsible for the compliance with the Environmental Policy and the Environmental and Social Management Program (ESMS), during the construction and operation phase of the project, is the Director of Stormwater and Sanitary Drainage of the Guajimía Canal Phase II Project of the Corporation of Aqueducts and Sewers (CAASD).

The Project Director will have the support of the Environmental and Social Management and the Monitoring and Evaluation Management of the CAASD (see Figure 8-1) who will be responsible for supervising the compliance with the measures of the program of preventive measures, mitigation and compensation in the construction and operation phases and the execution of the activities of the monitoring plan in both phases.

During the construction phase of the work, the CAASD will ensure that the main contractor (Helios Group) and the sub-contractor companies execute the corresponding measures within the ESDP. For these purposes, clauses relating to the obligation to comply with the ESMP will be established in the contracts with these companies, establishing possible sanctions for non-compliance.

Costs

The costs of execution of the program of preventive measures, mitigation and compensation in the construction phase are included in the working budget, so they will be borne by the contracting companies.

The costs of implementing the program of preventive measures, mitigation and compensation in the operation phase are included in the operating expenses of the work and will be covered by the CAASD.

The costs of the monitoring plan will be covered by the CAASD in both the construction and operation phase. This monitoring cost amounts to **USD$ 78,040.00** per year in the construction phase and **USD$ 63,800** per year in the operation phase (the reference date being July 2021).

8.1 Program of preventive measures, mitigation and compensation

This section presents the management measures that will allow to avoid, mitigate or compensate for the negative impacts that were identified in Chapter 7. Management measures to enhance the effects of positive impacts are also included.

The ESMP will apply to the entire organization, including the main contractors and suppliers over which the organization has control or influence, or to specific locations, facilities or activities.

The hierarchy of measures to address the identified risks and impacts will give priority to the prevention of impacts over measures to minimize them. When residual impacts persist, measures will be included to restore or compensate them, provided that it is technically and financially feasible. The hierarchy of measures is as follows:

1) Prevention measures
2) Minimization measures
3) Restoration or compensation measures
4) Mitigation and performance measures

8.1.1 Program of preventive measures, mitigation and compensation for the construction phase

Below are the preventive, mitigation and compensation measures organized by sub-programs to be implemented during the pre-construction and construction phases of the project. A summary table of these measures is presented in Annex 11.1 (Matrix 11-1).

8.1.1.1 *Sub-program of measures for the protection of air quality and noise pollution*

Impacts to which the subprogram is directed:

- Temporary deterioration of air quality.
- Contribution to climate change by the emission of greenhouse gases.
- Increased noise levels at the local level.
- Displacement and reduction of fauna, caused by dust and noise caused by construction activities, mainly by personnel, equipment and machinery.
- Increased stress of the population due to noise, dust and air pollution and the unforeseen events generated by works of this magnitude in their environment.

Objective:

Avoid or mitigate the impacts that may be caused by the actions of the construction phase of the project, on the quality of the air and the noise level at the local scale .

Measures to be implemented:

- Wetting of non-stabilized materials and exposed soils if dust generation is visible.
- Storage of aggregates in piles and covered with tarpaulins.
- Cover the cargo of aggregates, waste and debris transported in trucks.

- Keep equipment and machinery in good working order, including brakes, silencers and catalysts.
- Electricity generators, vehicles and machinery must be switched off when not in use.
- Restriction of the speed of equipment and vehicles to 25 km/h on unpaved roads.
- Establishment of daytime hours (7:00 am to 6:00 pm) for the execution of construction activities.
- Use existing quarries or loan banks.
- Minimize the amount of loan material.
- Construction of the works of the project by sections.
- Installation of the drinking water pipes and the storm and sanitary sewerage pipes parallel to the canal riverbed.

Performance indicators:

- Noise levels in db (A)
- Concentration of particles suspended in the air (Total suspended particles (PST), particles fraction PM-10 and Particles fraction PM-2.5 in µg/Nm^3)
- Amount of irrigations performed per month.
- Percentage of equipment and vehicles with up-to-date maintenance.
- Number of quarries or loan banks used.
- Number of sections under construction.

Goals:

- Noise levels below the maximum limits established by the Environmental Standard for Noise Protection (NA-RU-001-03).
- Concentration of particles suspended in 24 hours below the maximum limits established by the Environmental Technical Regulation on Air Quality.
- Specific goals will be set during the planning of the project's construction activities.

Responsible for execution: Contractors.

Supervisor: Environmental Technician of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: In the canals where the work will take place (Guajimía, Villa Aura, Las Caobas and non-intervention sections of the canals of Buenos Aires, El Indio and La Ureña), lots where the residential units will be built, temporary facilities of the work, quarries or benches where the materials will be extracted and in the access roads.

Frequency of follow-up: Semi-annual.

Implementation time: The measures of this subprogram will be implemented throughout the construction phase.

Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.1.1.2 *Subprogram on measures for soil protection*

Impacts to which the subprogram is directed:

- Soil erosion at the edges of the canals by reprofiling actions.
- Soil compaction.
- Soil contamination on the banks of the canals.

Objective:

Avoid or reduce the effects that the actions of these phases of pre-construction and construction of the project may cause on the soil element.

Measures to be implemented:

- Re-profiling of slopes with the appropriate slope according to the design.
- Coating of the slopes of the section of the canal where the re-profiling will be carried out (by means of the sowing of stabilizing plants of the soil) to control the erosion in the times established according to the schedule.
- Strictly restrict transportation to identified access roads.
- Avoid enabling access roads in areas with steep slopes.
- Avoid construction activities in areas where soils are highly saturated.
- Keep equipment and machinery in good working order, including brakes, silencers, and catalysts.
- Development and implementation of an appropriate strategy for the management of hazardous and non-hazardous solid waste (see subsection 8.1.1.3).
- Development and implementation of the Emergency Preparedness and Response Plan, which includes measures for prevention and action against hydrocarbon leaks.

Performance indicators:

- Percentage of area of slopes with coating.
- Percentage of equipment and vehicles with up-to-date maintenance.
- Volume (m^3) of solid waste in soils at non-established sites.
- Area of soils contaminated by oil spills.

Goals:

- All areas (100%) of the slopes with coating at the end of the work.
- All (100%) equipment and vehicles with up-to-date maintenance
- Absence of solid waste on soils at non-established sites.
- Absence of soil area contaminated by oil spills.
- All (100%) the events of oil spills on the site collected.

Responsible for execution: Contractors.

Supervisor: Environmental Technician of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: Edges of the canals where the works will take place (Guajimía, Villa Aura, Las Mahogany and non-intervening sections of the canals of Buenos Aires, El Indio and La Ureña), lots where the residential units will be built, temporary facilities of the work, access roads.

Frequency of follow-up: Semi-annual.

Implementation time: The measures of this subprogram will be implemented throughout the construction phase.

Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.1.1.3 *Subprogram on Solid Waste Management Measures*

During the construction phase of the Stormwater and Sanitary Drainage of the Guajimía Canal Phase II Project , non-hazardous and hazardous waste will be generated. Non-hazardous waste includes household waste generated by the workers of the construction site, waste resulting from the cleaning of the canals, waste from clearing and excavations, debris from demolitions and construction activities, among others. Hazardous waste can include welding butts, paint packaging and solvents, among others. The amount to be generated from this type of waste will be very low, considering the type of materials to be handled on site.

Impacts to which the subprogram is aimed:

- Soil contamination on the banks of the canals.
- Modification of the quality of surface water in the canals.
- Disturbance of the aquatic fauna present in the canals.
- Temporary degradation of the landscape on the site.

Objective:

Avoid negative impacts on the environment (soils, water quality, aquatic fauna, landscape, among others), which could cause inadequate management of hazardous and non-hazardous solid waste during the construction phase of the work through the development and application of an adequate strategy for the management of hazardous and non-hazardous solid waste.

Measures to be implemented:

- Spaces for the storage of solid waste with several compartments, intended for non-hazardous, recyclable and hazardous waste, will be enabled in the temporary facilities of the work.

The management that will be given to each type of waste in the work is described below.

Household waste:

- The generation of household solid waste will be reduced as far as possible (e.g. by using reusable utensils and packaging for food supply and measures rather than disposable, by not printing documents unnecessarily or by using both sides of the sheets of paper in the offices of the construction site).
- Options for the reuse of household waste on site will be evaluated.
- Trash cans or tanks of 55 gallons with plastic covers will be placed in the different points in the temporary facilities of the work for the collection of domestic solid waste (offices, bathrooms, employee canteens).
- Differentiated and identified trash cans or tanks will be placed for the collection of recyclable or reusable household waste in the places where these are generated (for example, papers in the offices).
- Household waste will be collected periodically from the trash cans or tanks and transferred to the corresponding compartment in the solid waste storage area.
- The non-recyclable and reusable domestic waste will be removed daily in trucks of the City Council of the Municipality of Santo Domingo Oeste, for transfer to the Duquesa landfill.
- Recyclable waste that cannot be reused on site will be sold to a manager who is authorized by the Ministry of Environment and Natural Resources, with a frequency of withdrawal that will vary depending on the volume generated.
- A monitoring record shall be maintained of the volume of each type of household waste generated and the frequency of removal.
- Targets will be set to reduce waste generation or increase the percentage of recycled waste.

Waste resulting from the Cleaning of the Canals:

- The waste resulting from the work of cleaning the canals will be stacked in an area previously defined and delimited by ribbons and stakes, where they do not interfere with the work of the work, do not cause prejudice to third parties, cannot be dragged by rain or wind, nor can hinder the normal runoff of surface water.
- The debris will be left stacked in the designated area so that it drains until it is dry.
- The waste will be transported in trucks owned by the contractor of the project to the Duquesa landfill.
- Lorries used to transport waste must be covered with tarpaulins to prevent their dispersion along the way.

Materials resulting from Clearing:

- The materials resulting from the clearing will be stacked in an area previously defined and delimited by tapes and stakes, where they do not interfere with the work of the work, do not cause harm to third parties, cannot be dragged by rain or wind, or can hinder the normal runoff of surface water.
- The topsoil or biomass may be separated from the soil material.

- The land can be stored for later use in gardening in the urban amenities of the project. The batteries should be covered with tarpaulins to prevent their dispersion.
- The topsoil will be moved to trucks owned by the contractor of the project to the Duquesa landfill.
- The frequency of withdrawal will be defined based on the volumes generated.
- A record shall be maintained to monitor the volume of waste resulting from the removal and the frequency of removal.

Excavation material:

- The excavation materials generated in the construction will be stacked in an area previously defined for these purposes and delimited by ribbons and stakes, where they do not interfere with the work of the work, do not cause harm to third parties, cannot be dragged by rain or wind, or can hinder the normal runoff of surface water.
- They must be covered with tarpaulins held by weights to avoid dispersion by the effect of the wind.
- They may subsequently be used for fillings within the same work if the characteristics of the materials allow it.
- The unusable excavation materials will be transported in trucks owned by the contractor of the project to the Duquesa landfill.
- The frequency of withdrawal will be defined based on the volumes generated.

Rubble:

- The debris generated as a result of the demolition and construction of the works will be stacked in an area previously defined for these purposes and delimited by ribbons and stakes, where they do not interfere with the work of the work, do not cause harm to third parties, cannot be dragged by rain or wind, or can hinder the normal runoff of surface water. They may also be placed in special containers for this type of waste. The debris must be stored separately from the rest of the waste.
- Materials that can be reused or recycled such as wood, metal elements, cardboard, among others, will be separated manually.
- Reusable or recyclable materials will be stored in the corresponding compartments in the solid waste storage area in the temporary facilities of the work.
- The unusable materials will be transferred in trucks owned by the contractor of the project to the Duquesa landfill where the Administrative Commission of this landfill and the City of Santo Domingo Norte enabled an area for the deposit of this type of waste (https://www.diariolibre.com/actualidad/ciudad/crean-espacio-en-duquesa-para-residuos-de-construccion-EA27051702). Lorries must be adequately covered with tarpaulins to avoid dispersion along the way.
- The frequency of withdrawal will be defined based on the volumes generated.
- Trucks transporting debris must have the transport stubs and material canisters issued by the Vice-Ministry of Soils and Water.
- A control record shall be maintained of the volume of debris generated removed and the frequency of removal.

Management of Hazardous Solid Waste:

Hazardous waste will be generated mainly as a result of the construction activities of the new apartment buildings. For the management of hazardous solid waste during the construction of the project, the following procedure will be carried out:

1) A container-van will be installed that will be located in the temporary facilities of the work on the site where the residential units will be built, in which the hazardous waste will be deposited.

   The container will be located more than 100 m from the canals and will be organized inside according to the types of hazardous waste that will be generated in the construction phase of the project. It must have adequate ventilation either natural or forced and be identified with the corresponding safety signage.

2) The generation of hazardous waste on the site will be avoided or reduced to the minimum possible.

3) Deposit each type of waste in independent containers which will be labeled in a clear, legible and indelible way. These containers shall be stored in the compartment intended for hazardous waste in a container-van, considering the characteristics of the materials to be stored (which are not incompatible).

4) Hazardous waste may not be stored for more than six (6) months.
5) The removal of the hazardous solid waste generated in the project will be carried out by a company accredited by the Ministry of Environment and Natural Resources that will be responsible for its final disposal.
6) A control record of the volume of each type of hazardous waste generated removed and the frequency of removal will be maintained.

The management of the different types of hazardous solid waste will be as follows:

Packaging of Paints and Solvents:

- A space in the container-van will be allocated and marked.
- Containers shall be placed for temporary storage.
- Paint and solvent containers can be used before disposal for mixing or other operations.
- The paint on the containers must be dry, before disposal.
- Use the leftover paint in small amounts to apply a layer of a similar color.
- Use the same solvent for cleaning and for formulation.
- Reuse solvent that is not completely depleted; let it decant for a few hours in such a way that dirt is deposited on the bottom and use the supernatant for the cleaning of brushes and surfaces that do not need a virgin solvent.
- Clean brushes after use and surfaces immediately staining paint, to save significant amounts of solvents.
- Before opening another container of paint or diluent make sure that the paint in the container that is in use is exhausted.
- Do not mix paint and solvent containers or used brushes with other hazardous waste.
- Do not mix paint and solvent containers or used brushes with non-hazardous waste.

Welding Butts:

- A space in the container-van will be allocated and marked.
- They will be stored and when you have a considerable amount they will be put together in a container and a concrete emptying will be done so that they are inside.

Performance indicators:

- Volume (m^3) of non-hazardous waste generated
- Percentage of recycled waste
- Frequency of removal of waste
- Volume (m^3) of hazardous waste generated and percentage withdrawn per manager accredited by the Ministry of the Environment and Natural Resources, frequency of withdrawal.
- Volume (m^3) of solid waste in soils.
- Volume (m^3) of solid waste in the canals.

Goals:

- Reduction of 5% of the volume of waste generated.
- Minimum frequency of removal of household waste on a daily basis.
- Minimum frequency of removal of hazardous waste every six months.
- 25% of recycled non-hazardous waste.
- 100% of hazardous waste removed by accredited managers.
- Absence of solid waste in soils.
- Absence of solid waste in the canals.

Responsible for execution: Contractors.

Supervisor: Environmental Technician of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: In the canals where the works will take place (Guajimía, Villa Aura, Las Caobas and non-intervening sections of the canals of Buenos Aires, El Indio and La Ureña), lots where the residential units and temporary facilities of the work will be built.

Frequency of follow-up: Monthly.

Implementation time: Phase prior to construction and throughout the construction phase.

Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.1.1.4 *Subprogram on Measures for the Protection of Water Resources*

Impacts to which the subprogram is aimed:

- Modification of the quality of surface water in the intervened canals.
- Modification of the parameters of the storm drainage of the canals in the process of intervention.

Objectives: To avoid or reduce the effects on water quality that may have the actions of these phases of pre-construction and construction of the project.

Measures to be implemented:

- Limit the number of access roads over the canals.
- Establish and implement strict procedures for water works.
- Development and implementation of an appropriate strategy for the management of hazardous and non-hazardous waste (see subsection 8.1. 1.3).
- Store hazardous materials more than 100 m from the canals.
- Do not refuel or repair equipment in the project area.
- Development and implementation of an Emergency Preparedness and Response Plan, which includes measures to prevent and respond to fuel and lubricant leaks.
- Placement of portable toilets for the use of construction workers.
- Construction of the works of the project by sections.
- Remove waste from canals that hinder normal runoff from surface water.
- Avoid undertaking work in areas subject to floods or floods.
- Carry out regular maintenance of the tracks and work areas in order to avoid the formation of grooves, parapets and mounds that would hinder natural runoff.
- Orient rainwater and drainage so that it passes around work sites.
- At the end of the work remove any temporary installation which has served to divert water or cross watercourses.
- Comply with the design parameters of the project, in terms of the construction of the storm drainage of the canals.

Performance indicators:

- Water quality parameters of the canals (see Table 8-5 in the monitoring program).
- Number of access roads built over the canals.
- Volume (m^3) of solid waste in the canals.

Goals:

- Water quality parameters that comply with the standards established by the Environmental Standard on Surface and Coastal Water Quality.
- Maximum planned number of access roads built over the canals.
- Absence of solid waste in the canals.

Responsible for execution: Contractors.

Supervisor: Water Quality Technician of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: In the canals where the work will take place (Guajimía, Villa Aura, Las Caobas and non-intervening sections of the canals of Buenos Aires, El Indio and La Ureña)

Frequency of follow-up: Semi-annual.

Implementation time: Phase prior to construction and throughout the construction phase.

Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.1.1.5 *Subprogram on Vegetation Protection Measures*

Impacts to which the subprogram is directed:

- Disappearance of vegetation and loss of flora in the areas where clearings will be carried out.
- Modification of the composition of species in the flora communities present in the project area.
- Introduction of invasive species and risk of spread.

Objective:

Minimize the negative impacts on vegetation because of the constructive actions of the project and improve the conditions of the existing secondary forest south of the 6 de Noviembre Highway.

Measures to be implemented:

- Restrict clearing to strictly necessary areas.
- Delimit all specimens of flora belonging to protected or threatened species, to keep them in their places or replant them if it is not possible.
- The protected or threatened species found in the project area that are included in the International Convention on Trafficking in and Trade in Endangered Species (CITES) or the National Red List are as follows: Mamón, Annona reticulata (EN); royal palm, Roystonea borinquena (VU); Corozo, Mahogany, Swietenia mahagoni (VU); Palm cana, Sabal domingensis (VU); Gri gri, Bucida buceras (VU); Jagua, Genipa americana (EN); Caimito, Chrysophyllum cainito (EN); Olivo, Simarouba berteroana (VU); Ceiba, Ceiba pentandra (EN); Cedar, Cedrela odorata (EN).
- Creation of green areas as part of the urban finishing works of the project.
- Planting of native and endemic species in the green areas created.
- Establish biological corridors in the canals that are tubed that connect the west zone (closest to the Green Belt) with the most urbanized areas.
- Improve the conditions of the existing secondary forest south of the 6 de Noviembre Highway by planting native and endemic species.

Performance indicators:

- Number of plants of protected or threatened species conserved or transplanted.
- Number of individuals sown.
- Number of species sown.
- Number of sown individuals belonging to native or endemic species.

Goals:

- Planned number of plants of protected or threatened species to conserve or transplant.
- Planned number of individuals to plant.
- Planned number of species to plant.

- At least ten (10) native and/or endemic species planted and growing in the green areas created and in the secondary forest south of highway 6 de Noviembre.

Responsible for execution: Contractors.

Supervisor: Environmental Technician of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: Surroundings of the canals where the work will take place (Guajimía, Villa Aura, Las Mahogany and non-intervening sections of the canals of Buenos Aires, El Indio and La Ureña),existing secondary forest south of the 6 de Noviembre Highway, green areas that are part of the urban amenities of the project.

Frequency of follow-up: Semi-annual.

Implementation time: During the entire construction phase.

Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.1.1.6 *Subprogram on Measures for the Protection of Terrestrial and Aquatic Fauna*

Impacts to which the subprogram is aimed:

- Fragmentation and degradation of the terrestrial habitat in the small areas where clearing will take place.
- Displacement and reduction of fauna, caused by dust and noise through construction activities, mainly by personnel, equipment and machinery.
- Modification of the species composition in the fauna communities present in the project area.
- Disturbance of the aquatic fauna present in the canals.

Objectives:

Protect terrestrial and aquatic fauna during the construction phase of the work.

Measures to be implemented:

The measures to be implemented for the protection of fauna are as follows:

For terrestrial fauna:

- Prior to construction, an exploration of the lagoon area should be carried out to detect the presence of specimens of Trachemys stejnegeri or Jicotea, which, being slow-moving reptiles, are easy to capture. The captured specimens must be transferred to the areas of abundant vegetation of the Guajimía canal, which are located in the existing secondary forest south of the 6 de Noviembre Highway. If specimens of fauna are detected during the construction actions, the workers must have specifications for the management and transfer of this and other species.
- Strictly prohibit hunting or harassment of any species or damage to nests and eggs.
- Limit the access of workers and vehicles only to the construction areas or activities or facilities related to the project. Actions that cause impacts on adjoining land outside the established construction limits will be avoided.
- Comply with the subprograms on measures for the protection of air quality and the sound environment (see subsection 8.1.1.1).

For aquatic fauna:

- Limit the number of access roads over the canals.
- Establish and implement strict procedures for water works.
- Development and implementation of an appropriate strategy for the management of hazardous and non-hazardous waste.
- Construction of the works of the project by sections.

For Terrestrial and Aquatic Fauna:

- Instruct construction workers on the importance of wildlife protection measures.
- Develop teaching materials about the importance of terrestrial and aquatic fauna, protected and threatened species and the role of the Green Belt of the city of Santo Domingo that can serve as a basis for training with construction staff and the community.
- To provide training workshops to the construction site staff and to the communities surrounding the communities in the project's area of direct influence.

Performance indicators:

- Number of specimens of fauna transferred.
- Number of teaching materials developed.
- Number of training workshops held.
- Number of trained construction workers.
- Number of community members trained.

Goals:

- Number of specimens of fauna found.
- Programmed number of teaching materials to be developed.
- Scheduled number of training workshops to deliver.
- All workers trained in measures for the protection of terrestrial and aquatic fauna.
- Scheduled number of community members to train in measures for the protection of terrestrial and aquatic fauna.

Responsible for execution: Contractors.

Supervisor: Environmental Technician of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: Throughout the project area, especially in the area of the Guajimía canal in the section between Autopista 6 de Noviembre and its mouth in the Haina River.

Frequency of follow-up: Semi-annual.

Implementation time: During the entire construction phase.

Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.1.1.7 *Subprogram on Social Management Measures*

Impacts to which the subprogram is directed:

- Affectation of land properties.
- Nonconformities of the population that will be resettled.
- Destruction of homes and other buildings located on the banks of the canals that will be intervened.
- Damage to existing infrastructure (roads, drinking water supply, sewage collection, among others).
- Increased traffic and traffic disruption.
- Disruption of commercial and service activity.
- Risk of interruption of the subsistence activities of the inhabitants in the area of influence of the project.
- Modification of life habits.
- Generation of conflicts related to compensation to tenants, homeowners, shops, workshops, among others.
- Generation of tensions due to problems in the interaction of the communities with the workers of the work.
- Generation of tensions in the neighborhoods of the area of influence of the project due to the low or low award of jobs and service contracts to residents, workers and professionals of these neighborhoods.
- Marginalization of women in the process of compensation to tenants and owners of homes, shops, workshops, among others.

- Possible interruption of subsistence activities in the project's area of influence.
- Increased marginalization and risk levels of vulnerable groups.
- Creation of temporary jobs.
- Stimulation of the local economy through the purchase of local goods and services.

Objectives:

Avoid conflicts in the population of the communities of the area of direct influence of the project derived from the resettlement process, minimize the inconvenience and affectations in these communities as a result of the constructive actions of the project and transport of materials and maximize the positive effects of the project for the local population through the creation of temporary jobs and the demand for goods and services for the construction of the work.

Measures to be implemented:

- Construction of housing solutions for the entire affected population.
- Location of housing solutions (apartment buildings) for the affected population in an area of the city close to where they currently reside.
- Limit the number of homes to be resettled to those located in the intervention area of the canals.
- Implementation of resettlement action plan (PAR).
- Involve community leaders in the resettlement process.
- Involve women community leaders in the resettlement process.
- Communicate with communities effectively.
- Financially compensate the business owners affected by the construction of the works.
- Construction of drinking water line and storm sewerage and sanitary parallel to the channel of the canal.
- Plan construction activities in collaboration with local authorities to minimize damage to existing infrastructure.
- Rehabilitate damaged infrastructure after construction.
- Strictly restrict transportation to identified access roads.
- The transport of building materials and debris should be done at low-traffic times.
- Notify residents and business owners in the vicinity of the canals about the construction schedule of the works.
- Compliance with the construction schedule of the work.
- Implement a complaint and claims reporting mechanism that is accessible to the local population.
- Implement human resources policies that favor the hiring of local labor.
- Encourage the hiring of working women.
- Implement training subprograms to develop local capacity.
- Disclose information about newly created business opportunities.

Performance indicators:

- Number of owners or tenants whose home was destroyed by the construction of the work.
- Number of resettled landlords or tenants.
- Percentage of owners or tenants of affected homes compensated.
- Number of business owners whose premises were destroyed.
- Number of financially compensated business owners.
- Percentage of financially compensated business owners.
- Number of complaints received from community members.
- Number of complaints investigated and answered to community members.
- Number of workers hired for the construction of the project.
- Percentage of contract workers belonging to the communities in the project's area of influence.
- Percentage of contract workers who are women.
- Number of training activities provided to develop local capacity.
- Number of contracts with local commercial establishments for the supply of products and services to the project.
-

Goals:

- 100% of the owners or tenants of homes that were affected compensated.
- 100% of the business owners who were affected compensated.
- 100% of the complaints received answered in no more than 45 days.
- Planned number of workers to hire for the construction stage of the project.
- Planned percentage of workers to hire belonging to the communities in the area of influence of the project.

Responsible for execution: Contractors and Environmental and Social Management of the CAASD.

Supervisor: Social Manager of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: Sectors of the area of influence of the project.

Frequency of follow-up: Semi-annual.

Implementation time: Pre-construction phase and throughout the construction phase.

Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.1.1.8 *Subprogram on Safety and Health*

Impacts to which the subprogram is aimed:

- Risk of accidents and physical injuries involving local workers and residents.
- Risk of traffic accidents involving local workers and residents.
- Increased stress of the population due to noise, dust and air pollution and the unforeseen events generated by works of this magnitude in their environment.

Objectives:

Reduce the risks of accidents and injuries for construction workers and the population of the communities in the area of direct influence of the project due to the construction activities of the project and the transport of materials and debris, as well as avoid health effects and inconvenience to the population of these communities due to exposure to noise , dust and unforeseen situations.

Measures to be implemented:

- Develop and implement the safety, health and hygiene plan.
- Creation of the safety and health committee and the emergency brigades.
- Require Contractors to provide safety and health training to workers that includes at least the following topics:
  - Prevention and action against accidents.
  - first aid.
  - Management of hazardous substances and waste.
  - Use of personal protective equipment.
  - Defensive handling and safe operation of heavy equipment.
  - Action in emergencies (hurricanes, floods, earthquakes, fires, among others).
- Delimit the construction areas of the project, especially where excavation work is being carried out.
- Signpost construction areas with signs and fences where necessary.
- Construction of the works of the project by sections.
- Keep equipment and machinery in good working order, including brakes, silencers and catalysts.

