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1.0 EXECUTIVE SUMMARY

1.1 Introduction

The Secretariat of State for Public Works and Communications (SEOPC, in Spanish) is the promoter of the Autopista del Coral road infrastructure project that consists of constructing a new 70km motorway which will connect the cities of La Romana, Higüey and Punta Cana. In addition, it will provide connectivity and continuity to the “Eastern Road Corridor”, which starts in the city of Santo Domingo traverses the country’s Eastern Region (**Figure 1-1**). The SEOPC has selected the Moya – Odebrecht Consortium as the company responsible for developing the Detailed Engineering, Construction and Operation phases under a contracting scheme known as Public – Private Participation Scheme (PPP Participación Pública-Privada in Spanish).

The Environmental Impact Assessment (EsIA) for the Project was conducted by Golder Associates Inc. in collaboration with RCMA GeoIngeniería CxA and other specialists according to the Terms of Reference provided by the Secretariat of State for Environment and Natural Resources (SEMARN) dated August 26, 2005 and renewed on March 21, 2007 according to Dossier Code No. 2336.

Golder Associates Inc. is a consulting firm registered as an environmental services provider before the Sub-secretariat of Environmental Management of SEMARN with Register No. 07-156, as is RCMA GeoIngeniería CxA with Register No. 01-053.

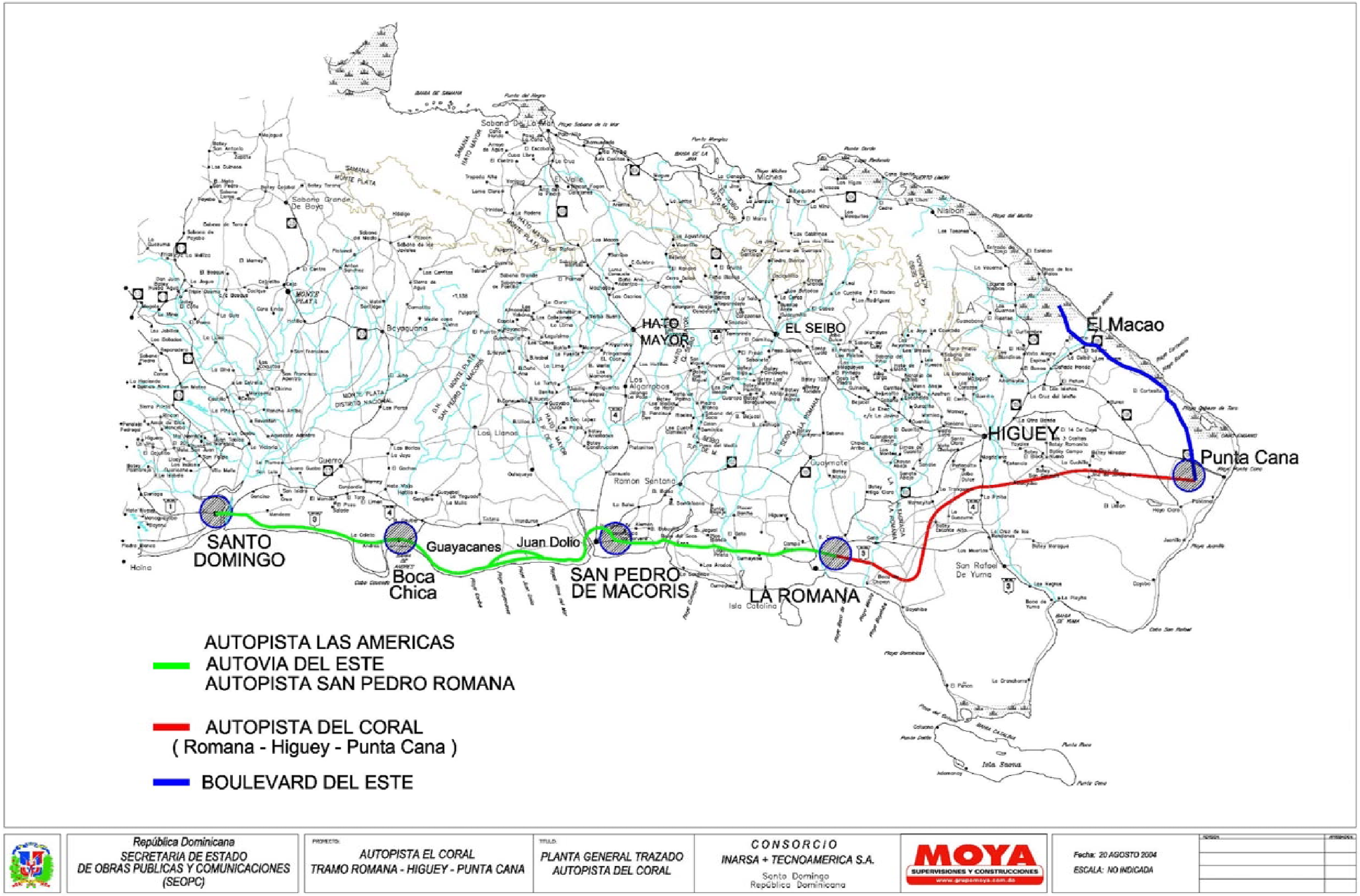
The Environmental Impact Assessment includes the perceptions, opinions and concerns gathered during a Citizen Participation process carried out during the EsIA. The EsIA also includes feedback from specialists from SEOPC and the Moya – Odebrecht Consortium.

The Final EsIA Report is organized according to the requirements established by the Environmental Authority (SSGA - SEMARN) in the Terms of Reference (TOR), as described below:

Section 1	Executive Summary
Section 2	Project Description
Section 3	Environmental and Social Baseline
Section 4	Institutional and Legal Framework
Section 5	Stakeholder Consultation
Section 6	Environmental Impact Identification, Characterization and Assessment
Section 7	Environmental Management and Adaptation Program

The following sections present a summary of the EsIA content.

FIGURE 1-1 Eastern Road Corridor



1.2 Project Description

1.2.1 Project Rationale

Justification of the Autopista del Coral project is explained below:

- The Autopista del Coral represents the missing link in a 224km road corridor that will directly link the city of Santo Domingo with the tourist areas of La Romana, Bayahibe, Higüey, and Verón and with those areas in the so called “Deep East” that include Punta Cana, Bávaro, Cap Cana, Cortecito, Macao, and Uvero Alto.

- The proposed road will provide visitors to the eastern tourist areas with easy access to the commercial, recreational and cultural activities in the city of Santo Domingo and other areas in the Eastern region of the Dominican Republic.

- The proposed project will play a vital role in interconnecting the main ports, airports, marinas and tourist areas of the region by offering tourists a quick and safe access road.

- With design speeds of 100 Km/h in all road sections, the East Corridor (including the Autopista del Coral Project section) will allow travel from Santo Domingo to Punta Cana International Airport in less than two hours. Currently, it takes about 4 hours to travel this route.

- Tourism is the main source of economic growth in the Dominican Republic and the greatest generator of foreign currency income. Tourism contributes 40% to the national economy, represents 22% of GDP, and generates 19.2% of the country’s direct and indirect jobs.

- The tourism sector in the Dominican Republic had the highest growth in Latin America, with 7.5 % in year 2005.

- The tourist areas in the country’s eastern region (La Romana, Bayahibe, Dominicus, Punta Cana, Bávaro, Macao, and Uvero Alto) contain approximately 60% of the 60,000 t rooms that constitute the country’s hotel availability. This area had an 82% average occupancy rate in year 2005. An increase of 10,000 hotel rooms is projected for the next three years in the Bávaro, Punta Cana and Cap Cana zone.

- The international airports located in the East Corridor (Las Américas, La Romana, Punta Cana) receive more than 75% of the foreign visitors to the Dominican Republic every year.

1.2.2 Analysis of Route Alternatives

The route selection for the Autopista del Coral analyzed three alternative routes:

Alternative 1: San Pedro de Macorís – Higüey - Verón

Alternative 2: La Romana – La Cruz de los Rondones – Arena Gorda

Alternative 3: La Romana – Higüey – Punta Cana

The alternatives analysis determined that alternatives 1 and 2 would have lengths of 95 km and 80 km, respectively. The route for Alternative 1 would go through flat topography, while the route for Alternative 2 would cross undulating topography. Both routes were predicted to directly impact towns located within the proposed road corridors. In the case of Alternative 3, the estimated length of the route is 70 km, with the route crossing mostly flat areas with a few undulating zones. Alternative 3 is not projected to directly impact any community in its corridor.

Finally, when comparing the three alternatives; alternative 3 has better technical and constructive characteristics due to its relatively flat topography.

Analysis of the alternatives indicates that the most feasible alternative from a technical point of view and considering environmental and social impacts is Alternative 3, which connects La Romana, Higüey and Punta Cana with a predominant eastward routing.

1.2.3 Route Location and Description

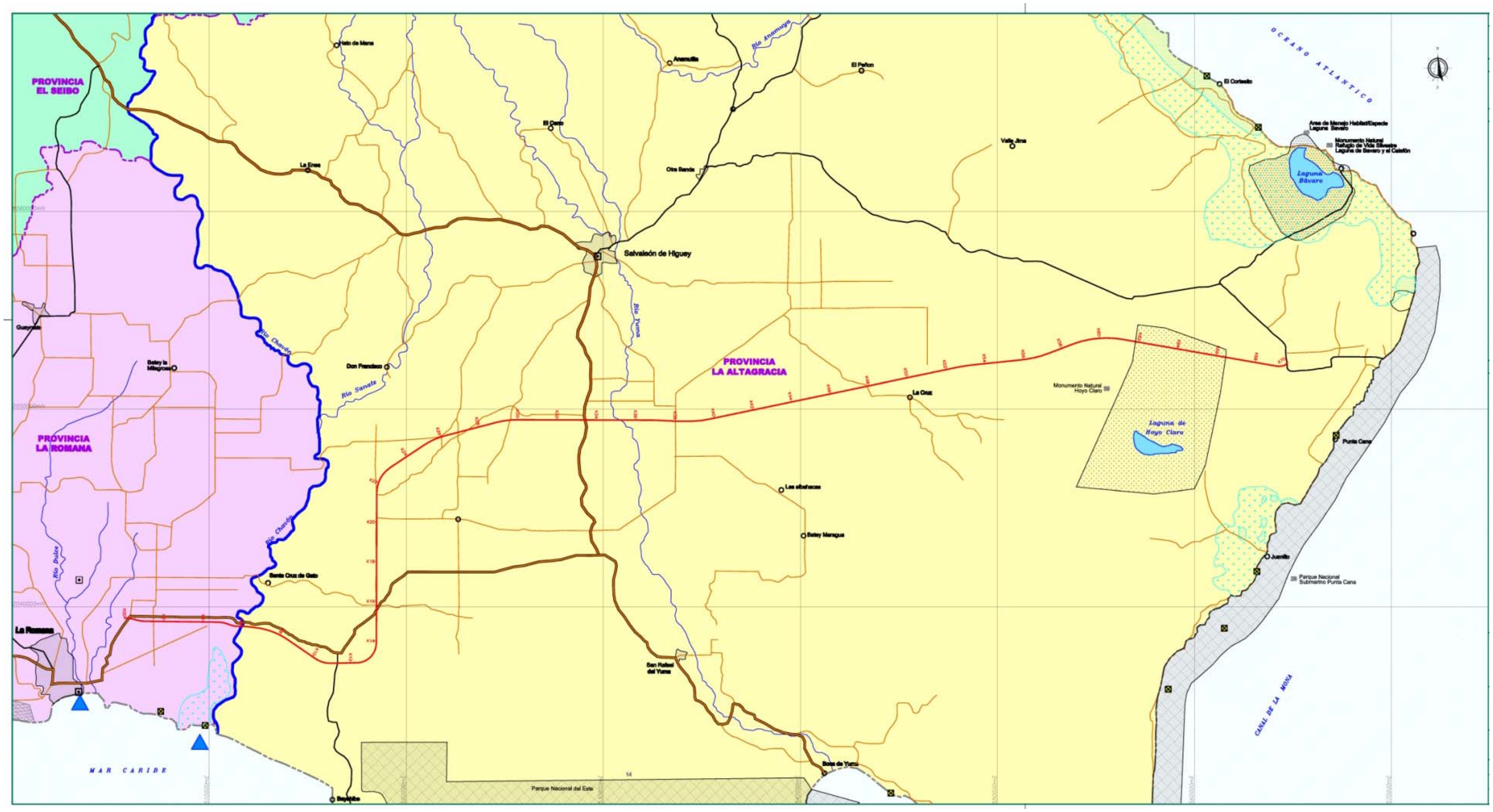
The proposed road corridor for the Autopista del Coral is located in the Southeastern zone of the Dominican Republic. It will start at the terminus of La Romana Beltway, which is currently under construction, thus linking with La Romana Airport, and then connecting with the Bayahibe tourist area, the projected Higüey Beltway and the Boulevard Turístico del Este (Eastern Tourist Boulevard); to finally, after an approximately 70km route, arrives at the Punta Cana International Airport. **Figure 1-2** shows the Project location.

The route can be described in three main sections, as follows:

Section I K0+000 to K13+000 (crossroads with Bayahibe)

In this section the preferred alternative is oriented predominantly in an eastern direction, crossing La Romana Beltway at K0+600, the entrance to La Romana Airport at the K3+590 and the crossroad to Bayahibe at K11+450. Additionally, at K6+300 the motorway crosses over the Chavón River for approximately 300m. This first section is characterized by flat topography on a predominantly calcareous soil.

FIGURE 1-2 General Project Location



Section II (K13+000 to K33+000, Higüey road crossing)

In the second section, the alignment advances northwards during the first 10km and then, at the K23+000, it changes to a predominantly eastward direction. In its 20km section, it crosses the Santa Clara stream at K30+500 and the road currently connecting La Romana with the city of Higüey at K30+020. Additionally, at K22+780 is the first of the two railroad crossings for the project. The flat topography continues in this section and extensive sugar cane farming is present.

Section III (K33+000 to K70+000)

In the final 37km stretch, the alignment travels predominantly eastwards, through lands with deep calcareous material and extensive pasture areas. In this section, the road corridor crosses the Duey River at K36+360, where an 80m long crossing structure is required. The second railroad crossing of the Project is found at K38+270. The relief in this section is characterized by hills, ascending to a cliff (escarpment) and finally a terrace composed of calcareous materials. The section from K61+820 to K66+500 goes through the northern limit of the Hoyo Claro Natural Monument.

1.2.4 Design Technical Aspects

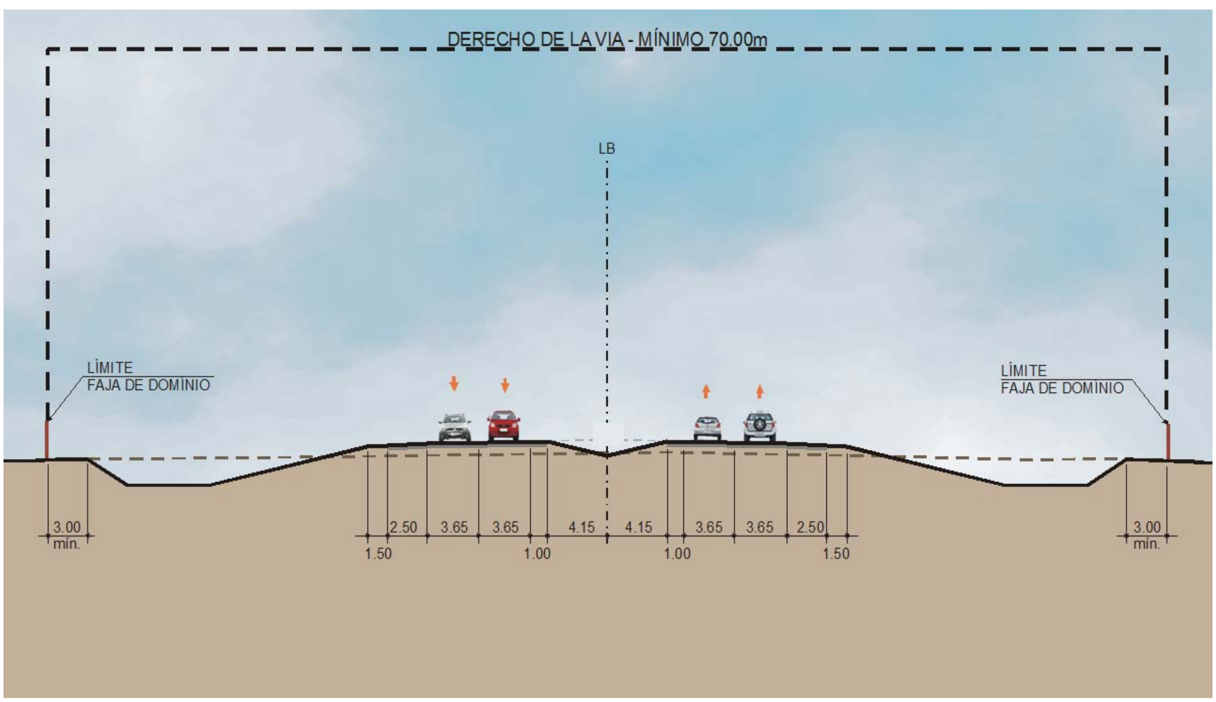
A summary of the main technical aspects considered in the basic engineering design of the Autopista del Coral is provided below:

- Total Project Length: Approx. 70 km
- Design Speed (km/h): 100
- Roadway Width: 2 lanes, 3.65m each
- Median Separator: Island, 8.30m
- Number of Lanes 4 lanes, two in each direction
- Platform: 32.9 m
- Right of Way: 70 m
- Design Vehicle: WB 20 (AASHTO)
- Causeway Slope: 2.0%
- Minimum Radius (m): 435 (useful. >1000)
- Maximum Camber: 6%
- Maximum Slope Length: Free (up to 0%)

- Vertical Clearance: 6m (road) / 7m (railroad)
- Ditches: Triangular cross section for carrying runoff water from the road.
- Channels: Trapezoidal, interception channels for preventing runoff and consequent erosion of the slopes exposed by cut shaping.
- Asphalt Wearing Surface: 10.0cm
- Granular Base with Cement: 18.0cm
- Granular Sub-base improved with Cement: 20.0cm
- Sub-grade Improvement 30.0cm

Figure 1-3 shows a typical cross section for the Project:

FIGURE 1-3 Typical Road Cross Section

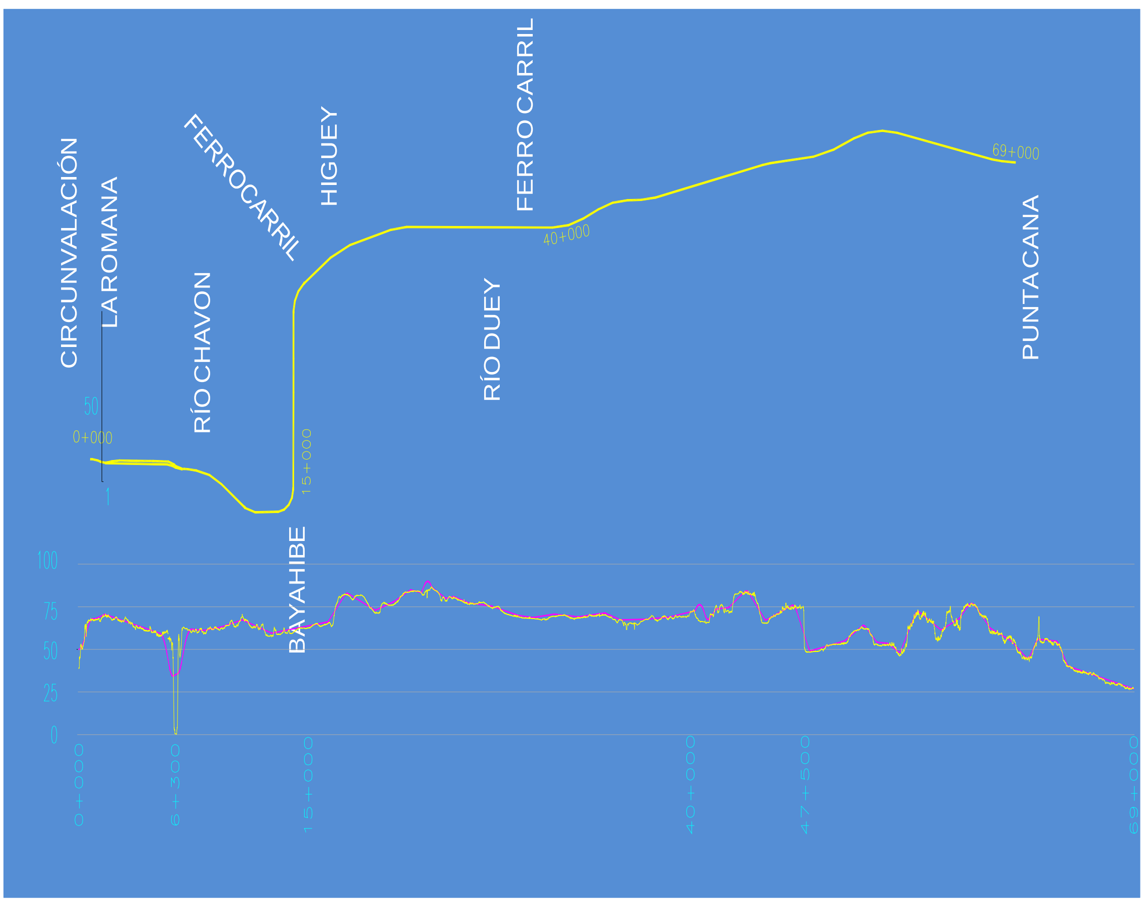


Additionally, the project includes the following associated infrastructure works that supplement the design:

- Interconnection with La Romana Beltway.
- Traffic Distributor at the entrance to La Romana Airport
- Bridge over the Chavón River
- Railroad crossing bridges
- Traffic Distributor to access road to Bayahibe
- Traffic Distributor to access road to Higüey
- Bridge over the Duey River
- Vehicle, cattle and sugar cane transportation crossings
- Traffic Distributor at entrance to Punta Cana Airport and Verón

Figure 1-4 illustrates the project alignment's plan and profile.

FIGURE 1-4   Alignment Plan-Profile



1.2.5 Project Implementation Phases

The Autopista del Coral Project will be implemented according to the following phases and general activities:

- Pre-construction activities: activities that shape the Project, such as studies and designs aimed at establishing the economic and technical requirements to be used during the project construction and operation works. These activities include detailed engineering, easement negotiation and land negotiation and expropriation.

- Construction phase: the activities for implementing all the construction works required by the Project. Among these activities are: location and lay-out, right of way clearance and cleaning, adaptation of access roads and temporary transit detours, construction of camps and temporary facilities, earth movement, drainage works, pavement structure, signposting and demarcation, installation of defenses and complementary infrastructure works. The Project will be constructed on four work fronts simultaneously, organized in sections of approximately 17 km each.

- Operation phase: includes the activities related to the road operation, such as the infrastructure preservation and maintenance plan.