- Develop and implement the emergency preparedness and response plan that includes prevention and action measures for: Hurricanes, floods, earthquakes, fires, fuel spills and lubricants.
- Restriction of the speed of equipment and vehicles to 20 km/h in populated areas.
- Placement of temporary traffic signs during the works.
- Have traffic controllers on the access roads to the project to direct the activities of entry and exit of trucks, heavy equipment and vehicles.
- Notify residents and business owners in the vicinity of the canals about the construction schedule of the works.
- Supply of personal protective equipment to workers on the site.
- Compliance with the construction schedule of the work.
- Implement a complaint and claims reporting mechanism accessible to the local population.
- Comply with the subprogram on measures for the protection of air quality and the sound environment (see subsection 8.1.1.1).

Performance indicators:

- Number of workers injured.
- Number of local residents injured.
- Number of traffic accidents involving equipment and vehicles on site during the execution of their work.
- Number of health and safety complaints received from community members.
- Number of health and safety complaints investigated and answered to community complaints.

Goals:

- No occurrence of disabling accidents for workers.
- No occurrence of disabling accidents for community members.
- No occurrence of disabling traffic accidents involving equipment and vehicles on site.
- Maximum planned number of health and safety complaints received from community members.
- 100% of the complaints received answered in no more than 45 days.

Responsible for execution: Contractors and Environmental and Social Management of the CAASD.

Supervisor: Safety and Health Manager of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: In the canals where the work will take place (Guajimía, Villa Aura, Las Caobas and non-intervening sections of the canals of Buenos Aires, El Indio and La Ureña), lots where the residential units will be built, temporary facilities of the work, access roads, sectors of the area of direct influence of the project.

Frequency of follow-up: Semi-annual.
Implementation time: Phase prior to construction and throughout the construction phase.

Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.1.1.9 *Subprogram on Archaeological Heritage Management Measures*

Impacts to which the subprogram is aimed:

- Possible alteration or destruction of sites with cultural value and/or archaeological objects.

Objectives:

Avoid the destruction of sites with cultural value and/or archaeological objects as a result of the construction of the project works.

Measures to be implemented:

- Communicate and train the workers in charge of carrying out the earthworks on the elements that can be indicators of the existence of archaeological sites. This communication and training should include the following:
  - Inform the workers who will perform the filling, leveling and compaction in the construction stage of the project of the possibility of finding evidence of the presence of an archaeological site.
  - Show photograph of the artifacts they could find.
  - Give a simple description of the characteristics of the artifacts.
  - Cordon off the area with visible signs and put up signs prohibiting access.
  - Notify the Museum of the Dominican Man to check if it is an archaeological site or not.
  - Do not begin the work until the Museum of the Dominican Man has carried out the rescue or has indicated that the work can continue, because there is no evidence of the existence of an archaeological site.
  - Make a borehole.
  - Take the coordinates of the site.
  - Deposit the material in plastic bags.
  - Label the bags with the coordinates of the site, level of excavation, stratum, and case observations.

Performance indicators:

- Number of archaeological sites or objects found.
- Number of archaeological objects (ceramics, remains of bones and remains of plants) rescued.

Goals:

- 100% of the archaeological sites found preserved.
- 100% of the archaeological objects found rescued.

Responsible for execution: Contractors.

Supervisor: Social Manager of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: All areas of the project, especially in the Guajimía Canal from November 6 to the mouth of the Haina River.

Frequency of follow-up: Semi-annual.

Implementation time: Throughout the construction phase.
Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.1.1.10 *Subprogram on Measures for the Protection of the Landscape*

Impacts to which the subprogram is aimed:

- Temporary degradation of the landscape on the site.

Objectives:

Reduce the impacts on the landscape during the construction phase of the work.

Measures to be implemented:

- Restrict clearing to strictly necessary areas.
- Creation of green areas as part of the urban finishing works of the project.

- Restore the areas occupied by the temporary facilities as soon as possible.
- Development and implementation of an appropriate strategy for the management of hazardous and non-hazardous waste (see subsection 8.1. 1.3).
- Storage of building materials in existing CAASD warehouse, outside the project area.
- Construction of the works of the project by sections.

Performance indicators:

- Total number of individuals sown.
- Volume (m^3) of solid waste generated by the project activities in the soils and canals.
- Areas (m^2) occupied by the restored temporary facilities.

Goals:

- Planned minimum total number of plant individuals to plant.
- Absence of solid waste in soils and canals.
- All (100%) the areas occupied by the restored temporary facilities.

Responsible for execution: Contractors.

Supervisor: Environmental Technician of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: In the canals where the work will take place (Guajimía, Villa Aura, Las Caobas and non-intervention sections of the canals of Buenos Aires, El Indio and La Ureña), lots where the residential units will be built, temporary facilities of the work, access roads, sectors of the area of direct influence of the project.

Frequency of follow-up: Semi-annual.

Implementation time: During the entire construction phase of the project.

Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.1.1.11 *Energy Efficiency Subprogram*

Impacts to which the subprogram is directed:

- Increase in the consumption of electricity and fuels.

Objectives:

Promote the sustainable use of electricity and fuels during the pre-construction and construction phase of the work to reduce greenhouse gas emissions related to the project.

Measures to be implemented:

- Keep equipment and machinery in good working condition, ensuring greater fuel efficiency.
- Electricity generators, vehicles and machinery must be switched off when they are 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 practices to save electricity and fuel.
- Place electric energy meters in the temporary facilities of the work that allow monthly records of the amount of energy consumed.
- Place fuel meter in the temporary facilities of the work that allow to keep monthly records of the amount of fuel consumed.

- Compare monthly the consumption of electrical energy and fuel recorded with the aim of setting performance goals and reducing consumption (if possible).

In this phase, the following measures will also be taken to reduce energy consumption in the operation phase:

- Placement of energy-efficient luminaires or LEDs in new apartment buildings.
- Placement of energy-efficient lighting or LED and that is lit by photocells in the exterior areas of the residential units and in the urban amenities of the project (roads, green areas, parks, among others).

Performance indicators:

- Monthly consumption (kW/month) of electrical energy in the temporary facilities of the work.
- Monthly fuel consumption (gallons/month) by amount of equipment and vehicles used.
- Number of workers trained monthly in energy saving issues.
- Number of drivers trained monthly in fuel economy issues.

Goals:

- Less than the maximum consumption or percentage of planned reduction of electrical energy in the temporary facilities of the work.
- Maximum consumption or percentage of planned fuel reduction in the project.
- All (100%) workers s trained in electric energy saving measures.
- All (100%) drivers of equipment and vehicles trained in fuel economy measures.

Responsible for execution: Contractors.

Supervisor: Environmental Technician of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: Temporary facilities of the work, residential units under construction, urban amenities under construction (roads, green areas, parks, among others).

Frequency of follow-up: Monthly.

Implementation time: Phase prior to construction and throughout the construction phase.

Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.1.1.12 *Subprogram on Water Consumption Efficiency*

Impacts to which the subprogram is aimed:

- Increased water consumption.

Objectives:

Promote the sustainable use of water during the pre-construction and construction phases of the work.

Measures to be implemented:

- Establish a program of periodic inspections in the temporary facilities of the work with the aim 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).

- Placement of spray nozzles to the hoses used for the irrigation of the plants planted in the green areas created as part of the urban amenities of the project.
- Train workers in water saving practices.
- Keep monthly records of the amount of water consumed.
- Compare monthly water consumption recorded with the aim of setting performance goals and reducing consumption.

In addition, in the construction phase, the following measures will be implemented with the aim of reducing water consumption in the operation phase.

- Installation of faucets with flow restrictors or aerators in the new apartment buildings.
- Installation of saving toilets (less than 6 liters per discharge) in the new residential units.
- Planting of native and endemic species in the green areas created (which require little water for maintenance).

Performance indicators:

- Monthly water consumption (m^3 / month) in the temporary facilities of the work.
- Number of workers trained in water saving measures.

Goals:

- Less than the planned maximum water consumption.
- All (100%) employees trained in water saving measures.

Responsible for execution: Contractors.

Supervisor: Environmental Technician of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: In the area of execution of the works, especially in the temporary facilities of the work and residential units under construction.

Frequency of follow-up: Monthly.

Implementation time: Pre-construction phase and throughout the construction phase.

Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.1.1.13 *Subprogram on Efficiency in the Consumption of Loan Materials*

Impacts to which the subprogram is aimed:

- Increase in the consumption of loan materials.

Objectives:

Promote the sustainable use of the use of loan materials from quarries on site.

Measures to be implemented:

- Avoid creating new quarries and loan banks to supply fill material to the project, use existing facilities for these purposes.
- To the existing quarries from which the filling materials are purchased, require them to have the Environmental Authorization issued by the Ministry of Environment and Natural Resources that is in force.
- Keep a control record of the volumes of filler materials used in the work.

Performance indicators:

- Volumes of filler materials used in the work (m^3 / month)
- Percentage of suppliers of filler material that are accredited by the Ministry of Environment and Natural Resources.

Goals:

- Less than the estimated maximum total volume of filler material during project planning.
- 100% of filler suppliers must be accredited by the Ministry of Environment and Natural Resources.

Responsible for execution: Contractors.

Supervisor: Environmental Technician of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: Quarries and banks of loans of materials used by the project.

Frequency of follow-up: Monthly.

Implementation time: Pre-construction phase and throughout the construction phase.

Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.1.1.14 *Pesticide Management Subprogram*

Impacts to which the subprogram is aimed:

- Modification of the quality of surface water in the intervened canals.
- Disturbance of the aquatic fauna present in the canals.
- Risk of accidents and physical injuries involving local workers and residents.

Objectives:

Avoid environmental pollution and impacts on wildlife, workers and local residents due to poor pesticide management in the project for possible vector and rodent pest control activities or for the maintenance of green areas that will be part of the urban amenities of the project.

Measures to be implemented:

- Do not apply pesticides near the canals.
- The use of pesticides will be minimized (e.g. by manually or mechanically controlling weeds without the use of chemicals, avoiding the accumulation of solid waste and standing water, by placing rodent traps, among others).
- If necessary, the use of pesticides will be used pesticides of low toxicity, avoiding the use of pesticides classified as extremely dangerous (I a) or highly dangerous (I b) and II according to the WHO classification or others that are prohibited by national, regional or local laws (Figure 8-2: Color Band of the Labels According to the Toxicological Category).

Color de la Banda	Clasificación de la OMS según los riesgos	Clasificación del Peligro
Rojo (PMS 199 C)	I a - Producto Sumamente Peligroso	MUY TÓXICO
Rojo (PMS 199 C)	I b - Producto Muy Peligroso	TÓXICO
Amarillo (PMS Amarillo C)	II - Producto Moderadamente Peligroso	NOCIVO
Azul (PMS 293 C)	Producto Poco Peligroso	CUIDADO
Verde (PMS 347 C)	IV - Producto que Normalmente no Ofrece Peligro	CUIDADO

Figure 8-2: Color Band of the Labels According to the Toxicological Category

- The products will be purchased from companies that are registered with the Department of Plant Health of the Ministry of Agriculture and that use safe and properly labeled containers in accordance with current regulations, with information about the product and its associated risks.
- The supplier must be asked for safety data sheets (SDS) for the chemicals to be used.
- The products will be applied by workers duly trained in the proper handling of these substances.
- Workers applying pesticides must be in place with appropriate personal protective equipment.
- In the event that an external company is hired for pest control tasks, it must be accredited by the Ministry of the Environment and Natural Resources, have the Fumigator Registration Certificate issued by the Ministry of Agriculture and the Certificate of No Objection of Use and Application of Pesticides for companies dedicated to Pest Control issued by the Ministry of Public Health.
- Pesticide packaging must be handled as hazardous waste in accordance with the project's waste management plan.

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.

Goal:

- Less than the estimated maximum volume of pesticides during project planning.
- 100% of the pesticides used classified as low toxicity.

Responsible for execution: Contractors.

Supervisor: Environmental Technician of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: Temporary facilities of the work and lots where the residential units will be built.

Frequency of follow-up: Semi-annual.

Implementation time: During the entire construction phase of the project.

Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.1.2 Program of Preventive Measures, Mitigation and Compensation for the Operation phase

Below are the preventive, mitigation and compensation measures organized by subprograms to be implemented during the operation phase. A summary table of these measures is included in Annex 11.2 (Matrix 11-2).

8.1.2.1 *Subprogram on Measures for Environmental Management Impacts to which the Subprogram is Directed*

- Slight degradation or air quality.
- Contribution to climate change due to potential greenhouse gas emissions.
- Increased noise and vibration levels at the local level due to maintenance activities.
- Risk of soil contamination by maintenance activities.
- Reduction of the pollutant load in the surface waters by the elimination of the accumulation of garbage in the canals.
- Reduction of the risk of floods.
- Improvement of surface runoff by rectifying the wet section in canals and pipes.
- Risk of contamination of storm drain water by maintenance activities.
- Modification of the parameters of the storm drainage of the Guajimía canal and the tributaries intervened.
- Deterioration of the green areas and gardens created by maintenance activities of the rainwater and sanitary sanitation works, drinking water supply and urban planning
- Possible introduction of invasive alien species (Improvement of the quality of aquatic habitats in the Guajimía canal in particular on the stretch from Highway 6 November to flow into the Haina River).
- Improvement of the landscape visual.

Objectives:

To avoid and minimize the negative environmental impacts derived from the operation and maintenance activities and to maximize the positive effects of the work through the execution of an adequate maintenance of its different components.

Measures to be implemented:

- Programs will be developed and executed for the adequate preventive and corrective maintenance of: storm drainage system of the canals, sanitary drainage redes built, drinking water supply networks, urban amenities of the project (roads, pedestrian walkways, parks, among others). These programs will describe the procedures for carrying out the different maintenance activities and the frequency at which preventive maintenance work should be carried out. These programs will include regular inspections of drinking water and sanitary and storm drainage networks to detect and correct leaks.
- To have available the service of report of leaks and breakdowns for the inhabitants of the communities of the area of influence of the project either through a telephone number, an email or in person at the offices of the CAASD.
- Electricity generators, vehicles and machinery used for maintenance must be switched off when not in use.
- Keep equipment and machinery used for maintenance work in good working condition, including brakes, silencers and catalysts.
- Establishment of daytime hours (7:00 am to 6:00 pm) for the execution of maintenance activities.
- During the maintenance work of the works, the green areas and gardens must be marked with fences and signs that prohibit the circulation of equipment and vehicles and people in the green areas and gardens created.
- Do not dump solid waste or debris into green areas and gardens when performing maintenance activities.
- Replace the plants that could be affected as a result of the maintenance work.

- Make periodic maintenance of the green areas created.
- Maintain native and endemic species in the green areas and gardens created.
- Avoid the use of highly or moderately toxic pesticides for the maintenance of the green areas of the project.
- Development and application of an appropriate strategy for the management of waste generated as a result of maintenance activities.
- Awareness to the population living in the environment of the canals on the importance of proper solid waste management.
- Development and implementation of the Emergency Preparedness and Response Plan, which includes measures to prevent and act on lubricant leaks.
- Implement the measures established for the construction phase in the following subprogram:
    - Subprogram on measures for solid waste management.
    - Energy efficiency subprogram.
    - Subprogram of efficiency in water consumption.
    - Pesticide management subprogram

Performance indicators:

- Water quality parameters
- Volume of solid waste generated
- Water consumption
- Fuel consumption
- Number of leaks or breakdowns reported for the project works.
- Number of plants replaced

Goals:

- Maximum permissible limits established in national environmental regulations or reference.
- Scheduled number of plants to replace.

The specific or detailed targets for the indicators will be established during the initial phase of the operation phase and may be modified as the project's operational activities progress.

Responsible for execution: CAASD and the City council of Santo Domingo Oeste (in the case of measures related to the management of solid waste and the maintenance of the urban amenities of the project).

Supervisor: Environmental Technician of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: Storm drainage, sanitary and drinking water networks, urban amenities of the project.

Frequency of follow-up: Semi-annual.

Implementation time: Throughout the life of the project.

Associated costs: The costs of implementing this subprogram are included within the operating expenses of the work.

8.1.2.2 *Subprogram on Social Management Measures Impacts to which the Subprogram is Directed*

- Illegal occupation of the spaces where the rainwater and sanitary drainage works are located, drinking water supply and urban planning.
- Destruction of stormwater and sanitary drainage works, supply of drinking water and urban planning for acts of vandalism.
- Creation of jobs for maintenance work.

- Improvement in the quality of life of the population of the neighborhoods with direct and indirect impact of the project and the resettled population.
- Improvement of the identity of the inhabitants with their neighborhoods.
- Disturbances of the population that was not resettled.
- Disturbances of the owners of shops, workshops, among others that were not compensated.
- Generation of tensions between residents and workers due to the inadequate interaction in the maintenance activities of the works.
- Reduction of the vulnerable population in the communities of the project's area of influence.

Objectives:

To avoid disturbances in the population of the area of influence of the project in the operation phase derived from the destruction of the built works, illegal occupation of the spaces where the works are located, and the nonconformities related to the resettlement or compensation process. Create employment opportunities for the local population during the maintenance activities of the works.

Measures to be implemented:

- Periodic monitoring of the state of the margins of the canals.
- Periodic monitoring of the status of the works built.
- Awareness of the local population about the importance of not occupying the margins of the canal.
- Awareness to the population living in the environment of the canals on the importance of proper solid waste management.
- Communicate with communities effectively and engage their leaders.
- Implement a complaint and claims reporting mechanism accessible to the local population.
- Monitoring the state of the population of the sectors of the area of direct influence of the project by conducting surveys or meetings with focus groups.
- Apply human resources policies that favor local labor for the execution of maintenance work.
- Implement training subprograms to develop local capacity.

Performance indicators:

- Number of training activities carried out with the community.
- Number of complaints received from community members.
- Number of complaints investigated and answered to community members.
- Number of workers hired for project maintenance activities.

Goals:

- Planned number of training activities with the community.
- 100% of the complaints received answered in no more than 45 days.
- Planned number of workers to hire for project maintenance activities.

Responsible for execution: CAASD.

Supervisor: Social Manager of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: Sectors of the area of direct influence of the project.

Frequency of follow-up: Semi-annual.

Implementation time: Throughout the life of the project.

Associated costs: The costs of implementing this subprogram are included within the operating expenses of the work.

8.1.3 Cumulative Impact Management Program

The management of cumulative impacts is achieved through the implementation of environmental and social management programs, good engineering practices, communication plans and community relations, among others. In this sense, it is also considered of utmost importance the application of the hierarchy of measures (prevention-minimization-compensation-mitigation), to effectively manage any contribution that the project could potentially have on the cumulative impacts; as well as using the best efforts to generate, improve and/or contribute to effective collaboration between the different social and institutional actors, in the implementation of coherent management actions, which are generally outside the scope of responsibility and exceed the capacity of action of the promoter of the particular project (Annex 11.5).

That is why it is necessary to differentiate between those actions over which the promoter/operator of the project has direct control and those in which it can influence third parties to achieve optimal management of cumulative impacts as part of an effort involving multiple actors.

In accordance with the above, for the management of the cumulative impacts of the Stormwater and Sanitary Drainage of the Guajimía Canal Phase II Project, measures have been identified that include:

a) Particular actions of the project that are fully controlled by the developer and its contractors. These measures are aligned with those indicated in the previous section, developed for the control of the particular impacts of the project in its different stages.

b) Collaborative actions to involve the participation of third parties (governmental entities, non-governmental organizations, service providers, representatives of other projects present in the area of influence, user community, among others). As a part of this effort, it is advisable to establish a coordination mechanism among all stakeholders, especially the government of the Dominican Republic, local governments and civil society.

Below are the measures to be implemented during the pre-construction, construction and operation phases of the project for the prevention, minimization, compensation, mitigation of cumulative impacts, according to the VEC identified. A summary table of these measures is presented in Annex 11 3. (Matrix 11-3).

8.1.3.1 *Subprogram of Measures related to the Valued Environmental Components (VEC) Environmental Quality*

Cumulative impacts to which the **sub-program is directed:**

- Deterioration of air quality.
- Increased noise levels.
- Modification of surface water quality.
- Cambio in runoff regimen.
- Soil contamination.

Objectives:

Avoid and/or minimize the accumulation of impacts on the quality of air, water, soil and sound environment that could be generated by the execution of the project and by the action of other activities, works and natural events in the area of influence.

Measures to be implemented:

- Implementation of the subprograms on measures for the protection of air quality, sound environment, soils, solid waste management, water resources that are part of the Environmental and Social Management Program of the present study (section 8.1.1.1and 8.1.1.2).
- Recommend/suggest as a governmental entity, that the government entity responsible for environmental management at the level of the region develop or continue to implement the control of compliance with conservation measures of the components of environmental quality by the different projects under construction and operation located in the Guajimía canal watershed (whose supervision is applied according to regulations); making this entity aware of the possible cumulative impacts analyzed as part of this study for the VEC of environmental quality.
- To disseminate to the community the actions of conservation of the environmental quality that implements the Stormwater and Sanitary Drainage of the Guajimía Canal Phase II Project , to encourage and promote the collective culture of conservation of these components at the level of the area of influence.

Performance indicators:

- Number of communication reports and/or minutes of meetings with the government entity responsible for environmental management to promote the monitoring of compliance with conservation measures of environmental quality components by projects located in the area of influence.
- Number of activities to disseminate to the community the actions of conservation of environmental quality implemented by the Stormwater and Sanitary Drainage of the Guajimía Canal Phase II Project.

Goals:

- At least one annual note/meeting with the government entity responsible for environmental management to promote the monitoring of projects in the area (construction).
- Make a disclosure to the community every three months (construction) and at the time it deserves (operation) about the conservation actions of the components of the environmental quality that the project executes.

Responsible for execution: Promoter and contractor (see Matrix 11-3 in Annex 11.3).

Supervisor: Environmental Technician of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: at the level of the area of influence of the project.

Tracking frequency: Annual / quarterly (see Matrix 11-3 in Annex 11.3).

Implementation time: the measures will be implemented during the construction and operation phase (see Matrix 11-3 in Annex 11.3).

Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.1.3.2 *Subprogram of Measures related to the VEC Habitats, Vegetation and Terrestrial Flora*

Cumulative impacts to which the **sub-program is directed:**

- Disappearance of vegetation and loss of flora.
- Modification of the composition of species in the communities of flora.
- Introduction and risk of spread of invasive species.

Objectives:

Prevent, minimize, compensate for the cumulative impacts that affect the terrestrial vegetation and flora due to the execution of the project and the simultaneous action of other activities, works and natural events in the area of influence.

Measures to be implemented:

- Implementation of the sub-program on measures for the protection of vegetation that is part of the Environmental and Social Management Program of the present study (section 8.1.1.1and 8.1.1.2).
- Make efforts so that through the governmental entity related to environmental management and/or through non-governmental organizations collective initiatives of reforestation/revegetation of free spaces are promoted at the level of the Guajimía canal watershed.
- Disseminate to the community the flora conservation actions implemented by the Stormwater and Sanitary Drainage of the Guajimía Canal Phase II Project and promote the culture of conservation of this component at the level of the area of influence.

Performance indicators:

- Number of notes and/or documents reflecting efforts to promote/participate in joint reforestation actions in the Guajimía canal watershed.
- Number of activities to disseminate to the community to the community of the actions of conservation of flora implemented by the Stormwater and Sanitary Drainage of the Guajimía Canal Phase II Project.

Goals:

- At least one Semi-annual action (construction), supported by note, meeting minutes or technical report, among others, to promote or participate in reforestation activities in the Guajimía canal watershed.
- Make a disclosure to the community every three months (construction) about the flora conservation actions that the project executes.

Responsible for execution: Promoter and contractor (see Matrix 11-3).

Supervisor: Environmental Technician of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: at the level of the area of influence of the project.

Frequency of follow-up: Semi-annual / quarterly (see Matrix 11-3).

Implementation time: Measures will be implemented during the construction phase.

Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.1.3.3 *Subprogram of Measures related to the VEC Habitats and Terrestrial Fauna*

Cumulative impacts addressed by the subprogram:

- Fragmentation and degradation of terrestrial habitat.
- Displacement and reduction of terrestrial fauna.
- Modification of the composition of terrestrial species.

Objectives:

Avoid or minimize the cumulative impacts that affect the terrestrial fauna and its habitats as a result of the execution of the project and the simultaneous action of other activities, works and natural events in the area of influence.

Measures to be implemented:

- Implementation of the subprogram of measures for the protection of terrestrial fauna that is part of the Environmental and Social Management Program of the present study (section 8.1.1.1).
- Make efforts so that through the governmental entity related to environmental management and /or through non-governmental organizations collective initiatives of reforestation / revegetation of free spaces at the level of the Guajimía canal watershed are promoted, which would contribute to promote / restore wildlife habitats.

Performance indicators**:**

- Number of notes and/or documents reflecting efforts to promote/participate in joint reforestation actions in the Guajimía canal watershed.

Goals:

- At least one semi-annual action (construction), supported by note, meeting minutes or technical report, among others, to promote or participate in reforestation activities in the Guajimía canal watershed.

Responsible for execution: Promoter.

Supervisor: Environmental Technician of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: at the level of the area of influence of the project.

Frequency of follow-up: Semi-annual.

Implementation time: Measures will be implemented during the construction phase.

Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.1.3.4 *Subprogram of Measures related to VEC Aquatic Habitats and Fauna*

Cumulative impacts addressed **by the subprogram**:

- Disturbance of aquatic fauna.

Objectives:

Avoid or minimize the cumulative impacts that affect the aquatic fauna and its habitats as a result of the execution of the project and the action of other activities, works and natural events in the area of influence.

Measures to be implemented:

- Compliance with the subprograms of measures for the protection of aquatic fauna and water resources that form part of the Environmental and Social Management Program of this study (section 8.1.1.1 and 8.1.1.2).
- Recommend/suggest as a governmental entity, that the government entity responsible for environmental management at the level of the region develop or continue to implement the monitoring of compliance with measures to conserve the environmental quality of water resources by the different projects under construction and operation located in the Guajimía canal watershed (whose supervision is applied according to regulations); making known to this entity the possible cumulative impacts analyzed as part of this study for the VEC habitats and aquatic fauna.
- Make public knowledge of the benefits that the sanitation project generates in the conservation of the quality of the waters of the canals and therefore in the habitat of the aquatic fauna and promote at the

same time the awareness of the community on the importance of contributing to the conservation of the condition of the water resources applying their own control measures.

Performance indicators:

- Number of communication reports and/or minutes of meetings with the government entity responsible for environmental management to promote the monitoring of compliance with water resources conservation measures by projects in the area of influence.
- Number of activities to disseminate to the community both the benefits generated by the project at the level of water resources and the promotion of the culture of conservation of the canals by the population.

Goals:

- At least one annual note/meeting with the government entity responsible for environmental management to promote the monitoring of projects in the area (construction).
- Make an information to the community every six months (construction and operation) about the benefits generated by the project to water resources and promote the culture of convoy of the canals at the level of the population.