1.2.6 Project Schedule and Construction Costs

According to the proposed project schedule, the pre-construction (Detailed Engineering) and construction activities will last approximately 24 months. The operation phase under the contract scheme adopted with the Moya-Odebrecht Consortium will last approximately 23 years.

The estimated total cost of the 70 km Autopista del Coral, with a cross section of four circulation lanes, is on the order of **US $255** million, including expropriations, engineering and total construction costs.

1.3 Environmental and Social Baseline

The Autopista del Coral Project is located in jurisdiction of La Romana and Altagracia provinces in the micro-basins of the Chavón and Duey Rivers that flow directly into the Caribbean Sea.

The first two sections of the project (Sections I and II) associated with the existing road, which runs from La Romana to Higüey, because they cross it or pass close to it at the following locations:

- Entrance to Cacata at K0+000 of the Right of Way -RoW
- Entrance to Casa de Campo at K2+000 of RoW
- Chavón River at K6+000 of RoW
- Entrance to Limón at K8+000 of RoW
- Entrance to Bayahibe at K11+000 of RoW
- Crossing north of Benedicto at K 16+000 of RoW
- Crossing north of La Piñita at K34+000 of RoW

In Section III, the road moves away from current Higüey – Verón – Punta Cana road, east and south of this road, at distances ranging from 10 km to 2 km near the end.

Concerning the point and direct area of influence, the Project has a 70km wide corridor consisting mainly of sugar cane plantations and pasture fields in different degrees of anthropic intervention.

A summary of the physical, biotic, socio-economic and cultural characteristics of the environment of the Autopista del Coral Project is given below.

1.3.1 Physical Component

The geology in Sections I and III corresponds to reef limestone, sand and Tertiary conglomerate (tpl-qp´c). In Section II undifferentiated fluvial deposits and debris fans of the Quaternary (q) predominate.

The majority of the soils are suitable for cultivation with management and they are located on a softly hilly relief (approximately 44 % of the corridor area belongs to Classes VI and VII). A third of the soils suitable for crops are situated on a moderately hilly relief (approximately 33% of the corridor area corresponds to Classes II and III). Finally, nearly 19% of the corridor contains soils susceptible to flooding during certain periods, on a flat relief (Class V).

The climate in the region is warm semi-dry, with monthly mean temperature 26.2 ºC. July and August are the hottest months, reaching 27.9ºC; while the lowest temperatures are recorded in the months of January and February, with an average value of 24.5ºC. The macroclimate of the Southeastern region shows a bimodal rainfall regime, a behavior that is a consequence of the Northeast trade winds and the winds blowing from the Southeast with the tropical storm season, typical of the Caribbean. The annual average rainfall is 1200 – 1400 mm, and the highest rainfall periods occur during the months of April and May and September through November. The two lowest precipitation periods are during January through March and in the months of June and July. The average relative humidity remains above 60% all year long; during the rainiest months it rises and stays above 70%, while in the dry seasons it falls up to 63%.

According to the hydrogeological map of the Dominican Republic (1989, included in the Hydrogeological Atlas of the Caribbean prepared by UNESCO), the proposed route for the Autopista del Coral Project goes mainly through hydrogeological units constituted by fractured rocks and porous rocks Type B1 (local aquifer restricted to fractured zones, generally extended by karstic dissolution, free and/or confined, composed of calcareous rocks, basically reef rocks), and Type A2 (continuous aquifer with regional to limited regional extension, free and/or confined, composed of consolidated clastic sediments), with high to medium permeability and high hydrogeological importance. The route's section through the cliffs (Section III) is considered of higher sensitivity, since it combines high porosity rocks and fractured rocks, in vicinity of a lagoon system of emerging waters located south of the reef terrace.

The proposed corridor for the Autopista del Coral crosses the Chavón River in its lower basin and the Duey or Yuma River in its middle basin; both rivers belong to the Southern or Caribbean watershed. Additionally, the corridor crosses the Santa Clara stream, an intermittent water course, which remains dry most of the year except during the periods of highest precipitation in this zone.

The analyses of water flow statistics for the Chavón River indicate an average value of 5.24 m^3, with the lowest records in the months of March and July (2.81 and 3.22 m^3, respectively) and the highest water flows in the months of November and October. For the Duey River, the records show a multiannual average water flow of 1.47 m^3, with lower flows in April and August and higher values in November and December.

The water quality analyses conducted on samples collected in the three water courses crossed by the Project; showed that all have alkaline waters with high content of organic matter, likely due to discharges of wastewater without treatment. The Chavón River water sample had a high content of chlorides and relatively high conductivity values, both indicators of a high mixture with sea water at the site where sampling was conducted. In Santa Clara stream, the Coliforms content was high; while in the Duey River a high value of nutrients was observed.

The Seismotectonic Zoning Map prepared by the SYSMIN program in 1998, indicated that the area of La Romana and La Altagracia provinces where the road corridor for the Autopista del Coral is located, corresponds to Area 8: zone of distributed seismicity without apparent relationship to well-known structures. According to historic climate data, one section of the road corridor is partially located in a zone considered as vulnerable to flooding.

1.3.2 Biotic Component

The corridor for the Autopista del Coral project corresponds to a Sub-Tropical Moist Forest Life Zone (Bh-S), according to Hartshorn et al. (1981)., also known as Llanura Costera del Caribe (Caribbean Coastal Plain) or Llanura Oriental (Eastern Plain). In the first and third section of the corridor the vegetation is morphologically xeromorphous, located on rocky substrate where water infiltrates quickly and produces physiological drought in the plants; while in the second section sugar cane crops predominate on deep and fertile soils.

In the study area, 10 coverage units or landscape units were identified, which are classified according to the predominating vegetation as arboreal coverage, shrub coverage, pasture fields, agricultural lands, crops, and areas without vegetation. Coverage units comprise not only natural vegetation but they also include the new elements that are incorporated to the landscape, especially those related to agricultural and livestock activities and the elements associated with anthropic infrastructure. **Table 1-1** includes a list of these units, indicating the surface area percentage of the mapped units, based on present aerial photography of the corridor and its area of influence.

TABLE 1-1 Vegetation Coverage and Landscape Units Present in the Study Area

Symbol	Coverage Unit	Area Percentage (%)
Bl	Broadleaved forest on limestone rock	14.4
Brc	Riverside vegetation, along the Chavón River	0.8
Pa	Pasture fields with trees	23.8
Bn	Native forest	2.2
Ca	Sugar cane fields	27.9
Br	Riverside vegetation	0.1
Bs	Secondary forest in advanced regeneration	3.5
Pr	Scrublands or fallow lands	26.5
Cu	Small farms or crops	0.7
Za	Urban zones without vegetation coverage	0.1

Most of the area within the proposed Autopista del Coral route is highly disturbed; its original vegetation has been replaced by the development of different human activities. Only the last section, in the coastal zone of Punta Cana, contains some vegetation patches, but it is mainly secondary growth vegetation.

Some threatened or protected plant species could be affected by the proposed Project in the first and third sections. Species potentially affected include the rain palm or palma de lluvia (*Gaussia attenuata*) and the corozo (*Acrocomia quisqueyana*).

A review of data on the Dominican Republic's ichthyofauna and the species' habits indicates the likely presence in the Chavón and Duey Rivers of at least 38 fish species, 16 of which are introduced species, 15 are native species and 7 are endemic species. Some of these species are more typical of estuarine environments, although, on some occasions, they can ascend through the rivers.

In the Project's direct area of influence, the field work verified the existence of six amphibian species native to the island (2 species of the Hylidae family and 4 species of the Leptodactylidae family) and two introduced species. The two amphibian species introduced to the island and observed in this study were the maco or bullfrog (*Rana catesbeiana*) and the maco pempén (*Bufo marinus*). The review of the conservation status of the species observed within the project's area of influence indicated that none are included in categories with extinction threat because all of the taxa show wide distribution areas and are common elements in the Hispaniola lowlands.

Nine (9) reptile species were observed during the field survey, of which 66% are lizards. The Polychrotidae family is represented in this zone by four species, all very common and abundant; some of them like the *A. distichus* and *A. cybotes* are typical of open and disturbed areas. The savannah serpent (*Antillophis parvifrons*), a common element in the lowlands of the islands eastern region, was observed in section three of the Project, along with the green snake (*Uromacer catesbyi*), where they are both relatively abundant according to information from inhabitants of the zone. Also, the icotea turtle (*Trachemys stejnegeri*) was observed during the survey in the marshes neighboring Hoyo Claro and Hoyo Hondo (section III), where it was abundant decades ago. None of the species recorded within the study area are regarded as endemic nor are they listed under any of the extinction threat criteria.

Taking into account the distribution areas known for the bird species present in Dominican Republic, it is estimated that within the Project's direct area of influence there are potentially around 106 wild bird species. Of these, 70 are reproductive residents; 8 are passing migrants; 26 are non-reproductive visitors; and, 2 are reproductive visitors. Among this potential group, represented by 15 Orders, 34 families and 75 genera, five species are classified as threatened and eleven are considered as endemic.

In the study area, natural habitat loss is due to extensive cultivation areas, conucos (small farms) and conversion to pasture for grazing. Thus, species richness and diversity have been significantly reduced and are currently composed primarily of generalist species with wide surface distribution and high tolerance to disturbed environments.

The field work also verified the presence of 50 species represented in 44 genera, 17 families and 12 orders. The dominance of species typical of terrestrial environments was observed during the field survey because only eleven taxa associated with aquatic environments were observed. This result is due to the almost total absence of wetland ecosystems along the Project route; except for the buffers remaining along the main rivers, such as the Chavón, Yuma and a few tributaries. The species observed during the field survey include nine species which are listed in conservation categories, eight of them are considered as endemic and two are regarded as threatened: the búcaro (*Burhinus bistriatus*: Burhinidae) is considered a threatened species and the Hispaniolan parrot (*Amazona ventralis*: Psittacidae) is regarded as endemic and threatened.

Among mammals, the bats are usually common elements, with abundant populations in the lowlands. In the study zone it is possible to find at least three species that possess wide distribution and are characteristic of environments from fairly conserved to very disturbed: the frugivore, *Artibeus jamaicensis*, and the insectivores, *Macrotus watterhoussi* and *Monophyllus redmani*.

1.3.3 Social, Economic and Cultural Components

The social and economic study adopted the following criteria to define the area of influence of the Autopista del Coral Project:

- Regional Area of Influence: involves the provincial political and administrative zone where the existing social relationships that might be affected, modified or disturbed by the proposed Project.

- Local Area of Influence: refers to the provincial capitals and towns, and the relationships that could be affected according to the location of these communities and the Project activities development.

- Direct Area of Influence: is the area to be disturbed, where the social relationships will be directly affected by the proposed actions and activities.

From the viewpoint of regional area of influence, the proposed corridor for the Autopista del Coral involves in the first 6 km of its route the province of La Romana, and in the remaining 64 km La

Altagracia province. Within the local area of influence, the corridor for the Autopista del Coral is associated with the existing road corridor that links La Romana - Higüey - Punta Cana because in some sections the proposed corridor travels parallel to the existing one and in other cases both corridors cross each other. The following towns are located in vicinity or along the motorway's route:

- La Romana Provincial capital, Casa de Campo and La Romana Airport (in La Romana province)
- Higüey Municipal capital, El Limón, Bocas de Chavón, Benedicto, Batey Cuesta Caribe, Batey La Ceja, Batey Magdalena, La Piñita, Batey Palo Bonito, Verón and Punta Cana Airport (in the Altagracia province).

Concerning the direct area of influence, the corridor goes through uninhabited lands, which are mainly sugar cane plantations, stockbreeding and pastures with vegetation cover at various degrees of disturbance.

Data on the area's social and economic condition confirm the dynamic economy existing in the sub-region constituted by the two provinces of La Altagracia and La Romana. In spite of the differences between the two provinces, both have the majority of their Economically Active Population employed, which contrasts with the rest of the country, given the existing high unemployment levels.

Tourism is significant to the area's economic activity, surpassed in Higüey only by commerce and in La Romana by the manufacturing industry. Transportation is also important in La Romana. Also important in this region is agricultural and livestock activity, especially stockbreeding.

There are differences between the two provinces, for instance, the illiterate population percentage is greater in La Altagracia because, although the number of illiterate in both provinces is similar (39,201 in La Altagracia and 41,521 in La Romana), the population of La Romana is higher.

In order to contextualize the archaeological survey in the corridor of the Autopista del Coral project, a bibliographic review was conducted to locate the different archaeological deposits reported in the provinces of La Romana and La Altagracia. This bibliographic review gave special attention to all the archaeological sites reported and/or published. Additionally, the study consulted the "Archaeological Sites Index" of the Department of Archaeology of the National Museum of the Dominican Man, as well as the "Inventory of Archaeological Material Deposits" of this museum to verify the possible presence of registered deposits not yet published.

The archaeological background review resulted in a list of the main archaeological sites located in vicinity of the Autopista del Coral project. This list includes 90 records, in which three (3) of them correspond to La Romana province and the remaining (87) are located in the Altagracia province. The location of all these archaeological sites identified in this listing, show a distribution pattern of the first human settlements in this zone of the island highly associated with coastal zones; which is probably due to the rivers that come down from the mountains and the food availability in estuarine zones, as well as the ease travel by sea and the relationship with other human groups in neighboring islands.

Based on the above mentioned list of archaeological records, indicators were established to direct the archaeological survey in the project's corridor towards areas considered to have more archaeological potential. This study surveyed 85 sites using as reference the centerline of the proposed corridor. In 3 of these sites, archaeological material was discovered outside the corridor but very close to it. None of these deposits had been previously reported. The 3 sites are located near K 61 and K62 of the Right of Way (Section III), and the archaeological material found indicates development of dwelling and farming activities in the past.

1.4 Legal and Judicial Framework

The environmental and legal framework in the Dominican Republic is currently based on Law 64-00 "General Lawon Environment and Natural Resources". Additionally, the environmental and legal context has been reinforced with the following:

- Resolution 05/2002 and Resolution 06-2004, which established the environmental license and permit system for projects through the following instruments:
  - Regulations of the Permit and License System;
  - Environmental Permit Application Procedures for Existing Facilities;
  - Environmental Impact Assessment Procedure
  - Explanatory Nomenclature for Construction Works, Activities and Projects
- Resolution No. 10 of 2003, establishing the following instruments:
  - Environmental Standard for Air Quality (NA-AI-001-03);

- Environmental Standard for Control of Air Pollution Emissions from Vehicles (NA-AI-003-03), and

- Environmental Standard for Control of Air Pollution Emissions from Point Sources (AR-FF-01).

- Resolution No. 09 of 2003, issuing the Environmental Standard on Water Quality and Discharge Control (NA-AG-001-03).

- Resolution No. 08 – 2003, setting the following norms:

  - Environmental Standard for Noise Protection (NA- RU-001-03)

  - Standard establishing a Reference Method for Measuring Noise from Point Sources (NA-RU-002-03)

  - Standard establishing a Reference Method for Measuring Noise from Vehicles (NA-RU-003-03)

  - Standard for Environmental Management of Non-Hazardous Solid Wastes (NA-RS-001-03), according to articles 106 to 108 of General Law on Environmental and Natural Resources (Law 64-00).

Additionally, the specific legal framework of the Autopista del Coral Project includes the following:

- Law No. 202 - 04 "Sector Law on Protected Areas", concerning the protected areas system and its interaction with Project activities.

- Law 318 of 1972, Law 564 of 1973 and Decree 297-87, concerning protection of the Archaeological and Cultural Patrimony of the Dominican Republic and its interaction with Project activities.

- Framework legislation of the Secretariat of State for Public Works.

Concerning the Project's institutional framework, the following institutions and some of their offices are considered of great relevance to the project development:

- Secretariat of State for Public Works and Communications (SEOPC)

- Secretariat of State for Environment and Natural Resources
- Secretariat of State for Culture

1.5 Stakeholder Consultation

During the Environmental Impact Assessment (EsIA) for the Autopista del Coral Project (La Romana – Punta Cana Highway), a Citizen Participation Plan (PPC, in Spanish) was designed and developed, which established the mechanisms of information exchange and dialogue with the communities located in vicinity of the Project area. This plan was developed along the EsIA's basic phases: Baseline Study, Environmental Assessment and Environmental Management and Adaptation Program (EMAP). It enabled Project proponents to obtain perceptions and opinions from the communities, which provided feedback to the EsIA content in the respective interaction stages.

1.5.1 Design of the Participation Plan

The Citizen Participation Plan was designed around public hearing (Vista Pública in Spanish) as stipulated by the regulations of the Dominican Republic. Three public hearings were conducted for the Project to interact with the communities of the local area of influence according to the following scheme:

- First Public Hearing – Project Presentation and Scope and Methodology proposed for the EsIA.
- Second Public Hearing – Progress on Project Description, Study Area Characterization and Preliminary Environmental Assessment.
- Third Public Hearing – Progress on Project Description, Impact Rating within the Environmental Assessment and Environmental Management and Adaptation Program.

Each of the public hearings was structured as participation workshops held in the communities of Benedicto, Higüey and Verón, which were scheduled for dates and hours previously agreed on with the interest groups identified within the local area of influence.

1.5.2 Public Hearings Development

Table 1-2 summarizes the three public hearings and nine participation workshops conducted according to the Citizen Participation Plan designed for this Project. Each of these events was recorded on a video-recording that is attached to the EsIA report.

TABLE 1-2 Public Hearings Summary

Date/Hour	Place	Number of Attendees
First Public Hearing		
May 4, 5 PM	Benedicto	35
May 5, 10 AM	Verón	25
May 5, 5 PM	Higüey	16
Second Public Hearing		
June 1, 7 PM	Higüey	19
June 2, 10 AM	Benedicto	28
June 2, 5 PM	Verón	17
Third Public Hearing		
June 15, 5 PM	Verón	19
June 16, 10 AM	Higüey	15
June 16, 4 PM	Benedicto	20

The Citizen Participation process developed during the EsIA was positively perceived by all the interest groups contacted by the Project. In the workshops conducted during this process, the audience expressed its interest that this and other future projects were carried out in the same way; that is, with a transparent disclosure of the project information prior to its implementation.

1.6 Impact Identification, Characterization and Assessment

The environmental assessment of the Autopista del Coral Project considered present characteristics of the environmental components in the road corridor where the Project will be implemented, as well as its interaction with the activities and phases planned for the Project development according to the following scenarios:

- **Construction Phase**: this scenario includes a time period of approximately 24 months; in this period all the activities associated with detailed engineering and works construction will take place.

- **Operation Phase:** this scenario comprises an estimated 23 year period. This estimate considered the Public – Private Participation (PPP) scheme under which the motorway will be constructed. During this time, the Moya – Odebrecht Consortium will conduct all the maintenance activities to ensure the adequate operation of the road.

1.6.1 Impact Identification

The impact identification consisted of: (1) differentiating between the diverse activities characterizing each of the scenarios subject to environmental assessment, (2) establishing the environmental components and change indicators of the resources and their sensitivity to exogenous and endogenous factors and, (3) establishing interactions between the activities, differentiated for each scenario and the environmental components and change indicators previously established.

1.6.2 Impact Assessment

During the Impact Assessment process, environmental specialists conducted a qualitative and quantitative identification and evaluation of environmental impacts using a cause-effect modified matrix set by Leopold. To identify each of the impacts, the following aspects were analyzed: 1) the cause, that is, the agent promoting change, represented by those activities identified for each scenario under evaluation; and 2) the effect, those changes that will be observed in the environmental or social component as a reaction to the activities conducted in each scenario.

The definition of Environmental Assessment used in this study refers to the product of the interaction of a Project activity that causes a change to a specific resource existing within the project's area of influence. The changes observed in the resource are the environmental effects, whose probability and significance are determined by means of an evaluation scheme that establishes how important this effect is for the project development.

In the environmental impact assessment process for the Autopista del Coral Project, the attributes and scale of values for the impact analysis were defined. The attributes established for the environmental impacts are based on the characteristics and space-time behavior resulting from the interaction project activity – environmental component affected.

The matrix resulting from the identification, assessment and rating of each of the impacts generated by the activities in both analyzed scenarios is presented below (**Table 1-4**).

For the purpose of visualizing these quantitative and qualitative characteristics of the impacts analyzed in the interaction matrix, a range of values was established and a color coding was assigned to each of them according to **Table 1-3.**

TABLE 1-3 Ranges of Values and Color Code

Ranges of Values				
			Predicted effect	**Color Code**
15	A	+1	Positive	
0		0	Neutral	
-5	A	-1	Slightly negative	
-10	A	-5,1	Moderately negative	
-15	A	-10,1	Highly negative	

TABLE 1-4 Impact Rating Matrix –Autopista del Coral Project

COMPONENT	CHANGE INDICATORS	Code	PROJECT ACTIVITIES – PHASES								
			CONSTRUCTION							OPERATION	
			PRELIMINARY WORKS	MOBILIZATION	SOIL AND MATERIAL MOVEMENT	SLOPE STABILIZATION AND DRAINAGES	PAVEMENTS	STRUCTURES	DEMOBILIZATION	ROAD OPERATION	ROAD MAINTENANCE
AIR	Air quality degradation	A-1	-0.6	-0.6	-6	-6	-2.4	-6	0	-6	-0.5
NOISE	Increase in noise levels	R-1	-7	-7	-7	-7	-7	-7	-2.8	-11	-0.7
WATER	Transport of sediments to water bodies.	H-1	-0.5	-0.5	-1	-1	-1	-1	0	0	0
	Degradation of water physical and chemical quality and quantity	H-2	-1.2	-1.2	-1.4	-1.4	-1.4	-1.4	-0.6	-1.8	-0.6
SOIL	Soil structure disturbance	SU-1	-2	-2	-14	-14	-13	-14	0	-13	0
	Susceptibility to erosion	SU-2	0	0	-1	-1	-0.5	-1	0	-0.7	-0.7
FLORA AND FAUNA	Loss of vegetative cover	FF-1	-1	-1.4	-13	-13	0	-13	0	0	-11
	Disturbance to protected species	FF-2	0	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	0	-2.4
SOCIAL	Temporary transit obstruction	S-1	-7	-7	-7	-7	-7	-7	-2	0	-2.8
	Temporary infrastructure interruption	S-2	0	0	-7	-7	-7	-7	0	0	-2.8
	Road safety improvement	S-3	0	0	0	0	0	0	0	13	0
ECONOMIC	Job generation	E-1	9	9	9	9	9	9	8	11	9
	Improvement of local and regional tourist mobility	E-2	0	0	0	0	0	0	0	13	0
CULTURAL	Alteration or destruction of archaeological heritage	AR-1	0	0	-0.7	-1.4	0	-1.4	0	0	-1.4

1.7 Environmental Management and Adaptation Program

The Environmental Management and Adaptation Program (EMAP) – or PMAA in Spanish- is a series of environmental measures planned for the phases of detailed engineering, construction and operation of the Autopista del Coral Project, which have been establish to prevent, mitigate, control, avoid and/or compensate for the negative impacts that could potentially be generated by the Project development in its different stages.

The Environmental Management and Adaptation Program (EMAP) was designed to cover all Project phases that could generate changes to the environmental resources within the Project’s area of influence (physical, biotic and social and economic environment). It is structure in manual form with actions that considers the project’s basic engineering design and present conditions in the area where the project will take place.

The EMAP also fulfills a commitment of the Secretariat of State for Public Works and Communications (SEOPC) as the project promoter and the Moya – Odebrecht Consortium as the project construction and operation company to comply with the environmental norms of the Dominican Republic applicable to this kind of project.

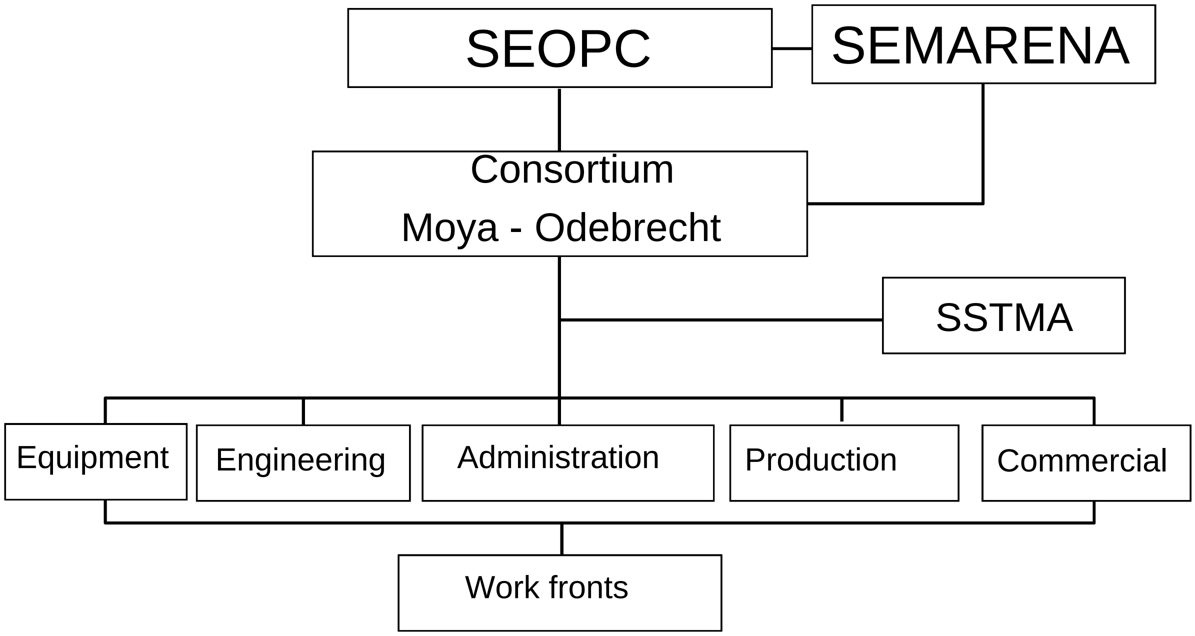
1.7.1 Environmental Management System

To ensure the implementation of the Environmental Management and Adaptation Program (EMAP), during the execution of the Autopista del Coral Project in the detailed engineering, construction and operation phases, an environmental management system will be established. This environmental management system will be implemented by the Moya – Odebrecht Consortium, a company identified by the Secretariat of State for Public Works and Communications as responsible for the Project execution and by the technical teams that will form part of the Consortium.

The Moya-Odebrecht Consortium will structure the environmental management system for the Project to include corporate elements from the company policy of Constructora Norberto Odebrecht S. A. (Odebrecht), such as the Integrated Health, Occupational Safety and Environment, and the Integrated Occupational Health and Safety and Environment Management Program (SSTMA).

The organization of the Environmental Management System (SGMA, in Spanish) proposed by the Moya-Odebrecht Consortium for the Autopista del Coral Project is shown in **Figure 1-5.**

FIGURE 1-5 Organization Chart of the Environmental Management System



1.7.2 Program Structure

The Environmental Management and Adaptation Program is composed of the programs and activities established for the construction and operation of the highway, which are organized in environmental sheets. **Table 1-5** presents a list of the environmental programs and sheets that are part of the PMAA which are described below.

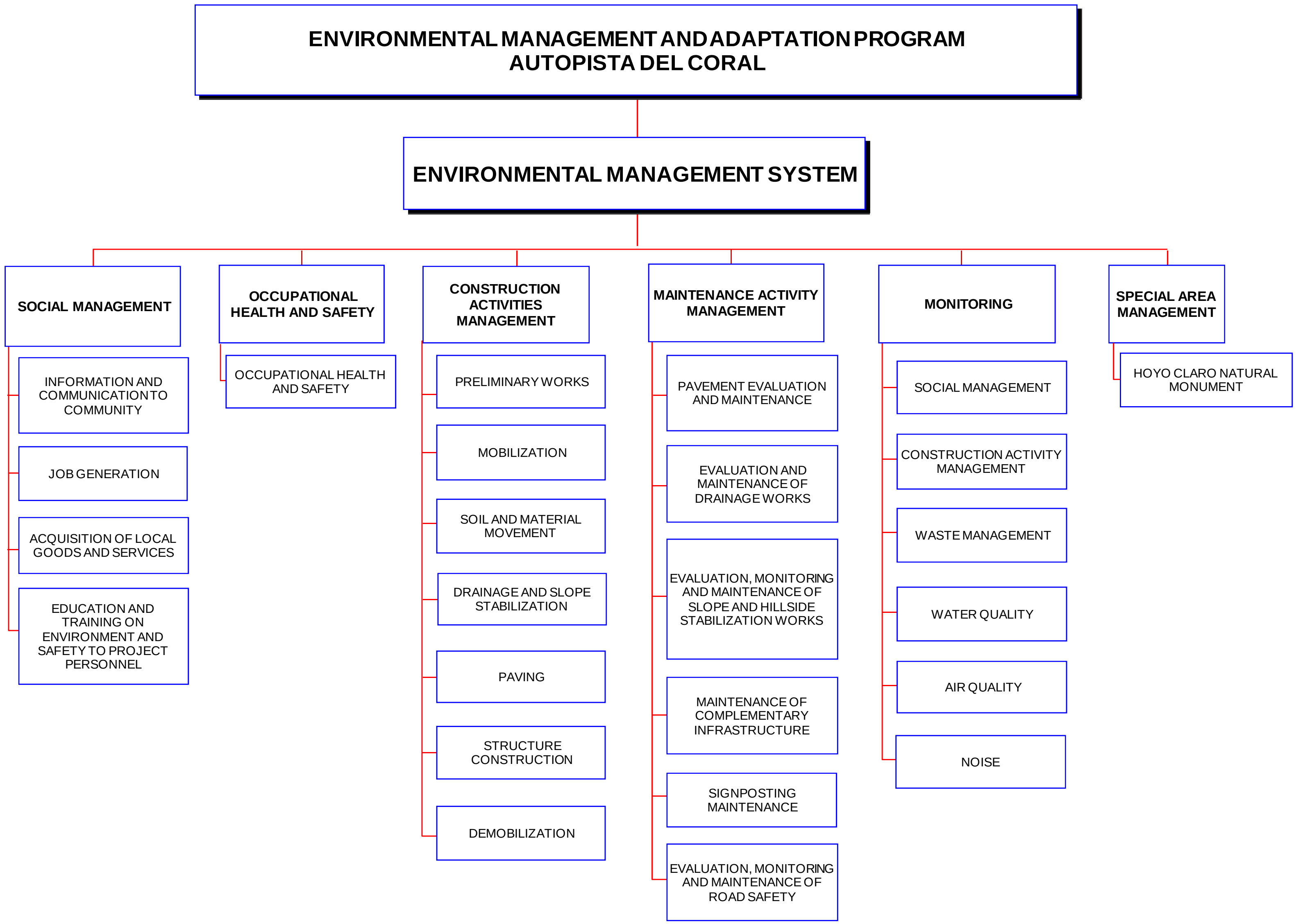
TABLE 1-5 Environmental Programs and Sheets

Program	Environmental Sheet
Social Management Program (GS)	**GS-1** Information and Communication to Community
	GS-2 Job Generation
	GS-3 Acquisition of Local Goods and Services
	GS-4 Education and Training on environment and personal safety
Construction Activity Management (AC)	**AC-1** Preliminary works
	AC-2 Mobilization
	AC-3 Soil and Material Movement
	AC-4 Drainage and Slope Stabilization
	AC-5 Road surfaces
	AC-6 Structures

Program	Environmental Sheet
	AC-7 Demobilization
Maintenance Activity Management Program (AM)	**AM-1** Evaluation and Maintenance of Road Surfaces
	AM-2 Evaluation and Maintenance of Drainage Works
	AM-3 Evaluation, Monitoring and Maintenance of Slope and Hillside Stabilization
	AM-4 Complementary Infrastructure Maintenance
	AM-5 Signposting Maintenance
	AM-6 Evaluation, Monitoring and Maintenance of Road Safety
Occupational Health and Safety Program (SST)	**SST-1** Occupational Health and Safety Program
Monitoring Program (SM)	**SM-1** Social Management
	SM-2 Construction Activity Management
	SM-3 Waste Management
	SM-4 Water Quality Monitoring
	SM-5 Air Quality Monitoring
	SM-6 Noise Monitoring
Special Area Management Program (PAE)	**PAE-1** Management of Special Area in Hoyo Claro National Monument section

Figure 1-6 shows the EMAP's structure and its integration into the Environmental Management System established for the Project.

FIGURE 1-6 EMAP's (PMAA) Structure



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2.0 PROJECT DESCRIPTION

2.1 Introduction

This chapter describes the Autopista del Coral (Coral Highway) Project. This project involves the construction of a 70 km highway, which will become the final link of the East Road Corridor. This Corridor links the international airports of La Romana and Punta Cana, which are estimated to handle two thirds of the country's air traffic.

Additionally, by connecting the international airports of La Romana and Punta Cana, the Autopista del Coral will complete an important transportation network, including transit by air, land and sea between the city of Santo Domingo and the tourist destinations in the eastern region.

It is worth noting that tourism in the Dominican Republic is currently the principal source of economic growth and one of the main generators of foreign currency income, contributing 40% to the national economy, representing 22% of GDP and directly or indirectly accounting for 19.2% of the country's employment.

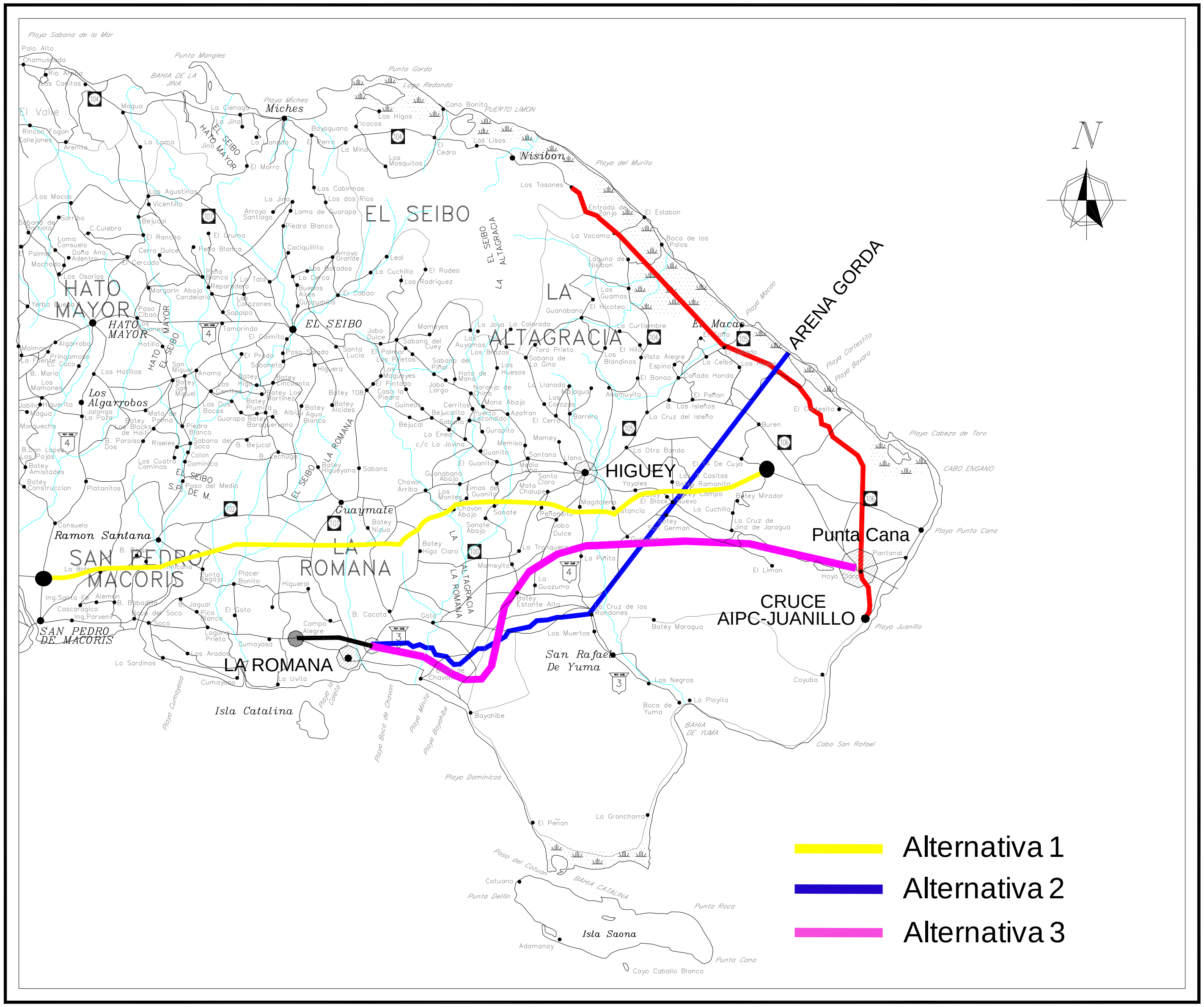
2.2 Analysis of Route Alternatives

For the design, construction and operation of the future Autopista del Coral, three route alternatives have been studied (**Figure 2.1**), designated in this report as alternatives 1, 2 and 3 respectively. Based on the analysis of these alternatives as described below and summarized in **Table 2-1**, the most convenient route for Project development was selected. Factors considered include: technical characteristics, characteristics of the area to be potentially developed and the investment required for project development.

2.2.1 *Alternative 1: San Pedro de Macorís – Higüey – Verón*

This alternative involves constructing the Autopista del Coral along a route that will link the city of San Pedro de Macorís to the town of Verón, in the vicinity of the Bávaro and Punta Cana hotel district.

FIGURE 2-1 Route Alternatives Location



Technical Characteristics – Alternative 1

This alternative proposes a route starting from the new Beltway of San Pedro de Macorís and ending in the vicinity of the Punta Cana International Airport. The Highway will be designed with four lanes, for a 120 km/h speed limit. It will be 95 km long and will be located on basically flat terrain, through sugar cane fields and pasture lands. This would allow a direct route from Santo Domingo to Punta Cana, which would cover about 175 kilometers, to be traveled in approximately two hours.

The horizontal and vertical geometry of the Autopista del Coral will be designed, as mentioned before, for a speed limit of 120 km/h. It will have four lanes, 3.65 m wide each, and 2.50 m sidewalks. It will also have a 12.00 m wide median, to allow a possible future extension to six lanes.

Characteristics of the potential area to be developed in Alternative 1

The economy around the area to be developed is very dynamic. San Pedro de Macorís is the main urban center of the Eastern region (200 thousand residents). Higüey is an important agricultural and services center. The east end hotel complex has approximately 15 thousand rooms, distributed among the Macao, Bávaro and Punta Cana centers. This area is the tourism center of the entire island and these establishments may provide as much as half of tourism income to the Dominican economy.

Required Investment for Construction - Alternative 1

The construction cost of this alternative, within the Macao-Bávaro-Punta Cana hotel area, is preliminarily estimated to be $250 million (US).

2.2.2 *Alternative 2: La Romana – La Cruz de los Rondones – Arena Gorda*

Proposed by the Secretariat of State for Tourism (SECTUR), this route travels about 10 km in its first sector, between La Romana airport and the access to Bayahibe, then it turns northeast to La Cruz de los Rondones before travelling 40 km to a site called Arena Gorda, located approximately 25 kilometers northwest of Punta Cana International Airport.

Technical Characteristics - Alternative 2

The route proposed by SECTUR goes through topographically complex terrains, including a 40 km section from La Cruz de los Rondones to Arena Gorda, which provides significant engineering complexities. Due to these issues, it is foreseeable that development of this 40 km section will require an additional 6 to 8 km of highway construction relative to the present distance presented for this alternative and extensive land moving.

Characteristics of the potential area to be developed in Alternative 2

This alternative, especially its last section, goes through a relatively populated zone, with several communities dedicated to livestock, sugar cane farming and agriculture. These communities include Guayabo, Batey San Germán, Batey El Block, Batey Campo Nuevo, Batey Ramonita, Las 3 Casitas, El 14 de Cuya, Burén and Los Hoyos.

Consequently, it is foreseeable that the process of land expropriation and improvement in the zone between La Cruz de los Rondones and Arena Gorda (approximately 40km) will be troublesome and costly.

Required Investment for Construction - Alternative 2

Although there is no preliminary design or study, based on the distance, the costs of expropriations, land movement, number of bridges and drainage works required, and the social and environmental conditions of the area, among other factors, the cost of this alternative can be estimated to be approximately $310 million (US).

2.2.3 *Alternative 3: La Romana – Higüey – Punta Cana*

The concept of this third option takes into account the long term plans prepared by the Secretariat of State for Public Works and Communications, prioritizing integration and excluding any priority to a specific location.

Technical Characteristics - Alternative 3

This alternative proposes an approximately 70 km long highway, connecting the towns of La Romana, Higüey and Punta Cana, whose geometric characteristics (horizontal and vertical alignment) provide for an average travel speed of 100 km/h, with four (4) lanes and a median that will allow the future expansion to six (6) lanes.

Characteristics of the potential area to be developed in Alternative 3

In this alternative, most of the route will be developed on flat lands, currently occupied by sugar cane fields, scrubland and pasture fields.

It is worth noting that in the section between K61+820 and K66+500, the proposed corridor goes through the Northern limit of the Hoyo Claro Natural Monument; therefore, this section will require the design and implementation of specific environmental management measures for managing the sensitive features within this area.

The benefit of this route is that no significant excavation or land filling is expected, which means minimal geomorphologic alteration. Additionally, the route proposed by this alternative does not directly affect any communities; there is no need to relocate populated centers, which reduces the social disruption that the project might generate.

Required Investment for Construction - Alternative 3

The estimated total cost of this 70 km, four lane alternative is $255 million (US), including expropriations, engineering and total construction cost.

This amount means an investment of $910,000 (US) per kilometer-lane. This amount is approximately equal (9% lower) to the most recent, similar highway projects, completed or under construction, in the country (about $1.0 million (US) per kilometer-lane in the Autopista 6 de Noviembre, Autopista Duarte, Autovía del Este, Autopista San Cristóbal-Baní, and Beltway of Santiago Norte).

TABLE 2-1 Summary of Alternative Analysis for Autopista del Coral

Alternative	Technical Characteristics			Characteristics of the Area to be Developed		Costs
	Length (km)	No. lanes	Speed (km/h)	No. of affected communities	Length in zones of environmental, social or geomorphologic complexity (km)	Construction costs and other associated costs, US $
1. San Pedro de Macorís – Higüey – Verón	95	4	120	4	NA	250 million
2. La Romana – La Cruz de los Rondones – Arena Gorda	80	4	100	10	40	310 million
3. La Romana – Higüey – Punta Cana	70	4	100	0	4.7	255 million

According to this analysis, the most feasible alternative from the technical and economic viewpoint and characteristics of the area to be developed is route alternative 3, which links La Romana, Higüey and Punta Cana, with a predominantly East-West orientation.

2.3 Project Rationale

The main aspects justifying the design and construction of the Autopista del Coral project are described below:

- The Autopista del Coral represents the final link in a 224 km road corridor that will directly connect the city of Santo Domingo with the tourist centers of La Romana, Bayahibe, Higüey and Verón and improve access to those located in the deep East (Punta Cana, Bávaro, Cap Cana, Cortecito, Macao, and Uvero Alto). **Table 2-2** details the connections that this Project will provide with other roads or developing projects.

TABLE 2-2 Connections of Autopista del Coral with other developing projects

Section	Length	Characteristics
Las Américas	30 Km	Expansion to six lanes under construction.
Autovía del Este	36 Km	Finished with 4 lanes.
Circunvalación San Pedro	12 Km	Constructed with two lanes. Expansion to 4 lanes under construction.
Autopista San Pedro de Macorís-La Romana	20 Km	Expansion to four lanes under construction.
Circunvalación La Romana	12 Km	Under construction with two lanes. It will be enlarged to four lanes under an approved concession.
Autopista del Coral	70 Km	In Project phase with 4 lanes.
Boulevard Turístico del Este	44 Km	Under construction with up to four lanes.
TOTAL CORRIDOR	224 Km	

- This highway will provide visitors of the western tourist centers with quick access to the commercial, recreational and cultural resources developed in the city of Santo Domingo and other destinations in the country’s eastern region.

- This Project will contribute to interconnection of the main ports, airports, marinas and tourist centers of the region, offering tourists a quick and safe access road.

- With design speeds of 100 Km/h in all of its sections, the East Corridor will allow travel from Santo Domingo to Punta Cana International Airport in less than two hours. Presently this route takes approximately 4 hours.

- Tourism is the main source of economic growth in the Dominican Republic and the greatest generator of foreign currency income, contributing 40% to the national economy; representing 22% of the GDP and directly or indirectly accounting for 19.2% of the country's employment.

- The tourism sector of the Dominican Republic showed the highest growth in Latin America, 7.5 %, in 2005.

- The tourist centers in the country's eastern region (La Romana, Bayahibe, Dominicus, Punta Cana, Bávaro, Macao, and Uvero Alto) have approximately 60% of the 60,000 hotel rooms in the Dominican Republic, with an 82% average occupancy in 2005. An increase of 10,000 hotel rooms is anticipated for the next three years in Bávaro, Punta Cana and Cap Cana.

- The international airports located in the East Corridor (Las Américas, La Romana, Punta Cana) receive more than 75% of the foreign visitors to the Dominican Republic every year.

2.4 Project Location and Route Description

The road corridor chosen for building the Autopista del Coral will be located in the Southeastern region of the Dominican Republic and it will start at the end point of the La Romana Beltway, currently under construction, thus linking with La Romana Airport. It will then connect with the Bayahibe tourist center, the Higüey Beltway, presently on project phase, the access to Boca de Yuma and the Boulevard Turístico del Este. Finally, after approximately a 70 km route, The Autopista del Coral will end at the Punta Cana International Airport. **Figure 2-2** shows the Project's general location.