Responsible for execution: Promoter.

Supervisor: Environmental Technician of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: at the level of the area of influence of the project.

Tracking frequency: Annual / Semi-annual (see Matrix 11-3).

Implementation time: during the construction and operation phase (see Matrix 11-3).

Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.1.3.5 *Subprogram on Measures related to the VEC Economy, Employment and Livelihoods*

Cumulative impacts addressed **by the subprogram**:

- Stimulation of the local economy.
- Modification of life habits.

Objectives:

Maximize the positive effects of a cumulative nature that at the level of development of the economy and habits of life could generate the project in conjunction with the other activities and works in the area of influence.

Measures to be implemented:

- Implementation of the subprogram on social management measures that is part of the Environmental and Social Management Program of the present study (section 8.1.1.1and 8.1.1.2).
- Suggest an inter-institutional coordination so that job fairs are held at the regional level (face-to-face or virtual) where the population is made aware of employment opportunities both at the level of the project and other private companies that have a requirement to hire personnel and that show interest in using this mechanism to fill their jobs.

Performance indicators:

- Number of communication reports and/or minutes of meetings with the government entity (Ministry of Labor) to suggest the implementation of job fairs.

Goals:

- At least one note/meeting with the Ministry of Labor to suggest the implementation of job fairs (prior to the start of construction).

Responsible for execution: Promoter and contractor.

Supervisor: Social Manager of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: at the level of the area of influence of the project.

Tracking frequency: Once.

Implementation time: the measure will be implemented prior to the start of the construction phase.

Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.1.3.6 *Subprogram of Measures related to the Valued Environmental Components (VEC)*

Cumulative impacts addressed **by the subprogram**:

- Affectation to vehicular flow.
- Risk of accidents and physical injuries involving local workers and residents.
- Improvement of the quality of life of the population.

Objectives:

Prevent and / or minimize the cumulative impacts regarding the vehicular flow and the risk of accidents and physical injuries to workers and the population, as well as maximize the positive effects that at the level of improvement of quality of life can occur by the execution of the project and the simultaneous action of other activities, works and natural events in the area of influence.

Measures to be implemented:

- Implementation of the subprogram on social management measures that is part of the Environmental and Social Management Program of the present study (section 8.1.1.1and 8.1.1.2).
- Cor operate with inter-institutional coordination to create strategies for collective collaboration in the event of the occurrence of extreme weather events (floods, cyclones, hurricanes).
- Promote inter-institutional coordination and coordination between private promoters of projects that are under construction, operating or that may be implemented in the future, to carry out in a coordinated and timely manner the establishment of traffic controls, reduction of road capacity and vehicular detours that may disturb the normal functioning of commercial and service activities.
- Make public knowledge of the benefits that the sanitation project generates in the conservation of the water resource of the watershed and therefore to the health of the population and promote at the same time the awareness of the community on the importance of contributing to the conservation of the condition of the canals applying their own control measures.
- Promote the dissemination of information of the project, aimed at guiding on the possible temporal disturbance /interaction that will generate the development of the activities with the daily activities of the area.

Performance indicators:

- Number of communications and/or minutes of inter-institutional meetings for the coordination of strategies of collective collaboration in the face of extreme weather events.
- Number of communications and/or minutes of interinstitutional meetings and with private promoters to coordinate traffic controls.
- Number of actions to disseminate to the population the benefits of the project and promotion of the culture of conservation of the canals at the level of the community.
- Number of dissemination actions to governmental and non-governmental entities, civil society, project promoters in the area regarding the interaction of the activities of the work with those of the environment.

Goals:

- The number of communications and/or meetings for interagency coordination of response to climate events will be subject to the programming/strategies of the government entity leading such actions.
- At least one communication and/or traffic control coordination meeting with the competent government entity and private sector/carriers, prior to the performance of each activity that disturbs the vehicular flow (construction and operation).
- Make an information to the community every six months (construction and operation) about the benefits generated by the project and promote the culture of conservation of the canals at the level of the population.
- At least one disclosure to the community, prior to carrying out activities that disturb/interact with the daily activities of the area (construction and operation).

Responsible for execution: Promoter and contractor (see Matrix 11-3 in Annex 11).

Supervisor: Social Manager of the Environmental and Social Management of the CAASD.

Place of implementation of the measures: at the level of the area of influence of the project.

Frequency of follow-up: Semi-annual / quarterly / when warranted (see Matrix 11-3 in Annex 11).

Implementation time: during the build and operation phase.

Associated costs: The costs of implementing this subprogram are included within the budget of the work.

8.2 MONITORING PROGRAM

The Monitoring Plan, as part of the ESMP, describes what will be monitored (and how) to ensure that the preventive, mitigation and compensation measures and the compliance with the local Environmental Legislation by the Project Promoter are respected.

8.2.1 Monitoring program for the construction phase

The Annex 11.3. presents a summary table of the monitoring subprograms to be implemented during the construction phase of the project (Matrix 11-3).

8.2.1.1 *Air quality monitoring subprogram Impacts to which the subprogram is aimed:*

- Temporary deterioration of air quality.

Objective:

- Monitor the quality of the air in terms of particulate matter during the construction of the work.

Measures to be implemented:

- Measurements of particulate matter.

Indicators and/or parameters to be measured:

- Total suspended particles (PST) (µg/Nm^3)
- PM-10 fraction particules (µg/Nm^3)
- PM-2.5 fraction particules (µg/Nm^3)

Targets for indicators and/or parameters to be measured:

- Concentration of particles suspended in 24 hours below the maximum limits established by the Environmental Technical Regulation on Air Quality.

Responsible for execution: Environmental Technician of the Environmental and Social Management of the CAASD.

Supervisor: Monitoring and Evaluation Technician of the Monitoring and Evaluation Management of the CAASD.

Methodology and technology used:

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 points of monitored shall be georeferenced and the climate variables shall be measured at each point. The following equipment shall be used to carry out the measurements:

- Portable station, to measure climate variables such as temperature, relative humidity and wind speed. The wind direction shall be calculated by indirect methods.
- Portable meter of particulate matter in the air that is approved by the Ministry of Environment and Natural Resources and properly calibrated.
- GPS to georeferenced coordinates.

Monitoring sites:

At least one (1) sampling point will be selected in each section of the Guajimía canal or tributary where work is being done and one (1) point in the temporary facilities of the work.

Frequency of monitoring: Semi-annual.

Implementation time: Throughout the construction phase.

Associated costs:

According to the estimates presented in Table 8-3, the cost of monitoring semi-annually is USD$ 3,635.00, sampling will be carried out in both climatic stations present in the country which leads to monitoring 2 times a year, having an estimated annual cost of USD$ 7,270.00 US dollars.

Table 8-3: Estimated Cost of Air Quality Monitoring in the Construction Phase.

Position	USD$ period	
Specialists	by campaign	
Two technical air quality monitoring.	800/technical=1,600.00	
	subtotal	USD$ 1,600.00
logistics	Details	USD$ period
Personal field feeding	21.00/person/day for 3 people 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 protective equipment, medicine cabinet, first aid, field notebooks, pens, insect repellent, among others	150.00
Spendable material for equipment used in monitoring	Filters for particulate matter measuring equipment, batteries for cameras and climate station	200.00
Office materials	printer ink, paper, USB among others	20.00
	subtotal	USD$ 370.00
Unforeseen events and operating expenses	Details	USD$ period
Incidentals	for unexpected and/or new expenses (e.g. increase in costs of a product)	550.00
Operating expenses	Internet, telephony, electricity costs	500.00
	subtotal	USD$ 1,050.00
	Cost per campaign	USD$$ 3,635.00
	Annual cost	**USD$ 7,270.00**

(The reference date is July 2021)

8.2.1.2 *Noise Level Monitoring Subprogram*

Impacts to which the subprogram *is* aimed:

- Increased noise levels at the local level.

Objectives:

Monitor noise levels during construction.

Measures to be implemented:

- Make measurements of noise levels.

Indicators and/or parameters to be measured:

- Ambient noise levels in decibels dB(A)

Targets for indicators and/or parameters to be measured:

Noise levels below the maximum limits established by the Environmental Standard for Noise Protection (NA-RU-001-03).

Responsible for execution: Environmental Technician of the Environmental and Social Management of the CAASD.

Supervisor: Monitoring and Evaluation Technician of the Monitoring and Evaluation Management of the CAASD.

Methodology and technology used:

Noise levels shall be measured for at least three (3) minutes at each monitoring point and these points shall be georeferenced. The following equipment shall be used to carry out the measurements:

- Digital sonometer
- GPS to georeferenced the coordinates.

The sonometer will be placed in situ at 1.0 m high at the point. UTM coordinates will be taken with GPS on a flat platform 1.0 m above ground level at the monitoring site location.

Monitoring sites:

At least three (3) sampling points will be selected in each section of the Guajimía Canal or tributary where work is being done and one (1) point in the temporary facilities of the work.

Frequency of monitoring: Semi-annual.

Implementation time: Throughout the construction phase.

Associated costs: According to the estimates presented in Table 8-4, the cost for the semi-annual monitoring is USD $3,485.00 dollars, the samplings will be carried out in both climatic stations present in the country which leads to monitoring 2 times a year, having an estimated annual cost of **USD $6,970.00** dollars.

Table 8-4: Estimated cost of construction-phase noise monitoring

Position	USD$ period	
Specialists	by campaign	
Two noise monitoring technicians.	800/technical=1,600.00	
	subtotal	USD$ 1,600.00
Logistics	Details	USD$ period
Personal field feeding	21.00/person for 3 people 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 protective equipment, medicine cabinet, first aid, field notebooks, pens, insect repellent, among others	150.00
Spendable material for equipment used in monitoring	Batteries for sonometers and cameras.	50.00
Office materials	printer ink, paper, USB among others	20.00
	subtotal	USD $ 220.00
Unforeseen events and operating expenses	Details	USD$ period
Incidentals	for unexpected and/or new expenses (e.g. increase in costs of a product)	550.00
Operating expenses	Internet, telephony, electricity costs	500.00
	subtotal	USD$ 1,050.00
	Cost per campaign	USD $3,485.00
	Annual cost	**USD $ 6,970.00**

(The reference date is July 2021)

8.2.1.3 *Water Quality Monitoring Subprogram Impacts to which the Subprogram is aimed*

- Modification of the quality of surface water in the intervened canals.

Objective:

Monitor the quality parameters of the surface waters of the canals during the construction phase of the work.

Measures to be implemented:

- Monitoring the water quality of the Guajimía canal and its tributaries

Indicators and/or parameters to be measured:

- Water quality parameters of the canals (See Table 8-5)

Table 8-5: Surface Water Quality Parameters

Parameters	Unit of measure
pH	
Water temperature.	ºC
electrical conductivity.	µS/cm
Total dissolved solids. (TDS)	Mg/l
Dissolved oxygen.	Mg/l
Oxygen saturation.	%
turbidity.	NTU
Total suspended solids.	Mg/l
Residual chlorine.	Mg/l
chloride.	Mg/l
Total coliforms	NMP/100 ml
Fecal coliforms	NMP/100 ml
nitrate	mg/l
sulphate	mg/l
Fats and oils	mg/l
BOD5	mg/l
Cod	mg/l
ammonium	mg/l
Total phosphorus	mg/l
Total nitrogen	mg/l
Hexavalent chromium	mg/l
Total arsenic	mg/l
Total cadmium	mg/l
Total copper	mg/l
Total iron	mg/l
Total selenium	mg/l
Total zinc	mg/l
Total mercury	mg/l

Targets for indicators and/or parameters to be measured:

- Water quality parameters that comply with the standards established by the Environmental Standard on Surface and Coastal Water Quality.

Responsible for execution: Water Quality Technician of the Environmental and Social Management of the CAASD.

Supervisor: Monitoring and Evaluation Technician of the Monitoring and Evaluation Management of the CAASD.

Methodology and technology used:

- Samples will be taken in the canals in the process of intervention, upstream and downstream of the sites where the construction activities of the work will be carried out.
- The coordinates of the points where the samples will be taken with a GPS will be taken.
- The parameters (pH, temperature, conductivity, salinity, TDS, dissolved oxygen and turbidity) shall be analysed in situ with portable measuring equipment.
- Three (3) types of packaging will be used for each sample: amber glass jars to analyze fats and oils, special plastic covers 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:

At least one (1) sampling will be done upstream and downstream in each section of the Guajimía Canal or tributary where work is being done.

Frequency of monitoring: Semi-annual for the duration of the construction phase.

Implementation time: Throughout the construction phase.

Associated costs:

According to the estimates presented in Table 8-6 the cost of monitoring semi-annually is USD$ 8,485.00, sampling will be carried out in both climatic stations present in the country which leads to monitoring 2 times a year, having an estimated annual cost of **USD$ 16,970.00** dollars.

Table 8-6: Estimated Cost of Water Quality Monitoring in the Construction Phase

Position	USD$ period	
Specialists	by campaign	
Two technical water quality monitoring.	800/technical=1,600.00	
	subtotal	USD$ 1,600.00
Logistics	Details	USD$ period
Personal field feeding	21.00/person for 3 people 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 protective equipment, medicine cabinet, first aid, field notebooks, pens, insect repellent, among others	150.00
Spendable 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 physico-chemical and microbiological analyses of water quality	4,750.00
Office materials	printer ink, paper, USB among others	20.00
	subtotal	USD$ 5,220.00
Unforeseen events and operating expenses	Details	USD$ period
Incidentals	for unexpected and/or new expenses (e.g. increase in costs of a product)	550.00
Operating expenses	Internet, telephony, electricity costs	500.00
	subtotal	USD$ 1,050.00
	Cost per campaign	USD$ 8,475.00
	Annual cost	**USD$ 16,970.00**

(The reference date is July 2021)

8.2.1.4 *Biodiversity Monitoring Subprogram Impacts to which the Subprogram is Directed*

- Disappearance of vegetation and loss of flora in the areas where clearings will be carried out.
- Modification of the composition of species in the flora communities present in the project area.

- Introduction of invasive species and risk of spread.
- Fragmentation and degradation of the terrestrial habitat in the small areas where clearing will take place.
- Displacement and reduction of fauna.
- Modification of the species composition in the fauna communities present in the project area.
- Disturbance of the aquatic fauna present in the canals.
- Modifications of aquatic habitats and their associated fauna.

Objectives:

Monitoring the state of vegetation, terrestrial and aquatic fauna during the construction phase of the project.

Measures to be implemented:

- Monitoring the state of terrestrial vegetation and flora.
- Monitoring of terrestrial fauna.
- Monitoring of aquatic fauna.

Performance indicators:

- Number of species of flora by type of vegetation found in the study area of the project, characterized by their way of life, richness and abundance.
- Number of species of fauna (reptiles, amphibians, birds and mammals) by type of vegetation found in the study area of the project, indicating their abundance.
- Number of aquatic fauna species (fish and macroinvertebrates) found in the project study area, indicating their abundance.
- Number of protected or threatened species found in the study area.

Goals:

- Improvement in performance indicators for vegetation compared to baseline survey.
- Improvement in the performance indicators of terrestrial fauna compared to the survey carried out at the baseline.
- Improvement in aquatic fauna performance indicators compared to that found during the baseline survey.

Parameters or units: Does not apply.

Responsible for execution: Environmental Technician of the Environmental and Social Management of the CAASD.

Supervisor: Monitoring and Evaluation Technician of the Monitoring and Evaluation Management of the CAASD.

Methodology and technology used:

A. For the monitoring of vegetation, the following procedure will be followed:

1) Define the footprint of the project with its area of direct influence and direct influence.

2) Elaboration of draft vegetation map through the analysis of recent Google Earth images or images obtained with drone, duly georeferenced with the footprint of the project and selection of sampling sites by vegetation type.

3) For the monitoring of vegetation through field tours at the selected points during the map preparation phase and selection of sampling sites by vegetation type. Transects will be established according to Matteuci &

Colma (1982) of 50 meters in length x 20 meters on each side of the canal (where possible) specifically where there is vegetation. Additionally, information will be gathered outside the transects, of species that are outside the selected transects to enrich the information of the flora of the place. At each sampling site, UTM WGS 84 coordinates will be taken using a GPS for subsequent location on the vegetation map according to the vegetation type evaluated.

All the field work will be supported by abundant photographic material, taken by the specialists in flora and vegetation themselves, showing the characteristics of the habitats, the soils, and the particularities of the species in question.

4) Tabulation and analysis of the information generated in the field, the identified species will be tabulated to generate a list of species where the family, status, estimated abundance, scientific and common names, number of individuals per species and number of species per family for each type of vegetation will be indicated. Once the lists have been completed and properly refined, the portals specialized in species with some conservation category, such as CITES and IUCN, will be consulted, as well as the consultation of the updated and approved local legislation such as the Red List of Vascular Flora in the Dominican Republic to generate information on the conservation status of the species registered in the study area.

B. For the monitoring of terrestrial fauna in each type of vegetation or habitat, the following procedure shall be followed:

Herpetofauna: The methodology suggested by Angulo et al. will be used. (2006), which consists of establishing stations or sampling points with 50 m radius in which free and unrestricted searches will be carried out for 25 minutes during the day and night, paying special attention to the micro-habitats available by vegetation type.

For the determination of the biogeographical status and conservation status of the registered species will be consulted in the Red List of the Species of Endangered Flora and Fauna of the Dominican Republic,

El International Trade in Endangered Species of Wild Fauna and Flora (CITES)and The Caribbean Amphibian and Reptile Database (IUCN, 2019., MIMARENA, 2011., UNEP CITES, 2021., Caribherp,2021).

Sampling technique for terrestrial mammals: To collect information from terrestrial mammals, the technique transects or linear paths of 150 meters of variable width, walking at a constant speed along the routes of 0.5 to one kilometer per hour will be used for a better probability of detection by direct observations of the species by visual and auditory means in vegetation type or habitat, (Birriones, 2004). These consist of linear routes with a length, set at each station for sampling. At each sampling site, GPS coordinates will be taken to indicate on the fauna map the sites evaluated by vegetation type or habitat.

After the field phase will be tabulated and analyzed the information collected for later preparation of the report of this component, the report will contain tables with the species identified with information of the order, family, species, number of individuals, biogeographical status and conservation of the registered species will be consulted in the Red List of the Species of Endangered Flora and Fauna of the Dominican Republic, El International Trade of Endangered Species of Wild Fauna and Flora (CITES)and IUCN. It will also include calculating relative abundance and species richness.

Sampling techniques for bats: To collect the information of this taxonomic group, two sampling techniques will be used: a) Capture using fog networks and b) Observations by transects of 150 m. To apply these techniques, sampling sites or stations will be selected in the vegetation types present within the study area, in which work will be done at night in each selected place. In these places will be placed the fog nets to capture bats,(Baillie et al. 1986 and Peach et al. 1991), with dimensions of six meters long and two meters wide for a period of three (3) hours.

The stations for the placement of the nets will be selected taking into account the places of passage and frequent use of this group. After capture, individuals will be identified and then, will be marked with a harmless ink, to check if it is recaptured and released. As for transects for direct observations and verification of the crossings of individuals, they will be made close to the places of capture, and by observation, the number of individuals and the height of the flights will be taken into account.

Sampling techniques for avifauna: In the case of birds, to collect information in the field will be used the most practical and appropriate methods to collect data on land bird populations in the Caribbean according to, Ralph et al., 1981, 1995., Wunderle et al, 1994. In this sense, three sampling techniques will be combined: the count by fixed points, the interview technique and opportunistic observations.

- Fixed points of counts: They serve to make lists of presence, calculate the relative abundance, richness, determine routes of displacement, estimate the height and direction of the flights, make comparisons between the different types of vegetation and use of habitats, will be made considering an average radius of observation of 25 m and a maximum of 50 m, at each point, (Ralph et al.1981, 1995; Wunderle, 1994; Allen, 1986., Lack, 1954 and 1966., Call, M. W. 1981., Lancia, et al.2005), with this technique, the species and individuals observed and heard within these perimeters will be identified and noted. The distance between the points should not be less than 200 m.

The duration of sampling at each fixed point should not exceed 10 minutes, since lasting 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 only two individuals are taken into account at most, in the case of mixed flocks, only one sound is noted for each species heard.

This method allows the observer to remain fixed for a certain time, increasing the probability of bird detection and decreasing the degree of disturbance generated during transect movements (Chávez-León and Velázquez, 2004).

- Interview: with this technique, it is intended to seek information on the history of the avifauna of the place, some species in particular and the possible impacts that have affected the taxonomic groups treated (Vicente, 1998).

- Opportunistic observations: as the name implies, they are observations that are made at random, providing new species that are located outside the techniques used during the process and serve to add qualitative data to the site list (Allen, 1986).

For the monitoring of **aquatic fauna**, the following procedure will be followed:

In the case of fish due to the characteristics of the canals, the basic catch will be made using physical methods with type D hand nets with extender rod, of the jatico type (cage) and if possible atarrayas (tuna fishing). The fish will be preserved in 4% formalin and labeled in plastic bags.

Qualitative analysis techniques will be used, which consists of identifying the taxa present in the sample, regardless of their quantity. Knowing the degree of contamination of the waters, disposable gloves, high rubber boots, disinfection equipment such as liquid soap and plenty of water for hand washing after sampling and washing the nets will be used.

Monitoring sites:

For vegetation: Vegetation within the footprint of the project in the sections of the Guajimía canal and its tributaries already intervened, secondary forest south of the 6 de Noviembre Highway, green areas that are part of the urban amenities of the project.

For terrestrial fauna: Vegetation within the footprint of the project in the sections of the Guajimía canal and its tributaries already intervened, secondary forest south of the 6 de Noviembre Highway, green areas that are part of the urban amenities of the project.

Table 8-7 shows the monitoring sites of terrestrial vegetation, flora and fauna.

Table 8-7: Pre-selected monitoring sites for the characterization of vegetation, flora and terrestrial fauna

Vegetation Sampling (VT).	Terrestrial Fauna Sampling (FT).	UTM coordinates		Canals	Description
		X	and		
VT-1	FT-1	394999.00	2043336.00	Mahogany.	Las Mahogany Park.
VT-2	FT-2	394558.00	2043375.00	Guajimía.	Agrarian City. (Between the canals Villa Aura and Las Mahogany).
VT-3	FT-3	394517.00	2043174.00	Guajimía.	The Valley. (Between the canals Villa Aura and canal Las Mahogany).
--	FT-4	395542.00	2042781.00	--	Between the canals Las Mahogany and Buenos Aires.
--	FT-5	394114.00	2042849.00	--	
--	FT-6	394589.00	2041885.00	--	
VT-7	FT-7	394714.00	2041517.00	--	Engombe Sector (Marcano Forest.
VT-8	FT-8	395134.00	2041741.00	Guajimía.	Located next to the Pollera.
VT-9	FT-9	395685.00	2041298.00	Ureña.	West Hills (Near the Extension February 27)
--	FT-10	395262.00	2040790.00	Guajimía.	Between the canals Ureña and Autopista 6 de Noviembre).
--	FT-11	394978.00	2039919.00	Guajimía.	Between the 6 de Noviembre Highway and its mouth in the Haina River).
VT-12	FT-12	394442.00	2039297.00	Guajimía.	Between the 6 de Noviembre Highway and its mouth in the Haina River.
--	FT-13	393774.00	2038751.00	Guajimía.	Between the 6 de Noviembre Highway and its mouth in the Haina River.
VT- 14	--	396404.21	2041852.05	--	Soto Mayor School (Near Canal El Indio).
VT- 15	--	395670.56	2041056.85	--	Next to the Canal Ureña.

For aquatic fauna: Sand recommends establishing 7 monitoring sites or stations (Table 8-8), which have been duly selected taking into account accessibility and absence of waste that prevent monitoring, in addition the water quality monitoring points were taken into account.

Table 8-8: Proposed Aquatic Fauna Sampling Sites

Aquatic Fauna Sampling (FA).	Coordinates UTM WGS 84, zone 19Q		Canals
	X	and	
FA-1	395029	2043942	Villa Aura.
FA-2	394647	2043696	Guajimía
FA-3	394632	2042833	
FA-4	395276	2043199	Mahogany
FA-5	397202	2042728	Buenos Aires
FA-6	395211	2041206	Guajimía
FA-7	395074	2039933	

Monitoring frequency: Semi-annual for the duration of the construction phase.

Implementation time: Throughout the construction phase.

Associated costs:

According to the estimates presented in Table 8-9, the cost for monitoring of a semi-annual nature is USD $16,685.00 dollars, sampling will be carried out in both climatic stations present in the country which leads to monitoring 2 times a year, having an estimated annual cost of USD $33,370.00 dollars.

Table 8-9: Estimated Cost of Biodiversity Monitoring under Construction

Position	USD$ Period	
Specialists	by campaign	
Mammal specialist	1300.00	
Botanical	1,300.00	
Bird Specialist	1,300.00	
Specialist in herpetofauna	1,300.00	
Specialist in Fish and macroinvertebrates	1,800.00	
Mammal Assistant: networks and cameras	1,200.00	
Bird assistant: transecto and nets	800.00	
GIS Specialist	1,200.00	
Herpetofauna Assistant	800.00	
subtotals	11,000.00	
Logistics	Details	USD$ period
Personal field feeding	21.00/person/day for 9 people for 15 days	2,835.00
Personal field transportation	600.00 /15 days	600.00
Fuel	Tours, coordination and meetings	100.00
subtotal		USD$ 3,535.00
materials	Details	USD$ period

Position	USD$ Period	
Specialists	by campaign	
Field materials for monitoring	First aid, field notebooks, bait for traps, ropes, threads, markers, insect repellent, among others	250.00
AA alkaline batteries 15 packs/period and AAA alkaline batteries 4 packs/period for field equipment	camera traps, head lamps, handheld flashlights,	550.00
Office materials	printer ink, paper, USB among others	300.00
	subtotal	USD$ 1,100.00
Unforeseen events and operating expenses	Details	USD$ period
incidentals	for unexpected and/or new expenses (e.g. increase in costs of a product)	550.00
Operating expenses	Internet, telephony, electricity costs	500.00
	subtotal	USD $1,050.00
Cost per campaign		USD $16,685.00
Annual cost		USD $33,370.00

(The reference date is July 2021)

8.2.1.5 *Subprogram of Monitoring the Impacts to the Social Environment Impacts to which the Subprogram is Directed*

- Affectation of land properties.
- Nonconformities of the population that will be resettled.
- Destruction of homes and other buildings located on the banks of the canals that will be intervened.
- Damage to existing infrastructure (roads, drinking water supply, sewage collection, among others).
- Increased traffic and traffic disruption.
- Disruption of commercial and service activity.
- Risk of interruption of the subsistence activities of the inhabitants in the area of influence of the project.
- Modification of life habits.
- Generation of conflicts related to compensation to tenants, homeowners, shops, workshops, among others.
- Generation of tensions due to problems in the interaction of the communities with the workers of the work.
- Generation of tensions in the neighborhoods of the area of influence of the project due to the low or low award of jobs and service contracts to residents, workers and professionals of these neighborhoods.
- Marginalization of women in the process of compensation to tenants and owners of homes, shops, workshops, among others.
- Increased marginalization and risk levels of vulnerable groups.

Objectives:

- Monitor the status of the communities in the project's area of direct influence.

Measures to be implemented:

- Investigation and response of complaints and claims received by the local population through the established mechanism.

Indicators and/or parameters to be measured:

- Number of complaints received from community members.
- Number of complaints investigated and responded to community members
- Response time to complaints.

Targets for indicators and/or parameters to be measured:

- 100% of the complaints received answered in no more than 45 days.

Methodology and technology used:

The methodology for following up and responding to complaints is presented in the Complaints and Claims Mechanism (see subsection 8.5 of this chapter).

Monitoring sites: Communities in the direct area of influence of the project.

Frequency of **monitoring**: Semi-annual.

Implementation time: During the entire construction phase.

Responsible for execution: Social Manager of the Environmental and Social Management of the CAASD.

Supervisor: Monitoring and Evaluation Technician of the Monitoring and Evaluation Management of the CAASD.

Associated costs:

According to the estimates presented in Table 8-10 the cost of monitoring semi-annually is USD$ 6,730.00 dollars, the sampling will be carried out in both climatic stations present in the country which leads to monitoring 2 times a year, having an estimated annual cost of **USD$ 13,460.00** dollars.

Table 8-10: Estimated cost of monitoring the social environment under construction

Position	USD$ period	
Specialists	**by campaign**	
2 sociologists	1200/each=2,400.00	
3 pollsters	600/each=1,800.00	
subtotal		**USD$ 4,200.00**
Logistics	**Details**	**USD$ period**
Personal field feeding	21.00/person/day for 6 people 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
Spendable material for equipment used in monitoring	Survey forms.	200.00
Office materials	printer ink, paper, USB among others	100.00
subtotal		**USD$ 450.00**
Unforeseen events and operating expenses	**Details**	**USD$ period**
Incidentals	for unexpected and/or new expenses (e.g. increase in costs of a product)	**550.00**
Operating expenses	Internet, telephony, electricity costs	**500.00**
subtotal		**USD$ 1,050.00**
Cost per campaign		**USD$ 6,730.00**
Annual cost		**USD$ 13,460.00**

(The reference date is July 2021)

8.2.2 Monitoring program for the operation phase

The Annex 11.4. presents a summary table of the monitoring subprograms to be implemented during the operation phase (Matrix 11-4).

8.2.2.1 *Water quality monitoring subprogram*

Impacts to which the subprogram is aimed:

- Reduction of the pollutant load in the surface waters by the elimination of the accumulation of garbage in the canals.
- Risk of contamination of storm drain water by maintenance activities.

Objectives:

- Monitor the quality parameters of the surface waters of the canals during the operation phase of the work.

Measures to be implemented:

- Monitoring of the water quality parameters of the canals.

Indicators and/or parameters to be measured:

- Water quality parameters of the canals. (See Table 8-11)

Targets for indicators and/or parameters to be measured:

- Water quality parameters that comply with the standards established by the Environmental Standard on Surface and Coastal Water Quality.

Table 8-11: Surface water quality parameters

Parameters	Unit of measure
pH	
Water temperature.	ºC
electrical conductivity.	µS/cm
Total dissolved solids.	Mg/l
Dissolved oxygen.	Mg/l
Oxygen saturation.	%
turbidity.	NTU
Total suspended solids.	Mg/l
Residual chlorine.	Mg/l
chloride.	Mg/l
Total coliforms	NMP/100 ml
Fecal coliforms	NMP/100 ml
nitrate	mg/l
sulphate	mg/l
Fats and oils	mg/l
BOD_5	mg/l
Cod	mg/l
ammonium	mg/l
Total phosphorus	mg/l
Total nitrogen	mg/l
Hexavalent chromium	mg/l
Total arsenic	mg/l
Total cadmium	mg/l
Total copper	mg/l
Total iron	mg/l
Total selenium	mg/l
Total zinc	mg/l
Total mercury	mg/l

Responsible for execution: Water Quality Technician of the Environmental and Social Management of the CAASD.

Supervisor: Monitoring and Evaluation Technician of the Monitoring and Evaluation Management of the CAASD.

Methodology and technology used:

- The same established procedure will be followed as in the construction phase of the work.

Monitoring sites: At least one sampling will be done downstream in each section of the Guajimía Canal or tributary that has been intervened, especially during maintenance activities.

Monitoring frequency: Semi-annual.

Implementation time: During the useful life of the project.

Associated costs:

According to the estimates presented in Table 8-12, the cost for monitoring on a semi-annual basis is USD$ 8,475.00, sampling will be carried out in both climatic stations present in the country which leads to monitoring 2 times a year, having an estimated annual cost of **USD$ 16,970.00** dollars.

Table 8-12: Estimated cost of water quality monitoring in operation

Position	**USD$ period**	
Specialists	**by campaign**	
Two technical water quality monitoring	800/technical=1,600.00	
subtotal		**USD$ 1,600.00**
Logistics	**Details**	**USD$ period**
Personal field feeding	21.00/person for 3 people 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 protective equipment, medicine cabinet, first aid, field notebooks, pens, insect repellent, among others	150.00
Spendable 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 physico-chemical and microbiological analyses of water quality	4,750.00
Office materials	printer ink, paper, USB among others	20.00
subtotal		**USD$ 5,220.00**
Unforeseen events and operating expenses	**Details**	**USD$ period**
Incidentals	for unexpected and/or new expenses (e.g. increase in costs of a product)	**550.00**
Operating expenses	Internet, telephony, electricity costs	**500.00**
subtotal		**USD$ 1,050.00**
Cost per campaign		**USD$ 8,475.00**
Annual cost		**USD$ 16,970.00**

(The reference date is July 2021)

8.2.2.2 *Biodiversity monitoring subprogram Impacts to which the subprogram is directed:*

- Deterioration of the green areas and gardens created by maintenance activities of the rainwater and sanitary drainage works; drinking water supply and urban planning.
- Possible introduction of invasive alien species (IAS).
- Improvement of the quality of aquatic habitats in the Guajimía Canal in the section from highway 6 November to the mouth of the Haina River.

Objectives:

Monitoring of the state of vegetation, terrestrial and aquatic fauna during the construction and operation phases of the project.

Measures to be implemented:

- Monitoring the state of terrestrial vegetation and flora.
- Monitoring of terrestrial fauna.
- Monitoring of aquatic fauna.

Performance indicators:

- Number of species of flora by type of vegetation found in the study area of the project, characterized by their way of life, richness and abundance.
- Number of species of fauna (reptiles, amphibians, birds and mammals) by type of vegetation found in the study area of the project, indicating their abundance.
- Number of aquatic fauna species (fish and macroinvertebrates) found in the project study area, indicating their abundance.
- Number of protected or threatened species found in the study area.

Goals:

- Improvement in performance indicators for vegetation compared to baseline survey.
- Improvement in the performance indicators of terrestrial fauna compared to the survey carried out at the baseline.
- Improvement in aquatic fauna performance indicators compared to that found during the baseline survey.

Parameters or units: Does not apply.

Responsible for execution: Environmental Technician of the Environmental and Social Management of the CAASD.

Supervisor: Monitoring and Evaluation Technician of the Monitoring and Evaluation Management of the CAASD.

Methodology and technology used:

- The same established procedure will be followed as in the construction phase of the work.

Monitoring sites:

For vegetation: Vegetation within the footprint of the project in the sections of the Guajimía Canal and its tributaries already intervened, secondary forest south of the 6 de Noviembre Highway, green areas that are part of the urban amenities of the project.

For terrestrial fauna: Vegetation within the footprint of the project in the sections of the Guajimía Canal and its tributaries already intervened, secondary forest south of the 6 de Noviembre Highway, green areas that are part of the urban amenities of the project.

Table 8-13 shows the monitoring sites of terrestrial vegetation, flora and fauna.

Table 8-13: Pre-selected Monitoring Sites for the Characterization of Vegetation, Flora and Terrestrial Fauna

Vegetation Sampling (VT).	Terrestrial Fauna Sampling (FT).	UTM coordinates		Canals	Description
		X	and		
VT-1	**FT-1**	394999.00	2043336.00	Mahogany.	Las Mahogany Park.
VT-2	**FT-2**	394558.00	2043375.00	Guajimía.	Agrarian City. (Between the canals Villa Aura and Las Mahogany).
VT-3	**FT-3**	394517.00	2043174.00	Guajimía.	The Valley. (Between the canals Villa Aura and canals Las Mahogany).
--	**FT-4**	395542.00	2042781.00	--	Between the canals Las Mahogany and Buenos Aires.
--	**FT-5**	394114.00	2042849.00	--	
--	**FT-6**	394589.00	2041885.00	--	
VT-7	**FT-7**	394714.00	2041517.00	--	Engombe Sector (Marcano Forest.
VT-8	**FT-8**	395134.00	2041741.00	Guajimía.	Located next to the Pollera.
VT-9	**FT-9**	395685.00	2041298.00	Ureña.	West Hills (Near the Extension February 27)
--	**FT-10**	395262.00	2040790.00	Guajimía.	Between the canals Ureña and Autopista 6 de Noviembre).
--	**FT-11**	394978.00	2039919.00	Guajimía.	Between the 6 de Noviembre Highway and its mouth in the Haina River).
VT-12	**FT-12**	394442.00	2039297.00	Guajimía.	Between the 6 de Noviembre Highway and its mouth in the Haina River.
--	**FT-13**	393774.00	2038751.00	Guajimía.	Between the 6 de Noviembre Highway and its mouth in the Haina River.
VT- 14	**--**	396404.21	2041852.05	--	Soto Mayor School (Near Canal El Indio).
VT- 15	**--**	395670.56	2041056.85	--	Next to the Canal Ureña.

For aquatic fauna: Se recommends establishing 7 monitoring sites or stations (Table 8-14 ,which have been duly selected taking into account accessibility and absence of waste that prevent monitoring, in addition the water quality monitoring points were taken into account.

Table 8-14: Proposed Aquatic Fauna Sampling Sites

Aquatic Fauna Sampling (FA).	Coordinates UTM WGS 84, zone 19Q		Canals
	X	and	
FA-1	395029	2043942	Villa Aura.
FA-2	394647	2043696	Guajimía
FA-3	394632	2042833	
FA-4	395276	2043199	Mahogany
FA-5	397202	2042728	Buenos Aires
FA-6	395211	2041206	Guajimía
FA-7	395074	2039933	

Monitoring frequency: Semi-annual during the useful life of the project.

Implementation time: During the useful life of the project.

Associated costs:

According to the estimates presented in Table 8-15, the cost for the semi-annual monitoring is USD $16,685.00 dollars, the samplings will be carried out in both climatic stations present in the country which leads to monitoring 2 times a year, having an estimated annual cost of USD **$33,370.00** dollars.

Table 8-15: Estimated Cost of Biodiversity Monitoring in Operation

Position	**USD$ Period**	
Specialists	**by campaign**	
Mammal specialist	1300.00	
botanical	1300.00	
Bird Specialist	1300.00	
Specialist in herpetofauna	1300.00	
Specialist in Fish and macroinvertebrates	1800.00	
Mammal Assistant: networks and cameras	1200.00	
Bird assistant: transect and nets	800.00	
GIS Specialist	1200.00	
Herpetofauna Assistant	800.00	
Subtotals	**11,000.00**	
Logistics	**Details**	**USD$ period**
Personal field feeding	21.00/person/day for 9 people for 15 days	2835.00
Personal field transportation	600.00 /15 days	600.00
Fuel	Tours, coordination and meetings	100.00
subtotal		**USD$** 3535.00
Materials	**Details**	**USD$ period**
Field materials for monitoring	First aid, field notebooks, bait for traps, ropes, threads, markers, insect repellent, among others	250.00
AA alkaline batteries 15 packs/period and AAA alkaline batteries 4 packs/period for field equipment	camera traps, head lamps, handheld flashlights,	550.00
Office materials	printer ink, paper, USB among others	300.00
subtotal		**USD$ 1100.00**
Unforeseen events and operating expenses	**Details**	**USD$ period**
Incidentals	for unexpected and/or new expenses (e.g. increase in costs of a product)	**550.00**
Operating expenses	Internet, telephony, electricity costs	**500.00**

Position	USD$ Period
Specialists	**by campaign**
subtotal	**USD $1,050.00**
Cost per campaign	**USD $16,685.00**
Annual cost	**USD $33,370.00**

(The reference date is July 2021)

8.2.2.3 *Subprogram of Monitoring the Impacts to the Social Environment Impacts to which the Subprogram is Directed*

- Illegal occupation of the spaces where the rainwater and sanitary drainage works are located; drinking water supply and urban planning.
- Destruction of stormwater and sanitary drainage works; supply of drinking water and urban planning for acts of vandalism.
- Improvement of the identity of the inhabitants with their neighborhoods.
- Disturbances of the population that was not resettled.
- Disturbances of the owners of shops, workshops, among others that were not compensated.
- Generation of tensions between residents and workers due to the inadequate interaction in the maintenance activities of the works.

Objectives: To monitor the state of the communities in the area of direct influence of the project during the operation phase of the works.

Measures to be implemented:

- Investigation and response of complaints and claims received by the local population through the established mechanism.
- Conducting interviews and meetings with focus groups to determine the degree of conformity of the population with the construction of the work.

Indicators and/or parameters to be measured:

- Number of complaints received from community members.
- Number of complaints investigated and answered to community members.
- Response time to complaints.
- Number of interviews conducted.
- Number of focus group meetings held.

Goals:

- 100% of the complaints received answered in no more than 45 days.

Responsible for execution: Social Manager of the Environmental and Social Management of the CAASD.

Supervisor: Monitoring and Evaluation Technician of the Monitoring and Evaluation Management of the CAASD.

Methodology and technology used:

- The methodology for following up and responding to complaints is presented in the Complaints and Claims Mechanism (see subsection 8.5 of this chapter).

- The methodology for conducting interviews and meetings with focus groups is described in the Stakeholder Participation Plan (see subsection 8.4 of this chapter).

Monitoring sites: Communities in the area of direct influence of the project (Las Caobas, Duarte, Buenos Aires, La Rosa, Herrera, Manoguayabo, Bayona, Engombe, La Altagracia and Santo Domingo Country Club).

Frequency of **monitoring**: Semi-annual.

Implementation time: During the useful life of the project.

Associated costs:

According to the estimates presented in Table 8-16, the cost of monitoring on a semi-annual basis is USD$ 6,730.00, sampling will be carried out in both climatic stations present in the country which leads to monitoring 2 times a year, having an estimated annual cost of **USD$ 13,460.00** dollars.

Table 8-16: Estimated Cost of Monitoring the Social Environment in Operation

Position	USD$ period	
Specialists	**by campaign**	
2 sociologists	1200/each=2,400.00	
3 pollsters	600/each=1,800.00	
subtotal		**USD$ 4,200.00**
Logistics	**Details**	**USD$ period**
Personal field feeding	21.00/person/day for 6 people 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
Spendable material for equipment used in monitoring	Survey forms.	200.00
Office materials	printer ink, paper, USB among others	100.00
subtotal		**USD$ 450.00**
Unforeseen events and operating expenses	**Details**	**USD$ period**
Incidentals	for unexpected and/or new expenses (e.g. increase in costs of a product)	**550.00**
Operating expenses	Internet, telephony, electricity costs	**500.00**
subtotal		**USD$ 1,050.00**
Cost per campaign		**USD$ 6,730.00**
Annual cost		**USD$ 13,460.00**

(The reference date is July 2021)

8.2.3 Audits for Environmental Compliance Reports (ICA)

The audits for the construction and operation phase of the project will define the status of compliance with the prevention, mitigation and compensation plan and the monitoring plan, as well as another condition or requirement established in the Environmental Authorization.

These audits will be carried out in accordance with the monitoring frequency established in the program of preventive measures, management and compensation, in the monitoring program and the frequency established

by Environmental License No. 0103-07-RENEWED for the delivery of Environmental Compliance Reports (ICA) through the ICA Platform, which is semi-annual.

The CAASD will be responsible for the preparation of environmental compliance reports (ICA) during the construction and operation phases.

8.2.4 Monitoring Plan Reports

The reports of the monitoring plan will be prepared either semesterly or in accordance with the frequency established in Environmental License No. 0103-07-RENEWED, for the verification of the measures of the program of preventive measures, mitigation and compensation and for the monitoring program of each environmental variable, which will be included in the Environmental Compliance Reports (ICAs).

The Monitoring and Evaluation Technician of the Monitoring and Evaluation Management of the CAASD will prepare and upload the ICAs to the ICA platform every six months according to the frequency established in Environmental License No. No. 0103-07-RENEWED, to give continuity to its validity in both phases.

The information of the ICA will be uploaded to the ICA platform according to the information that the same demand and that which the Ministry of Environment and Natural Resources requests.

8.2.5 Responsible for the implementation of the Monitoring Program

The Monitoring and Evaluation Management of the CAASD will be responsible for the execution of the Monitoring Program in both the construction and operation phases.

Environmental consultants may be hired in order to provide advice for the execution of the project monitoring plan.

Its functions will be external to give advice, perform environmental audits and punctual measurements of environmental quality, they will not have responsibilities for planning and execution of environmental policies and actions. These functions shall be the responsibility of the CAASD.

8.2.6 Schedule and costs

The Monitoring Program will be developed according to the time established for the implementation of preventive, mitigation and compensation measures and the frequency of monitoring of each environmental variable.

The costs of the Monitoring Program will be borne by the CAASD in both the construction and operation phases.

8.3 Monitoring Plan

8.3.1 Waste Management Plan

8.3.1.1 *International Standards and Guidelines*

The Project is aligned with the IFC Performance Standards (PS). The IFC presents eight PS to provide guidance on identifying the risks and impacts associated with projects and to avoid or mitigate those risks and impacts. Of these standards, the PS 3: Resource Efficiency and Pollution Prevention refers to waste management. The objective of this standard is to avoid or minimize adverse effects on the environment and human health, promote sustainable use of natural resources and reduce greenhouse gas emissions.

For waste management, this standard states that CAASD will avoid generating hazardous and non-hazardous materials, but where this is not feasible, the waste generated will be reduced, recovered and reused in a manner that is safe for the environment and human health. If waste cannot be recycled or reused, disposal will be

accomplished by reputable and legitimate third parties with permits issued by the appropriate government regulatory agencies. CAASD will be responsible for documenting the final destination of the waste.

In case the waste managed or produced is considered hazardous, CAASD will adopt alternatives in accordance with international good practice, taking into account the limitations applicable to their transboundary transport[13].

Final disposal sites will have to meet acceptable standards. If not, CAASD will be required to reduce the amount of waste sent to these sites and implement other disposal options, such as building its own recycling and disposal facilities on the Project site.

8.3.1.2 *National Waste Management Legislation*

The Dominican Republic has implemented several regulations to control waste management. The "Ley 64-00 General de Medio Ambiente y Recursos Naturales" provides the general framework. In August 2020, a new Law (No. 225-20), "Ley General de Gestión integral y Coprocesamiento de Residuos Sólidos de la República Dominicana", was approved and includes new requirements to promote waste reduction and recycling. It applies to citizens, public sector and private sector companies and organizations.

Among the sixteen general principles of this law, it is mentioned for the first time in the Dominican Republic the principle of extended producer responsibility, which indicates that producers are responsible for the waste produced during its entire life cycle. This extended responsibility applies on the list of priority wastes defined by the Ministry of Environment and Natural Resources:

- Lubricating Oil
- Batteries
- Pesticides
- Tires
- Electrical and electronic waste
- Containers and packaging
- Foam

The Ministry may modify this list and decide on the order of application of the wastes subject to the extended responsibility program.

A list of other national legislation relevant to the waste management aspects of the Project is presented below:

- Constitución de la República, 2015.
  Ley Orgánica 1-12 de la Estrategia Nacional de Desarrollo (END), 2012.
- Convenio de Basilea sobre el Control de los Movimientos Transfronterizos de los Desechos Peligrosos y su Eliminación, 1992.
- Ley General sobre Medio Ambiente y Recursos Naturales, No. 64-00, 2000.
- Ley No. 218, que Prohíbe la Introducción al País por Cualquier Vía de Excrementos Humanos o Animales, Basuras Domiciliarias o Municipales y sus Derivados, Cienos o Lodos Cloacales, Tratados o no, así como Desechos Tóxicos, provenientes de Procesos Industriales, 1984.
- Ley General de Salud No. 42-01, 2001.
- Ley No. 176-07 del Distrito Nacional y los Municipios, 2007.
- Norma para la Gestión Ambiental de Residuos Sólidos No Peligrosos, 2009.
- Reglamento de Etiquetado e Información de Riesgo y Seguridad de Materiales Peligrosos, 2009.
- Reglamento para el Transporte de Sustancias y Materiales Peligrosos, 2006.
- Reglamento para la Gestión de Aceites Usados, 2007.

[13] Basel Convention & Basel Protocol on Liability and Compensation (2019):
http://www.basel.int/TheConvention/Overview/TextoftheConvention/tabid/1275/Default.aspx

- Ley No. 57-07, de Incentivo al Desarrollo de Fuentes Renovables de Energía y sus Regímenes Especiales. Reglamento, 2007.
- Reglamento para la Gestión de Sustancias y Desechos Químicos Peligrosos, 2009.
- Ley No. 120-99, que Prohíbe a Toda Persona Física o Moral Tirar Desperdicios Sólidos y de Cualesquiera Naturaleza en Calles, Aceras, Parques, Carreteras, Contenes, Caminos, Balnearios, Mares, Ríos, etc., 1999.

8.3.1.3 *National Waste Classification*

According to the law "Ley General de Gestión integral y Coprocesamiento de Residuos Sólidos de la República Dominicana", waste is classified into three types:

- **urban solid waste**: waste generated in homes resulting from domestic activities or with similar characteristics and waste from the cleaning of roads and public places.
- **waste requiring special treatment**: waste derived from products considered as priorities under the law, which are subject to the principle of extended responsibility, non-hazardous waste generated in large volume by production plants and waste produced by large generators of municipal solid waste.
- **hazardous waste**: waste that possess one or more of the characteristics of corrosiveness, reactivity, explosiveness, toxicity, flammability, or that contain biological-infectious agents, as well as containers, recipients, packaging that have been contaminated with hazardous waste, in accordance with the provisions of this law and waste that have been classified as hazardous in international agreements to which the Dominican Republic is a party.

Moreover, the law defines a contaminated site as a site whose chemical, biological, or physical characteristics have been adversely affected by the presence of hazardous components of human origin, at a concentration that constitutes a risk to human health or the environment.

8.3.1.4 *Roles and Responsibilities*

Waste management will be the responsibility of all parties involved in the Project. The key responsibilities are presented in Table 8-17. They may evolve depending on the agreed Project contractual arrangements and design requirements.

Table 8-17: Roles and Responsibilities

Roles	Responsibilities
Construction Manager	Ensure that the plan is carried out with appropriate resources. Be aware of the procedures and regulations applicable to waste management. Support Project environmental staff in waste reduction / management programs.
Site Environmental Manager	Ensure that waste management follows regulations. Ensure proper implementation of the plan and report non-conformities and performance of the Plan to the upper management. Collect data from waste contractors and disposal sites. Conduct periodic internal audits. Ensure that personnel are trained on proper waste management.

Roles	Responsibilities
Project Supervisors / Workers	Be aware of the procedures and regulations applicable to waste management. Dispose of waste properly in accordance with regulations and in a timely manner. Be informed of emergency response procedures in the event of a hazardous waste spill.
Waste Transport Contractor and Waste Receiver	Provide the necessary documentation for waste tracking. Maintain licensing as required and appropriate. Conduct waste handling, transport, disposal in accordance with applicable regulations.

8.3.1.5 *Waste Management*

Most of the anticipated waste will come from the canal, which is mainly filled with domestic waste from residents. Then, other wastes will potentially be produced during the construction of the sanitary drainage system. These wastes will be composed of concrete and soil from the demolition and excavation works.

8.3.1.5.1 Construction Phase

Canal Waste Management

The first objective of the Project is to clean the canal of solid waste. This canal has been used for years by the inhabitants as a dumping ground for solid waste as well as for sewage. This constant flow of solid waste (garbage, plastics, chemicals, etc.) is much larger than the environmental carrying capacity of the canal.
Due to the origin of this waste, which has been deposited by citizens over the years, it is likely that both hazardous and non-hazardous waste will be present.

Non-Hazardous Wastes

Typical expected non-hazardous wastes are given below:

- Domestic waste
- Recyclable waste
- Packaging waste
- Road cleaning waste
- Excavation waste
- Tires

Hazardous Wastes

Among all the solid waste dumped in the canal, several types of hazardous waste could be found:

- Waste oil
- Medical waste
- Waste paint
- Waste batteries and accumulators
- Pesticides
- Hazardous waste containers

Excavated Soils

Once the waste is removed, potentially contaminated soils will be excavated to install the sanitary drainage system.

Waste Collection and Transportation

Hazardous and Non-hazardous Wastes

Due to the nature of the Project, waste separation will not be conducted on-site for this phase of the Project. Indeed, this waste has been present for years and its composition is unknown. In addition, it is in a canal that runs alongside homes, making it impossible to set up a safe and permanent sorting platform at the Project site.

In the case where waste can be segregated without the use of a sorting platform, it must be identified, classified, and quantified. For each type of waste identified and separated, the following information shall be documented by the Site Environmental Manager:

- Number of the collection contract with a company licensed to handle this type of waste.
- Name of the disposal, recycling or recovery site as well as any transfer station, being authorized to take in charge this type of waste.
- Specific management plan as needed.
- Final waste quantities generated (reuse, recovery, disposal).

The rest of the collected waste will be transported off-site to the Duquesa landfill by a company licensed to handle hazardous and non-hazardous waste.

Excavated Soils

Prior to the start of the excavation works and throughout their duration, if any visual, olfactory sign of contamination or significant PID (Photo Ionization Detector) measurements are detected and are confirmed by the Site Environmental Manager, a soil sample from site will be submitted for analysis in a laboratory authorized by the Ministry of the Environment and Natural Resources. In absence of national criteria, the USEPA[14] grids may be used to define environmental soil quality criteria for the Project.

Since the Project will be carried out in areas close to homes, two grids will be used, namely the "Composite Worker Soil" grid used when workers are in contact with soils and the "Resident Soil" grid that is applicable to soils with which the population may be in contact on a regular basis. Pending the results, impacted soils should be considered contaminated and will be segregated and transported to the Duquesa landfill or similar authorized site to be stored in a dedicated area.

A soil must not leave the Project site until a written confirmation from a receiving site is provided and the Site Environmental Manager will be responsible for ensuring that the site storage area will meet these recommendations:

- An appropriate storage area must be designated and properly identified;
- Each stockpile of soil should be numbered and both contaminated and uncontaminated stockpiles should be stored on a hard-standing surface to avoid cross-contamination with the soil beneath them;
- Stockpiles should be covered with an impermeable tarp to prevent the formation of contaminated leachate and dust.

An excavated soil register should be set up on site and contain the following information:

- Stockpile number
- Date of creation
- Origin
- Material Classification

[14] USEPA, Regional Screening Levels (2021): https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

- Date sampled
- Date removed from site
- Pictures
- Final destination

Once the results of the characterization are known, if the soil meets the "Resident Soil" criteria, it can be used without environmental restrictions. In the case where the soil only meets the criteria of the "Worker's Composite Soil" grid, it can only be reused on sites used by workers or as a base or foundation layer. If the soil does not meet the criteria of either grid, it will remain at the Duquesa Landfill or a similar authorized site for treatment and disposal.