The Project route goes through relatively flat lands, primarily occupied by extensive sugar cane fields, pastures dedicated to livestock and scrublands with various levels of development, but without any highly populated centers.

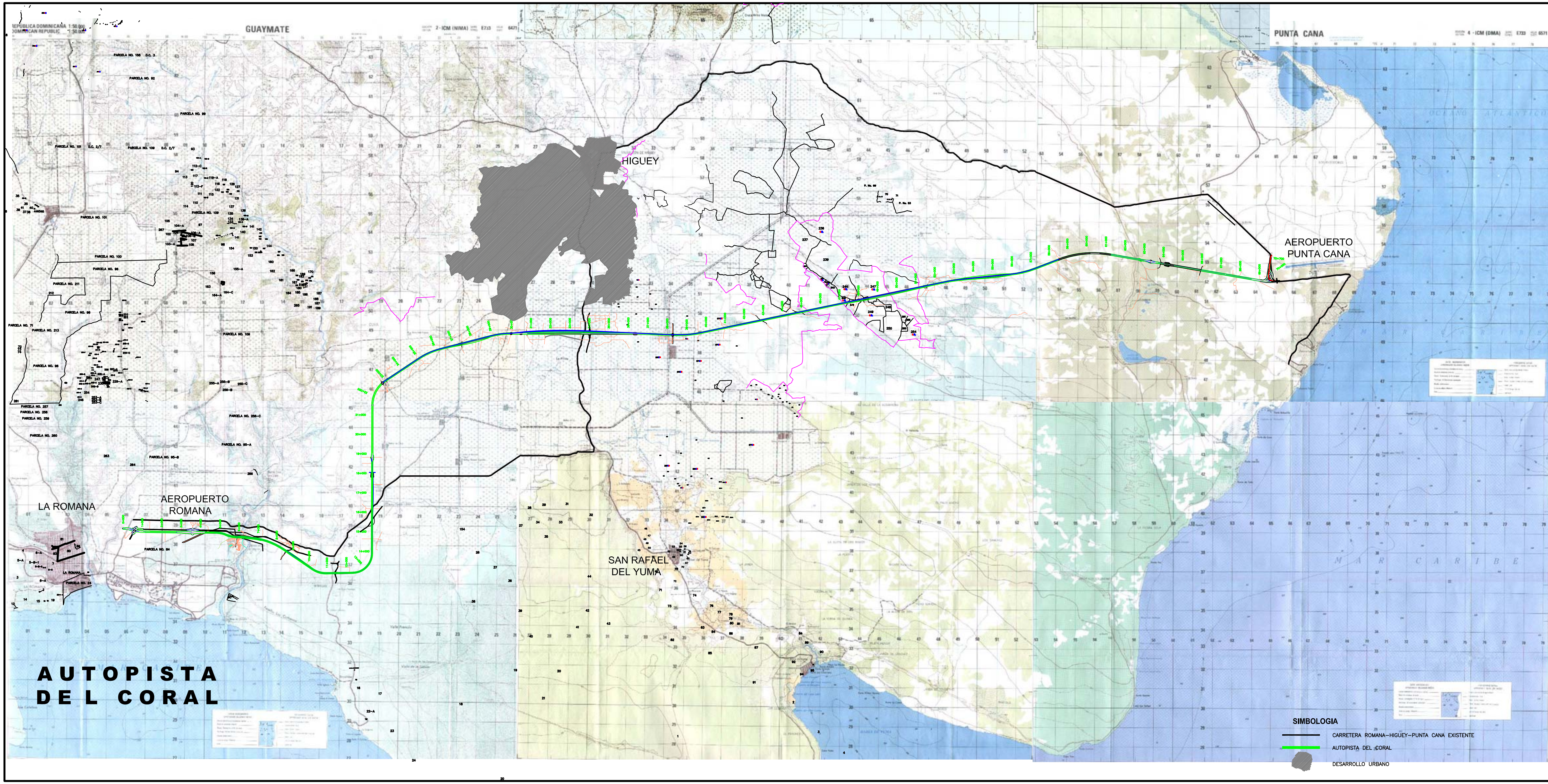


Figura 2-2 Localización General del Proyecto

2.4.1 *Corridor Sections*

Based on the corridor location for the Autopista del Coral Project, it is possible to establish three sections, as follows:

Section 1 K0+000 to K13+000 (crossroads with Bayahibe)

In this section the selected alternative is oriented predominantly in the eastward direction. It intercepts the La Romana Beltway at K0+600, the entrance to La Romana Airport at K3+590 and the crossing of the road to Bayahibe at K11+450. Additionally, at K6+300 the highway crosses the Chavón river. This first section is characterized by flat relief and predominantly calcareous soil.

Section 2 K13+000 to K33+000(Higüey road crossing)

In this second sector, the corridor runs northward during the first 10 km and then, at K23+000, it changes to a predominantly eastward direction. Over its 20 km route, this section crosses the Santa Clara stream at the K30+500 and the highway currently connecting La Romana to the city of Higüey at the K30+020. Additionally, at K22+780 is the first of the two railroad crossings for the project. In this sector the flat relief continues with presence of extensive sugar cane farming.

Section 3 K33+000 to K70+000

In this final 37 km stretch the route continues predominantly eastwards through areas with deep calcareous soils and extensive pasture lands. In this section, the corridor crosses the Duey river at K36+360 where an 80 m crossing is required. Also, the second railroad crossing is found at K38+270.

The 4.7 km stretch between K61+820 and el K66+500 goes through the northern limit of the Hoyo Claro Natural Monument.

The topography in this section is characterized by hills, ascending to a cliff (escarpment) and finally a plateau composed of calcareous soils.

2.4.2 *Project Infrastructure*

Regarding civil works and infrastructure, the Autopista del Coral will be composed of 68.5 kilometers of regular highway. There will be two lanes in each direction and a median wide enough to allow future addition of one more lane in each direction. The 68.5 kilometers of highway will be complemented with 300 meters of distribution bridges, 500 meters of river bridges, 50 meters of railroad crossings and 450 meters of vehicle, cattle and agricultural crossings, completing the approximately 70 kilometer corridor estimated for connecting the airports of La Romana and Punta Cana.

According to the corridor's configuration, of the 68.5 km of road to be constructed, 75% will be constructed by means of backfill, while the remaining 25% will be achieved with cuts where slopes ranges from 70 to 85%.

Table 2-3 shows the infrastructure works that will constitute the Autopista del Coral, according to the current highway configuration.

TABLE 2-3 Infrastructure Works for the Autopista del Coral

Section	Approx. Section		Approx. Length (M)	Engineering structure
	Start	Finish		
1	K0+000	K0+060	60	Distribution Bridge at La Romana Beltway
	K0+000	K0+120	120	Regular Road on Cut
	K0+120	K0+160	40	Regular Road on Cut
	K0+160	K0+350	190	Regular Road on Fill
	K0+350	K1+160	810	Regular Road on Cut
	K1+160	K4+000	2840	Regular Road on Fill
	K4+000	K4+060	60	Distribution Bridge at La Romana Airport entrance
	K4+060	K5+400	1340	Regular Road on Fill
	K5+400	K6+170	770	Regular Road on Cut
	K6+170	K6+480	310	River Bridge over Chavón River
	K6+480	K7+340	860	Regular Road on Cut
	K7+340	K8+500	1160	Regular Road on Fill
	K8+500	K8+560	60	Vehicle crossing at Boca de Chavón road
	K8+560	K11+500	2940	Regular Road on Fill
	K11+500	K11+560	60	Distributor Approach to Bayahibe
	K11+560	K11+900	340	Regular Road on Fill
	K11+900	K12+080	180	Regular Road on Cut
2	K12+080	K16+670	4590	Regular Road on Fill
	K16+670	K18+700	2030	Regular Road on Cut
	K18+700	K18+900	200	Regular Road on Fill
	K18+900	K18+960	60	Cattle and Sugar Cane Vehicle Crossing - Gato Section
	K18+960	K19+750	790	Regular Road on Fill
	K19+750	K20+100	350	Regular Road on Cut
	K20+100	K21+100	1000	Regular Road on Fill
	K21+100	K21+600	500	Regular Road on Cut
	K21+600	K22+500	900	Regular Road on Fill
	K22+500	K22+525	25	Railroad Bridge 1
	K22+525	K27+000	4475	Regular Road on Fill
	K27+000	K27+300	300	Regular Road on Fill

Section	Approx. Section		Approx. Length (M)	Engineering structure
	Start	Finish		
	K27+300	K27+360	60	Sugar Cane Vehicle Crossing - La Matilla
	K27+360	K29+600	2240	Regular Road on Fill
	K29+600	K29+660	60	Vehicle Crossing - Jobo Dulce Road
	K29+660	K30+500	840	Regular Road on Fill
	K30+500	K30+520	20	River Bridge - Santa Clara Stream
	K30+520	K34+000	3480	Regular Road on Fill
	K34+000	K34+060	60	Distributor Approach to Higüey
3	K34+060	K37+000	2940	Regular Road on Fill
	K37+000	K37+080	80	River Bridge over Duey River
	K37+080	K38+500	1420	Regular Road on Fill
	K38+500	K39+800	1300	Regular Road on Fill
	K39+800	K40+200	400	Regular Road on Fill
	K40+200	K40+320	120	Regular Road on Cut
	K40+320	K41+000	680	Regular Road on Fill
	K41+000	K41+025	25	Railroad Bridge 2
	K41+025	K42+000	975	Regular Road on Fill
	K42+000	K42+060	60	Vehicle and Cattle Crossing – Pasture land areas Central Romana
	K42+060	K43+000	940	Regular Road on Fill
	K43+000	K44+700	1700	Regular Road on Cut
	K44+700	K46+700	2000	Regular Road on Fill
	K46+700	K47+400	700	Regular Road on Cut
	K47+400	K50+200	2800	Regular Road on Fill
	K50+200	K51+000	800	Regular Road on Fill
	K51+000	K51+900	900	Regular Road on Cut
	K51+900	K52+900	1000	Regular Road on Fill
	K52+900	K53+400	500	Regular Road on Cut
	K53+400	K54+100	700	Regular Road on Fill
	K54+100	K54+900	800	Regular Road on Fill
	K54+900	K55+400	500	Regular Road on Fill
	K55+400	K57+200	1800	Regular Road on Cut
	K57+200	K57+600	400	Regular Road on Fill
	K57+600	K58+200	600	Regular Road on Cut
	K58+200	K59+000	800	Regular Road on Fill
	K59+000	K59+500	500	Regular Road on Cut
	K59+500	K62+000	2500	Regular Road on Cut
	K62+000	K62+060	60	Vehicle Crossing - Vieja Rufina Road
	K62+060	K62+400	340	Regular Road on Cut
	K62+400	K62+900	500	Regular Road on Cut
	K62+900	K63+700	800	Regular Road on Cut
	K63+700	K64+300	600	Regular Road on Cut
	K64+300	K69+150	4850	Regular Road on Cut
	K69+150	K69+210	60	Distributor Boulevard Turístico del Este
	K69+210	K69+450	240	Regular Road on Fill

Appendix 2-1 shows the Plan and Profile Geometric Design of the Autopista del Coral Reference Project, according to the above data in **Table 2-3.**

2.5 Technical Aspects of the Highway Design

A description of the main technical aspects considered during the preliminary design of the Autopista del Coral is given below.

2.5.1 *Design Speed*

The Autopista del Coral has been designed for an average speed of 100 km/h between La Romana and Punta Cana airports. At this design speed travel from Santo Domingo to the Punta Cana International Airport should take less than two hours.

2.5.2 *Expected Traffic*

Predicted traffic on the Autopista del Coral, according to traffic projections established by the AUDING – CINESI consulting company, is presented in **Table 2-4** for worst-case, average and best-case scenarios.

TABLE 2-4 Traffic Projections for the Autopista del Coral

Year	Vehicles – Worst-Case Scenario			Vehicles – Average Scenario			Vehicles – Best-Case Scenario		
	Sections			Sections			Sections		
	I	II	III	I	II	III	I	II	III
2010	6,254	4,309	4,188	7,216	4,944	4,637	7,779	5,575	5,100
2011	6,502	4,554	4,319	7,577	5,278	4,971	8,285	6,055	5,541
2012	6,760	4,812	4,455	7,955	5,634	5,329	8,823	6,577	6,021
2013	7,028	5,085	4,594	8,352	6,015	5,712	9,396	7,144	6,542
2014	7,306	5,374	4,738	8,770	6,422	6,124	10,007	7,759	7,109
2015	7,596	5,679	4,887	9,208	6,856	6,564	10,657	8,428	7,724
2016	7,738	5,790	5,008	9,472	7,067	6,810	11,061	8,745	8,150
2017	7,884	5,904	5,133	9,744	7,285	7,066	11,481	9,073	8,599
2018	8,032	6,020	5,261	10,023	7,510	7,331	11,917	9,414	9,073
2019	8,182	6,139	5,392	10,311	7,742	7,605	12,370	9,768	9,573
2020	8,336	6,259	5,526	10,607	7,981	7,890	12,839	10,135	10,101
2021	8,486	6,376	5,653	10,893	8,209	8,159	13,306	10,501	10,607
2022	8,632	6,490	5,771	11,168	8,426	8,407	13,769	10,863	11,085
2023	8,775	6,599	5,881	11,432	8,631	8,634	14,225	11,222	11,529

Year	Vehicles – Worst-Case Scenario			Vehicles – Average Scenario			Vehicles – Best-Case Scenario		
	Sections			Sections			Sections		
	I	II	III	I	II	III	I	II	III
2024	8,913	6,704	5,981	11,682	8,821	8,837	14,674	11,576	11,933
2025	9,046	6,805	6,070	11,916	8,998	9,014	15,114	11,923	12,291
2026	9,182	6,907	6,161	12,154	9,178	9,194	15,492	12,221	12,598
2027	9,320	7,010	6,254	12,397	9,361	9,378	15,880	12,526	12,913
2028	9,460	7,116	6,348	12,645	9,548	9,565	16,277	12,840	13,236
2029	9,602	7,222	6,443	12,898	9,739	9,757	16,684	13,161	13,566
2030	9,746	7,331	6,540	13,156	9,934	9,952	17,101	13,490	13,906
2031	9,892	7,441	6,638	13,419	10,133	10,151	17,528	13,827	14,253
2032	10,040	7,552	6,737	13,687	10,335	10,354	17,966	14,173	14,610
2033	10,191	7,665	6,838	13,961	10,542	10,561	18,415	14,527	14,975
2034	10,344	7,780	6,941	14,240	10,753	10,772	18,876	14,890	15,349
2035	10,499	7,897	7,045	14,525	10,968	10,988	19,348	15,262	15,733
2036	10,656	8,016	7,151	14,816	11,187	11,207	19,831	15,644	16,126
2037	10,816	8,136	7,258	15,112	11,411	11,431	20,327	16,035	16,529
2038	10,978	8,258	7,367	15,414	11,639	11,660	20,835	16,436	16,943
2039	11,143	8,382	7,477	15,722	11,872	11,893	21,356	16,847	17,366
2040	11,310	8,507	7,589	16,037	12,110	12,131	21,890	17,268	17,800

2.5.3 *Geometric Design*

Considering the flat to slightly rolling topography present in the road corridor, the following geometric design parameters were established for the Autopista del Coral.

Alignment

The horizontal alignment of the projected Autopista del Coral is characterized by extensive straight alignments linked by clotoidal curves with a wide radius, designed for maintaining a vehicle speed around 100 km/h.

Regarding vertical alignment, in general the grade was adjusted as far as possible to the level of the existing terrain, with maximum slopes not exceeding 6%. Gentle vertical curves have been designed along the entire profile, to enable adequate visibility according to the design speed established for the project.

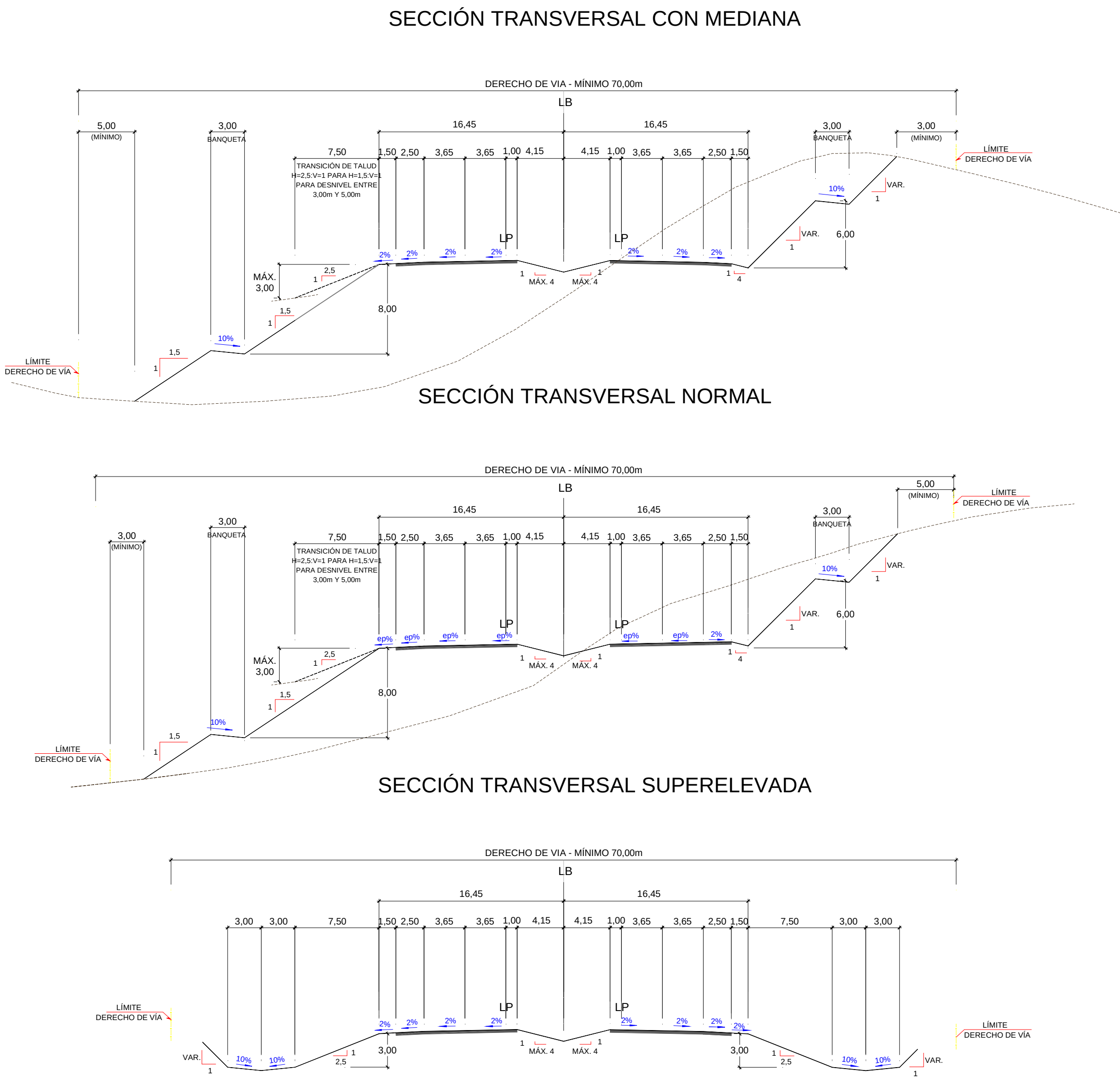
Cross Section

In order to ensure an average speed for the Autopista del Coral of 100 km/h, the typical road cross section will distribute the vehicle flow across four lanes, two in each direction. Two directions of traffic are separated by a median that could be replaced in the future by two lanes, one in each direction. It is predicted that the expansion will be necessary in the future to accommodate increased traffic while preserving functionality at the designed speed.

In general, the geometric characteristics of the Autopista del Coral cross section, either on cut or fill, will be those indicated below and shown in **Figure 2-3**.

- **Road Cross Section on Cut**
  - Roadway width: 7.3 m.
  - Shoulder width: 1.0 m. left side and 2.5 m right side
  - Median width: 8.3 m
  - Slope: 2.0%
  - Cut slope: Variable according to the geomechanical properties of the soil to be cut and the height of the cut to be made.
  - Gutters: Triangular cross section for carrying runoff from the road.
  - Channels: Trapezoidal channels for preventing runoff and consequent erosion of the slopes exposed by the cut configuration.
- **Road Cross Section on Fill**
  - Roadway width: 7.3 m.
  - Shoulder width: 1.0 m. left side and 2.5 m right side
  - Median width: 8.3 m
  - Slope: 2.0%
  - Fill slope: Variable according to the geomechanical properties of the soil to be used and the fill height.

FIGURE 2-3 Typical Cross Sections for Autopista del Coral



2.5.4 Pavement

The most relevant criteria considered in the selection and design of the pavement to be used between La Romana and Punta Cana airports, are described below.

Design Criteria

The pavement structure will be designed using the American Association of State Highway and Transportation Officials (AASHTO) method, and will also take into consideration results of the

Traffic Study for the next 20 years. Also, an additional consideration is giving to difficulties of obtaining construction materials in the project area, in order to minimize effects of setting new borrow pits.

Subgrade line

The highway route will be developed by sub-sections with different soil characteristics concerning bearing capacity for supporting the Pavement Structure. When the soil capacity is not suitable for the pavement sizing, the solution will be improving the subgrade by using nearby or borrow pit material in its construction.

Pavement Structure

According to the traffic studies conducted by AUDING – CINESI consulting, the number of passes by the standard 8.2 ton axle adopted for the Project is 20 E+06 for a 20 year period. The Project will use materials with the highest performance in terms of structural (fatigue) and functional (plastic deformations, wearing, disintegration, etc.) characteristics.

The pavement structure will be composed of:

- Asphalt Concrete Layer = 10.0cm
- Granular Base with Cement = 18.0cm
- Cement Treated Granular Sub-base = 20.0cm
- Subgrade Improvement = 30.0cm
- Subgrade Finishing

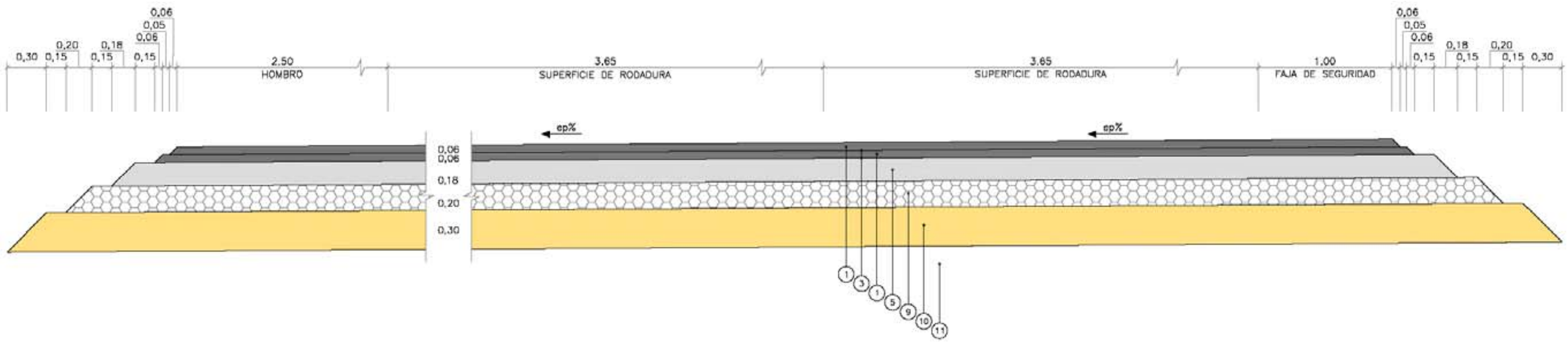
Figure 2-4 illustrates the typical configuration of the pavement structure proposed for the construction of the Autopista del Coral for its approximately 68.5 kilometers of regular roadway.