For soils with no sign of contamination during excavation, they will be transported and disposed of in sites that will be identified later, according to their characteristics. If no sites are available, they will be disposed of at the Duquesa landfill or similar authorized site.

In the event these methods are not applicable, similar methods must be implemented with the approval of the Ministry.

Sanitary Drainage System

Non-Hazardous Wastes
Potential non-hazardous wastes during construction of the sanitary drainage system are listed below:

- Tree branches, plant residues
- Recyclable waste
- Packaging waste
- Excavation waste (concrete, asphalt, etc.)

Hazardous Wastes

- Oil filters
- Waste oil
- Waste batteries and accumulators
- Hazardous waste containers
- Medical waste

Waste Collection, Segregation, and Transportation

In line with the legal requirements, an extended responsibility management plan will be prepared and submitted to the Ministry of Environment and Natural Resources by CAASD. The waste generated by the construction of the sanitary drainage system will be separated and classified to allow their recovery. Waste shall not be removed from the site until properly classified and an appropriate disposal route has been found.

For each type of waste identified and separated, the following information shall be documented by the Site Environmental Manager:

- Number of the collection contract with a company licensed to handle this type of waste.
- Name of the disposal, recycling or recovery site as well as any transfer station, being authorized to take in charge this type of waste.
- Specific management plan as needed.
- Final waste quantities generated (reuse, recovery, disposal).

Non-Hazardous Wastes
The storage of waste for special treatment will be done in separate containers according to the type of waste.

The segregation and storage area will be inspected regularly by Project environment staff.

The collection and transportation of waste will be carried out by service providers who have obtained their authorization from the Ministry of the Environment and Natural Resources and of the municipality, in closed or covered collection vehicles.

These service providers must submit to the manager a monthly report indicating the quantities and volumes of waste collected and transported as well as the name and number of the treatment, recovery or disposal site. In addition, the service provider must comply with the responsibility of declaring to the Ministry the waste it handles according to the instructions of the entity.

Hazardous Wastes
Hazardous waste will be stored in rigid containers, separated according to the characteristics of the waste, with a lid and labels for identification. These containers must have sufficient capacity to hold the waste generated. To prevent damage or spills, containers will be checked on a regular basis.

If on-site maintenance operations on construction equipment are required, they will be performed on areas with proper drainage. An impermeable cover shall be laid under the equipment to avoid possible soil contamination. In the event of a leak, this contamination will be controlled with absorbents and the contaminated soil will be excavated and managed as hazardous waste.

The storage area will be accessible only to authorized personnel. It will not have sanitary drainage and will have a spill collection system and a sump with a capacity of one fifth of the liquid waste storage capacity. In addition, it will be equipped with a ventilation system, fire extinguishing equipment and anti-spark lighting.
Within a period of six months, the hazardous waste will be sent to a recovery, treatment or disposal center authorized by the Ministry of the Environment and Natural Resources. The transportation of the waste will be done by an authorized service provider in sealed trucks with a container for spills, a refrigeration system if the type of waste requires it and a fire extinguisher.

Excavated Soils
The excavated natural soils and construction residues will be taken and disposed of in sites that will be identified later, according to their characteristics. In the absence of available sites, these residues will be disposed of at the Duquesa landfill or similar authorized site.

In the event these methods are not applicable, similar methods must be implemented with the approval of the Ministry.

Monitoring
To ensure that waste management is carried out in accordance with current regulations, the waste types, classifications, and amounts will be recorded monthly. Records will be kept of the waste generated by the Project and their management process until their destination.
The Project site will be routinely inspected to ensure proper maintenance and management of the waste storage areas by Project environmental staff. In addition, internal audits will be conducted quarterly during the construction phase. Based on the results of this inspection and audits, corrective actions will be taken. Their effectiveness will also be monitored and reported.

8.3.1.5.2 Operation Phase

Waste generation during this stage will be minimal and will be mainly related to specific maintenance activities of the sanitation system. The amount and types of waste will depend on the complexity of the maintenance work to be performed.

As in the construction phase, waste will be separated and classified, identifying those that can be recovered or reused and separating hazardous from non-hazardous. All waste must be transported and managed by an authorized service company in compliance with current regulations.

8.3.2 Control Measures / Adaptation for Climate Change

In order to determine to recommend adaptation for the project, it is important to identify how the climate and future climate projections are susceptible to affect the project and the impacts on the community and the biodiversity of the region, as per PS4 and PS6. The three significant components of the project are the storm sewers, the sanitary sewers, the pavement and roads built over the sewers systems. Adaptation measure may vary depending on what component or element is analysed.

Control Measures/Adaptation for Climate Change in regard to Community Health, Safety and Security

Unemployment is very high in the Dominican Republic, which is further pronounced in poorest communities, where residents face unemployment without social benefits. This situation is the one faced by many households in the canals, where the heads of the household have little education.

Access to health services is extremely difficult because there are very few clinics or other health centres in the Guajimía area. As well, the families who live in the canal area typically use traditional medicines before trying to go to one of the 2 hospitals located on either side of the canals. The hospitals, however, are difficult to access and are only used in cases of extreme emergency. The Guajimía lower valley has no medical infrastructure. The residents of La Ureña must go to the Buenos Aires zone for their medical needs. In regard to disease, the diseases found in the valley are primarily water related and related diseases include dengue fever and diarrhoea.

The following section will present control and climate adaptation measures related to storm sewers, sanitary sewers and pavements and roadways focused on mitigating climate change impacts on the community that has not been resettled and that is still living within the project area, its health, safety and security.

Storm sewers and Sanitary Sewers:

Extreme Temperatures:

Ambient air temperatures are not same temperatures found underground, depending of the depth at which the storm sewers and sanitary sewers are installed heat can damage infrastructure integrity. Between 3-6 meters depth, hot ambient temperatures have low impact on the infrastructure, and therefore, the community. However, hot temperatures and heat waves could impact staff wellbeing and productivity during peak daytime hours (e.g., heat exhaustion, dehydration, heat stress).

Proposed adaptation measures include, but are not limited to:

- Use materials for storm sewer and sanitary sewer pipes that have high heat resistance.
- Implement worker safety measures to protect the health and safety of staff.

Precipitation, Tropical Storms, and Flooding:

Even if precipitation is predicted to decrease, precipitation can remain significant, specially during the rainy season and during tropical storm events. In heavy rain events, the pipe flow capacity might be surpassed causing flooding and sewer backup. Heavy rainfall can cause catch watersheds to become overwhelmed and result in flooding and water pooling. Wind is also an important element to consider. Strong winds can cause debris to clog catch watersheds and therefore increase the probability of flooding.

Flooding can also cause property damage, affect home safety, and reduce road safety for drivers, pedestrians, and cyclists. Intense rainfall increases flow into the sewer system during and after rainfall events. Sanitary sewers are designed to accommodate a certain amount of inflow and infiltration and during intense rainfall events, this amount of inflow and infiltration may be exceeded and therefore lead to sanitary sewer overflow. Sanitary sewers

are more vulnerable to overflow when both sanitary sewers and storm sewers are combined. Combined sewer systems are sewers that are designed to collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe. Most of the time, combined sewer systems transport all their wastewater to a sewage treatment plant, where it is treated and then discharged to a water body. During periods of heavy rainfall, the wastewater volume in a combined sewer system can exceed the capacity of the sewer system or treatment plant. When sewer capacity is exceeded and wastewater overflows, flooding the area and properties, there can be significant repercussion on public health and safety. Sewer overflow discharge can carry bacteria and disease that cause diarrhea, nausea, infection, cholera, dysentery, infectious hepatitis, and severe gastroenteritis.

Proposed adaptation measures include, but are not limited to:

- Consider the installation of separate sanitary sewer and storm sewer systems
- Storm sewer pipes and sanitary sewer pipes should have a larger diameter in order to increase sewer capacity in heavy rainfall events
- Implement stormwater diversions
- Install backwater valves to reduce sewer back-up risk
- Install inlet control devices to restrict the flow of stormwater from streets into storm sewers
- In prevision of a major storm, make sure that the catch watersheds are free of debris to prevent flooding
- Clear drainage systems of debris (e.g., objects, leaves) to prevent sewer back up
- Modify work schedules under conditions induced by climate-related disruptions
- Provide real-time flood alerts so the affected community can prepare accordingly
- Develop and implement an Emergency Preparedness and Management Plan in the case of a heavy rainfall event and flood events

These adaptation measures could limit and mitigated health, security and safety impacts on the Guajimía valley community.

Pavement and Roadways:

Extreme Temperatures and Drought:

Higher temperatures may cause premature deterioration to road pavements and pedestrian asphalt (e.g., potholes, rutting, cracking) and impact that drought has on roads can be catastrophic; a lack of rainwater and the heat that often comes during a time of drought can damage roads significantly. Roads can warp, buckle, crack and shift due to the intense heat and dry conditions. Extreme temperatures and drought could result in decreased road safety for the community and people who use the concerned roadways. Also, heat waves may exacerbate the urban heat island effect due to increased surface temperatures of the pavement. The urban heat island effect can have negative impact on public health, creating warmer temperatures that are uncomfortable and dangerous for the health of the population and workers.

Proposed adaptation measures include, but are not limited to:

- Use light colored materials for pavement surfaces
- Use Heat resistant paving materials with high solar reflectance to reduce damages and UHI effect
- Track impacts of extreme heat to identify "hot-spots" that may require an increased rate of inspection
- Conduct frequent inspections of pavement surfaces to ensure cracks are properly sealed
- Shift maintenance work to cooler parts of the day or change work schedule to avoid work during extreme temperature events
- Implement worker safety measures to protect health and safety of staff
- Communicate the health risks of extreme heat events with the public, for example, share heat wave warnings
- Consider adding vegetation and trees to the design around roads, walkways, and pavement to create shade, reduce exposure to heat and reduce the urban heat island effect

Precipitation, Tropical Storms, and Flooding:

Heavy rainfall could cause premature deterioration to road pavements and pedestrian asphalt (e.g., potholes, rutting, cracking) that can be exacerbated in low lying areas. This could result in decreased road safety. Also, heavy rainfall may result in localized flooding. Flood can cause property damage, affect home safety, reduce road safety for drivers, pedestrians, and cyclists and promote the spread of disease. Furthermore, strong winds could lead to accumulation of debris on roads and reduce road safety. On roadways, appropriate lighting and signage is planned to be installed. The safety and securement of these elements is important in the context of heavy winds that can damage them and blow them away creating a safety hazard for the surrounding community.

Proposed adaptation measures include, but are not limited to:

- Increase the area of permeable surfaces and promote the implementation of rain gardens in order to reduce flood risk of pavement and roads
- Incorporate low impact development practices or green infrastructure to manage stormwater runoff and prevent flood damages
- Clear and roads sidewalks of debris or objects that may be blown away
- Clear drainage system of debris
- Make sure that there is installation of sufficient catch watersheds on roads, streets and paved areas to adequately channel and drain rainfall towards the sewers
- Install signage, traffic lights and light poles that withstand heavy winds. Some examples include, increasing the installation depth, securing poles with an anchor base mounting, or using concrete foundations.

Control Measures/Adaptation for Climate Change in regards to Biodiversity Conservation and Sustainable Management of Living Resources

The project area is located in the city of Santo Domingo, where there are no floristic endemic species in danger of extinction, and where original vegetation cover has already been substituted for human activity many years ago. Therefore, there is limited vegetation cover in the area. Species that are found in the area include cultivated fruit trees, ornamental plants, medicinal plants, ceremonial plant, plants and trees to create shade in gardens and invasive plants or weeds. In general, the project is projected to diminish what vegetation cover there currently is in the project area.

Historic land transformation and destruction of the original vegetation has had its reflection in the general impoverishment of the fauna of the region. Therefore, it is predicted that the project will not have severe impacts on terrestrial fauna. However, the impacts on the current flora will naturally lead to impacts on the fauna due to loss of habitat.

The following section will present control and climate adaptation measures related to storm sewers, sanitary sewers and pavements and roadways focused on mitigating climate change impacts on biodiversity in order to protect and conserve it, to maintain the benefits from ecosystem services and to promote the sustainable management of living natural resources. Furthermore, by preserving and protecting the biodiversity in the region, it promotes a healthier living environment for the community.

Due to the similar nature of the adaptation measures for all project elements (storm sewers and sanitary sewers, pavements and roadways), they will be grouped together in the following section.

Storm Sewers, Sanitary Sewers and Pavement and Roadways:

Extreme Temperatures and Drought:

Ambient air temperatures are not same temperatures found underground, depending of the depth at which the storm sewers and sanitary sewers are installed heat can damage infrastructure integrity. Between 3-6 meters

depth, hot ambient temperatures have low impact on the infrastructure. The impacts of extreme temperatures and drought on the storm sewers and sanitary sewers infrastructure will likely not have any impact on biodiversity. Furthermore, the impact that extreme temperatures and drought have on pavements and roadways does not directly impact biodiversity either. However, conserving and promoting biodiversity in the project area can have a positive effect on the community by mitigating and limiting hot temperatures, heat waves and the urban heat island effect. Extreme temperatures, heatwaves and drought may exacerbate the urban heat island effect due to increased surface temperatures of the pavement. The urban heat island effect can also be exacerbated by the lack of vegetation in the area. This can have negative impact on public health, creating warmer temperatures that are uncomfortable and dangerous for the health of the population and workers. Promoting a healthy environment by protecting biodiversity may mitigate negative effects on the community.

Proposed adaptation measures include, but are not limited to:

- Revegetate the project area with native species and endemic species to promote a healthy environment and to help mitigate the negative impacts of high temperatures, heat waves and limit the urban heat island effect
- Revegetate the project area with species that have high heat and drought tolerance in prevision future probabilities of higher temperatures and drought
- Try to maintain and protect as much vegetation as possible during the construction phase of the project
- Try to maintain and save as much natural vegetated area as possible in the project region
- Ensure proper maintenance of landscaping during summer months

Precipitation, Tropical Storms, and Flooding:

Even if precipitation is predicted to decrease, precipitation can remain significant, specially during the rainy season and during tropical storm events. In heavy rain events, the pipe flow capacity might be surpassed causing flooding and sewer backup. Heavy rainfall can cause catch watersheds to become overwhelmed and result in flooding and water pooling. Species that are vulnerable to flooding can be impacted. Due to limited flora and fauna in the project area and the probable destruction of what is currently there, flooding might be exacerbated. Furthermore, flood water can contain debris, pollutants and nutrients and can be carried on a certain distance and may have an impact further out of the project area and jeopardize water quality. The direct destructive impacts of precipitation, tropical storms and flooding on pavement and roadways do not have an impact on biodiversity. Wind is an important element to consider because it can cause damage to trees and vegetation. Furthermore, strong winds can cause debris to clog catch watersheds and therefore increase the probability of flooding.

Proposed adaptation measures include, but are not limited to:

- Revegetate the project area in flood prone areas with species that have high flood tolerance
- Revegetate the project area with species that have water pollution filtration or sequestering capacities
- Revegetate the project area with local species that are resistant to strong winds
- Try to maintain and protect as much vegetation as possible during the construction phase of the project
- In regard to maintenance, monitor vegetation elements that could become projectiles in times of strong winds
- Schedule landscape inspections after heavy rainfall and storm events to inspect the integrity of the vegetation, fauna habitat and to ensure the safety of the community

8.4 Fauna and Flora Rescue and Relocation Plan

8.5 Resettlement Action Plan

8.5.1 Brief description of the process

In 2008, the studies and designs of the Second Phase of the Storm and Sanitary Drainage Project of the Guajimía Canal and its tributaries were presented. The objective formulated for this stage was to intervene the upper watershed of this canal, to face the obstacles that accumulated the rainwater so that they were evacuated, and the canal continued to be used as a receiver only of wastewater.

It is currently in the preparatory phase to give continuity to this Second Phase of the Project, contemplating extending the intervention, in addition, from the upper part of the watershed of the Guajimía Canal and its tributaries (Las Caobas and Villa Aura), to sections of the canals Buenos Aires, El Indio Derecho and La Ureña, whose intervention did not finish what was planned for these three canals in the First Phase.

As part of the solutions contained in the project, a Relocation Action Plan is contemplated aimed at resetting the existing family and economic social units that are located above or on the edge of the Guajimía canal and its tributaries.

A nodal element of this Relocation Action Plan (PAR) is its commitment to lead, in accordance with national laws and IFC performance standards, a transparent and participatory process to guarantee the rights of affected populations, with an inclusive approach that pays special attention to vulnerable groups.

The Relocation Action Plan has included a census of existing family and economic social units in order to determine the number of people and structures in the area affected by the project, as well as the socio-economic profile of this population.

This census has been carried out by a technical team made up of people who participated in the resettlement process of the First Phase of this project and in the most recent experiences of resettlements carried out in the Dominican Republic, such as the La Nueva Barquita and Domingo Savio project.

Also, in the days of conducting the census, it has been accompanied by leaders of community organizations in the area of affectation.

In addition, along with the conduct of the census, a process of information and consultation of the affected population and other actors involved has been directed through the realization of community meetings, focus groups and interviews, a process in which the population of the affected area, community leaders and institutional actors relevant to the project previously identified have participated.

The PAR also includes a Plan for Relations with Social Actors who have interests or are affected by the Project, in all its phases, paying special attention to vulnerable groups and the situation of women.

8.6 Environmental Education Plan (EEP)

8.6.1 Objectives

The environmental education plan to be implemented in the Project Pluvial and Sanitary Drainage of the Guajimía Canal and its Main Tributaries Phase II has the following objectives:

- To make known to the workers of the work the measures that are part of the Program of Measures of the Program of Environmental and Social Management (PGAS) of the project.
- To instruct workers on how they should carry out their work in their respective jobs, so as to minimize the effects on the environment.

- Raise awareness among construction workers about the importance of their collaboration with compliance with the ESM to avoid, mitigate or compensate for the negative impacts that the project may cause to the environment.
- To raise awareness among the population living in the sectors of the project's area of influence about the importance of their collaboration for the protection of the environment and for Phase II of the Rainwater and Sanitary Drainage project of the Guajimía Canal and its Main Tributaries to be successful, especially in relation to the proper management of solid waste.
- Train the inhabitants of the sectors of the area of influence in different trades so that they increase their capacities and aptitudes for the possible obtaining of jobs both in the project and in future projects.
- To inform the inhabitants of the sectors of the area of influence of the project about procedures for the reporting of complaints.

8.6.2 Existing Programs, Strategies, Policies and Guidelines

For the elaboration of the Environmental Education Plan, the different subprograms of measures that make up the ESPS and the Environmental and Social Policy of the project were taken into account. The Environmental and Social Policy of the Project contemplates the development of actions of education, dissemination and environmental information for the workers of the project and the community of the environment and the foundation of mutual commitments with the community, relative to the minimization of the effects on the environment.

During the construction phase, the training programs will be executed by the different contractors of the work, who may sub-hire environmental consultants or experts in environmental education for these purposes. The execution of the Environmental Education Plan will be supervised by the Corporation of Aqueducts and Sewers of Santo Domingo (CAASD). The costs of the environmental education plan are included in the budget of the work.

In the operation phase, the Education Plan will be executed by the Corporation of Aqueducts and Sewers of Santo Domingo (CAASD) in coordination with the City of Santo Domingo Oeste. External consultants may also be subcontracted for these purposes. The costs of the Plan of Environmental Education in this phase are included in the operating costs of the work.

8.6.3 Types of Training Required

Training plans will be developed on topics related to the Social and Environmental Management Plan, both for workers and for the inhabitants of the communities that make up the area of influence of the project. The topics to be addressed in the training plans will be the following:

Training ^Programs aimed at Construction Workers:

- General induction in environmental protection (including aspects of environmental legislation). Measures for the protection of air quality and the sound environment.
- Measures for soil protection.
- Management of hazardous and non-hazardous solid wastes.
- Measures for the protection of water resources.
- Vegetation protection, including procedures for tree transplantation.
- Protection of terrestrial and aquatic fauna, including procedures for the transfer of species.
- Archaeological heritage management measures.
- Efficiency measures in the consumption of electrical energy and fuels.
- Water consumption efficiency measures.
- Measures for the proper management of pesticides.
- Measures for the control of infectious and contagious diseases (including COVID-19).
- Measures for traffic control.
- Relationship with neighboring communities.
- human rights.

- Mechanism for reporting complaints.

Training programs aimed at the community:

- Measures for the protection of flora and fauna.
- Proper solid waste management and recycling.
- Awareness to the population about the importance of not occupying the margins of the canals and the protection of the built works.
- Mechanisms for reporting complaints.
- Training in different trades (e.g. plumbing, electricity, masonry, blacksmithing, cabinetmaking, painting, among others) to develop the capacities of the local community.

In order to provide the training courses in trades, the services of the National Institute of Vocational Technical Training (INFOTEP) will be requested.

8.6.4 Development of the Training Package

The Plan of Environmental Education will be implemented from the pre-construction phase with the training of the local population to develop their capacities, however, most of the training programs will be developed in the construction phase of the work.

The education activities will be extended to the operation phase, in the case of training aimed at the community of the sectors of the project's area of influence. Table 8-18 presents the implementation phase of training programs for workers and Table 8-19 for the community.

Table 8-18: Implementation Phase of Training Programs for Workers

Programs	Topics	Phase		
		Construction	Construction	Operation
Training programs aimed at workers.	General induction in environmental protection (including aspects of environmental legislation).			
	Measures for the protection of air quality and the sound environment.			
	Measures for soil protection.			
	Management of hazardous and non-hazardous solid wastes.			
	Measures for the protection of water resources.			
	Vegetation protection, including procedures for tree transplantation.			
	Protection of terrestrial and aquatic fauna, including procedures for the transfer of species.			
	Archaeological heritage management measures.			
	Efficiency measures in the consumption of electrical energy and fuels.			
	Water consumption efficiency measures.			

Programs	Topics	Phase		
		Construction	Construction	Operation
	Measures for the proper management of pesticides.			
	Measures for the control of infectious and contagious diseases (including COVID-19).			
	Measures for traffic control.			
	Relationship with neighboring communities.			
	human rights.			
	Mechanism for reporting complaints.			

Table 8-19: Implementation phase of training programs for the community

Programs	Topics	Phase		
		Construction	Construction	Operation
Programs of trainings aimed at the community.	Measures for the protection of flora and fauna.			
	Proper solid waste management and recycling.			
	Awareness to the population about the importance of not occupying the margins of the canals and the protection of the built works.			
	Mechanisms for reporting complaints.			
	Training in different trades (e.g. plumbing, electricity, masonry, blacksmithing, cabinetmaking, painting, among others) to develop the capacities of the local community.			

The courses will be taught in the first months of each phase with semi-annual reinforcements or when significant numbers of new workers are incorporated. There will be a schedule of the trainings to be taught to maintain a better control of the implementation. The following is an example of the training schedule format.

Training Schedule

Project Pluvial and Sanitary Drainage of the Guajimía Canal and its Main Tributaries Phase II

Update date:

#	Training	Number of participants	Duration of training	Trainer name	Place of training	Day of execution of the training	month											
							1	2	3	4	5	6	7	8	9	10	11	12
1	General induction in environmental protection																	
2	Protection of air quality and sound environment.																	
3	Soil protection.																	
4	Management of hazardous and non-hazardous solid wastes.																	
5	Protection of water resources.																	
6	Protection of vegetation																	
7	Protection of terrestrial and aquatic fauna																	
8	Management of archaeological heritage.																	
9	Efficiency in the consumption of electrical energy and fuels.																	
10	Efficiency in water consumption.																	
11	Proper handling of pesticides.																	
12	Control of infectious and contagious diseases																	

Training Schedule

Project Pluvial and Sanitary Drainage of the Guajimía Canal and its Main Tributaries Phase II

Update date:

#	Training	Number of participants	Duration of training	Trainer name	Place of training	Day of execution of the training	month											
							1	2	3	4	5	6	7	8	9	10	11	12
13	Traffic control.																	
14	Relationship with neighboring communities.																	
15	human rights.																	
16	Mechanism for reporting complaints.																	

Elaborates:_____ Approves:_____
____ _____

8.6.5 Appropriate Instructional Methods

Environmental education will be taught following different methods:

- courses
- talks
- workshops
- placement of informative posters or murals
- development of advertising campaigns

The courses and talks will be given in person for construction staff and residents in the surrounding communities. They can also be carried out under virtual or semi-face-to-face modality for the managers, engineers and supervisors of the project.

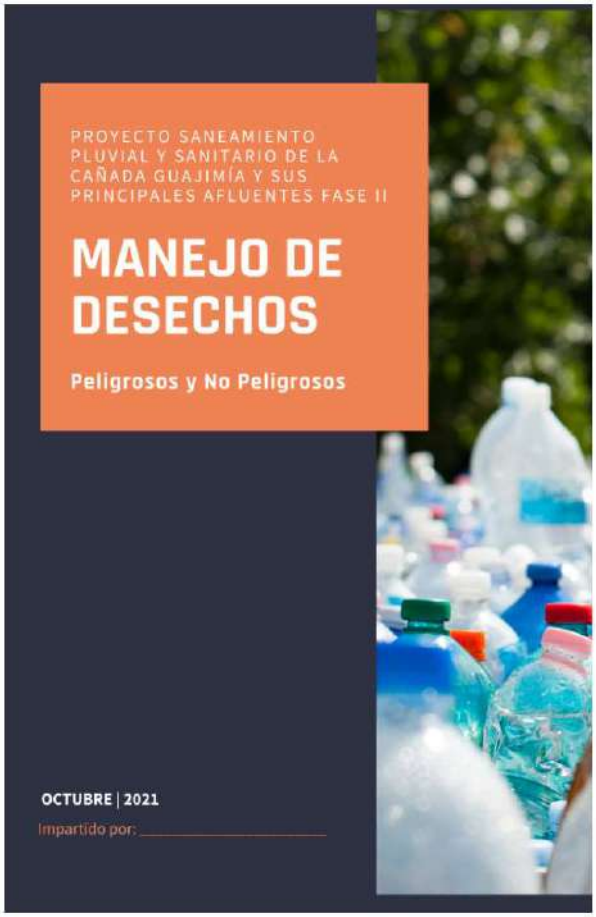
All workers on the site will receive a general induction on environmental protection. The other trainings will be organized by groups depending on the positions occupied by the workers and the potential environmental impacts that each activity could cause. An example of how to divide the trainings is presented in Table 8-20.

Table 8-20: Topic in which each member of the project and the community will be trained

group	Topics in which they will be taught
Heavy equipment operators.	-Measures for the protection of air quality and the sound environment. -Measures for the protection of soils. -Measures for the protection of water resources. - Measures of management of the archaeological heritage. -Traffic control
Workers who will carry out the clearing and creation of green areas and gardens (gardeners).	-Measures for the protection of vegetation. -Measures for the protection of fauna. -Measures for the proper management of pesticides.
All workers.	-Management of hazardous and non-hazardous solid wastes. -Efficiency measures in the consumption of electrical energy and fuels. -Measures of efficiency in the consumption of water. -General induction in environmental protection. -Mechanism for reporting complaints. -Human Rights. -Relationship with neighboring communities. -Control of infectious and contagious diseases.
Residents of the communities in the area of direct influence of the project.	-Measures for the protection of flora and fauna. -Proper solid waste management and recycling. -Awareness to the population about the importance of not occupying the margins of the canals and the protection of the built works. -Mechanisms for reporting complaints -Training in different trades (for example, plumbing, electricity, masonry, blacksmithing, cabinetmaking, painting, among others) to develop the capacities of the local community.

The courses will have a theoretical and practical part (in the subjects that are necessary). The necessary teaching materials will be prepared in advance, including digital presentations to be projected, pamphlets to be distributed among the workers, posters or murals, among others (Figure 8-3).

Figure 8-3: Example of cover of pamphlets to be delivered to workers



When preparing teaching materials, account should be taken of workers or community members who cannot read or write, as well as staff who do not speak Spanish.

The advertising campaigns would be aimed mainly at the population of the area of influence of the project, on issues such as the proper management of waste and recycling. These campaigns can be developed through radio, television, social networks, among other means of communication.

8.6.6 Training records

Attendance records must be kept for all of the trainings given to both the workers and the inhabitants of the community in the area of influence of the project.

Attendance records must include at least the following information:

- name of the training
- date
- place
- duration
- facilitator
- lists with the names and surnames of the attendees, contractor company or community to which it belongs and signature.

The following is an example of the format of the register to be considered in the training.

LIST OF PARTICIPANTS

Activity: _____

Date: **Location:**

_____ _____

Duration: **Facilitator:**

_____ _____

name	area	signature

On the other hand, when the trainings are carried out, photographs or videos must be taken, which serve as evidence of the activities carried out. Documents will be prepared with the rapporteur ships of these activities.

Other records of the trainings may include the teaching materials used, certificates of participation, results of evaluations carried out, among others.

8.6.7 Assessment of Training Effectiveness

At the end of the courses or talks, simple questionnaires can be applied to assess the level of understanding of the workers on the topics covered.

However, the effectiveness of the training plan will be verified during the evaluation of the performance indicators of the preventive, mitigation and restorative measures subprogrammes and the subprogrammes of the Monitoring Plan.

8.7 Social Stakeholder Relations Plan

8.7.1 Introduction

Phase II of the Storm and Sanitary Drainage Project of the Guajimía Canal and its tributaries is located in the Municipality of Santo Domingo Oeste, and includes work on the canals of Guajimía, Villa Aura and Las Caobas, and three sections that were pending from Phase I of the canals: Buenos Aires, El Indio Derecho and La Ureña.

The Project impacts, directly and indirectly, almost the entire urban area of the Municipality of Santo Domingo Oeste, hence its high impact on the quality of life of the inhabitants of this municipality. The neighborhoods with Project Affected Populations (PAPs), which will require the relocation of residents are: Las Caobas, Buenos Aires, Juan Pablo Duarte, Herrera and Engombe.

Other neighborhoods to the north of the Project, La Alameda and Manoguayabo, will benefit by facilitating water drainage. To the south of the Project, the Finca de Engombe, La Altagracia and Santo Domingo Country Club neighborhoods will benefit, which will not receive the flow of contamination from the open canal system, as is currently the case.

This plan is an instrument that can be enriched and improved with new data and suggestions, always following the purposes outlined and the strategies and procedures of the IFC and national regulations.

Regulations and 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 principle's community participations in the protection of the environment.

The international requirements for community participation are set out in the IFC Performance Standards and the Guidance Notes to these standards, which promote the participation of the affected population in the decision-making processes that affect them.

In both standards it is important to work on the issue of gender and vulnerable groups affected by projects; develop mechanisms for information and consultation with stakeholders during all phases of project implementation, as well as mechanisms to address complaints and grievances.

Summary of Previous Social Stakeholder Relationships

For the EIA and the Phase II RAP, between the end of 2007 and the beginning of 2008, three consultations were held with the potentially affected population in the canals to be impacted, to inform them about the project and the

compensation measures, in addition to answering any concerns they may have. Another meeting was held with community leaders in the project's area of influence.

As Phase I of the Project was underway, work was carried out through the Social Office to provide information to stakeholders on this new Phase II on a permanent basis.

As part of the review process, on May 5, 2021 the CAASD, as promoter of the Project, announced to the residents the restart of the studies for Phase II in three of the critical points of the Guajimía Canal, where its general director, Mr. Felipe Subervi, answered some questions from the media and the residents.

In the afternoon of that day, a meeting was held at the premises of the United Citizens Relief Society, in the Duarte neighborhood, to provide more details to the residents about the project and to answer their concerns. Subsequently, another meeting was held at the Buenos Aires Relief Society on June 17, with another group of residents and community leaders from the project's impact zone.

In addition, 30 individual interviews and 8 group interviews have been conducted with key stakeholders about the Project, a survey applied to 393 residents of the neighborhoods to be directly or indirectly impacted and four focus groups: two with residents of the buildings to which they were relocated during Phase I of the Project and two with residents to be resettled by Phase II of the Project.

8.7.2 Project Social Stakeholders

8.7.2.1 *Affected Parties*

Key stakeholders	Description, degree of influence and type of interest in project	Level of interest
Resident Organization		
Project Affected Populations (PAPs)	The inhabitants of the neighborhoods surrounding the Guajimía canal and its tributaries, who are the people affected by the project and who will be relocated, are the stakeholders most interested in the project to clean up the canal and its tributaries. They influence the project through the organizations that represent them and through assemblies that are held periodically to discuss aspects related to the project. The creation of a "dialogue and participation table" promoted by the CAASD's social directorate tends to enhance community participation and, consequently, the community's influence on the project's development.	High
Block of Neighborhood Association of the Guajimía canal and its tributaries	It is a second level organization that coordinates the work of the different neighborhood associations in the vicinity of the canal. It has been the most active organization. Its interest is high and its level of influence in the development of the project has also been high in all phases of the Project.	High
Libertador de Herrera Neighborhood Association	For the Pluvial and Sanitary Drainage Project of the Guajimia Canal, the neighborhood association of Libertador de Herrera is a major player, as indeed it has been for the residents of the El Indio Derecho canal, since it has been the interlocutor of the community's demands and claims. Its level of incidence is médium.	High

Key stakeholders	Description, degree of influence and type of interest in project	Level of interest
Buenos Aires Neighborhood Association	For the Pluvial and Sanitary Drainage Project of the Guajimia Canal, the neighborhood association of Libertador de Herrera is a major player, as indeed it has been for the residents of the El Indio Derecho canal, since it has been the interlocutor of the community's demands and claims. Its level of incidence is medium.	High
Barrio Duarte Neighborhood Association	For the Pluvial and Sanitary Drainage Project of the Guajimía Canal and tributaries, the neighborhood association of the Duarte neighborhood is a major player, as indeed it has been, for the inhabitants of the area surrounding the canal. This neighborhood, together with the Buenos Aires neighborhood, is affected by the Buenos Aires canal. Its level of incidence is medium	High
Engombe Neighborhood Association (El Abanico)	The neighborhood association of the Engombe (El Abanico) neighborhood is a major player for the Pluvial and Sanitary Drainage Project of the Guajimía Canal and its tributaries, since this neighborhood is in the area of influence of the Ureña canal. It has a medium level of incidence.	High
Las Caobas Neighborhood association	For the Pluvial and Sanitary Drainage Project of the Guajimía Canal, the neighborhood association of Las Caobas is a key stakeholder for the residents of the surrounding area of Las Caobas and Villa Aura canals. Its level of influence is medium.	High
Las Caobas Neighborhood Association (Frito Lay)	For the Pluvial and Sanitary Drainage Project of the Guajimía Canal and its tributaries, the neighborhood association of the Las Caobas neighborhood known as Frito Lay is an actor of singular importance, because in this area converge Las Caobas and Guajimía canals, causing it to become an area of great vulnerability to flooding, so it has been delimited numerous structures for resettlement purposes. Its level of influence is low.	High
Ciudad Agraria Neighborhood Association (Manoguayabo)	Although resettlement is not planned in this sector, since it is a middle-class sector where the houses are not located on the edge of the canal, the bad odor emanating from the canal determines that the residents in this sector have a high interest in the sanitation project. They favor the project and their degree of influence is low.	High
La Rosa Neighborhood Association	For the inhabitants of the La Rosa neighborhood, the project's sanitary solutions, specifically in the El Indio Derecho canal, represent a solution for them, since this neighborhood is located in the lower watershed of this canal, which means that the solid waste dumped in the upper part obstructs the section of the canal already plugged in the first phase of the project, causing flooding. They favor the project and their degree of influence is low.	High
Holguín-La Rosa Neighborhood association	As well as for the inhabitants of the La Rosa neighborhood, the project's sanitary solutions, specifically in the El Indio Derecho canal, represent a solution for the residents of the sub-neighborhood known as Holguín, since this sub-neighborhood is located in the lower watershed of this canal, which means that the solid waste dumped in the upper part of the canal obstructs the section of the canal already plugged in the first phase of the project, causing flooding. They favor the project and their degree of influence is low.	High
La Nueva Rosa Neighborhood Association	This is the same situation in the La Rosa neighborhood and the Holguin sub-neighborhood. They favor the project and their degree of influence is low.	High

Key stakeholders	Description, degree of influence and type of interest in project	Level of interest
La Altagracia Neighborhood association	Although no work will be carried out in this neighborhood, since it is located in the lower watershed of the Guajimía canal, the sanitation work carried out will have a positive impact on the quality of life of the residents of this neighborhood. They favor the project, although they have not been involved and their degree of influence is low.	Medium
El Café Neighborhood association	Its situation is similar to that of the La Altagracia neighborhood, so it should be positively impacted in the same way. They favor the project and their degree of influence is low.	High
El Libertador de Herrera Relief Society	Mutual societies are organizational forms of mutual support that exist in urban and rural areas of the Dominican Republic. Many of them have premises that are normally used as community halls. This is the case of the El Libertador de Herrera Relief Society. Its degree of influence is low.	High
Buenos Aires de Herrera Relief Society	Mutual societies are organizational forms of mutual support that exist in urban and rural areas of the Dominican Republic. Many of them have premises that are normally used as community halls. This is the case of the Buenos Aires de Herrera Relief Society. Its degree of influence is low.	High
Citizens United Relief Society (Duarte neighborhood)	Mutual societies are organizational forms of mutual support that exist in urban and rural areas of the Dominican Republic. Many of them have premises that are normally used as community halls. This is the case of the United Citizens Relief Society (Barrio Duarte). Its degree of influence is low.	High

Source: Stakeholder interviews, EMPACA-AECOM.

8.7.2.2 *Other Stakeholders*

Key stakeholders	Description, degree of influence and type of interest in project	Level of interest
Non-Governmental Organizations, Churches		
Dominican Association of Persons with Physical-Motor Disabilities (ASODIFIMO)	This entity supports the implementation of the project and is very interested in the inclusion and accessibility approaches for people with disabilities being taken into account in the project. Its degree of influence is low	High
Buenos Aires Church of God	Churches bring together members of the communities, contributing to social cohesion. As they meet regularly, they constitute ideal information mechanisms that could be useful for communication between the management of the Pluvial and Sanitary Drainage Project of the Guajimía Canal and the surrounding neighborhoods. Supports the project. Its degree of influence is low.	High

Key stakeholders	Description, degree of influence and type of interest in project	Level of interest
Rosa de Sarón Church	Churches bring together members of the communities, contributing to social cohesion. As they meet regularly, they constitute ideal information mechanisms that could be useful for communication between the management of the Pluvial and Sanitary Drainage Project of the Guajimía Canal and the surrounding neighborhoods. Supports the project. Its degree of influence is low.	High
San Francisco Javier Catholic Parish (Buenos Aires de Herrera)	Churches bring together members of the communities, contributing to social cohesion. As they meet regularly, they constitute ideal information mechanisms that could be useful for communication between the management of the Pluvial and Sanitary Drainage Project of the Guajimía Canal and the surrounding neighborhoods. Supports the project. Its degree of influence is low.	High
Living with Dignity Foundation	It is a long-standing entity in the area doing social assistance work. It supports the project, although its impact is low.	Medium
Evangelical Church, Loyola, El Abanico de Herrera	Their church offers religious services to the community in several of the project's impact zones. This includes psychological services provided by the church itself. Its level of impact is low.	Medium
Catholic Church, West Vicarial Catechetical Coord.	The Catholic Church community in the area is very interested in the completion of the Guajimía project, especially in the opinion that it should begin where Phase I left off. That no canals should be left pending. They have little impact on the project.	High
Catholic Church	Churches bring together members of the communities, contributing to social cohesion. As they meet regularly, they constitute ideal information mechanisms that could be useful for communication between the management of the Pluvial and Sanitary Drainage Project of the Guajimía Canal and the surrounding neighborhoods. Supports the project. Its degree of influence is low.	High
Community House of Justice, Las Caobas, Manager	High interest in the sanitation project and in being able to contribute to it from the Community House, to educate and support families in their social responsibilities and to serve in the mediation of conflicts that arise. They propose to give the houses to the family, to the couple and not to one person, in order to facilitate the protection of the family's property. Because of its range of action and specialized personnel, its impact on the project can be very positive. Its degree of influence is medium.	High
Public Institutional Actors		
Santo Domingo Aqueduct and Sewerage Corporation (CAASD, *by its Spanish acronym*)	It is the executing entity of the project and therefore has the highest level of influence.	High
City Council of the Municipality of Santo Domingo Oeste, Mayor	Major player given that it is the body that manages the environmental management factors that impact the quality of life of the inhabitants of the municipality in general and of the area of influence of the project in particular, as well as the strategies for the development of their social and economic life. The most important factor that makes them a major player, both in terms of interest and influence or power, is the fact that they are the entity in charge of solid waste management, a variable without whose solution it is impossible to complete the project's sanitation work. Its level of influence is high.	High
Economic and Social Council of	Participation mechanism established by municipal law to promote community participation in the management of municipalities. Its relevance for the Storm and	Low

Key stakeholders	Description, degree of influence and type of interest in project	Level of interest
the Municipality of Santo Domingo Oeste	Sanitary Drainage of the Guajimía Canal Phase II Project is given by the fact that it is a mechanism aimed at the integral development of the municipality of Santo Domingo Oeste, promoting the participation of civil society organizations. So far there has been no involvement in the project. Low level of incidence.	
Presidency of the Republic	The Presidency has been a major player in the project, and its interest is evidenced by the fact that, in addition to motivating members of Congress from the governing party to approve the requested loan, it has also provided for the inclusion in the national budget of a line item for the initiation of the environmental impact study. The level of influence is high.	High
Vice-Ministry of Territorial Planning (VODT, *by its Spanish acronym*)	It is a dependency of the Ministry of Economy, Planning and Development. Since the land use planning bill is not yet in force, its degree of influence is low; however, the experience of its technical team can be valuable, so its accompaniment is recommended.	Low
Senate of the Republic, Presdencia	The loan that will make this project possible was approved in the Senate. High level of influence.	High
Chamber of Deputies, Presidency	The loan that will make this project possible was approved in the Chamber of Deputies. High level of influence.	High
Ministry of Environment and Natural Resources	This agency is in charge of preparing, executing, and overseeing national environmental and natural resource policies, promoting and stimulating activities for their preservation, protection, restoration, and sustainable use. This ministry is a major player in the Pluvial and Sanitary Drainage Project of the Guajimía Canal, since under Law 64-00 this ministry oversees compliance with regulations regarding the environmental impacts (physical and social) that the project will cause and the measures to prevent and mitigate them. High level of impact.	High
National Housing Institute (INVI, *by its Spanish acronym*)	It is the governing body for public policies related to housing. However, as far as is known, it has had no influence on the project.	Low
Executing Unit for the Rehabilitation of Neighborhoods and Environs (URBE, *by its Spanish acronym*)	It is not known if it has been invited to accompany the resettlement process but having led the last resettlement processes in the country (La Barquita and Domingo Savio) is a good credential. It does not appear, however, to have any degree of influence over the project.	Low
Senate of the Republic. Senator of the Province of Santo Domingo	He is currently the main legislator of the province. Being interested in the development of the province, his support for the project is significant, as indicated by having assumed the submission of the World Bank loan for approval in the Senate of the Republic and his attendance at the presentation ceremony on the progress of the project carried out by the Director of the CAASD Felipe Suberbí, on June 22, 2021. His degree of influence has been high in the approval phase.	High
Chamber of Deputies. Deputy Santo Domingo Oeste	Congressman of the municipality of Santo Domingo Oeste who assumes and supports a project that influences the improvement of the quality of life of a high percentage of the population he represents. His degree of influence has been high in the approval phase.	High

Key stakeholders	Description, degree of influence and type of interest in project	Level of interest
Chamber of Deputies. Deputy Santo Domingo Oeste	Congressman of the municipality of Santo Domingo Oeste who assumes and supports a project that influences the improvement of the quality of life of a high percentage of the population he represents. His degree of influence has been high in the approval phase.	High
Chamber of Deputies. Deputy Santo Domingo Oeste	Congressman of the municipality of Santo Domingo Oeste who assumes and supports a project that influences the improvement of the quality of life of a high percentage of the population he represents. His degree of influence has been high in the approval phase.	High
Chamber of Deputies. Deputy Santo Domingo Oeste	Congressman of the municipality of Santo Domingo Oeste who assumes and supports a project that influences the improvement of the quality of life of a high percentage of the population he represents. His degree of influence has been high in the approval phase.	High
Governor of the Province of Santo Domingo. Governor.	The governor is the main representative of the central government in the province, and its support and assistance are important. However, in the case of Santo Domingo province, the governor's relevance is not similar to that of provinces in the interior of the country because, since the governor's functions are essentially representative of the executive branch, they are often not necessary in the case of localities, such as Santo Domingo province, close to the National District, which is where the central government is located. Supports the project, its degree of influence is low.	High
Ozama Regional Civil Defense	Its relevance is given by the fact that flooding frequently occurs in the canal. It supports the project, its interest is high, its influence is low.	High
Santo Domingo Oeste City Council, Deputy Mayor	Although Doña Felipa is currently Deputy Mayor, she is a legendary political and community leader of more than 50 years in the municipality. She intervened in part of the canal problem when she was a congresswoman, in a solution that is still in good condition. She proposes that one-room houses should not be built in the project because they do not constitute a solution for the families of the sector and promote overcrowding. Likewise, she believes that empty spaces should not be left without a regulated use, in order to avoid invasions and privatization of public space. Her level of impact on the project is low.	High
Santo Domingo Oeste City Council. Pedestrian Mayor of El Libertador de Herrera	For the mayor, it is essential to finish the project, especially what was left unfinished in Phase I. The community supports the project, although there is a lot of distrust, because there have been many years of waiting. For this reason, it is important that progress and problems are reported, so that information does not remain in some areas. Low level of influence.	High
Juan Bosch Elementary School, Herrera, Director	Prior to Phase I, the school was located in a rented wooden building. The school is now located on the old course of the canal, on Anacaona Street. However, the slopes of Phase I of the project have caused plagues of cockroaches and other vermin to invade the area and the school. The occupation of public spaces makes it difficult for children to use the few sidewalks and there are many accidents as a result. It is important that the authorities regulate. Its level of influence is low.	High
Basic School Vedrunas, Herrera, director	A significant part of the school population they serve is affected by flooding and contamination from Phase I of the Project, which was not completed. They consider it important to preserve public spaces for community use and to avoid invasions that privatize these new spaces, making community life even more difficult. Its level of incidence is low.	High.

Key stakeholders	Description, degree of influence and type of interest in project	Level of interest
National Association of Businesses and Industries of Herrera	The relevance of this association transcends the scope of the municipality; however, it is historically linked to it. Its past president is the current senator of the province of Santo Domingo. In addition, due to its proximity, part of the workers of these industries reside in the municipality and some of the effects of the execution of the project, such as its effect on the roads, will have a positive influence. It favors the project. Its degree of influence is low	High
Empresas el Primo, Buenos Aires, Herrera, President	They are highly interested in the project and believe it is very important for the community. Concerned about the amount of plastic of the so-called fon, which appears in the canal, they understand its origin may be from companies that are in the upper part, they believe it is necessary to regulate. They understand that the project should invest in social issues, community sanitation, education. Contribute to improve the waste collection system. Help the community generate income. Their degree of impact is low.	High.

Source: Stakeholder interviews, EMPACA-AECOM. And secondary sources.

8.7.3 Disadvantaged or Vulnerable Individuals and Groups

8.7.3.1 *Haitian and Venezuelan Migrants*

The municipality of Santo Domingo Oeste, as part of Gran Santo Domingo, has been one of the places where migrants from Haiti and Venezuela have settled, a phenomenon to which the fact that the cost of renting housing in this municipality is lower than in the National District has contributed.

Almost all of the Haitian and Venezuelan households in the municipality of Santo Domingo Oeste, especially in the neighborhoods around the Guajimía canal and its tributaries, are under the status of tenants, due to the fact that these migrants often lack documents.

Some landlords may try to ignore their tenant rights. This condition adds to the general disadvantages faced by all migrants to make them more vulnerable to the Project's compensation or resettlement processes.

8.7.3.2 *Tenants*

When a project arrives in a neighborhood that involves compensation such as housing, among others, because it is necessary to resettle part of the families, some homeowners take measures against their tenants, which seek to deny the tenants' rights and appropriate the compensation that would correspond to them.

Hence, the census of households affected by the project is a key instrument to guarantee tenants' rights to compensation. But it should not be the only one. Some of those interviewed for this study reported how some tenants were unable to claim their rights in Phase I of the project, due to the conditions of symbolic and physical violence generated by some landlords.

And although we do not have the evidentiary proof of these cases, it happens as with the gender violence described above. It is so common, as well as the cases against tenants, that it is not possible to deny this reality and therefore it is necessary to take social, legal and other measures that contribute to ensure that the families impacted by the project can fully exercise their rights and receive the established compensations.

8.7.3.3 *Elderly Persons*

Elderly persons are another group that universally falls into the category of vulnerable. In the Dominican Republic, Law 352-98 of 1998 created the National Council for the Elderly (CONAPE, *by its Spanish acronym*) and

established a series of rights and affirmative actions for the vulnerable population. This law defines an elderly person as any person over 65 years of age, regardless of any other condition.

In the municipality of Santo Domingo Oeste, according to the 2010 National Population and Housing Census, there are 15,225 people over the age of 65. In the area of direct impact of the Project, 23.2% of the heads of household are 56 years of age or older. In the surroundings of the Guajimía canal and its tributaries, they are exposed to the risks of flooding that periodically affect these neighborhoods, as well as the unsanitary conditions that prevail.

Therefore, it is important that, in the cases that require the relocation of some of them, the project prioritizes the relocation of these people to the first floors of the buildings. Likewise, they should locate their social environment or neighbors, if possible, in the same building, since the social survival networks of these people are seriously affected when this neighborhood is broken, often seriously damaging their health. This recommendation is also valid for people with disabilities.

8.7.3.4 *Persons with Disabilities*

Similar to the elderly, people with disabilities, whether physical-motor, sensory or mental, constitute a vulnerable group of universal recognition. The Dominican Constitution of 2010 recognizes in its Article 58 the protection of persons with disabilities. Through Law 5-13 of 2013, the Dominican state defines the rules aimed at making effective the protection of the rights of persons with disabilities.

The National Population and Housing Census yields data on certain levels of disability existing in the municipality of Santo Domingo Oeste as we can see in the following Table 8-21.

Table 8-21: Levels of disability in the municipality of Santo Domingo Oeste

Disability	Frequency	(%)
Difficulty seeing, even when wearing glasses	26,994	7.43
Difficulty walking or climbing steps	8,618	2.37
Difficulty in walking, missing one or both legs	521	0.14
Difficulty in doing chores, missing one or both arms	4,087	1.12
Social and occupational difficulties, has mental problems	1,751	0.48

Source: IX National Population and Housing Census, 2010.

The municipality of Santo Domingo Oeste has the particularity of being the headquarters of the Dominican Association of Persons with Physical-Motor Disabilities (ASODIFIMO, *by its Spanish acronym*). This non-governmental organization has highlighted the need for people with physical and motor disabilities to be addressed in a special way in the solutions contemplated in the project to clean up the Guajimía canal, taking measures of accessibility and inclusion.

8.7.3.5 *Women Heads of Household or at Family Risk*

A significant proportion of the women are heads of household and have raised their children without the support of a father figure. In the area affected or directly impacted by the project, 49% of the heads of household are women. These families, often with many children, tend to be at levels of poverty or critical poverty, so that some of the children assume the role of providers at a very early age.

Another gender risk that occurs with significant frequency in projects that offer compensation to families is that of fathers who manage to sell the goods received and abandon the wife and children, which is why the Project needs to take preventive measures and accompany the cases that arise.

8.7.3.6 *Project Stakeholder Needs Summary*

Table 8-22: Stakeholder Needs

Stakeholder group	Main characteristics	Needs
Residents affected by the project (PAPs, *by its Spanish acronym*)	845 family units, along the entire length of the Project, which is extensive.	Coordinate information and calls with the support of organizations that know the leadership of each zone and are recognized by the residents, such as the Block of Organizations of the Guajimía canal.
Haitian migrants	Economic migrants. Most are illegal and do not speak Spanish.	Translation of information and announcements into Creole. Carry out specific activities with them, with the support of translators. Review compensation procedures to take this reality into account. Documentation to be received or signed by them must be in Creole, if they do not speak, read and write in Spanish.
Venezuelan migrants.	Economic migrants. Most are in illegal status.	Review compensation procedures to take this reality into account.
Tenants	In the area affected by the Project, 55.7% of the households are renters. Most of the migrants are tenants.	Inform tenants and landlords of their rights. Provide contact information for the Project, in case of abuse by landlords to tenants. All information for Haitian nationals must be available in Creole.
Elderly persons	In the area affected by the Project, the number of heads of household aged 56 years or older is 23.2%.	In the case of the elderly living alone, take measures to ensure that the necessary information about the Project reaches the home. Take the necessary measures to provide the support required in each case. Locate on the first or second floor. Take into account current neighbor networks, which are survival networks, for relocation.
People with disabilities	Especially severe motor or visual disability.	Take measures to ensure that the necessary information about the Project reaches the household. Take the necessary measures to provide the support required in each case. Locate on the first or second floor, according to disability. Take into account current neighbor networks, which are survival networks, for relocation.
Women heads of household or at family risk	Women at gender risk, running households with no partner or with partners who seek to keep the compensations and abandon the family.	Offer gender and legal support. Put housing or other compensation in the couple's name. Coordinate support with other entities, such as the Las Caobas Community House of Justice and the Block of Organizations of the Guajimía canal.

Source: Own elaboration based on interviews. EMPACA-AECOM.

8.7.4 Social Stakeholder Relations Program

8.7.4.1 *Purpose and Goals of the Program*

Purpose of the Program

Develop a program to facilitate stakeholder participation in the Pluvial and Sanitary Drainage Project of the Guajimía Canal and its tributaries Phase II.