2.5.5 *Complementary road works*

In addition to the regular road line of the Autopista del Coral to be constructed, additional intersections and access roads are proposed, as indicated in **Table 2-5.**

Additionally, two toll boothes and accompanying administrative offices will be necessary for road operation. The first one will be located at K18+800 and the second at K58+400. Appendix 2-1 illustrates the locations of the above complementary works.

FIGURE 2-4 Typical Pavement Configuration for the Lanes of the Future Autopista del Coral



CONVENCIÓN

LEYENDA	DESCRIPCIÓN
1	CARPETA DE HORMIGÓN ASFALTICO
2	LOSA DE HORMIGÓN DE CEMENTO PORTLAND
3	RIEGO LIGANTE
4	RIEGO DE IMPRIMACIÓN
5	BASE GRANULAR CON CEMENTO
6	BASE GRANULAR
7	SUELO CEMENTO
8	HORMIGÓN DE CEMENTO ROLADO
9	SUB BASE GRANULAR MEJORADA CON CEMENTO
10	MEJORAMIENTO DE SUBRAZANTE
11	TERMINACIÓN DE SUBRAZANTE
12	PELÍCULA PLÁSTICA

TABLE 2-5 Complementary Works for Construction of Autopista del Coral

Station	Construction Works	Type	Quantity	Length
00+600	Distribution Access to La Romana	Overpass	1	60.00
03+600	Access Road to La Romana Airport	Underpass	2	30.00
06+340	Bridge over Chavón River	BRIDGE	2	290.00
08+560	Relocation of Boca de Chavón road	Overpass	1	60.00
11+540	Distributor Approach to Bayahibe	Overpass	1	60.00
15+320	Relocation of Highway to Higüey	Overpass	1	60.00
17+900	Return + Relocation of Gato Section	Overpass	1	60.00
18+800	Toll Booth	TOLL		
22+800	Railroad tracks + Relocation	Underpass	2	30.00
27+200	Relocation La Minilla	Overpass	1	60.00
29+980	Relocation Jobo Dulce	Underpass	2	30.00
30+500	Bridge over Santa Clara River	BRIDGE	2	30.00
33+980	Distributor Highway to Higüey	Overpass	1	60.00
36+350	Bridge over Duey River	BRIDGE	2	70.00
38+280	Railroad + Relocation	Underpass	2	30.00
43+940	2 relocations 42+880 - Potreros CR 44+900 Local Highway	Overpass	1	60.00
48+400	Return + Relocation	Overpass	1	60.00
51+400	Relocation 51+600 Local Road	Overpass	1	60.00
58+400	Toll Booth	TOLL		
61+560	Return 65+965 63+860 Vieja Rufina Road	Overpass	1	60.00
63+860	Relocation 1 - Vieja Rufina Road	Overpass	1	60.00
65+965	Relocation 2 - Vieja Rufina Road	Overpass	1	60.00
69+540	Distributor Tourist Boulevard	Underpass	2	60.00

Table 2-6 provides preliminary quantities of vegetation of native arboreal species that will be planted along road distributor areas.

TABLE 2-6 Vegetation for Distributors

Distributor	Native Arboreal Species (Unit)
Access to La Romana	102
Access to La Romana Airport	104
Access to Bayahibe	66
Highway to Higüey	66
Tourist Boulevard	65

2.5.6 *Drainage Works*

The drainage systems to be implemented along the corridor for the Autopista del Coral, were designed according to Manual M-019 “Provisional Recommendations for Design and Construction of Drainage Systems” from the General Directorate of Regulations and Systems of the Secretariat of Public Works and Communications of the Dominican Republic, taking into account climatologic data on 24 hour maximum rainfalls in the cities of Punta Cana, Higüey and La Romana.

The transverse drainage system proposed includes pipe and box sewers, according to the drainage flow rate estimated for each sewer. Also, the discharge capacity for each sewer was determined assuming that the sewers will operate with inlet control, minimum slope of 0.005, and a maximum inlet water level 1.20 times the pipe diameter. **Table 2-7** indicates the traverse drainage works proposed for the road alignment.

TABLE 2-7 Traverse Drainage Works Proposed for Autopista del Coral

Location		Length of Riverbed (Km)	Max. Flowrate (m^3/sg)	Sewer Dimensions							
Basin	**Station**			**30"**	**36"**	**42"**	**48"**	**60"**	**1.50 x 1.50**	**2.00 x 2.00**	**2.50 x 2.50**
Chavón	1+400	0.59	8.883					2			
	2+150	0.61	5.467				2				
	2+770	0.46	7.500					2			
	3+710	0.81	11.161					3			
	5+240	0.92	10.478					3			
	6+340	85.96	3.181.59	BRIDGE							
	7+380	0.58	3.006			1					
	7+760	0.56	2.362				1				
	8+300	0.22	0.890		1						
	9+230	0.33	1.338			1					
	10+250	0.35	2.300				1				
	11+330	0.22	0.925		1						
	11+800	0.92	5.478				2				
	12+410	0.74	7.178					2			
	13+150	0.18	0.325		1						
	13+600	0.68	6.378				2				
	13+900	0.43	1.225		1						
	16+530	0.50	6.250				3				
Channel	19+585					1					
	22+500	0.61	1.048		1						
	23+710	0.75	3.733			3					
	24+020	0.33	1.575			1					
	24+450	0.42	1.680			1					
	27+000	1.28	5.000				3				

Location		Length of Riverbed (Km)	Max. Flowrate (m³/sg)	Sewer Dimensions							
Basin	**Station**			**30"**	**36"**	**42"**	**48"**	**60"**	**1.50 x 1.50**	**2.00 x 2.00**	**2.50 x 2.50**
	30+300					1					
Santa Clara	30+500	16.00	403.5	BRIDGE							
Channel	32+420					1					
	33+100					1					
	33+870					1					
Ditch	34+070					1					
	34+950	0.36	1.227			1					
	35+210	0.36	1.20		1						
	35+640	0.16	0.85		1						
Duey's Tributary	35+830										3
Duey	36+340	45.00	1.096.13	BRIDGE							
	37+850	1.06	9.92					3			
	38+550	0.83	5.47				3				
	38+880	0.91	5.37				3				
	39+740	0.65	2.73				1				
	41+200	1.06	6.40				3				
	41+500	0.50	5.00				3				
	41+950	0.50	5.00				3				
	42+620	0.58	2.45			2					
	42+880	1.42	11.50					3			
	44+950	0.40	1.25		1						
	48+710	0.87	3.25					1			
	50+120	1.15	5.33				3				
	52+040	1.39	12.50					3			
	53+635	1.00	35.69							3	
	55+030	0.17	0.20		1						
	56+160	1.50	20.06							2	
	57+550	1.75	60.00								3
	59+750	0.17	1.48		1						
	62+000	0.47	2.23				1				
	62+800	0.21	0.33		1						
	62+970	0.17	0.35		1						
	63+680	0.86	4.60				2				
	64+550	0.21	0.33		1						
	65+450	0.20	0.38		1						
	65+970	0.19	0.35		1						
	66+730	0.20	0.41		1						
	67+090	0.43	7.50					2			
	67+850	0.22	0.40		1						
	68+600	0.21	0.43		1						

2.5.7 *Retaining Structures*

According to the geometric configuration of the design and the cut and fill to be conducted for shaping the embankment for the Autopista del Coral, and taking into account the geomechanical properties of the materials to be removed and disposed of during cuts and fills, no slope stabilization or soil retaining structures are anticipated. However, if potentially unstable sections are found during the detailed engineering design phase, they will be treated by means of retaining structures such as gabions or concrete structures, complemented by additional surface and subsurface drainage works.

2.5.8 *Access Roads to the Zone of Interest*

The main access roads to the Right of Way (RoW) established for the project will be constructed via the road currently connecting the cities of La Romana, Higüey and Punta Cana, which intersects the RoW at the following sites:

Accesses to Area 1

- Entrance to Cacata at K0+000 of RoW
- Entrance to Casa de Campo at K2+000 of RoW
- Chavón River at K6+000 of RoW
- Entrance to Limón at K8+000
- Entrance to Bayahibe at K11+000 of RoW

Accesses to Area 2

- Benedicto Crossing at K 16+000 of RoW
- La Piñita Crossing at K34+000 of RoW

Accesses to Area 3

- Entrance to La Rufina at K63+800 of RoW
- Entrance from Verón crossing at K65+900 of RoW
- Entrance to Roundpoint of Punta Cana Airport at K70+000 of RoW

During construction of the Autopista del Coral, all of the above mentioned accesses will be controlled and marked with the respective safety signposting, in order to avoid interruptions of vehicle flow in the current road or in the existing non-paved access roads.

According to the Project characteristics, construction of new accesses to the RoW will not be necessary, but adaptation of non-paved roads connecting the project's RoW with temporary facilities or auxiliary areas may be required. **Table 2-8** includes the secondary non-paved roads that will be used during construction of the Autopista del Coral.

TABLE 2-8 Secondary Accesses Required during Construction of the Autopista del Coral

Road	Width	Present Condition
0+600	11.00	Paved
2+180	12.00	Paved
4+200	7.00	Non-paved
5+700	7.00	Non-paved
6+270	10.00	Non-paved
6+440	11.00	Paved
7+200	7.00	Non-paved
8+560	7.00	Non-paved
11+400	7.00	Non-paved
14+630	7.00	Non-paved
15+600	13.00	Non-paved
16+180	7.00	Non-paved
17+420	7.00	Non-paved
18+040	7.00	Non-paved
18+350	7.00	Non-paved
18+510	7.00	Non-paved
18+660	7.00	Non-paved
18+820	7.00	Non-paved
18+970	7.00	Non-paved
19+120	7.00	Non-paved
19+280	7.00	Non-paved
19+440	7.00	Non-paved
19+600	7.00	Non-paved
19+900	7.00	Non-paved
20+200	7.00	Non-paved
20+520	7.00	Non-paved
20+840	7.00	Non-paved
21+140	7.00	Non-paved
21+460	7.00	Non-paved
21+760	7.00	Non-paved
21+920	7.00	Non-paved
22+100	7.00	Non-paved

Road	Width	Present Condition
22+260	7.00	Non-paved
22+440	7.00	Non-paved
22+660	7.00	Non-paved
22+900	7.00	Non-paved
23+100	7.00	Non-paved
23+220	7.00	Non-paved
23+460	7.00	Non-paved
23+720	7.00	Non-paved
23+990	7.00	Non-paved
24+560	7.00	Non-paved
24+760	7.00	Non-paved
25+000	7.00	Non-paved
25+120	7.00	Non-paved
25+400	7.00	Non-paved
25+760	7.00	Non-paved
26+560	7.00	Non-paved
26+940	7.00	Non-paved
27+400	10.00	Non-paved
28+120	7.00	Non-paved
28+450	7.00	Non-paved
29+230	7.00	Non-paved
29+980	10.00	Non-paved
30+780	7.00	Non-paved
31+760	7.00	Non-paved
32+420	7.00	Non-paved
33+100	7.00	Non-paved
33+520	7.00	Non-paved
34+040	11.00	Paved
34+780	7.00	Non-paved
35+440	7.00	Non-paved
35+700	7.00	Non-paved
36+460	7.00	Non-paved
37+300	7.00	Non-paved
37+840	7.00	Non-paved
38+060	7.00	Non-paved
38+300	7.00	Non-paved
38+540	7.00	Non-paved
38+820	7.00	Non-paved
39+400	7.00	Non-paved

Road	Width	Present Condition
39+860	7.00	Non-paved
40+400	7.00	Non-paved
42+900	7.00	Non-paved
44+920	7.00	Non-paved
48+240	7.00	Non-paved
51+620	7.00	Non-paved
52+440	7.00	Non-paved
52+800	7.00	Non-paved
58+500	7.00	Non-paved
63+860	7.00	Non-paved
65+950	7.00	Non-paved
67+760	7.00	Non-paved
69+000	7.00	Non-paved
69+520	11.00	Paved

2.6 Right of Way and Concession Areas

The following is a description of issues concerning the right of way characteristics and the concession areas authorized for the construction, operation and maintenance activities in the corridor for the Autopista del Coral.

2.6.1 *Right of Way*

This is the corridor where all the construction, operation and maintenance activities associated with the Project will be conducted. According to the design, the corridor will be 70 m wide, including the necessary space for developing the maintenance and operational works. However, in some sections where complementary infrastructure adaptation will be needed, it is possible that the regular width will be extended up to the necessary size for project construction.

2.6.2 *Concession Areas*

These areas are defined as the areas located within the RoW, that to the date that they will be handled over to the Moya-Odebrecht Consortium for constructing and operating the road infrastructure and services are not occupied by people.

The Concession Area will be increased proportionally and progressively, after the procedures for land acquisition or expropriations, as applicable, are over. Within this concessional areas the road construction and operation, its accesses and complementary works, such as engineering structures, drainage, retaining walls, signposting, secondary roads, bridges, services and safety zones, as well as the toll booth facilities, will take place.

2.7 Project Phases

The following is a description of each of the phases the Autopista del Coral Project will go through, and the activities involved in each phase.

2.7.1 *Pre-Construction Activities*

These study and design elements will be aimed at establishing all the economic and technical requirements of project construction and operation.

Detailed Engineering

The detailed engineering will determine the detailed location and dimensions of all the infrastructure, drainage, retaining and pavement works, based on detailed topographic surveys, field visits, and geological, geotechnical, hydrological and traffic studies, among others.

Easement Negotiation

In addition to expropriations, easements on privately held land are sometimes required. Easements are negotiated with landowners for temporary use of lands in addition to the RoW needed to support highway construction and operation. It is not anticipated that any easements will be required for the Autopista del Coral project.

Land Negotiation and Expropriation

Includes land acquisition for Project construction and operation by means of negotiation or purchase from the current owners. This will be conducted by the **Secretariat of State for Public Works and Communications (SEOPC)**; the negotiations are developed by this organization according to the following procedure:

1. *The Supervisor, in coordination with the Operational Group from SEOPC in charge of the Project, proceeds to conduct a survey along the proposed route of the road to be constructed.*

2. *The Operational group informs the Department of the Valuation Commission about the new project and its location.*
3. *The Supervisor determines and demarcates the area to be expropriated.*
4. *After receiving the project route plans, the coordinator of the Valuation Commission, through the Secretariat of State for Public Works and Communications of SEOPC, requests to the General Directorate of the National Cadastre to officially determine the Price Index of the properties to be affected,.*
5. *The project Supervisor will identify all the properties to be affected along the road and obtain, in coordination with local authorities:*
    a. *Topographic survey of the area to be expropriated*
    b. *Individual verification of plantations, improvements and/or buildings located within the area to be expropriated.*
6. *The authority (a representative from the army) representing the Valuation Commission of SEOPC will go to project site and proceed with a survey of the property owner's documents, such as:*
    a. *Copy of the identity and electoral card of the proprietor or occupant, in case he (she) is not the property owner.*
    b. *Copy of the official documentation that proves that he (she) is the property owner, such as: property title, including its cadastral plan.*
7. *The Valuation Commission surveys the Project site, in order to appraise the houses or any other existing improvements. Photographic documentation of the surveyed area should be included.*
8. *The Valuation Commission, with the field data, conducts the valuation of the property to be expropriated, which consists of three main parts:*
    a) <u>Land:</u> The Price Index previously determined by the Cadastre Commission is applied on an areal basis to the properties identified by the Supervisor.

    b) <u>Plantations:</u> Trees or other crops reported by the Supervisor are valued according to the prices determined by the Secretariat of State for Agriculture, clearly indicating their condition or productivity

    c) <u>Improvements and Buildings:</u> Structure will be valued based on type of construction and condition. The value is generally based on calculation of replacement costs.

9. The Valuation Commission issues an appraisal form for each property to be expropriated. This list, supported with the property's legal documentation, is sent to SEOPC's administrative section, in order to request the corresponding funding.

10. The SEOPC's administrative section proceeds to issue the corresponding payments to the landowners.

11. Once the payments are available, the Valuation Commission in coordination with an auditor and a representative from SEOPC, will deliver them to the affected landowners. Such payments are completed by a lawyer who receives the Property Titles corresponding to the properties purchased by SEOPC.

12. The authority (a representative from the army) in charge of Project safety, together with the Supervisor, informs the affected residents of the timeline for re-location from the project area.

13. When the stipulated term for re-location is over, the Supervisor authorizes the contractor to go proceed with the Project, using the expropriated areas.

14. The Property Titles are delivered to the lawyer of the Valuation Commission in order to proceed with the Project activities in the area purchased by the Dominican State.

Note: In some cases, the occupants of the properties to be expropriated cannot present the necessary documents proving ownership. The Valuation Commission conducts a case by case determination to resolve these situations and facilitate the advance of the Project. Generally, these residents are compensated for the improvements on the land.

2.7.2 *Construction Phase*

This phase includes the construction projects necessary to facilitate highway construction.

Location and Lay-out

This activity consists of on-site layout of the right of way and the other areas to be used during Project construction and implementation, based on the approved design plans.

The layout activities will require topographical survey teams with precision instruments duly calibrated, such as level, total station, stadimetric reticle, tape, etc.

Clearance and Cleaning

This phase consists of removing the surface layer of soils along the road corridor using a bulldozer. These soils will be later used for restoring the neighbor or related impacted areas.

The organic soil or cover will not be mixed with the inert excavation material, which will require the supervision of a competent person during surface soil excavation.

Access Road Adaptation

The adaptations for ensuring the traffic of machinery and equipment to the different project work-sites consist basically of rehabilitation of existing cuts and fills and construction and/or repair of traverse and longitudinal drainage structures.

In the dry season the surface of access roads will be wetted along sections near houses and other inhabited sites using water tankers, at least twice a day, in order to reduce the dust generated by normal transit of vehicles and machinery.

Traffic Detours

Before starting the planned activities and respective heavy equipment mobilization, the contractor in charge of the various projects related to access roads to the areas of interest, populated centers and environmentally sensitive sections, will preview the need for adapting restrictions and detours to ensure the adequate transit of machinery and equipment, as well as the safety of the inhabitants and the environment.

Consequently, it will be necessary to establish adequate signs during construction, according to specifications in the "Manual of Road Signposting" prepared by SEOPC in 1983. Signs will take into account the Average Daily Traffic (ADT) and type of vehicles normally traveling the roads, as well as the location of intersections and areas where the route overlaps with sites of environmental importance.

Adaptation of Camps and Temporary Facilities

The proposed construction of the Autopista del coral will necessitate that camps be established, located strategically along the authorized road corridor. These camps will include administration and cafeteria facilities for project personnel, and they will be equipped with systems for solid and liquid wastes disposal, such as a waste water treatment system, incinerators, etc.

In general, temporary facility construction will use prefabricated materials or elements that are easily dismantled, in order to facilitate the site abandonment phase. Whenever use of lumber is necessary, it shall be purchased from authorized companies, avoiding irregular deforestation processes.

Soil Movement

This includes land clearing, leveling, and the cuts and fills to be conducted along the road corridor. It also includes as well as pit areas and zones for the disposal of excavated materials. Excavated material with good technical properties will be used in fills, while the soil with low technical specification will be disposed of in dumps authorized for the Autopista del Coral project. In those sections where the cut material is not sufficient for fill requirements, the required volumes will be filled with material excavated from borrow pits duly permitted by the environmental authorities.

The project will make the best use of the materials excavated in the road area, minimizing the need for additional material extraction.

As stated before, the top soil coming from clearing and leveling of the right of way and overburden disposal areas will be carefully kept for its future use in the re-vegetation of the areas affected by Autopista del Coral construction.

The excavation of areas of solid rock will be performed after an evaluation of the geological sensitivity of the areas to be impacted. Excavation will be by controlled blasting methods or hydraulic or pneumatic drills.

Excavation and loading of rocky, fragmented material will be conducted with hydraulic excavators or retro-excavators, in combination with front-end loaders.

Transportation of the excavated material from borrow pits to the work sites or from excavations in the construction zones to the disposal areas, will be conducted using $14m^3$ capacity dump trucks.

The fill activity will use caterpillar tractors for spreading, shaping and homogenizing the fill material. To homogenize and compacting the fill material up to 95% Modified Proctor, motor grader, tankers and automotive road roller compactors will be utilized.

In the areas for disposal of overburden materials, caterpillar tractors and automotive roller compactors will be used for spreading and compacting the material up to 90% Modified Proctor. The slope shaping will be conducted using hydraulic excavators.

Drainage Works

Drainage structures will be divided into those that cross the corridor (sewers and box-culverts) and those that run along the corridor (ditches, intercepting channels, filters and curbs).

Structures crossing the corridor will be constructed concurrently with earth-moving activity, after the area is cleared, ensuring continuity of the different water pathways.

Structures paralleling the roadway will be constructed simultaneously with the embankment shaping, once the earth-moving is completed.

In general, in order to control erosion, the placement of rip rap protection at the inlet and outlet of water courses will be considered. Additionally, with the purpose of minimizing erosion, all the water coming from drainage structures will be directed to a natural water course. Whenever necessary, the flowing water will be slowed by means of energy dissipaters according to the design engineering.

Small hydraulic retro-excavators will be used for the drainage structure excavations. Manual compactors will be used when using the excavated material as fill during drainage structure construction.

Lumber used in the construction of molds and forms for drainage structures will not be constructed using lumber from within the area. Concrete mixing will also be done off-site to decrease the need activity and impact at the project site.

Pavements

As mentioned before, the corridor of the Autopista del Coral contains several soil types with different weight-bearing capacities. When the soil's weight-bearing capacity is not suitable for the traffic requirements, it will be reinforced with sub-drainage works, subgrade improvement with cement addition, or by performing deep replacement with material from borrow pits, whichever is most suitable to the specific case.

The materials selected for highway construction, taking into account the volume of traffic anticipated for the Project, will have the highest performance characteristics in terms of structural (break) and functional (wear, disintegration, etc.) lifespan.

The layers for sub-grade and sub-base improvement will be constructed with conventional equipment, such as motor graders, tankers and roller compactors. Excavations of material to be disposed of during these activities will be conducted with hydraulic excavators, caterpillar tractors and rubber tire loaders.

As stated before, the wearing surface to be built with asphalt and concrete will be produced in industrial plants with sufficient capacity for meeting the Project demand, and will be spread using compatible vibro-finishers.