Program Goals

a. Establish an effective and permanent communication with the social actors interested in the Pluvial and Sanitary Drainage Project of the Guajimía Canal and its tributaries, during all the phases of the Project. And as part of it:
   - Create a permanent structure or dialogue table, with the participation of the Social Direction of CAASD and representatives of community organizations (neighborhood associations, churches, NGOs).
   - Design and apply consultation instruments on a regular basis: interviews, questionnaires, focus groups, community meetings.
   - Design and implement a mechanism for complaints and grievances.
   - Design, implement and disseminate periodic information instruments on the project.

b. Satisfactorily address and respond to the views and interests of the neighborhoods of direct influence of the project and, within them, especially the family and economic units registered for relocation, as well as women and vulnerable groups (elderly, disabled, tenants, foreigners, etc.).

c. To make effective the participation of the neighborhoods, directly or through their organizations and local leaders, in the decision-making process regarding the use of the new urban spaces created by the project.

d. To achieve the participation of the family units to be relocated and other stakeholders in the definition of the characteristics of the housing solutions to be implemented by the Project.

8.7.4.2 *Information Disclosure*

Table 8-23: Information Disclosure

Project Stage	Information to Disclose	Proposed Methods or Means	Schedule: Locations/ Dates	Target Stakeholders	Percent Achieved	Responsible
Pre-construction	Link in CAASD's Web Page, of the Project, to provide information and serve as a means of communication.	Web page (linked to CAASD Portal). Flyer to be distributed via the Block of Organizations of the Guajimía canal, Churches, City Council of Santo Domingo Oeste. Media of the municipality of Santo Domingo Oeste.	Flyers are placed in the Project's murals, 2 in each canal, and in Guajimía 5 (because it is the longest).	Residents, leaders of interested organizations and institutions.	70% of residents. 80% of the leadership of organizations and institutions.	Community Relations and Communications Officer
Pre-construction	Biweekly newsletter	Web page (linked to CAASD Portal). Flyer to be distributed via the Block of Organizations of the Guajimía canal, Churches, City Council of Santo Domingo Oeste.	Biweekly. Printed on the Project's murals, 2 in each canal, and in Guajimía 5 (because it is the longest).	Residents, leaders of interested organizations and institutions.	40% of residents. 70% of the leadership of organizations and institutions.	Community Relations and Communications Officer

Project Stage	Information to Disclose	Proposed Methods or Means	Schedule: Locations/ Dates	Target Stakeholders	Percent Achieved	Responsible
		Media of the municipality of Santo Domingo Oeste.				
Pre-construction	General Project Report by Phases. Summary in Popular Language	Web page (linked to CAASD Portal). Flyer to be distributed via the Block of Organizations of the Guajimía canal, Churches, City Council of Santo Domingo Oeste. Newsletter	Printed on the Project's murals, 2 in each canal, and in Guajimía 5 (because it is the longest). Presentation of the summary at key points in the five canals.	Residents, leaders of interested organizations and institutions.	40% of residents. 70% of the leadership of organizations and institutions.	Community Relations Officer and Project Coordinator
Pre-construction	Project office location, contacts, address	Web page (link with CAASD Portal). Flyer to be distributed via the Block of Organizations of Guajimía canal, Churches, City Council of Santo Domingo Oeste. Media of the municipality of Santo Domingo Oeste. Newsletter	Flyer is placed in the Project's murals, 2 in each canal, and in Guajimía 5 (because it is the longest). Presentation of the summary at key points in the five canals.	Residents, leaders of interested organizations and institutions.	70% of residents. 80% of the leadership of organizations and institutions.	Community Relations and Communications Officer
Pre-construction	Installation of the Social Office. Responsible persons, contacts.	Web page (linked to CAASD Portal). Flyer to be distributed via the Block of Organizations of Guajimía canal, Churches, City Council of Santo Domingo Oeste. Media of the municipality of Santo Domingo Oeste. Newsletter	Flyers are placed in the Project's murals, 2 in each canal, and in Guajimía 5 (because it is the longest).	Residents, leaders of interested organizations and institutions.	70% of residents. 80% of the leadership of organizations and institutions.	Community Relations and Communications Officer
Pre-construction	Agreements with NGOs for project implementation	Web page (link with CAASD Portal). Media of the municipality of Santo Domingo Oeste. Newsletter.	Press release	Residents, leaders of interested organizations and institutions.	40% of residents. 70% of the leadership of organizations and institutions.	Community Relations Officer and Project Coordinator.
Pre-construction	Agreements with State institutions for the execution of the project	Web page (link with CAASD Portal). Media of the municipality of Santo Domingo Oeste. Newsletter.	Press release	Residents, leaders of interested organizations and institutions.	40% of residents. 70% of the leadership of organizations and institutions.	Community Relations Officer and Project Coordinator.
Construction	Biweekly newsletter	Web page (link with CAASD Portal). Printed material, to be distributed via the Block of Organizations of Guajimía canal, Churches, City Council of Santo Domingo Oeste. Media of the municipality of Santo Domingo Oeste.	Biweekly. Printed on the Project's murals, 2 in each canal, and in Guajimía 5 (because it is the longest).	Residents, leaders of interested organizations and institutions.	40% of residents. 70% of the leadership of organizations and institutions.	Community Relations and Communication Officer

Project Stage	Information to Disclose	Proposed Methods or Means	Schedule: Locations/ Dates	Target Stakeholders	Percent Achieved	Responsible
Construction	Sites where the Project's apartments will be built	Web page (link with CAASD Portal). Media of the municipality of Santo Domingo Oeste. Newsletter.	Printed is placed on the Project's murals, 2 in each canal, and in Guajimía 5 (because it is the longest).	Residents, leaders of interested organizations and institutions.	70% of residents. 80% of the leadership of organizations and institutions.	Community Relations Officer and Project Coordinator.
Construction	Resettlement Strategy, summary in popular language	Web page (link with CAASD Portal). Media of the municipality of Santo Domingo Oeste. Newsletter.	Printed is placed on the Project's murals, 2 in each canal, and in Guajimía 5 (because it is the longest).	Residents, leaders of interested organizations and institutions.	70% of residents. 80% of the leadership of organizations and institutions.	Community Relations Officer and Project Coordinator.
Construction	Right of the family, owners and tenants to the benefits of the project. (training and preventive conflict management)	Web page (link with CAASD Portal). Printed, to be distributed via the Block of Organizations of the Guajimía canal, Churches, City Council of Santo Domingo Oeste. Newsletter	Print is placed in the Project's murals, 2 in each canal, and in Guajimía 5 (because it is the longest). Presentation of the printout at key points in the five canals.	Residents, leaders of interested organizations and institutions.	70% of residents. 80% of the leadership of organizations and institutions.	Community Relations Officer. Las Caobas Community House of Justice
Construction	Mechanism of Attention to Complaints and Claims	Web page (linked to CAASD Portal). Printed material to be distributed via the Block of Organizations of Guajimía canal, Churches, City Council of Santo Domingo Oeste. Media of the municipality of Santo Domingo Oeste. Newsletter	Print is placed in the Project's murals, 2 in each canal, and in Guajimía 5 (because it is the longest). Presentation of the printout at key points in the five canals.	Residents, leaders of interested organizations and institutions.	70% of residents. 80% of the leadership of organizations and institutions.	Community Relations and Complaints and Grievances Officer.
Construction	Project personnel hiring policy	Web page (link with CAASD Portal). Media of the municipality of Santo Domingo Oeste. Newsletter.	Summary in popular language in a printout. The printout is placed in the Project's murals, 2 in each canal, and in Guajimía 5 (because it is the longest).	Residents, leaders of interested organizations and institutions.	60% of residents. 70% of the leadership of organizations and institutions.	Community Relations Officer and Project Coordinator.
Construction	Measures Taken by the Project Regarding Vulnerable	Web page (linked to CAASD Portal). Printed material to be distributed via the Block of Organizations of the	Summary in popular language in a printout. The printout is placed in the	Residents with disabilities, foreign migrants,	90% of residents with some vulnerability. 80% of the	Community Relations Officer and Project Coordinator.

Project Stage	Information to Disclose	Proposed Methods or Means	Schedule: Locations/ Dates	Target Stakeholders	Percent Achieved	Responsible
		Guajimía canal, Churches, ASODIFIMO, City Council of Santo Domingo Oeste. Media of the municipality of Santo Domingo Oeste. Newsletter	Project's murals, 2 in each canal, and in Guajimía 5 (because it is the longest).	women at risk of domestic violence, women heads of household, the elderly and tenants. Residents, leaders of interested organizations and institutions.	leadership of organizations and institutions.	
Construction	New Solid Waste Collection Plan of the City Council of SDO	City Council of Santo Domingo Oeste. Web page (linked to the CAASD Portal). Printed material to be distributed via the Block of Organizations of the Guajimía canal. Media of the municipality of Santo Domingo Oeste. Newsletter	Summary in popular language in a printout. The printout is placed in the Project's murals, 2 in each canal, and in Guajimía 5 (because it is the longest).	Residents, leaders of interested organizations and institutions.	60% of residents. 70% of the leadership of organizations and institutions.	Community Relations Officer, Mayor of SDO and Project Coordinator.
Construction	Key interventions to be carried out per canal: relocation of residents, demolitions, construction, cleaning of canals, water diversion.	Web page (linked to CAASD Portal). Printed material to be distributed via the Block of Organizations of the Guajimía canal. Newsletter	Summary in popular language in a printout. The printout is placed in the Project's murals, 2 in each canal, and in Guajimía 5 (because it is the longest).	Residents, leaders of interested organizations and institutions.	60% of residents. 70% of the leadership of organizations and institutions.	Community Relations Officer and Project Coordinator.
Operation	Biweekly newsletter	Web page (link with CAASD Portal). Printed material, to be distributed via the Block of Organizations of Guajimía canal, Churches, City Council of Santo Domingo Oeste. Media of the municipality of Santo Domingo Oeste. Newsletter	Biweekly. Printed on the Project's murals, 2 in each canal, and in Guajimía 5 (because it is the longest).	Residents, leaders of interested organizations and institutions.	40% of residents. 70% of the leadership of organizations and institutions.	Community Relations and Communications Officer
Operation	Installation of Residents' Boards in new buildings	Web page (link with CAASD Portal). Media of the municipality of Santo Domingo Oeste. Newsletter.	Press release	Residents, leaders of interested organizations and institutions.	60% of residents. 70% of the leadership of organizations and institutions.	Community Relations Officer.

Project Stage	Information to Disclose	Proposed Methods or Means	Schedule: Locations/ Dates	Target Stakeholders	Percent Achieved	Responsible
Operation	Canals operation report and recommendations	Web page (link with CAASD Portal). Printed material, to be distributed via the Block of Organizations of Guajimía canal, Churches, City Council of Santo Domingo Oeste. Media of the municipality of Santo Domingo Oeste. Newsletter	Summary in popular language in a printout. The printout is placed in the Project's murals, 2 in each canal, and in Guajimía 5 (because it is the longest).	Residents, leaders of interested organizations and institutions.	60% of residents. 70% of the leadership of organizations and institutions.	Community Relations Officer and Project Coordinator.
Operation	Presentation of the Works Maintenance Program by CAASD	Web page (link with CAASD Portal). Printed material, to be distributed via the Block of Organizations of Guajimía canal, Churches, City Council of Santo Domingo Oeste. Media of the municipality of Santo Domingo Oeste. Newsletter	Summary in popular language in a printout. The printout is placed in the Project's murals, 2 in each canal, and in Guajimía 5 (because it is the longest).	Residents, leaders of interested organizations and institutions.	60% of residents. 70% of the leadership of organizations and institutions.	Community Relations Officer and Community Relations Officer of the CAASD.
Closing	Final Project Monitoring Report	Web page (link with CAASD Portal). Printed material, to be distributed via the Block of Organizations of Guajimía canal, Churches, City Council of Santo Domingo Oeste. Media of the municipality of Santo Domingo Oeste. Newsletter	Summary in popular language in a printout. The printout is placed in the Project's murals, 2 in each canal, and in Guajimía 5 (because it is the longest).	Residents, leaders of interested organizations and institutions.	60% of residents. 70% of the leadership of organizations and institutions.	Community Relations Officer.

8.7.4.3 *Consultation Mechanisms*

Project Stage	Subject of Consultation	Method to be used	Schedule: Places and Dates	Target Stakeholders	Responsible
Pre-construction	Land available for construction of apartments, designed project: comments and suggestions	Dialogues with community leaders, residents to be relocated and NGOs.	School or community locations. At least one meeting per canal and one in the host community.	Community leaders. Residents to be relocated. Receiving community.	Community Relations Officer and Project Coordinator.

Project Stage	Subject of Consultation	Method to be used	Schedule: Places and Dates	Target Stakeholders	Responsible
Pre-construction	Follow-up report, observations and suggestions.	Workshop with residents of the area affected by the project and community leaders.	School or community facilities. At least one workshop per canal.	Community leaders. Families to be relocated. Vulnerable groups.	Community Relations Officer.
Construction	Resettlement and Family Rights Strategy (Conflict Prevention)	Training workshops with families to be relocated.	School or community facilities. Number according to need. Not less than two per canal.	Community leaders. Families to be relocated. Vulnerable groups.	Community Relations Officer, Las Caobas Community House of Justice, Block of Organizations of the Guajimía canal.
Construction	Resettlement and Family Rights Strategy (Conflict Prevention)	Specialized consultation with vulnerable groups.	School or community facilities. Number according to need. Not less than two per canal.	Vulnerable groups in each canal.	Community Relations Officer, Las Caobas Community House of Justice, Block of Organizations of the Guajimía canal.
Construction	Spaces freed up by the Project, Community Commitments and SDO City Council Authorities.	Training and engagement workshops between SDO City Council and organizations.	School or community facilities.	Community leaders. Residents to be relocated	Community Relations Officer and Mayor of SDO.

Project Stage	Subject of Consultation	Method to be used	Schedule: Places and Dates	Target Stakeholders	Responsible
Construction	SDO City Council Solid Waste Collection Plan Monitoring Report: Observations and Suggestions.	Workshop with residents of the area affected by the project and community leaders.	School or community facilities.	Community leaders. Residents of the Project's area of influence.	Community Relations Officer, Consultant responsible for Monitoring and SDO City Council.
Operation	Report on the Operation of the Canals: Observations and Suggestions.	Workshop with residents of the area affected by the project and community leaders.	School or community facilities.	Community leaders. Residents of the Project's area of influence.	Community Relations Officer and Project Coordinator.
Closing	Final Project Monitoring Report: Observations and Suggestions	Workshop with residents of the area affected by the project and community leaders.	School or community facilities.	Community leaders. Residents of the Project's area of influence.	Community Relations Officer, Consultant in charge of Follow-up, CAASD and SDO City Council.

8.7.4.4 *Measures to Incorporate the Opinion of Vulnerable Groups*

To facilitate the incorporation of measures suggested by vulnerable groups into the Project, the following measures are being suggested:

a) Carrying out specific information, consultation and follow-up activities with vulnerable groups. In this regard, the following should be taken into account:

   a. Specific activities for Haitian residents, whether or not they speak Spanish, all information and all documentation to be signed or of interest, must be available in their native language, Creole. It must be guaranteed that, if they are deported before or during the process, due to the irregular status of most of them, or the owner evicts them, their compensation will be delivered as they decide. This is an issue that should be worked on during the interviews with them.

   b. Venezuelan migrants speak Spanish but are mostly tenants. And they may suffer the same consequences from landlords. For this reason, as in the previous case, it should be guaranteed that, if they are deported before or during the process, due to the irregular status of most of them,

or the landlord evicts them, their compensation will be delivered as they decide. This is an issue that should be worked on when having the interviews with them.

c. Tenants in general, whether Dominican or of other nationalities, may have the problems indicated above with landlords. Therefore, it should be guaranteed that if the landlord evicts them, their compensation will be handed over as they decide. This is an issue that should be worked on when having interviews with them.

d. Elderly people in many cases will not be able to attend the activities they are invited to, due to their health conditions. The project should have social workers who come to their homes to ensure that the project information reaches them in a timely manner. It is also necessary for the social worker to ensure that the elderly person knows and understands the most important information and their rights.

Collect the suggestions you make and channel them to the Project, so that they can be taken into account.

e. People with disabilities are another vulnerable group that requires specific attention from the Project. Depending on the disability, the Project must take specific measures to guarantee the information and rights of these people. In the case of motor disabilities, it is likely that they will not be able to travel to participate in the Project's activities, so a social promoter will have to assist them. In the case of severe visual impairment, which prevents them from reading, the social promoter must provide them with the relevant information and their rights, in the presence of a family member or person of their trust.

f. In the case of severe mental disabilities, which prevent them from understanding their reality and communicating, legal consultations will have to be made on how to proceed in this regard. If you are the head of household and have a spouse and children, the solution could be easier, since the compensations should go out in the name of the couple, who should protect you in case of moving.

g. In the case of women heads of household or women at risk of domestic violence, it is necessary to take into account that: Women heads of household may be victims of partners who may be waiting for this opportunity to dispossess them of the compensation they are entitled to. Hence the importance of making it clear to them that only they and their children (if applicable) are the beneficiaries of these benefits. Likewise, in the case of women at risk of violence by their current partners, a social worker should be assigned to these cases and counseling and support should be provided by institutions such as the Las Caobas Community House of Justice and community organizations that can offer support and daily follow-up in the neighborhood.

b) Making agreements with institutions specialized in the problems of the identified vulnerable groups, for the proper management of the Project. Among them, the following are suggested: Las Caobas Community House of Justice, Dominican Association of People with Physical and Motor Disabilities (ASODIFIMO, *by its Spanish acronym*), Haitian and Venezuelan Migrant Associations.

c) With these entities, and others that may be suggested, it is proposed to set up a Consultative Committee for the Project's Vulnerable Groups, to help ensure that their opinions and suggestions are taken into account.

d) Take into account the specific needs of vulnerable groups for their participation in the Project, as detailed in item 4.3.6.

e) Inform vulnerable groups of the changes that have been made to the Project's processes, procedures and methodologies, as a result of their observations and suggestions. Inform this in the Project's biweekly newsletter, the murals established in the canals and other media.

8.7.5 General Schedule of Activities

This timeline is general and therefore includes all the activities proposed in this chapter. As a schedule on social issues, it can always be improved according to the objectives of the Project and the national and IFC regulations.

Activities	Date	Place	Responsible
EIA and RAP Development Phase			
Identification of key stakeholders	May – June 2021	Project impact zone and office	EMPACA-AECOM
Key stakeholder interviews	May – June 2021	Project impact zone and others	EMPACA-AECOM
Information and consultation with residents, together with the CAASD, in three meetings and two meetings held in the neighborhoods to be impacted by the Project.	May 5 and June 17	Project impact zone. And Mutual Relief Society, Buenos Aires.	EMPACA-AECOM-CAASD- Block of Organizations of the Guajimía canal
Consultation with residents relocated in Phase I and residents to be relocated in Phase II (4 focus groups)	June 11 and July 6	Project impact zone.	EMPACA-AECOM
Consultation carried out through the application of a survey to 393 residents of the neighborhoods to be impacted.	May 13, 14 and 15	Neighborhoods directly and indirectly impacted by the Project.	EMPACA-AECOM
Preparation of plans for information, consultation and participation of key stakeholders in the Project.	July - August	Office	EMPACA-AECOM
Pre-Construction Phase			
Designate personnel responsible for social affairs and/or community relations of the Project.	First week of start of work	Project Office	Project Manager
Design and establish a mechanism for complaints and claims.	Second month of start of work	Project Office	Community relations officer and project manager
Design and set up the Project's web page.	First month of start of work	Project Office	Responsible for community relations and IT of the Project.
Inform about the installation of the Project offices, including the Social Office, contacts, means of communication.	First month of start of work	Project Office/ Communities.	Community relations officer
Open and publicize the account of the Pluvial and Sanitary Drainage Project of the Guajimia Canal and its tributaries in social networks (Facebook, Twitter, Instagram, WhatsApp community chats).	First month of start of work	Project Office	Responsible for community relations and IT of the Project.
Create a physical and/or virtual space to document and systematize the project's experience in its relationship with the communities.	First month of start of work	Project Office	Responsible for community relations
Apply periodic surveys to residents affected by the Project in the six canals. At least once a year.	From the third month after of start of work	Neighborhoods where work will be performed	Responsible for Community Relations, Project Manager and polling company.

Activities	Date	Place	Responsible
Create a dialogue roundtable with the participation of CAASD's Social Directorate and community organizations.	First month of start of work	Neighborhoods where work will be performed	Project management, CAASD's Social Management, community organizations
Update stakeholder mapping of the project	Permanent	Project Office	Staff responsible for community relations.
Collect information from project contractors on human resources, inputs and services needs during the construction phase.	Permanent	Project Office	Executive Management of the project
Identify NGOs that have offered to support the proper development of the Project, such as the Las Caobas Community House of Justice, in order to define with them their participation in this initiative. Announce agreements.	First month of start of work	Project Office	Community relations officer and project manager
Gather information on human resources available for contracting in the mayor's office of the municipality of Santo Domingo Oeste and the community organizations of Buenos Aires, Engombe, Herrera and Las Caobas, in order to propose contractors for the works.	From the second week of start of work	Buenos Aires, Herrera, Engombe, Las Caobas.	Responsible for community relations, project manager, Santo Domingo Oeste mayor's office, Block of Organizations of the Guajimía canal.
Biweekly Project Newsletter	From the second month after of start of work	Social Office	Responsible for community relations and communications.
Identify with the CAASD the public institutions that can and should, due to their institutional mission, collaborate with the proper development of the Project, in order to establish permanent coordination mechanisms with them, especially with the City Council of Sto. Dgo. Oeste, the VMODT, INVI and URBE. Announce agreements.	First month of start of work	Project Office	Project Manager and Community Relations Officer.
Coordinate consultations with heads of households and organizations to address issues related to relocation and the characteristics of the housing solutions, including construction sites.	Second month of start of work	Premises of mutual societies in the project's neighborhoods, City Council halls.	Community relations officer and project manager.
Coordinate community meetings to define the use of the released spaces and the role of community organizations, the City Council of SDO and the CAASD in this matter.	Fourth month of start of work	Premises of mutual societies in the project's neighborhoods, City Council halls.	Executive Direction of the project, in charge of community relations. Mayor's Office of the Municipality of Santo Domingo Oeste. CAASD. Block of Organizations of the Guajimía canal.
Hold open-door community meetings every two months with the representatives of community organizations to hear their complaints, observations and suggestions for a better performance of the Project.	Second month of start of work	Community centers in Buenos Aires, Herrera, Las Caobas and Engombe. City Council Hall.	Project Manager, Community Relations Officer and Complaints and Grievance Officer.

Activities	Date	Place	Responsible
Queries on project monitoring reports	From the sixth month of the start of the work	School or community premises in the Project's zone of incidence.	Community Relations Officer.
Respond to complaints and claims filed.	Permanent as of the first week of the start of work	Project Office	Responsible for complaints and claims in coordination with the community relations manager.
Monitor the Project's web page	Permanent as of the first month after the start of the work	Project Office	Responsible and community relations assistants
Archive documents that serve to document and systematize the project's experience in its relationship with the communities.	Permanent as of the first month after the start of the work	Project Office	Responsible and community relations assistants
Monitor the account of Pluvial and Sanitary Drainage Project of the Guajimía Canal and its tributaries in social networks (Facebook, Twitter, Instagram).	Permanent as of the first month after the start of the work	Project Office	Responsible and community relations assistants
Construction Phase			
Publish resettlement strategy in popular language.	Fifth month of work.	Neighborhoods of influence of the Project.	In charge of community relations and communication.
Family, landlord and tenant rights. Preventive training for conflict management. Printing and conducting workshops.	From the fourth month after the start of the work.	Neighborhoods of influence of the Project. Vulnerable groups and PAPs.	In charge of community relations and Las Caobas Community House of Justice
Family, landlord and tenant rights. Training and consultation with vulnerable groups.	From the fourth month after the start of the work.	Neighborhoods of influence of the Project. Vulnerable groups. Activities with Haitian migrants who do not speak Spanish.	In charge of community relations and Las Caobas Community House of Justice
Consultation: Spaces released by the Project, Community Commitments and SDO City Council Authorities.	From the sixth month after the beginning of the works.	Neighborhoods of influence of the Project	Community Relations Officer and Mayor of SDO.
Implement the complaints and claims mechanism. Train the project managers to attend to the users of this mechanism.	From the fifth month of work	Project work camps	Complaint and grievance management officer, community relations officer and assistants, project management.
Organize meetings with key stakeholders listed and described in the mapping to inform about the beginning of the construction phase and about the needs of human resources, products and services	Fifth month from start of work.	City Council Municipality of Santo Domingo Oeste	Institutions and organizations in stakeholder mapping. (See mapping).

Activities	Date	Place	Responsible
required by the Project and that can be offered locally. Inform contracting policy.			
Inform through local media in Santo Domingo Oeste and through the project's social media accounts on human resources, supplies and services needs for the construction phase of the Project.	Fifth month from start of work.	Local media and social networks	Social Direction of CAASD and community relations managers, human resources managers, general population of Buenos Aires, Engombe, Herrera and the urban area of the municipality of Santo Domingo Oeste.
Information on measures taken by the Project on vulnerable groups	Sixth month of start of work	Dissemination media (see information measures)	Community Relations Officer
Inform residents of the key interventions to be carried out per canal, in order to contribute to risk management and prevention.	From the beginning of the construction phase	Dissemination media (see information measures)	Community Relations Officer
Operation Phase			
Report the installation of residents' meetings of the buildings to which the residents of the affected area have moved.	During the week in which the gaskets are installed.	Dissemination media (see information measures)	Community relations officer and communications officer.
Report on the operation of the canals and recommendations	Fifteen days after receipt of the follow-up report	Media outlets	Community relations officer and communications officer.
Consultation on the Report on the operation of the canals.	Fifteen days after receipt of the follow-up report	Community or school premises in the Project's area of impact.	Community Relations Officers of the Project and CAASD.
Report on the CAASD works maintenance program.	First month of the operation phase	Media outlets	Community Relations Officers of the Project and CAASD.
Closing Phase			
Final follow-up report on the Project. Summary in popular language and dissemination with Block of Organizations of the Guajimía Canal, churches, NGOs in the zone and other state institutions.	Within a week of receiving the report.	Community or school premises in the Project's zone of impact.	In charge of community relations for the Project, the CAASD and the City Council of SDO.
Consultation on the Final Project Follow-up Report	Fifteen days after submitting the report to the community.	Community or school premises in the Project's zone of impact.	In charge of community relations for the Project, the CAASD and the City Council of SDO.

8.7.6 Other Activities to be Performed

Activities	Date	Place	Responsible
Pre-construction phase			
Initiate contacts with the Herrera Industrial Association, NGOs, City Council and neighborhood associations to explore the possibility of cooperation in the creation of a program for co-management and recycling of solid waste in the municipality, with economic incentives.	Third month of start of work		Project Manager, Project Community Relations Officer, Mayor SDO, CAASD Management.
Visit the local experiences of foundations that work in this direction, such as Zurza Environmental Sanitation Foundation (Fundsazurza, *by its Spanish acronym*) and others.	Third month of start of work	Local Fundsazurza. Neighborhoods served.	Project Manager, Project Community Relations Officer, Mayor SDO, CAASD Management.
Construction Phase			
Organize meetings with the Block of Organizations of the Guajimía canal, neighborhood associations, organizations and NGOs to present a proposal for community co-management of solid waste in the neighborhoods of La Rosa, Buenos Aires, Herrera, Engombe and Las Caobas.	Sixth month of start of work	Premises of mutual societies in the project's neighborhoods, City Council halls, etc.	Mayor's Office of SDO, with the support of CAASD's Community Relations Officer and the Project
Start of project work. Formation of the responsible team.	Seventh month of start of work.		Mayor's Office of SDO, with the support of CAASD's Community Relations Officer and the Project
Organize talks in Buenos Aires, Herrera, Engombe and Las Caobas schools on solid waste management and disposal and on climate change.	From the sixth month after the start of the works	School premises in La Rosa, Buenos Aires, Engombe, Herrera and Las Caobas neighborhoods.	Mayor's Office of SDO, with the support of CAASD's Community Relations Officer and the Project
Organize educational and single-use plastic collection activities with schools.	From the sixth month after the start of the works	Neighborhoods of influence of the project	Mayor's Office of SDO, with the support of CAASD's Community Relations Officer and the Project

8.7.7 Resources and Responsibilities

The Plan for the Relationship with Social Stakeholders will have an available budget that must come out of the Project's general budget, which must guarantee the development of the activities and the achievement of the purposes.

The Project Management will work in coordination with the CAASD Social Directorate, which will be responsible for coordinating the project's relations with the impacted neighborhoods and overseeing compliance with the objectives formulated, through follow-up and monitoring of the activities programmed in this Plan.

The CAASD Social Directorate will be supported by several assistants at the beginning of the project, each of whom will be responsible for relations with the neighborhoods around the work camps that will be installed.

8.7.7.1 *Grievance Mechanism*

The purpose is to establish a mechanism to receive, evaluate, respond to and/or address concerns, problems or complaints from the communities of influence of the Pluvial and Sanitary Drainage Project of the Guajimía Canal and its tributaries project (see Item 8: Complaint Mechanism).

8.7.7.2 *Follow-up and Preparation of Reports*

The Project will hire the services of external consultants to prepare follow-up reports on both social and physical infrastructure issues. The results of these reports will be delivered to the community in an understandable, popular language for their knowledge and suggestions.

The reports should be done at least every year and should provide information on the progress of the project as well as suggestions for improving its implementation.

8.8 General Health and Safety Management Plan

8.8.1 Objectives

The general Health & Safety Management Plan (HSMP) of the Storm and Sanitary Drainage of the Guajimia Canal Phase II Project (‘’The Project’’) represents the framework that is part of the project's Occupational Health and Safety System and a structured approach to workplace health & safety, in order to achieve a consistently high standard of safety performance and ensure the safety of the workers and the community during the construction and operation activities of the project, in accordance with the health and safety laws and standards in force in the Dominican Republic, the international conventions to which it is a signatory and the Performance Standards (PS) on Environmental and Social Sustainability of the International Finance Corporation (IFC).

This shall be achieved through:

- Development, implementation and commitment to the project’s Health and Safety Policy and Health and Safety Management System.
- Allocation of responsibilities and accountabilities of internal and external stakeholders towards defined objectives and targets.
- Strict adherence to all legal and other required health and safety obligations.
- Definition of the framework for identifying and assessing health and safety risks related to the project.
- Establish of the appropriate measures to prevent, mitigate or minimize these risks.
- Provision of training and awareness programs for all employment levels based on the identified risks.
- Documentation and reporting of occupational accidents, illnesses and incidents.
- Definition of the mechanisms for preparing for and managing emergency situations (see Emergency Response and preparation Plan).
- Description of the monitoring, review and continual improvement processes of the Health and Safety management system.

8.8.2 Legal / Regulatory Framework and Other Requirements

Through the HSMP, The Project shall comply with all applicable Dominican Republic health and safety laws, regulations, codes of practice, and other legal requirements which apply to their activities and operations, and exercise their duty of care with respect to personnel and the communities in which they operate.

This shall be achieved by means of the following:

- All safety-related acts, regulations, by-laws and other legislative and regulatory requirements applicable to The Project’s operations shall be identified and their implications assessed.

- All amendments and changes to legislation and licenses (including new requirements) shall be identified and reviewed annually and all personnel who need to be aware of these changes shall be advised.
- Compliance with all requirements related to regulatory reporting and record keeping shall be maintained.

In the next sections, regulations, by-laws and other legislative and regulatory requirements applicable to The Project's operations are listed:

National Regulations
International Conventions adopted by the Government of Dominican Republic
International IFC Performance Standards

8.8.2.1 *National Regulations*

Health and Safety Legislation in force in Dominican Republic include, but are not limited to:

Law No. 147-02 on Risk Management (*Ley No. 147-02 sobre Gestión de Riesgos*)
Occupational Health and Safety Regulation, Decree No. 522-06, dated October 17, 2006) (*Reglamento De Seguridad y Salud En El Trabajo, Decreto Núm. 522-06, del 17 de octubre de 2006*)

8.8.2.2 *International Conventions adopted by the Government of Dominican Republic*

International Conventions adopted by the Government of Dominican Republic, include but are not limited to:

- International Conventions those of the International Labour Organization (ILO) and the United Nations (UN)
- ILO Convention 87 on Freedom of Association and Protection of the Right to Organize
- ILO Convention 98 on the Right to Organize and Collective Bargaining
- ILO Convention 29 on Forced Labor
- ILO Convention 105 on the Abolition of Forced Labor
- ILO Convention 138 on Minimum Age (of Employment)
- ILO Convention 182 on the Worst Forms of Child Labor
- ILO Convention 100 on Equal Remuneration
- ILO Convention 111 on Discrimination (Employment and Occupation)
- UN Convention on the Rights of the Child, Article 32.1
- UN Convention on the Protection of the Rights of all Migrant Workers and Members of their Families

8.8.2.3 *International Standards*

The Project Health & Safety Management Plan (HSMP) shall comply with the following International standards:

- International Finance Corporation (IFC) Performance Standards (PS)
- The World Bank EHS Guidelines
- Guidelines of the Organization for Economic Cooperation and Development

The objectives of the 2012 International Finance Corporation (IFC) Performance Standards (PS) related to health and safety aspects are summarized in the table below:

Table 8-24: Objectives of the Performance Standards related to Health and Safety Aspects

No.	Performance Standards	Objectives
SP1	Assessment and Management of Environmental and Social Risks and Impacts	- Identify and evaluate the social and environmental impacts, both negative and positive, in the area of influence of the project - Avoid or, when this is not possible, minimize, mitigate or compensate negative impacts on workers, affected communities and the environment - Ensure that the affected communities are appropriately involved in the resolution of issues that may affect them - Promote a better social and environmental performance of societies, through an effective use of management systems - Ensure that potentially affected populations, especially vulnerable groups, due to their current situation of precariousness and negative societal attitudes and prejudices towards them, are informed and consulted in a specific manner and/or favored with respect to certain actions or processes.
SP2	Labor and Working Conditions	- Establish, maintain and improve the relationship between management and workers - Promote the fight against discrimination and equal opportunities and treatment of workers and compliance with national labor and employment laws - Protect workers by fighting against child labor and forced labor - Promote safe and healthy working conditions and to protect and promote the health of workers.
SP4	Community Health, Safety, and Security	- Avoid or minimize risks and impacts on health, especially communicable diseases such as STIs and HIV/AIDS, and safety of the local community during the project life cycle, taking into account the different risks and needs of men and women and other social groups on these issues; - Ensure the protection of staff and assets in a legitimate manner that avoids or reduces safety and community protection risks

A more specific and detailed Health and Safety Plan for construction and operation phase will include the following requirements to elaborate policies and procedures regarding the comply with IFC Performance Standards.

8.8.3 Policies and Procedures to comply with IFC Performance Standards

8.8.3.1 *Policy and Management Commitment*

An overarching Health and Safety policy shall be established, defining the Health and Safety objectives and principles to be applied in the context of the project and on all activity sites, and designating the person or persons responsible for its implementation.

The policy shall be based on the commitment of the top management and shall aim to provide support for the daily implementation of the health and safety management plan, in particular by:

- Demonstrating the importance of Health and Safety.
- Ensuring the availability of the resources (financial, material and human) required to implement and maintain the prevention and protection measures adopted.
- Ensuring compliance with the applicable laws and regulations in force in the Dominican Republic, the international conventions and the Performance Standards (PS) on Environmental and Social Sustainability of the International Finance Corporation (IFC).
- Promoting active participation of workers, communication and cooperation.
- Encouraging each worker to report incidents, risks, opportunities and accidents.
- Actively promoting the identification of opportunities for health and safety improvement, including site visits and monitoring of targets.

The policy shall apply to all contractors and subcontractors, be signed by the top management, distributed to all workers, made public and reviewed annually or more often when necessary.

8.8.3.2 *Management of Risks*

Some procedures for identifying the Health and Safety risks of the project shall be established and maintained by setting up an approach which aims at:

- Identifying the hazards to which the personnel are exposed by workstation.
- Establishing management programs that define the prevention and protective measures to address the identified risks of the project.
- Training the workers to these management programs and measures.
- Establishing procedures to monitor and measure the effectiveness of the management programs, as well as compliance with any related legal obligations and regulatory requirements.
- Documenting all cases of illness, accidents, incidents and dangerous situations.
- Developing an emergency preparedness and response procedures to respond to accidental and emergency situations associated with the project in a manner appropriate to prevent and mitigate any harm to people.

The activities to be carried out during the construction and operation phase of the project present conditions that could involve risk situations with consequences for the personnel working on site, for equipment and infrastructure and for residents of adjacent homes.

For the assessment of the hazards and risks associated to the construction and operation phase of the project, the various tasks to be executed, and the physical, chemical and biological hazards associated with these will need to be taken into consideration.

The general analysis for the identification of health and safety risks that may arise due to the activities that will be carried out in the project in the construction and operational phase, these may be classified into the following categories: physical, chemical and biological risks.

Physical risks: occupational noise and vibrations; risk of fall, slip and trip; risks from exposure to natural elements (earthquakes, storms and floods); risks associated with the use of mechanical equipment, electrical risks and fire hazards.

Chemical risks: Risks from working in hazardous environments and those arising from use, handling and spills of chemical or hazardous substances.

Biological risks: include some of the conditions identified include animal/insect bites and/or stings; animal attacks and/or contact with poisonous, stinging and/or allergenic vegetation or invertebrates; exposition to different types of waste, propagation of diseases (mainly COVID-19).

A more detailed identification of health and safety hazards and risk evaluation will be carried out during the start of the construction phase and operational phase with the participation of the project´s staff.

8.8.3.3 *Labor and Working Conditions*

Working Conditions and Management of Worker Relationship

Human resources policies and procedures shall be adopted and implemented and shall describe the means used to ensure that workers are provided with clear and understandable information regarding their rights under applicable labor laws and collective agreements, including their rights related to employment, health, safety, welfare, immigration and emigration more specifically hours of work, wages, overtime, compensation, and benefits upon beginning the working relationship and when material changes occur.

Protecting the Work Force

Policies and procedures shall be adopted and implemented, prohibiting the employment of forced labor of any work that is not voluntarily performed, and of children in any manner that is economically exploitative, or is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development.

Occupational Health and Safety

A safe and healthy work environment shall be provided, taking into account inherent risks in the work areas, including physical, chemical, biological, and other applicable hazards if present. Areas shall include the:

- Identification of potential hazards to workers, particularly those that may be life-threatening;
- Provision of preventive and protective measures, including elimination or substitution of hazardous conditions or substances, engineering and administrative controls, or provision of the necessary personal protective equipment.
- Training of workers.
- Documentation and reporting of occupational accidents, diseases, and incidents; and
- Emergency prevention, preparedness, and response arrangements.

Workers Engaged by Third Parties

With respect to contracted workers, commercially reasonable efforts shall be taken to ascertain that the third parties who engage these workers are reputable and legitimate enterprises and have an appropriate Health and Safety Management System/Plan that will allow them to operate in a manner consistent with the requirements of this plan.

Policies and procedures shall be established for managing and monitoring the performance of such third-party employers in relation to the requirements of this plan.

Supply Chain

Procedures to monitor the primary supply chain shall be adopted and implemented on an ongoing basis in order to identify any significant changes in its supply chain and if new risks or incidents of child and/or forced labor are identified, appropriate steps to remedy them shall be taken.

Procedures and mitigation measures shall be introduced to ensure that primary suppliers within the supply chain are taking steps to prevent any significant health and safety issues related to supply chain workers and to correct any life-threatening situations.

8.8.3.4 *Specific Aspects Related to Community Health, Safety and Security*

Community Health and Safety

The risks and impacts to the health and safety of the Affected Communities during the project life cycle shall be evaluated and preventive and control measures that are commensurate with their nature and magnitude shall be established. These measures shall favor the avoidance of risks. Health and Safety risks to third parties or affected communities arising from Infrastructure and equipment design, Hazardous materials, Ecosystem services, Community exposure to disease shall be taken into consideration.

Assistance and collaboration shall be provided to the Affected Communities in their preparations to respond effectively to emergency situations, especially when their participation and collaboration are necessary to respond to such emergency situations.

Security Personnel

If required by The Project, security personnel (direct or contracted workers) shall be retained to provide security to safeguard its personnel and property and shall assess risks posed by its security arrangements to those within and outside the project site. Some reasonable inquiries shall be conducted to ensure that those providing security are not

implicated in past abuses, are trained adequately in the use of force (and where applicable, firearms), have appropriate conduct toward workers and Affected Communities, and act within the applicable law**.**

COVID-19 Risk

In relation to the COVID-19 Coronavirus outbreak that has been occurring since February 2020, a COVID-19 Risk Mitigation Plan shall be developed and implemented as a complement to the HSMP.

The objectives of the COVID-19 Risk Mitigation Plan are as follows:

- To present general prevention and protection measures against the risk of COVID-19 contamination to be followed by all The Project personnel, consultants, contractors and subcontractors involved in the project, in order to contain the risk of contamination and slow the spread of the COVID-19 virus.
- Ensure that the Project personnel are prepared to assess risks and make informed decisions on how to protect themselves, workers and surrounding communities so that risks related to the COVID-19 pandemic are eliminated or mitigated as appropriate.
- Ensure that the work remains in compliance with the Government of the Dominican Republic and IFC guidelines as well as the public health authorities' best practices with respect to the COVID-19 pandemic.

8.8.4 Roles and responsibilities

All personnel including contractors share the responsibility of avoiding personal injuries, unplanned outages resulting from accidents during construction and promoting maximum efficiency.

All managers, supervisors and employees will be notified of their responsibilities, and their performance will be evaluated on a regular basis.

The responsibilities of the staff shall be described in the specific and detailed Health and Safety Plan for construction and operation phase, and examples of roles and responsibilities are described below:

Project Manager

The responsibilities of the Project Manager in charge are the following:

- Lead the organization of the project's occupational health and safety efforts.
- Establish, implement and maintain the Health and Safety Management Policy.
- Ensure that all health and safety laws, regulations, and other requirements are complied.
- Maintain effective communication on health and safety issues with subcontractors, suppliers, customers and government authorities.
- Organize the Occupational Health and Safety Committee.
- Ensure that health and safety procedures are adopted and implemented.
- Ensure that occupational health and safety requirements are transmitted to subcontractors correctly.
- Demonstrate and maintain a commitment to the Health and Safety Policy and objectives of the project.
- Ensure that the site is kept in a safe and healthy state and that activities are carried out following the applicable health and safety procedures; through regular on-site inspections with supervisory staff and participating in health and safety inspections and/or audits.
- Lead the investigation of incidents, accidents, and diseases to identify and enforce corrective actions to prevent a recurrence.

Managers

- Lead its section in charge in order to carry out and track activities in a safe and healthy responsible manner.
- Overseeing and coordinate the activities of the subcontractors and suppliers, ensuring that they are aware of compliance and implementation of occupational health and safety measures, legal and contractual requirements.
- Ensure the implementation of all health and safety procedures and include them in the working methods for each activity.
- Ensure that area supervisors have developed and approved work permits applicable to health and safety.
- Verify that the hazards and control measures indicated in this health and safety plans are understood by the team.
- Coordinate the employees training in health and safety topics.

Supervisors

- Ensure that all staff, including subcontractors and providers, work safely following the occupational health and safety plan and procedures.
- Promote and carried out inductions and daily talks for the staff.
- Maintain constant communication with health and safety personnel to address health and safety issues.
- Verify the application and implementation of health and safety requirements by subcontractors and providers.

- Evaluate the implementation of Health and safety management system requirements in collaboration with occupational health and safety personnel.
- Implement health and safety preventive and corrective actions.
- Provide adequate personal protective equipment to work personnel.
- Participate in incident investigation.

Occupational Health and Safety Manager

- Monitor the effective implementation of the Health and Safety Management System.
- Support to managers and supervisors in health and safety issues.
- Verify that the project complies with the necessary health and safety policy and requirements.
- Coordinate the execution of monitoring and measurements of occupational health and safety parameters.
- Coordinate the investigation of incidents, accidents, and diseases to identify and enforce corrective actions to prevent a recurrence.
- Document and report on occupational incidents, accidents, and diseases.
- Supervise the tasks of health and safety officers.

Subcontractors and Suppliers

- Implement this project Occupational Health and Safety Plan.
- Identify and evaluate all work hazards to which your staff is exposed according to the activity to be implemented,
- Prepare your own Health and Safety Plan
- Train the staff in related health and safety requirements, plans and procedures.
- Implement all necessary preventive and corrective actions
- Provide personal protective equipment to their workers.
- Attend health and safety meetings and implement any identified action items.
- Comply with all health and safety regulations and requirements applicable to the project.
- Ensure that your staff has adequate access to medical care and first aid in cases of injury or accidents at work.
- Immediately notify to the Project Manager and Occupational Health and Safety Manager of the occurrence of any incident and/or accident.
- Cooperate with an incident investigation to identify and enforce preventive and corrective actions.

8.8.5 Monitoring and Supervision

8.8.5.1 *Inspections and Audits*

As part of monitoring and supervision of compliance with health and safety measures and requirements, at the construction and operational stage of the project, inspections and audits will be carried out, generating written records of their results; the necessary corrective measures will be taken, setting a final date for their implementation.

Any corrective action must be implemented immediately by the applicable Section Manager, and the Sector Manager in turn will be monitored regularly by occupational health and safety personnel.

These inspections and audits should also identify opportunities for improvement whose development strengthens the Health and Safety System.

8.8.5.2 *Reports*

Monthly health and safety reports should be generated which will include in its content the statistics of occupational incidents, accidents, injuries, and diseases of the period and accumulated for the project.

8.8.5.3 *Administration and Monitoring of Occupational Accidents, Incidents, and Diseases*

All accidents and incidents (including near misses) and diseases related to project activities, both at the construction and operation stage, must be recorded. Early reporting and in-depth analysis of these events provide an important performance indicator.

8.8.6 Health and Safety Education Plan

Education is an essential element of the success of the Health and Safety Management Plan, so it is necessary to formulate a continuous health and safety training strategy to ensure that workers know and have the skills to meet possible emergencies that may arise at the site during construction and operation of the project.

Personnel involved in the project shall be given initial training before the start of the project, and they must participate periodically in presentations to bolster their initial training.

A training program in the area of occupational hygiene and safety for all new employees will be established so that they know the basic rules governing work in the project and the use of personal protective equipment. This training shall include at least the following:

- Basic knowledge of risks.
- Workplace-specific risks.
- Practices for safe work.
- Emergency procedures in case of fire, evacuation, and natural disaster.
- Any code representative of the specific risks of a workplace or color code used in the place.

All workers, without discrimination and with equal opportunities, will have access to the required skills, according to the activities carried out and in accordance with their jobs. Contractors will provide appropriate training to their employees.

Employees or contractors providing security services to protect project personnel and property (security guards) will be included in the training program. Training will also be conducted for persons related to land acquisition and involuntary resettlement activities.

Drivers will be trained on the benefits of vehicle driving practices to reduce the risk of accidents such as fuel consumption, as well as the importance of avoiding sharp accelerations and respecting speed limits.

A detailed Health and Safety Education Plan will be elaborated before the start of construction and operation phase.

8.9 Contingency Plan

8.9.1 Content Overview

The dismantling, disassembly and removal of project structures will undoubtedly require activities that could affect noise, air, and vibration conditions in the environment at that time. In addition, the high load of waste and residues that would be handled during this phase could directly affect the water, soil, social environment, landscape, and even flora and fauna, if they are not managed in a more responsible manner.

The management during the dismantling phase must be carried out in compliance with the proper application of prevention and mitigation measures, in addition the restoration of the affected area must be promoted as far as possible. Therefore, the actions to be implemented during this phase must be focused on preserving / restoring the physical, biological and sociocultural components of the environment, also maintaining the commitment to comply with health and safety measures in the work team that will be involved in the process. In turn, the surrounding populations must be informed of the actions to be implemented for the abandonment of the facilities.

8.9.2 Decommissioning phase activities

Among the activities of the process of the dismantling stage to be executed in the project are the following:

- *Dismantling of temporary facilities.*

  At the end of the construction of the works in the canal and in accordance with the execution schedule, the facilities created for the work will be dismantled, which are limited to the containers used as offices, portable bathrooms, facilities for workers and temporary warehouses equipped as warehouses of materials. Portable toilets and containers used as offices will be removed by the company that provided the rental service.

- *Transport of the temporary facilities and equipment of the work to its place of origin.*

  The equipment used during the work, the containers and portable toilets by the subcontracted companies will be transferred to their place of origin using the same routes used for their transfer in the construction phase.

- *Cleaning of the land occupied by the temporary facilities and final disposal of the solid waste generated in the dismantling phase.*

  The 55-gallon tanks used for solid waste collection will be removed and all areas occupied by temporary facilities will be cleaned. The hazardous and non-hazardous solid wastes generated in this phase will be handled following the same procedures as in the construction phase and by managers accredited by the Ministry of Environment and Natural Resources of the Dominican Republic.

  If necessary, specific rubbings will be available for the management of surplus materials and waste of concrete, scrap and stones.

- *Restoration of intervened areas.*

  The last stage of the activities related to the dismantling phase is the restoration of the intervened areas. For the restoration, the original conditions of the environment must be analyzed and considered and will have to be planned according to the final use of the land. As restoration measures are contemplated:

  a. Leveling of the ground and restoration of pavements and infrastructures of basic services where necessary.
     In the places where necessary, the ground will be leveled and the pavement or any other service infrastructure (drinking water, electricity, sewerage, among others) that have been affected by the installation of the temporary facilities of the work will be restored.

  b. Creation of green areas in the places intended for this purpose.

     In the places occupied by temporary facilities where the creation of green areas is planned according to the General Plan of the project, plants of native and endemic species of the area will be planted (see Chapter 8 Environmental and Social Management Program, Subsection 8.1.1.5).

9. CONCLUSIONS AND RECOMMENDATIONS

After finishing and completing the activities associated to the Environmental and Social Impact Assessment for the Project "Storm and Sanitary Drainage of the Guajimía Canal Phase II, we present the following conclusions and recommendations.

9.1 Conclusions

The components assessed to prepare this study are associated with the different phases established for the execution of Storm and Sanitary Drainage of the Guajimía Canal Phase II project. These include housing solutions, the channeling of the upper part of the Guajimía Canal and its tributary streams, the sanitary sewerage of the main networks of the axes, the expansion of the distribution networks, urban amenities and the re-profiling of the final section of Guajimía.

With the development of this project, we estimate improvements to the social, economic and environmental conditions in the sector and for residents who are part of the project's area of influence, by optimizing the Guajimía Canal drainage system, through an efficient rainwater and sanitary drainage system.

The project will be located in an area with very well-defined distinctive features related to the environment, which is characterized by its circumstances, that is, the problem of the quality of wastewater discharges and the high degree of anthropic intervention throughout the canal.

Ecologically, the Guajimía Canal is located within the subtropical moist forest. At present there is no primary vegetation in the environment; the vegetation present there is secondary. In some cases, patches of gallery vegetation were observed. The most abundant vegetation is herbaceous and is located on the banks of the canal and in the courtyards of the houses. The study also identified scattered trees, mainly fruit trees.

Due to the degree of existing intervention in the area, it is not very rick in terms of flora and fauna representation. In the case of zooplankton, no species of this group were observed during the samplings.

Through the assessment of visibility, fragility and quality, it was determined that the area's landscape is affected due to the fact that there is an intense anthropization, which covers more than 63% of the extension of the watershed.

The lack of urban and territorial planning together with the existing alterations described above result in the area's current circumstances, which is why this project seeks to stimulate the implementation of preventive or mitigation measures that this study proposes.

The potential impacts were assessed taking into account the different stages of the project, from pre-construction to operation. The most significant changes are seen during the pre-construction and operation phases, since several of the activities will take place simultaneously. During the operation phase, the stud determined a decrease in negative impacts. It observed that this project will also have a positive impact, mainly on the socioeconomic and historical-cultural environment, fostering the generation of jobs, the improvement of the quality of life of the inhabitants and of the visual landscape. All the impacts identified are normal for this type of project and can be prevented or mitigated by applying the environmental measures described in the Environmental and Social Management Program.

The population residing in the area may be subject to involuntary resettlement due to the objectives of the project, so this represents a turning point regarding social cohesion, which has a significant impact during compensation negotiations.

The Social and Environmental Management Program has been designed taking into account the preventive, mitigating and restorative or compensating measures of the identified impacts, as well as the provisions of the Environmental Laws and Regulations of the Dominican Republic, the Performance Standards on Environmental and Social Sustainability and the IFC Guidelines on Environment, Health and Safety.

9.2 Recommendations

- Develop a detailed Work Plan before starting construction activities, including compliance with mitigation measures for each of the components and applicable national regulations and international standards. In order to obtain efficient compliance, this plan must be disclosed to contractors and subcontractors through a formally structured communication program for this purpose.
- Coordinate in a timely and appropriate manner with the corresponding authorities the interventions in public spaces.
- Establish continuous communication between the authorities, social groups and others involved in the project, in order to maintain effective coordination during the processes involved in the development of the different activities, including the process of compensating those affected.
- Maintain channels of communication with the community, instructing them on the mechanisms for presenting claims, complaints or suggestions about the project and making them aware of the way in which they will be dealt with by the authorities or those responsible.
- Consider the recommendations obtained during the public consultation processes of this study, with the participation of residents and those potentially affected by the resettlement actions.
- Avoid initiating any activities planned for the construction phase before the families that will be directly affected by the project are relocated to their new residential units. This process must be carried out in accordance with the procedures established in the PAR.
- Maintain the established timeframe of 48 months for the development of pre-construction and construction activities, thus avoiding causing greater disturbance in the areas to be intervened.
- Establish an education program aimed at the community, with the objective of raising awareness among the population regarding the importance of good wastewater management and the benefits that these practices represent for human health and the environment.
- Maintain optimal solid waste management, including the final disposal of solid waste by the responsible entity.
- Once the construction phase is completed, perform the necessary maintenance of the project to prevent their deterioration.
- Adequately implement the Environmental and Social Management Program and each of its programs, so identified impacts can be prevented, mitigated or eliminated.

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