The transportation of aggregate material for the asphalt and concrete will be done using $14m^3$ capacity dump trucks, while the asphalt and concrete will be transported to the project site by large mixing trucks.

Signposting and Demarcation

These activities include the installation of both vertical and horizontal traffic signs, according to the stipulations in the Manual of Road Signposting of SEOPC. Regulations are aimed at ensuring that motorists are adequately informed of construction activities and their impacts to the regular flow of traffic.

Defense Installation

In addition to the installation of the appropriate signs, steel rails and concrete barriers will be installed as required by highway characteristics. These structures will increase safety to motorists and pedestrians in the vicinity of the corridor.

Complementary Works

The Autopista del Coral road Project will require the construction of bridges, underpasses and overpasses for crossing rivers and avoiding intersections to the road surface level. The technical specifications for each of these complementary works will be established on a site-specific basis during the detailed engineering phase. Nevertheless, it may be stated that that such structures will be constructed of reinforced concrete with the steel reinforcement assembled on site. The concrete will be pre-mixed at industrial plants and transported to the Project site in large mixer trucks.

2.7.3 *Operational Phase*

During the operational phase of the Autopista del Coral, the following activities will be implemented:

Road Operation

Operation of The Autopista del Coral will be conducted by the Moya-Odebrecht Consortium; during this phase, the operator will be responsible for maintaining the structures constructed according with the standards and service levels established by SEOPC.

Infrastructure Preservation Plan

Once construction of the Autopista del Coral is satisfactorily completed, the Moya-Odebrecht Consortium will conduct the “Preservation of Reversible Assets” received from the Secretariat of State for Public Works and Communications. This plan will be implemented for the extent of the concession contract (as agreed on the adopted PPP Public – Private Participation Scheme) and any additional “Reversible Assets” may be included as deemed appropriate.

The Moya-Odebrecht Consortium will preserve the infrastructure as required for maintaining the service levels established by the Secretariat of State for Public Works and Communications. The Consortium is also responsible for defining the techniques, procedures and frequency of the “Periodic Preservation and Maintenance” activities.

Maintenance Activities

The maintenance activities planned for the Autopista del Coral are intended to maintain the Project infrastructure in adequate condition for safe transit.

2.8 Resources Requirements During Construction Phase

2.8.1 *Areas and Materials*

The area and materials needed for project construction are described below.

Right of Way

The right of way required for the regular roadway is 70 m wide. Additional space is required for the complementary works which will require additional infrastructure.

Consequently, the right of way will require an area of approximately 6,000,000 square meters.

Links and Special Road Works

The estimated amount of materials required for the construction of the complementary works is presented in **Table 2-9**

TABLE 2-9 Material for Complementary Works Adaptation

Construction Work	Hydraulic Concrete (m^3)	Sand (m^3)	Gravel (m^3)	Cement (kg)	Water (gal)
1.- BRIDGE-DISTRIBUTOR					
1.1.- La Romana Beltway (overpass)	675.00	330.75	229.50	121.986.00	8.916.00
1.2.- Entrance to La Romana Airport (underpass)	900.00	441.00	306.00	162.648.00	11.880.00
1.3.- Access to Bayahibe road (underpass)	1.350.00	661.50	459.00	243.972.00	11.880.00
1.4.- La Romana-Higüey road (underpass)	1.350.00	661.50	459.00	243.972.00	11.880.00
1.5.- Bávaro-Punta Cana road (underpass)	1.350.00	661.50	459.00	243.972.00	11.880.00
2.- RIVER BRIDGE					
2.1.- Chavón River	13,500.00	6,615.00	4,590.00	2,439,720.00	178,316.00
2.2.- Santa Clara Stream	900.00	441.00	306.00	162,648.00	11,880.00
2.3.- Duey River 1	2,115.00	1,036.35	719.10	382,222.80	27,936.80
2.4.- Duey River 2	2,115.00	1,036.35	719.10	382,222.80	27,936.80
3.- RAILROAD BRIDGE					
3.1.- Railroad 1 with Relocation (Underpass)	900.00	441.00	306.00	162,648.00	5,944.00
3.2.- Railroad 2 (Underpass)	900.00	441.00	306.00	162,648.00	5,944.00
4.- VEHICLE, CATTLE, AGRICULTURAL CROSSING					
4.1.- Road to Boca de Chavón (Vehicle) (Overpass)	450.00	220.5	153.00	81,324.00	5,944.00
4.2.- Relocation of Existing road	585.00	286.65	198.90	105,721.20	7,727.20
4.3.- Gato Section (Cattle and Sugar Cane Transport Vehicles) U-turn with Return	675.00	330.75	229.50	121,986.00	8,916.00
4.4.- La Matilla (Sugar Cane Vehicles)	450.00	220.5	153.00	81,324.00	5,944.00
4.5.- Road to Jobo Dulce (Former Higüey road) (Vehicle)	900.00	441.00	306.00	162,648.00	11,888.00
4.6.- Pasture land area Central Romana (Cattle and vehicle crossing)	450.00	220.5	153.00	81,324.00	5,944.00
4.7. - Vieja Rufina Road (Vehicle) U-turn with return.	675.00	330.75	229.50	121,986.00	9,906.00
4.8.- Jaragua Road(U-turn)	450.00	220.5	153.00	81,324.00	9,906.00
4.9.- Return	450.00	220.5	153.00	81,324.00	9,906.00
4.10.- Vieja Rufina 1 Road	450.00	220.5	153.00	81,324.00	5,944.00
4.11.- Vieja Rufina 2 Road	1,350.00	661.50	459.00	243,972.00	5,944.00
TOTAL	**32,940.00**	**14,817.60**	**11,199.60**	**5,952,916.80**	**402,362.80**

Access Road Adaptation

It is not anticipated that any additional space or materials will be required for modification of the access roads shown in Table 2-7.

Borrow material areas

The Autopista del Coral design will require excavations and fills as indicated in **Table 2-10**, according to which no borrow material will be needed along the project corridor.

TABLE 2-10 Estimated Soil Movement for the Autopista del Coral Embankment

Activity	Abscissa			Total
	K0+000 to K13+000	K13+000 to K33+000	K33+000 K70+000	
Excavation (m³)	1,290,559	1,261,346	1,612,555	4,164,460
Fill (m³)	463,892	921,779	1,605,466	2,991,137

Disposal areas

The excavations will likely generate material that cannot be used as fill material; due either to excess quantities or unsuitable properties, therefore authorized areas will be needed as final disposal sites for such material. **Table 2-11** shows the expected soil movement and the excess material to be disposed of. **Table 2-12** presents the location of areas to be developed as disposal areas and their location along the corridor.

TABLE 2-11 Soil Movement and Borrow Material for Autopista del Coral

Activity	Abscissa			Total
	K0+000 to K13+000	K13+000 to K33+000	K33+000 K70+000	
Excavation (m³)	1,290,559	1,261,346	1,612,555	4,164,..460
Fill (m³)	463,892	921,779	1,605,466	2,991,137
Disposal (m³)	826,667	339,567	7,089	1,173,323

TABLE 2-12 Location of Disposal Areas to be Used During the Autopista del Coral Construction

Section	Section Length (km)	Disposal area	Coordinates		Capacity (m³)
			North	East	
K0+000 to 6+180	6.18	1	2.039.700	506.300	297.000
		2	2.039.600	507.200	249.600
K6+480 to K15+000	8.52	3	2.037.900	514.350	153.600
		4	2.037.420	515.520	57.600
		5	2.037.580	518.150	150.000
		6	2.038.450	518.350	180.000
		7	2.039.100	518.600	90.000
K15+000 to K31+500	16.5	8	2.039.800	518.600	196.800
		9	2.040.050	518.350	192.000
		10	2.040.600	518.600	144.000
		11	2.041.580	518.620	120.000
		12	2.041.980	518.380	115.200
		13	2.043.400	518.400	117.600
		14	2.044.350	518.580	93.600
		15	2.045.260	518.370	109.200
		16	2.046.580	518.600	78.000
		17	2.047.730	520.400	86.400
		18	2.048.700	521.660	148.350
		19	2.048.630	522.420	108.000
		20	2.049.240	523.700	133.950
		21	2.049.340	525.340	67.200
K31+500 to K40+000	8.5	22	2.049.520	527.800	108.000
		23	2.049.340	529.340	126.000
		24	2.049.600	530.350	108.000
		25	2.049.360	530.640	90.000
		26	2.049.530	532.480	117.000
		27	2.049.300	534.050	120.000
		28	2.049.230	535.360	108.000
K40+000 to K50+000	10	29	2.049.530	536.300	255.000
		30	2.050.050	537.600	144.000
		31	2.050.580	538.630	72.000
		32	2.050.680	540.350	72.000

Section	Section Length (km)	Disposal area	Coordinates		Capacity (m³)
			North	East	
		33	2.050.920	541.860	117.600
		34	2.051.050	543.580	186.000
		35	2.051.340	543.860	86.400
		36	2.051.600	544.880	240.000
K50+000 to K59+500	9.5	37	2.051.970	547.800	100.800
		38	2.052.070	548.360	96.000
		39	2.052.340	548.740	180.000
		40	2.052.240	550.080	144.000
		41	2.052.540	550.800	93.600
		42	2.053.100	553.090	144.000
		43	2.053.020	553.520	156.000
K59+500 to K70+000	10.5	44	2.053.430	556.400	126.000
		45	2.053.300	558.200	109.200
		46	2.053.000	559.670	86.400
		47	2.052.730	560.000	240.000
TOTAL					**6'314.100**

Camp Areas

As mentioned before, the construction phase of the Autopista del Coral will require camps that will be strategically located, and will support the personnel taking part in Project construction. **Table 2-13** shows the approximate location of camps proposed for the Autopista del Coral.

TABLE 2-13 Location of Camps Proposed for the Autopista del Coral Construction

Section	Type of Camp	Approx. Abscissa	Location
1	Production Camp next to Chavón Bridge	K7+000	Camp Moya
2	Main	K34+000	Yuma Pit
3	Production	K69+000	Distributor-Boulevard

Industrial Plants

Three industrial plants will be installed, which will be located in the same zones as the camps indicated in Table 2-13. These facilities will include, among others, the premixed and prefabricated concrete plant, and the laboratories for concrete quality control.

Explosives Usage

Explosives will be required during excavations of loose or solid rock and also at pits for the extraction of construction granular material. An authorization issued by competent authorities will be required for the use of explosives.

Vegetation Removal

According to preliminary designs and considering the areas to be used for implementing the Autopista del Coral, the vegetation to be removed during construction is estimated on the following order:

- From K0+000 to K15+000 = 1,010,000m^2
- From K15+000 to K50+000 = 2,294,000m^2
- From K50+000 to K70+770 = 1,263,100m^2

Water Consumption

The water for human consumption in the construction camps will be collected by means of deep wells; the construction and use of these wells must be authorized through the issuance of a license by the appropriate authority. Development of deep wells will be preceded by specific studies to determine water quality and the type of treatment required for human consumption. These studies will be conducted by companies specialized in this field.

It is worth noting that the water to be used in the construction processes must comply with technical specifications established for the Autopista del Coral construction.

Consequently, the water collected and used for construction must be technically suitable for preparing the hydraulic concrete for building the concrete slabs in the toll zones and for the engineered structures such as pontoons, bridges, sewers, etc. Additionally, the water must be acceptable for processing aggregate materials, preparing the material to be compacted for constructing the pavement structure layers, and for environmental control when used on existing roads and in the Right of Way itself, for dust management.

Table 2-14 shows estimated volumes of water required for civil works construction, environmental control, human consumption and maintenance activities on the Autopista del Coral, as well as the corresponding water source.

TABLE 2-14 Water Quantities Required for Autopista del Coral Construction

Activity	Water Quantity monthly average for the whole project (m^3)	Water Source
Services at Works	78,117.27	Chavón and Duey rivers
Camps	6,272.54	Artesian Wells
Industrial Plants	15,403.04	Chavón and Duey rivers, complemented with artesian wells
Service Roads	4,173.91	Chavón and Duey rivers
Total monthly average (m^3)	**103,966.76**	

Power

During construction, the electricity demand for the operation of the industrial plants, personnel camps, and administrative facilities is estimated to be on the order of 2,400 kW, as indicated in **Table 2-15.**

TABLE 2-15 Electricity Demand for Autopista del Coral Construction

Facility	Abscissa	Location	Power demand	Unit
Main Camp	km 34	Yuma Pit	200	KVA
Production Camp 1	km 7	Camp Moya	150	KVA
Production Camp 2	km 69	Distributor-Boulevard	150	KVA
Yuma Industrial Plant		Yuma Pit	1,500	KVA
Mobile Production Plant 1	km 17	Pits 3 and 4	200	KVA
Mobile Production Plant 2	km 57	Pits 12 and 13	200	KVA

Quarries

These areas have been selected for the extraction of materials to be used in the construction of the Autopista del Coral. These materials meet the necessary technical specifications for their use in fills, replacements, stabilized granular base and hydraulic concrete, as required. **Table 2-16** shows the location of the proposed quarries for this project.

TABLE 2-16 Location of Quarries Required for Autopista del Coral Construction

Name	Use	UTM Coordinates (WGS84)		Owner
		North (m)	East (m)	
Gran Calle	Fill or improved subgrade	2.041.374.28	510.878.49	Central Romana Sugar Mill
	Fill, improved subgrade or sub-base	2.043.444.31	515.452.40	Private
	Fill, improved subgrade or sub-base	2.045.477.19	516.100.74	Private
	Fill, improved subgrade or sub-base	2.041.644.04	517.936.54	Private
	Fill, improved subgrade or sub-base	2.042.080.21	516.152.76	Private
Ramón Gordo	Fill or improved subgrade	2.042.145.42	524.616.88	Central Romana Sugar Mill
	Fill or improved subgrade	2.049.917.27	525.962.35	Private
Naco	Fill, improved subgrade or sub-base	2.042.923.90	529.789.80	Central Romana Sugar Mill
	Fill or improved subgrade	2.059.928.38	546.443.99	Private
	Fill or improved subgrade	2.059.244.92	564.862.25	Private
	Fill, improved subgrade or sub-base	2.051.936.49	551.402.20	Private
	Fill, improved subgrade or sub-base	2.052.687.07	554.491.43	Private
	Fill, improved subgrade or sub-base	2.054.546.48	554.440.26	Private
	Fill, improved subgrade or sub-base	2.047.494.59	548.067.25	Private
	Fill, improved subgrade or sub-base	2.059.246.33	546.861.55	Private
Yuma	Concrete aggregates	2.040.100.71	529.613.34	Romana Sugar Mill
El Gato	Concrete aggregates	2.041.994.11	491.077.30	Private
Peñón	Concrete aggregates	2.039.232.02	500.942.05	Romana Sugar Mill
Enea	Concrete aggregates	2.062.765.61	516.817.65	Elsamex
Altagracia	Concrete aggregates	2.059.649.83	563.362.61	Agregados Altagracia
km 62+750	Concrete aggregates, asphalt and base	2.053.350.00	577.900.00	**¡Private**

2.9 Labor Requirement during Construction

A monthly average requirement of 1,007 man-hours is predicted as the labor required for construction to the Autopista del Coral. This includes qualified and non-qualified labor. **Table 2.17** shows the estimated monthly hours based on the required qualifications.

TABLE 2-17 Labor Requirements for Autopista del Coral Construction

No.	Personnel	Unit	Monthly average quantity
1	Washer	H	1
2	Helper	H	290
3	Fuel service operator	H	5
4	Tool keeper (EQ)	H	7.
5	Workshop helper	H	1
6	Drill bit sharpener	H	6
7	Qualified helper	H	81
8	Drilling operator	H	13
9	Soil movement operator	H	26
10	Paving operator	H	29
11	Explosives operator	H	12
12	Civil works operator	H	25
13	Welder I	H	1
14	Welder II	H	23
15	Light Equipment Mechanic (EQ)	H	29
16	Heavy Equipment Mechanic (EQ)	H	22
17	GP-18 – Heavy Equipment Mechanic II	H	7
18	Electrician I	H	1
19	Electrician, alternate current	H	13
20	Equipment and vehicle washer	H	3
21	Lubricator	H	10
22	Painter-Equipment/Metal Structure	H	7
23	Mechanic I	H	3
24	Tire repair/change	H	6
25	Autobody repair	H	8
26	Lathe Operator II	H	15
27	Plant Operator	H	7
28	Retroexcavator operator	H	3
29	Compressor operator	H	3
30	Crane operator	H	4
31	Motor grader operator	H	17
32	Front-end loader operator	H	27
33	Heavy vehicle driver	H	189
34	Roller compactor operator	H	16
35	Truck driver	H	17
36	Hydraulic excavator operator	H	18
37	Tractor operator	H	19
38	Operator - Tamrock 600 Hydraulic drill	H	6
39	Industrial Plant Foreman	H	3
40	Civil Works foreman	H	2
41	Soil movement foreman	H	18
42	Paving foreman	H	8
43	Foreman in charge of mechanic workshop (EQ)	H	5
44	Supervisor	MH	1

2.10 Machinery and Equipment Requirements during Construction

The required equipment and machinery for the Autopista del Coral project are listed in **Table 2-18**.

TABLE 2-18 Machinery and Equipment Required for Autopista del Coral Construction

No.	Machinery and equipment	Unit	Monthly average quantity
1	Motor grader CAT 140	H	12
2	Pneumatic Hammer - Atlas Copco RH5715LS 33IPM - 39L/SEG	H	1
3	Hydraulic Breaker - A Copco MB1200CL II 2900 Joules 340 IPM	H	1
4	Caterpillar Tractor - CAT D6R	H	9
5	Caterpillar Tractor - CAT D6R - 165 HP - 3.78 m	H	1
6	Caterpillar Tractor - CAT D8 – with Scarifier	H	7
7	Mechanical Lathe - 4000 MM	H	5
8	Front-end Loader - CAT 950 - 207 HP, 3.1 m^3	H	24
9	Pneumatic Loader - CAT 928G 2.1 m^3	H	1
10	Truck Crane w/Munk MB 10 TN	H	1
11	Fuel Tanker - 8000 L	H	1
12	Asphalt Distributor - 7M3 MB LB-2423B	H	1
13	Dump Truck - 14 M3 Volvo N10	H	122
14	Water Tanker - Volvo 20000 L	H	12
15	Lubricator Truck Volvo	H	2
16	Fuel Tanker	H	1
17	Stakebed Truck	H	2
18	Concrete Batching Plant - 50 M3/H	H	1
19	Soils Plant	H	1
20	Low bed 60 TON	H	1
21	Retroexcavator - CAT 426 C	H	3
22	Hydraulic excavator - CAT 320	H	4
23	Hydraulic excavator - CAT 330	H	9
24	Hydraulic Hammer	H	3
25	Mini-loader -Bobcat type with Sweeper	H	3
26	Mobile Screener with Feeder - 50 m^3/h	H	2
27	Asphalt Distribution Truck	H	4
28	Crusher – Yuma, 120 m^3/H	H	1
29	Electric Generator	H	6

No.	Machinery and equipment	Unit	Monthly average quantity
30	Self Loading Mixer - 500 liters	H	4
31	Extruder Gomaco CP	H	1
32	Semi-Trailer Workshop - Massari	H	1
33	Telescopic Crane - Madal 10 TN	H	3
34	Hydraulic Drill w/Caterpillar - TAMROCK RANGER 600	H	4
35	Self-driven Roller Compactor - Cat CC422	H	10
36	Asphalt Vibro-Finisher - CIBER AF6000 M 155 HP 7.0 M	H	3
37	Pneumatic Automatic Roller Dynapac CP-22 145 HP 3 TN	H	5
38	Vibro-Compactor Flat Tandem Roller - Dynapac CC422 1.25 HP	H	3
39	Bobcat Mini-loader	H	2
40	Portable Compressor - Atlas Copco XA 136 250 PCM 84 HP	H	3
41	Gravimetric Asphalt Plant - 140 TON / H KM – 35	H	1
42	Electric Compressor A.C. (Workshop)	HR	4
43	Diesel Compressor - A.C. XAS-136 250 PCM	H	1
44	Portable Compressor - Atlas Copco XA-350- 764 PCM - 269 HP	H	2

It is worth noting that prior to starting construction, the machinery and equipment must be inspected to ensure that they are mechanically sound and will not experience fuel or lubricant leaks or have unacceptable emissions. Similarly, during highway operation the Moya-Odebrecht Consortium must implement a road maintenance schedule, describing the machinery and equipment to be used, as well as their maintenance programs.

2.11 Emissions, Discharges and Wastes during Construction

2.11.1 *Air Emissions*

During the construction of the Autopista del Coral, an increase in the levels of suspended particles will occur. This is due to soil movement and material extraction from quarries, machinery and heavy equipment emissions, equipment and vehicles in operation, as well as dust generation during loading and unloading of soils in the industrial plants and the Right of Way.

2.11.2 *Noise and Vibrations*

Construction will generate noise and vibrations caused primarily by the movement of machinery, equipment and vehicles and the use of explosives for rock removal and cuts. The quarries and production plants will also generate noise and vibrations, which will be taken into account for environmental management.

2.11.3 *Solid Wastes*

Two types of solid wastes will be generated during project construction. The first one will be produced at the project site (work fronts) and in the camps, by the workers. These wastes will be stored in closed containers for transportation to dump sites located in the vicinity of La Romana, Higüey and Punta Cana. The camps, in general, will produce approximately 700 kg of solid waste per week, which will be transported to the dumps 3 times a week. **Photos 2-1, 2-2 and 2-3** show current conditions of the dump sites, where the waste management practices include “burial method” (La Romana dump) and “free exposure under open sky” (Higüey dump).

Photo 2-1 *Present condition at La Romana dump*

Photo 2-2 *Present condition at Higüey dump*

Photo 2-3 *Present condition at Punta Cana hotels dump*

The second type of solid wastes will be produced during the Project operation phase, generated by the users of the highway. These wastes will also be transported by the road Operator to the dumps located in the vicinity of the towns La Romana, Higüey and Punta Cana. The weekly frequency will depend on the volume generated.

Prior to transportation to the dump, these wastes will be stored in dedicated closed containers.

For safety reasons, personal contact with these wastes must be avoided by the operators in charge of the cleaning, transportation and final disposal activities.

2.11.4 *Debris*

Debris generated during road construction will be transported to the nearest area identified for overburden material disposal, ensuring that it will not affect the stability of these areas.

2.11.5 *Liquid Wastes*

The operation of the three camps proposed for the construction phase will generate liquid wastes estimated at 1100 liters per person per day; which will be managed by the treatment systems that will be constructed at each camp.

During construction, discharges from the concrete mixer wash or liquid fuel spills from trucks and machinery may occur.

Also, during highway operation, spills of grease and other substances from vehicles on the road may occur. Such spills will require the implementation of a contingency plan for avoiding impacts to water bodies.

2.12 Project Schedule

The construction works proposed for the Autopista del Coral will follow the general schedule shown in **Figure 2-5**. This figure illustrates the estimated timeline for developing the main tasks involved in the road project design and construction, taking into account the proper sequencing of the different phases.

According to Figure 2-5, the construction works for the Autopista del Coral will last approximately 24 months, preceded by three months of pre-construction activities.

Similarly, **Figure 2-6** shows the work fronts plan established for constructing the 70 km Autopista del Coral. This will include four work fronts located and oriented as indicated in **Table 2-19.**

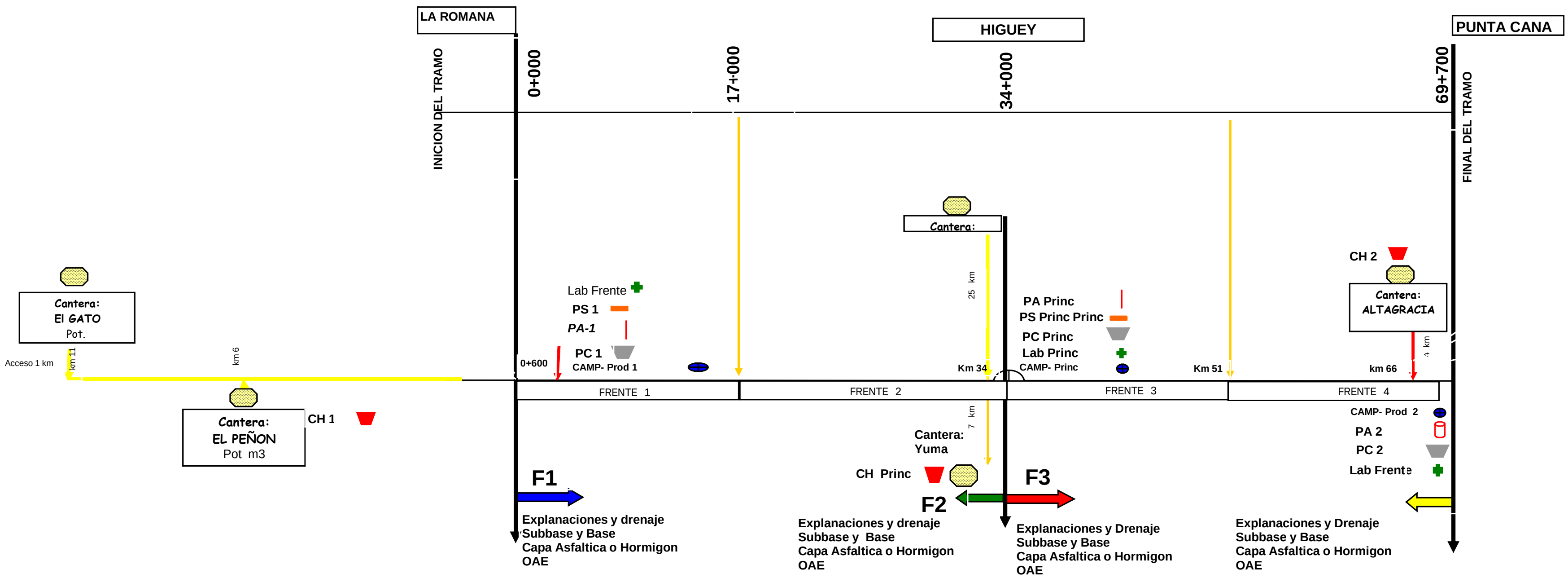
TABLE 2-19 Work Fronts Plan for Autopista del Coral Construction

Work Front	Start	Finish	Length (km)
1	K0+000	K17+000	17
2	K34+000	K17+000	17
3	K34+000	K51+000	17
4	K70+000	K51+000	19

FIGURE 2-5 General Project Schedule for Autopista del Coral Construction

	Año 1												Año 2											
	2007			2008												2009								
	Oct	Nov	Dic	Ene	Feb	Mar	Abr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dic	Ene	Feb	Mar	Abr	May	Jun	Jul	Ago	Sep
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Proyecto de Ingenieria Detalle	10	20	30	40																				
Permisos Ambientales																								
Campamentos,Plantas y Canteras		100																						
Eje y Distrubuidores		20	80																					
Movilizacion Campamentos	20	40	40																					
Plantas Industriales		20	30	30	20																			
Explanaciones Eje y Distribuidores																								
Desbroce		2	4	5	5	5	5	6	6	6	6	6	6	6	6	5	5	5	5	4	2			
Excavaciones		2	4	5	5	5	5	6	6	6	6	6	6	6	6	5	5	5	5	4	2			
Rellenos		2	4	5	5	5	5	6	6	6	6	6	6	6	6	5	5	5	5	4	2			
Prestamos		2	4	5	5	5	5	6	6	6	6	6	6	6	6	5	5	5	5	4	2			
Acarreo Explanaciones		2	4	5	5	5	5	6	6	6	6	6	6	6	6	5	5	5	5	4	2			
Drenaje																								
Alcantarillas y Cabezales		2	4	6	6	6	6	6	6	7	7	7	7	6	6	6	6	4	2					
Excavacion Estructural		2	4	6	6	6	6	6	6	7	7	7	7	6	6	6	6	4	2					
Relleno Granular para estructuras		2	4	6	6	6	6	6	6	7	7	7	7	6	6	6	6	4	2					
Puentes																								
Chavon							2	4	6	7	7	8	8	8	8	8	8	7	7	6	4	2		
Duey							8	10	12	13	13	13	13	10	8									
Santa Clara															8	12	15	15	15	15	12	8		
Pasajes Superiores sobre la via y ferrocarril							2	4	6	7	7	8	8	8	8	8	8	7	7	6	4	2		
Pavimentacion																								
Mejoramento Subrasante						4	5	6	7	8	8	8	8	8	8	8	7	6	5	4				
Subbase							4	5	6	7	8	8	8	8	8	8	8	7	6	5	4			
Base								4	5	6	7	8	8	8	8	8	8	8	7	6	5	4		
Carpeta Asfaltica o Hormigon Hidraulico(Imprimacio y Riego)									4	5	6	7	8	8	8	8	8	8	8	7	6	5	4	
Drenaje Superficial																								
Cunetas de Corte							3	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	4
Cunetas de Coronacion							3	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	4
Bordillos							3	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	4
Readecuacion Ambiental																								
Reconformacion de Botaderos		2	4	5	5	5	5	6	6	6	6	6	6	6	6	5	5	5	5	4	2			
Rehablitacion de Canteras y Prestamos														10	20	10						10	20	10
Rehablitacion de Vía y Distribuydores													10	10	10	10			10	10	10	10	10	10
Rehablitacion de Campamentos y Plantas																					10	30	30	30
Plazas de Peaje													4	4	12	12	12	12	12	12	12	4	4	
Señalizacion																								
Señalizacion Vertical																				10	20	20	20	30
Señalizacion Horizontal																				10	20	20	20	30
Defensa New Jersey								2	4	6	6	7	7	7	7	7	7	7	7	7	7	6	4	2

FIGURE 2-6 Work Front Plan for Autopista del Coral Construction



2.13 Construction Works Costs

The estimated total cost of the four-lane, 70 km Autopista del Coral project, is approximately **$255** million (US), including expropriations, engineering and total construction costs.

This amount is equivalent to $910,000 (US) per kilometer-lane which is on the same order (9% lower) than the costs of the most recent road construction projects built or in process in the country (about US $1.0 million per kilometer-lane in the Autopista 6 de Noviembre, Autopista Duarte, Autovía del Este, Autopista San Cristóbal-Baní, Circunvalación de Santiago Norte).

2.14 Construction Works Preservation and Maintenance

For preserving and maintaining the Autopista del Coral, the Moya-Odebrecht Consortium will implement a maintenance schedule that ensures the continued reliable service at the established traffic levels.

The activities involved in the maintenance plan to be developed for Highway operation, are listed below:

- Pavement evaluation and maintenance
- Evaluation and maintenance of drainage works
- Evaluation, monitoring and maintenance of slope and hillside stabilization
- Maintenance of complementary infrastructure (bridges, distributors, medians, operational turnarounds, tolls, etc.)
- Signs and Signal Maintenance
- Evaluation, monitoring and maintenance of road safety

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3.0 ENVIRONMENTAL AND SOCIAL BASELINE

This section describes the physical, biological, socio-economic and cultural environments within the area of influence of the Autopista del Coral project (La Romana – Punta Cana Highway).

The characterization of the environmental components will permit establishment of the baseline conditions of the different physical, biotic, social and cultural variables, which together with the Project description, will allow for identification on potential impacts due to development of the new road corridor and determination of pertinent environmental management measures.

In order to clarify the definitions of the terms study area, area of interest and area of influence, a description of the differences between them is provided below.

The study area is that area that was reviewed in the environmental characterization and it is represented in the cartography; while the area of interest is the zone that will be directly disturbed by any of the project components or activities. The area of interest for the project is a 70m wide by 70 km long corridor.

The area of influence refers to the environmental, social and cultural environment where interaction may occur with the project activities in the construction and operation phases. The area of influence may be defined as direct or indirect with different connotations depending on whether they are physical, biotic, social and cultural components.

Table 3-1 describes direct and indirect areas of influence for the Project as their definition above.

TABLE 3-1 Project's Area of Influence

Component	Type of Influence	Description
Physical – Biotic	Direct	Area of the Project corridor, 70 m wide and 70 km long, starting at La Romana beltway and ending at the distributor of Punta Cana airport.
	Indirect	Areas outside the corridor and that correspond to the lower basin of the Chavón river and middle basin of the Duey River or Yuma River.
Socio-economic	Direct	Corridor areas to be disturbed by the project, constituted by 70 m of width and a 70 km length, where there is currently no human settlement.
	Local	Areas by the corridor to be disturbed and located relatively close to the project's intersections with the existing highway. In this case the closest sites are El Limón, Benedicto and La Piñita.
	Regional	From the geographic, political and administrative viewpoints, the road corridor is located in the provinces of La Romana and Altagracia.

Map EIA ALR-01 clearly shows the context of the above definitions and the general project location.

3.1 Physical Environment

3.1.1 Geology

The geological studies were conducted by means of a photogeological study of a 1,000 m wide strip along the project corridor. Additionally, data from other studies in the area was gathered and the available bibliography in the country was reviewed.

A geological field reconnaissance permitted collection of data regarding types of rocks, weathering degree, characteristics of surface soils, and geological factors that may influence the road's route; as well as muddy soil zones with a low bearing capacity and compression, active faults, landslides and karstic zones. Additionally, an identification and description is given of the zones where cuts and fills will be conducted for the motorway construction. Data on quarries for obtaining construction materials, both new and in operation, was gathered, as well as characteristics of the zones for excess material disposal, located along the road's route.

Based on the above data, a geotechnical survey plan was prepared, composed of a geophysical survey, that is, seismic refraction and electrical probing in the more significant zones of cut, pits and bridges. Exploratory mechanical soundings were programmed using mixed sounding with extraction of samples and/or cores of 2" diameter and 1.0m x 1.0m exploratory surface test pits for the pavement subgrade study.

The purpose of the geophysical survey was to establish the characteristics of the rocky massif, concerning thickness of the different material layers, excavability and existence of cave zones that might interfere with the proposed road. The mechanical survey was used for calibrating the results of the geophysical investigation and for collecting samples of rocky materials for mechanical characterization testing. The exploratory test pits for the pavement subgrade study permitted collection of soil samples, which were tested to determine the soil geotechnical properties.

The test pit location, sampling points and their respective depths are presented on the maps in **Appendix 3-3**; the probe sites and corresponding depths are included below:

Probe	Site	Probe Depth [M]
SM-1	Chavón River Bridge	35.00
SM-2	Chavón River Bridge	50.75

Probe	**Site**	**Probe Depth [M]**
SM-3	Chavón River Bridge	34.25
SM-201	Chavón River Bridge	31.90
SM-7	Duey River Bridge	35.20
SM-8	Duey River Bridge	38.25
SM-10	Pit 4	10.00
SM-12[a]	Yuma Pit	10.10
SM-12	Yuma Pit	11.00
SM-12B	Yuma Pit	10.60
SM-13	17+430	10.06
SM-15	57+840	10.00

The probes that identified ground water level were the following:

In the SM-2 probe the water level was 1.0m below the surface and in the SM-3 probe the water level was found at 2.30 m under the surface.

- *Regional Stratigraphy*

The general lithological characteristics of the geological units existing in the project area are shown on **Map EIAALR-02** and they are described in **Table 3-2**.

TABLE 3-2 Geological Units Present in the Study Area

Lithological Unit	Symbol	Description
Undifferentiated Quaternary deposits	Q	Polygenic gravels, sands and silts, etc., undifferentiated fluvial deposits, and stratified drift formations, debris fans.
Fluvial deposits, terraces	q`f	Polygenic gravels and sands in the shape of fluvial terraces.
Reef limestone, sand, conglomerate (type Santo Domingo and La Romana).	Tpl-qc`	Reef debris limestone.
Volcano-sedimentary rocks	Teo`vc-s	Tuff, greywackes, thin limestone lenses.
Eocene limestones.	Teo`c	Algal limestone and reef debris limestone.
Paleocene limestone	Tpac`	Stratified limestone with marl intrusions.
Tonalite	Ks-tpg`to	Complex plutonic rock series, consisting basically of quarzodioritic to tonalitic; the lithological composition varies between diorite, quarzodiorites and tonalites, up to granodiorites and granites.
Cretaceous limestone	Ks`c	Limestone with thin to flaser stratification, also with thick stratification and grey color; intruded by marl layers.
Volcano sedimentary rocks	Ks`vs	Tuff, agglomerates and conglomerates.
Migmatites and island-arc sediments	Kmgm	Extraordinarily hard series of volcanic to volcano sedimentary rocks of the island-arc type, and plutonic rocks were differentiated as far as possible (gabbros, pyroxenite, and ultramafites).

The above units are described below, according to data from Hartmut M, 2004 and Geofitec S.A., 2007a and 2007b:

- *Quaternary*

UNDIFFERENTIATED QUATERNARY DEPOSITS (Q)
This lithological unit is constituted by polygenic gravels, sands and silts (undifferentiated fluvial deposits, and stratified drift formations, debris fans).

FLUVIAL DEPOSITS, TERRACES (Q'F)
This lithological unit is composed of polygenic gravels and sands in the shape of fluvial terraces.

- *Tertiary*

REEF LIMESTONE (TPL - QP'C)
Lithological unit appearing in the Cordillera Septentrional (Northern Mountain Range), Samaná Peninsula, Los Haitises in the Cordillera Oriental (Eastern Mountain Range), the carbonated platform of Santo Domingo/Higüey and Valle del Cibao. In general, it is constituted by recent calcareous rocks, mainly extremely porous, partially cavernous coral limestone, and marl limestone, sandy marl, marl clays. The Autopista del Coral will be constructed on this geological unit.

VOLCANO-SEDIMENTARY ROCKS (TEO`V-S)
This unit appears in the northern side of the Cordillera Central, west of Cotui; Cordillera Oriental and El Peñón hill. It corresponds to an Eocene volcano-sedimentary series, formed by tuff, greywackes and thin limestone lenses.

EOCENE LIMESTONE (TEO`C)
The main outcrops are located in the northern end of the Cordillera Central, west of Cotui; Dajabón; Cordillera Oriental, El Peñón hill, west of Cotui and in Dajabón. Lithologically, limestone and reef limestone outcrop in the Cordillera Oriental.

PALEOCENE LIMESTONE (TPA`C)
This unit is composed of stratified limestone with marl intrusions, which outcrops in the imbrications north of Baní; Cordillera Oriental, El Peñón hill.

- *Cretaceous*

TONALITE (KS – TPG`TO)
This unit outcrops in the Cordillera Central, Oriental and in a subordinate manner in the Cordillera Septentrional. It comprises a complex plutonic rock series, consisting basically of quarzodioritic to tonalitic. The lithological composition varies between diorite, quarzodiorites and tonalites, up to granodiorites and granites; it is the tonalitic intrusive cycle of the island-arc late formation.

Petrographically, tonalites are medium to coarse-grained, with the typical texture of plutonic rocks, often with oriented structure, and presence of shales. The light components are quarze and plagioclase, the last one being often caolinized; the dark elements are hornblende with titanium magnetite, subordinate biotite and muscovite and secondary chlorite and epidote. The contacts are intrusive in migmatites and island-arc sediments; the contact metamorphism has been intense, with formation of hornfels and contact migmatites (lit-par-lit intrusions); these thermo-metamorphic, enclosing rocks have been included so far, among others, in the Duarte Formation.

LIMESTONE (KS`C)

This unit outcrops mainly in the northern side of the Cordillera Central (Cotui, Monción) and Cordillera Oriental. It corresponds to a limestone rock series with thin to flaser stratification, and also with thick stratification and grey color; intrusions of marl layers.

VOLCANO-SEDIMENTARY ROCKS (KS`V-S)

This volcano-sedimentary lithological unit is constituted by tuff, agglomerates and conglomerates, and outcrops mainly in the northern Cordillera Oriental.

MAGMA AND VOLCANO-SEDIMENTARY ROCKS (KMG)

Lithological unit composed of migmatites and island-arc sediments of Cretaceous Age, that appear principally in the Cordilleras Central, Septentrional and Oriental; they are rocks of regional metamorphism found in the northern and northeastern sides of the Cordillera Central, south of Bonao; between the Cordilleras Central and Oriental the rocks of ocean association and they occur together with ultrabasites and shales of Maimón—Amina.

Lithologically, they are an extraordinarily hard series of volcano-sedimentary rocks of the island-arc type. Due to the complex composition of these rocks, the difficult access particularly to the Cordillera Central, and for the limited outcrop conditions, only incomplete, non-uniform mapping of these regions is available. Therefore, these series have been considered as undifferentiated volcano-sedimentary rocks; the plutonic rocks have been differentiated as far as possible (gabbros, pyroxenite, ultramafites). These rocks have been changed by dynamic or thermal metamorphism and partly by both; the dynamic metamorphism hardly surpasses occasionally the prehnite and pumpelite subfacies of the green shale facies; only south of Janico and Bonao it reaches the amphibolite facies; the dynamic deformation of these rocks could have occurred during the formation phases of the island arc, up to the more recent tectonic thrust on the southern foreland. The contact metamorphism is due basically to intrusions of tonalites, granites and rhyodacites that resulted in the formation of hornfels and contact migmatites; therefore, the formation of these thermo-metamorphic rocks occurred mostly in the Cretaceous – Tertiary.

Local Geology – Road Corridor

The road corridor of the Autopista del Coral is located in the southeast of the Dominican Republic, on a relatively flat zone of the Eastern Coastal Plain, with slightly undulating zones that have soft to moderate slopes in the foothills of the Cordillera Oriental, where the highway will cross karstic lands with low elevations.

From the tectonic point of view the Southeast region, as far as tectonic activity in the Miocene, there is currently no evidence of seismic movements or their intensity is very low.

In general, the first section of the road (Romana – Bayahibe) and the second section of the road (Farallones – Punta Cana) are dominated by presence of cave coral limestone, while the Bayahibe - Farallones section is dominated by presence of marly limestone and limestone marl (usually called *caliche*) and yellowish marly clays, where the extensive sugar cane cultivation has developed a thick, black organic soil layer, rich in humus, with thickness varying between 0.20 and 0.70 m (Geofitec S.A. 2007).

- *Section Romana - Bayahibe (K0+000 – K13+000)*

The lithological units along the access road in this section are represented from K0+000 to K6+170 by recent coral limestone (shallow waters environment) of grey color (due to intense weathering) to yellow, very fragmented, and sporadically clayey soils.

From the K6+170 up to K6+480 the route travels a relief of fluvial terraces that are part of the Chavón River valley. Geoelectrical profiles conducted on the right bank indicated that most of the material present in the subsoil is of clayey character (water-saturated), except at the western escarpment, where a fill of caliche and limestone blocks is found, which reaches about twenty-five (25) m width by three (3) m thick.

The corridor between the K6+480 and K7+340, consists mainly of calcareous rocks, favorable to cutting. Between K7+340 and K13+000, the route crosses a flat relief with slight undulations, covered by a clayey, reddish soil layer with fragments of (stony) caliche and scarce organic matter cover.

- *Section Bayahibe - Los Farallones Crossing (K13+000 – K52+000)*

In this section, stretching from K13+000 to K52+000, the alignment goes through a flat, slightly undulating relief, composed of marly limestone (mature caliche), limestone marl (soft caliche) marly clays (susceptible to erosion), which are covered by a thick layer of black, organic soil (humus).

From K13+000 to K20+000 the route crosses a flat, slightly undulating relief, covered by a clayey, reddish soil layer with fragments of (stony) caliche and in depth by coral limestone. Between K20+100 and K39+800 the route crosses a farming zone, composed in the surface of a thin organic layer (varies from 0.20 to 0.50 m), except in the section between K21+600 and K27+000, where clayey soils are observed on the surface.

After crossing this section, the route continues through a hilly relief between K39+800 and 44+700, which consists of coral limestone of medium to high resistance, where small diameter caverns are present due to dissolution. In the last stretch from K44+700 to K52+000, the alignment crosses an extensive plain, with dominant relief represented by a coral reef (stony) terraces and covered on the surface by a thin organic layer of 0.15 m maximum thickness.

- *Section Los Farallones – Aeropuerto Punta Cana (K52+000 – K69+450)*

This section goes from K52+000 to K69+450, and consists of coral limestone (tpl - qp'c), which is extremely porous, partially cavernous and of diverse hardness, and is characterized by presence of surface graphite (dogtooth). It is a hydrological unit of great importance, characterized by being a local aquifer limited to fractured zones, generally extended by karstic dissolution, free and/or confined, permeability usually from high to medium and generally hard waters. South of the alignment, a depression is present with a lagoon or flooding system, whose main source is runoff and subsurface water coming from the upper terrace. A detailed description of the road corridor sections is presented below (**Table 3-3**).

TABLE 3-3 Geological Description of the Road Corridor

Section	Abscissa	Description
I	0+000 – 6+170	Plain landscape, formed by fragments of grey-colored, reef limestone, with sandy-clayey matrix.
	6+170 – 6+480	Fluvial terrace relief at both banks of the Chavón River.
	6+480 – 7+340	The outcropping material corresponds to calcareous deposits with a 20° inclination eastwards.
	7+340 – 13+000	Extensive plains with slight undulations and depressions, from 1 to 2 m height, covered by a clayey, reddish soil layer with fragments of stony, white caliche and scarce, black organic matter cover with high plasticity; most of them are pasture lands.
II	13+000 – 20+100	Extensive plains with slight undulations and depressions, from 1 to 2 m height, covered by a clayey, reddish soil layer with fragments of stony, white caliche and a scarce, black organic matter cover with high plasticity; most of them are pasture lands.
	20+100 – 21+100	Farming lands with a 0.20m thick organic layer.
	21+100 - 21+600	This zone is covered by 0.15m thick stony clay and, in depth, by reef limestone.
	21+600 –	A zone on clayey, stony soils with scarce organic cover, 0.15 to 0.20 meters depth. At

Section	Abscissa	Description
	27+000	Km.22+780 an outcrop of coral limestone rocks is present.
	27+000 – 38+500	A section of approximately 11 km length, characterized by a farming zone with significant organic soil thickness (0.30 to 0.50m).
	38+500 - 39+800	Zone on fill, with rounded hills and surface covered by stony, residual clayey soil with fragments of caliche (1 to 3 cm).
	39+800 – 44+700	A hilly zone starts here, steep profile, with a 0.05-0.10m thick soil cover; outcrops of coral rock with dissolution caverns of small diameter -1 to 4 cm- and stony soil.
	44+000 – 52+000	Plain landscape with reef terrace relief, steep profile, outcrops of massive coral limestone with cavern structures, and residual clayey soil of high plasticity in depressions, but with minimum thickness and stony.
III	52+000 – 69+450	Plain landscape with reef terrace relief, steep profile, outcrops of massive coral limestone with cavern, and stony. This zone rises through a narrow passage next to K62+700 towards a more elevated and extensive terrace.

Geomorphology

- *Regional Geomorphology*

The Dominican Republic is divided into twenty (20) geomorphologic regions and eight (8) sub-regions, grouped into two (2) distinctly defined landscape units: the mountain landscape (rocky zones) formed by a steep topography zone towards the northeast area and a plain zone towards the southeast (deposition zones), corresponding to a flat to slightly undulating topography.

The main geomorphologic units present in the study area are described in **Table 3-4** and shown on **Map EIAALR-03** at a detailed scale of 1:100.000.

TABLE 3-4 Geomorphologic Description of Study Area

Region	Zones	Convention	Landscape	Description
VII	COSTAL REEF LIMESTONE	ZONE VII - 2	PLAINS	Zones consisting of coastal reef limestone, slightly undulating to undulating relief.
	ALLUVIUM, FANS	ZONE VII - 3		Zone characterized by alluvial fans, undulating relief.
VIII	MOUNTAINOUS ZONE	ZONE VIII - 1	MOUNTAINS	Mountainous landscape, strongly dissected relief.
IX	HILLY ZONE, PLATFORMS OR VALLEYS WITH BASS RELIEF	ZONE IX - 1	FOOTHILLS	Zone characterized by a foothill landscape and an undulating to hilly relief.
	HILLS AND PLATFORMS ZONE	ZONE IX - 2		Zone characterized by a foothill landscape and hilly relief.
X	LOW LANDS, WITH COASTAL REEF LIMESTONE	ZONE X -1 AND X - 2	PLAINS	Zone characterized by a plains landscape, and slightly undulating to undulating relief. Typical of deposition zones.
	ZONE OF MARINE, LACUSTRIAN DEPOSITS	ZONE X -3		
	ALLUVIUM	ZONE X -4		

3.1.2 Soils

The methodology used in the study of soil mechanics in the project area was described in Section 3.1.1, along with the methodology employed for the geological study.

The organic layer will be removed due to its low bearing capacity to avoid damages to the fill and pavement structure of the proposed road. According to the studies, the following thickness must be removed along the road's route:

- km 0 to 15: 20 cm
- km 15 to 50: 30 cm
- km 50 to 70: 10 cm

This material shall be placed along the right-of-way of the road for future use in revegetation and restoration efforts.

The shaping and grading of the Autopista del Coral alignment will require earth movement as indicated below:

Activity	Abscissa			Total
	K0+000 to K13+000	K13+000 to K33+000	K33+000 K70+000	
Excavation (m^3)	1,290,559	1,261,346	1,612,555	4,164,460
Fill (m^3)	463,892	921,779	1,605,466	2,991,137

The soil properties are summarized in **Table 3-5**

A summary of the principal works, conclusions and recommendations derived from the activities developed so far (Project's basic engineering), in terms of engineering and studies of structural foundation mechanics, is presented below:

<u>Main Roadway:</u> Test pits have been conducted between km 14+000 and km 43+000. These pits in the soil were performed to determine the types of soils in the surface layer by tactile and visual inspection, and collection of samples for testing full granulometry, compression, CBR and liquid and plastic limits, in order to characterize the soil and determine whether it will be suitable to support the pavement. The Project's test pits program anticipated a 1.50m deep pit every 500m, but this distance was reduced to 250m whenever deemed necessary by the geology or pavement specialist.

TABLE 3-5 Summary of Soil Property Analysis

CALICATA Nº	PROGRESIVA (PROG)	PROGRESIVA (EJECUTADA)	UBICACIÓN	COODENADAS		OBSERVACIONES	ENSAYOS															
							COMPACTACIÓN Y CBR					CLASSIFICACIONES		GRANULOMETRÍA						CARACTERIZACIÓN		
				NORTE	ESTE		DESCRIPCIÓN MATERIAL ENSAYADO	PESO ESPECÍFICO MÁXIMO (kg/m³)	HUMEDAD ÓPTIMA (%)	CBR (95% DENSIDAD MÁXIMA) (%)	EXPANSIÓN (95% DENSIDAD MÁXIMA) (%)	USCS	AASHTO	GRAVA GRUESA	GRAVA FINA	ARENA GRUESA (% EN MASA)	ARENA MEDIANA (% EN MASA)	ARENA FINA (% EN MASA)	SILTE + ARCILLA (% EN MASA)	LIMITE DE LIQUIDEZ	LIMITE DE PLASTICIDAD	ÍNDICE DE PLASTICIDAD
C-39	14+000	14+000	aterro	2.338.283,00	518.482,00	CAPA A	SANDY LEAN CLAY	1.620	13%	1,3	0,4	CL	A-6(7)	0,0	0,0	0,1	19,9	24,6	55,4	38	19	19
C-42	15+000	15+000	aterro	2.039.281,00	518.483,00	CAPA A	CLAYEY GRAVEL WITH SAND	1.730	13%	2,7	0,4	GC	A-2-6(0)	52,0	5,5	2,5	14,6	7,0	18,4	37	19	18
C-45	16+000	16+000	aterro	2.040.284,00	518.514,00	CAPA A	CLAYEY GRAVEL WITH SAND	1.920	13%			GC	A-2-6(0)	40,3	21,7	5,0	8,0	4,7	20,3	38	19	19
C-48	17+000	17+000	aterro	2.041.300,00	518.509,00	CAPA A	CLAYEY SAND WITH GRAVEL	1.640	11%			SC	A-2-6(0)	11,4	7,5	18,0	31,4	7,5	24,2	34	19	15
C-48	17+000	17+000	aterro	2.041.300,00	518.509,00	CAPA B	POORLY GRADED GRAVEL WITH CLAY AND SAND	1.990	12%			GP-GC	A-2-6(0)	18,4	29,9	13,1	16,5	10,1	12,0	38	20	18
C-50	18+000	18+000	aterro	2.042.279,00	518.490,00	CAPA B	CLAYEY GRAVEL WITH SAND	1.980	12%			GC	A-2-7(2)	31,8	24,5	4,6	5,8	4,7	28,6	45	20	25
C-53	19+000	19+000	aterro	2.043.275,00	518.492,00	CAPA A	CLAYEY GRAVEL WITH SAND	1.920	9%	23	0,0	GC	A-2-6(0)	23,1	26,3	10,0	7,0	7,4	26,2	29	18	11
C-53	19+000	19+000	aterro	2.043.275,00	518.492,00	CAPA B	POORLY GRADED GRAVEL WITH CLAY AND SAND	1.940	9%			GP-GC	A-2-4(0)	49,2	14,9	7,7	11,5	5,4	11,3	28	18	10
C-65	23+000	23+000	aterro	2.047.036,00	519.200,00	CAPA A	CLAYEY GRAVEL WITH SAND	1.950	10%			GC	A-6(1)	35,1	5,8	2,4	6,2	8,1	42,4	29	18	11
C-65	23+000	23+000	aterro	2.047.036,00	519.200,00	CAPA B	CLAYEY GRAVEL WITH SAND	1.980	10%			GC	A-6(2)	38,5	7,6	3,6	6,8	3,5	40,0	32	18	14
C-68	23+500	23+500	aterro	2.047.301,00	519.607,00	CAPA A	CLAYEY SAND WITH GRAVEL	1.880	9%			SC	A-6(3)	8,4	11,7	8,7	16,0	8,0	47,2	31	18	13
C-68	23+500	23+500	aterro	2.047.301,00	519.607,00	CAPA B	CLAYEY SAND WITH GRAVEL	1.950	9%	33	0,0	SC	A-4(1)	11,5	14,4	7,8	14,1	5,3	46,9	26	18	8
C-70	24+000	24+000	aterro	2.047.590,00	520.020,00	CAPA A	LEAN CLAY	1.710	13%	3,2	0,5	CL	A-7-6(19)	0,0	1,2	3,3	6,2	3,8	85,5	42	20	22
C-70	24+000	24+000	aterro	2.047.590,00	520.020,00	CAPA B				32	0,0											
C-72	24+500	24+500	aterro	2.047.868,00	520.450,00	CAPA A				37	0,0											
C-76	25+500	25+500	aterro	2.048.372,00	521.287,00	CAPA A					1,7	0,5										
C-78	26+000	26+000	aterro	2.048.577,00	521.770,00	CAPA A	LEAN CLAY WITH SAND	1.730	13%	2	0,1	CL	A-6(16)	0,0	6,8	2,6	5,0	2,7	82,9	40	20	20
C-78	26+000	26+000	aterro	2.048.577,00	521.770,00	CAPA B	SILTY CLAYEY GRAVEL WITH SAND	1.940	9%	26,7	0,0	GC-GM								23	16	7
C-82	27+000	27+000	aterro	2.048.832,00	522.724,00	CAPA A	LEAN CLAY	1.720	14%	3	0,2	CL	A-7-6(18)	0,0	5,1	2,7	4,7	2,1	85,4	41	20	21
C-85	27+500	27+500	aterro	2.048.961,00	523.205,00	CAPA A	GRAVELLY LEAN CLAY	1.730	14%	2	0,2	CL	A-7-6(8)	42,7	3,6	1,5	0,9	0,6	50,7	45	22	23
C-85	27+500	27+500	aterro	2.048.961,00	523.205,00	CAPA B	SILTY CLAYEY GRAVEL WITH SAND	1.980	10%			GC-GM	A-2-4(0)	40,0	17,3	6,9	6,4	3,3	26,1	24	17	7
C-87	28+000	28+000	aterro	2.049.089,00	523.696,00	CAPA A	FAT CLAY	1.650	14%			CH	A-7-6(43)	0,0	0,8	0,5	1,7	5,0	92,0	65	23	42
C-87	28+000	28+000	aterro	2.049.089,00	523.696,00	CAPA B	CLAYEY GRAVEL WITH SAND	1.780	11%			GC	A-7-6(4)	29,6	16,7	7,5	5,0	2,5	38,7	44	20	24
C-87	28+000	28+000	aterro	2.049.089,00	523.696,00	CAPA C	CLAYEY GRAVEL WITH SAND	1.750	11%			GC	A-2-7(1)	55,7	6,5	6,4	5,1	3,9	22,4	47	21	26
C-89	28+500	28+500	aterro	2.049.215,00	524.181,00	CAPA A	FAT CLAY	1.640	14%			CH	A-7-6(34)	0,0	0,2	0,7	3,4	3,7	92,0	56	22	34
C-106	34+800	34+800	aterro	2.049.425,88	530.447,64	CAPA A	LEAN CLAY	1.610	15%	1,6	0,4	CL	A-6(17)	0,0	0,2	1,8	3,6	3,3	91,1	38	20	18
C-128	43+000	43+000	corte/aterro	2.050.139,41	538.573,78	CAPA A	CLAYEY SAND	1.580	14			SC	A-7-6(5)	4,7	3,2	10,0	27,5	13,7	40,9	45,0	21	24

In the cut sections, seismic refraction testing was conducted to identify the contacts between the layers of different materials, and mixed sounding was performed to classify the materials to be removed and segregate them into one of the following three categories: unclassified (soil), rippable, and non-rippable. Also, electric probing testing was conducted to identify the different categories and probable anomalies in the soil, such as the presence of caverns.

The testing program includes compression resistance of rock cores, uniaxial compression resistance, reactivity, resistance to sulfate cycles, specific weight and absorption, and Los Angeles wear test to determine whether these materials can be used for fills, concretes, base or sub-base.

Bridges: Soundings were conducted on the right and left banks of the Chavón and Duey Rivers and in the Chavón River stream to determine the type of foundation required, its depth, and to verify the bearing capacity of the foundation base.

Distributors and Underpasses: Soundings were scheduled to determine the geotechnical characteristics of soil and rock, layer thickness, water level and to evaluate the SPT resistance to establish the foundation characteristics.

The field inspections permitted identification of areas where the rocks outcrop or are very close to surface; in these areas direct, shallow foundations are proposed. In the other areas, deep foundations are planned, with lengths adapted to the soundings already conducted.

Pavement: Existing pits were evaluated for the road pavement, including geophysical studies, sounding and laboratory testing to determine the characteristics of the materials initially classified by visual inspection as likely quarries for concrete aggregates and for pavement.

Soil Classification

The soil was classified in the Project's area of influence according to their present use and potential use, based on the report from the soil specialist and cartographic data from the *Atlas de los Recursos Naturales de la República Dominicana, SEMARN (2004).*

The interaction of diverse factors such as the type of rock, ground slope, climate and biota, favor the formation and development of the different soil units or types. The conditions of the environment where it developed are a key factor understanding the spatial variability of the different soils found in the study area. For instance, the climate of the region is warm and dry, with a mean temperature of 26.4º C and an average annual rainfall of 1200 – 1400 mm. The relief in general, is flat to undulating, with slopes lower than 1%. According to the methodology proposed by Holdridge, this region belongs to a humid sub-tropical forest (Bh-S); nevertheless, the original vegetation cover has been disturbed or removed due to intensive cultivation of sugar cane and conversion to pasture.

On the other hand, since the beginning of the colonization the soil has been subject to an intense disturbance of the original vegetation cover and the consequent change on use, not always with positive results from the economic and environmental viewpoint.

Seven (7) of the eight soil classes described in the Manual 210 of the Soil Conservation Service of the United States are present in the study area.

The system comprises eight soil classes which are designated by Roman numerals I through VIII. Class I includes soils that have few limitations that restrict their use, they are suitable for most field crops with low or no damage risk due to farming and crops.

The other soil classes have progressively greater limitations; from class V on, they require intensive conservation practices and/or may be suitable for specific crops, and class VIII is not suitable for agriculture or livestock and can only be used for wildlife conservation, recreation or conservation.

The soil classification according to their use capacity was grouped into classes, as follows:

- **Classes I to III**: Soils suitable for crops with methods varying from very simple to intensive.
- **Class IV**: Soils with severe limitations that restrict their use for crops and that require very careful management, they can be used for crops, pastures, woodland or vegetative cover.
- **Class V:** flat soils that get flooded for extended periods and have limitations most of the year for agriculture.
- **Classes VI and VII**: soils suitable for specific crops or permanent vegetation, requiring intensive soil conservation practices.
- **Class VIII:** soils with greater restrictions and damage risks; they are not suitable for agriculture and must be used for wildlife conservation, recreation and natural forest conservation.

Map EIAALR-04 shows the soil classification in the proposed road corridor according to the potential use of the soil; the soil classes identified in the road corridor are listed below:

Classes	Area (Ha)	Percentage
II	18	4.3
III	115.2	27.8
IV	20.4	4.9
V	81	19.6
VI	6.0	1.4
VII	173.4	41.9
Total	**414**	**100**

As can be seen, Class VII is the most extensive of the 6 identified classes; with 173.4 Ha representing 41.9 % of the total study area to be occupied by the proposed road corridor, and it's located basically in the southeast. This class is characterized by a slightly sloped relief, with very poor soils on rock surfaces, dogtooth, very eroded, with cave and cavern formations given its karstic origin.

In order of importance, the following is Class III with 115.2 Ha, representing 27.8 % of the total area to be disturbed. It is characterized by flat to sloped relief, with deep soils. Occasionally, they have limitations that reduce the selection of plants that can be cultivated and they require special conservation practices. Class III soils are suitable for stockbreeding and gramineous crops in general. The soils belonging to Class II, which are the most suitable for agriculture, are limited to only 4.3 % of the total disturbed area.

3.1.3 Climate

Methodology

The description of climate conditions at the regional scale include the analysis of secondary data from previous studies conducted in the zone and meteorological data obtained in the stations located near to the study area. The stations were selected according to their geographic location, representativeness and homogeneous distribution within the study area; with these criteria, the chosen stations were La Romana, Higüey and Punta Cana, which are managed by the Meteorology National Office of the Department of Climatology of the Dominican Republic.

The analyzed climate parameters include average data from statistics for the years 1971 through 2000, corresponding to multi-annual, total monthly precipitation (mm), maximum precipitation in 24 hours, temperature (°C), and relative humidity (%).

Regional Climate Framework

In general, the climate in the southeastern region of the Dominican Republic is influenced by the northeast trade winds coming from the Atlantic Ocean, releasing their humidity load while crashing against the highest mountains, creating orographic rains, which, in turn, create zones of lower precipitation in the southeastern region of the country, which are considered the most fragile regions and susceptible to desertification and drought.

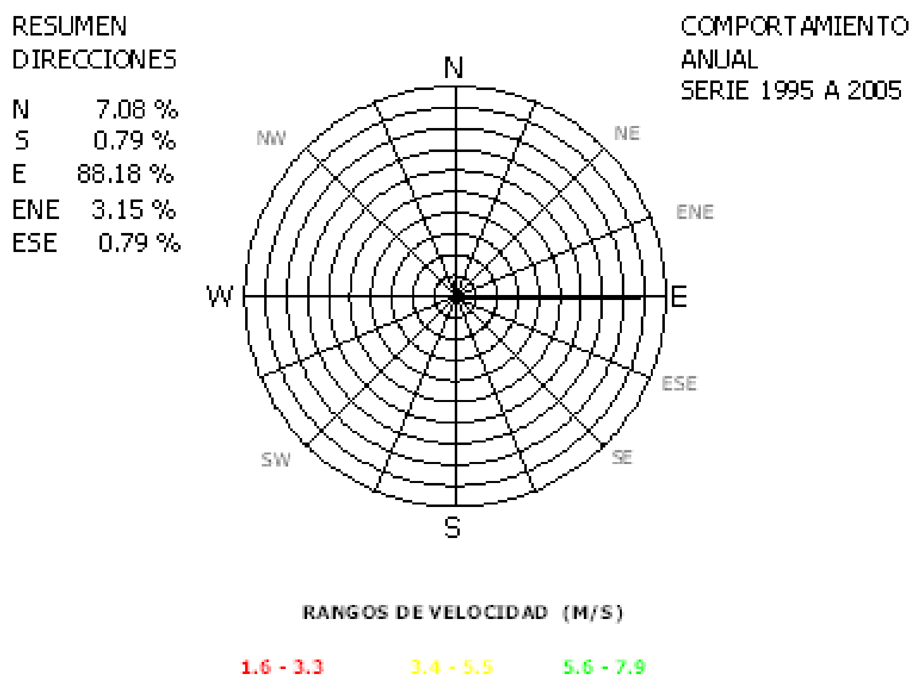
The macroclimate of the southeastern region shows a bimodal rainfall regime; a behavior that is a consequence of the northeast trade winds and winds blowing from the southeast with the tropical storm season, typical of the Caribbean (**Map EIAALR-05**).

Main Climate Elements

- *Wind*

Data on wind direction and wind speed from the meteorological station located in Punta Cana (monthly average data for the 1995 – 2005 period); indicate that the wind has a marked eastward direction 88.18% of the time in the analyzed series. On very few occasions the wind changes to other directions; for instance, 7.08% Northwards and 3.15% towards Northeast. Predominating wind speed ranges from 3.4 to 5.5 m/s, while the strongest gusts predominate towards North, East, East-Northeast and East-Southeast, reaching speeds ranging from 5.6 to 7.9 m/s. (**Figure 3-1).**

FIGURE 3-1 Wind Rose



- *Total Precipitation*

According to data obtained from stations above mentioned, the study area presents a bimodal rainfall regime as presented in **Figure 3-2** and **Table 3-6**.

The periods of higher precipitation are between May and October; and the two periods with lower rainfall occur in March and in December.

FIGURE 3-2 Multi-annual Monthly Average Precipitation

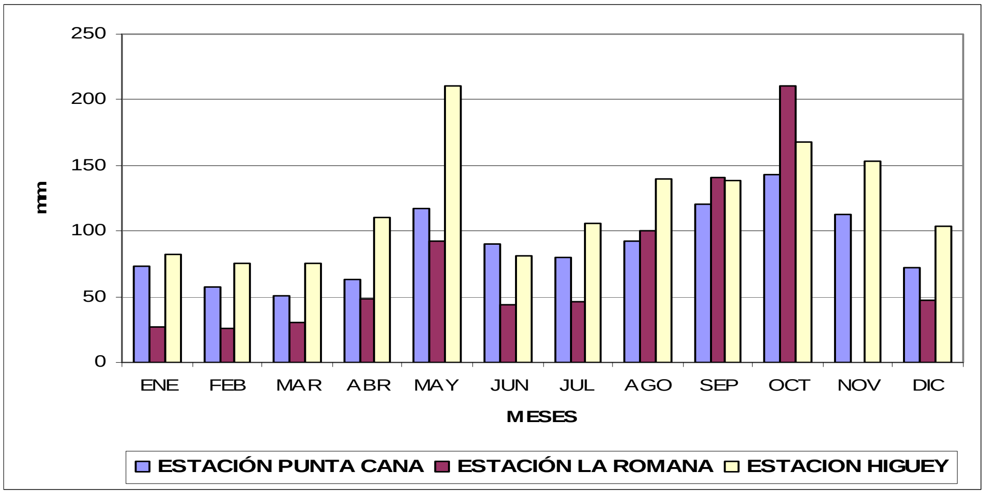


TABLE 3-6 Multi-annual Monthly Average Precipitation (mm)

Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
PUNTA CANA STATION	72.7	57.3	50.5	63.3	117.3	89.7	79.9	92.8	120.6	142.7	112.5	72	1071.3
LA ROMANA STATION	27.1	26.2	30.8	48.8	92.2	43.7	46.1	100.6	141.2	210.7	0	47.4	814.8
HIGÜEY STATION	82.0	75.2	74.9	110.4	210.1	81.1	105.7	140.0	138.8	168.0	153.6	104.0	1443.8

Precipitation data recorded by the meteorological stations indicate that the multi-annual total average rainfall ranges from 814.8 mm, in La Romana zone to 1443.8 mm in the Higüey zone, according to values shown in Table 3-6**.** This behavior is directly related to the local circulation of trade winds in the orographic system and the mountain effect. **Map EIAALR-07** shows the isohyets that illustrate how the Project region is found between the 1200 mm and 1400 mm of annual average rainfall.

According to Figure 3-2, the rainiest month at Punta Cana station is October, with a 142.7mm value, while March has the lowest rainfall record with 50.5 mm. At La Romana station, the rainiest month is October, with a 210.7mm of precipitation; February recorded a 26.2 mm value, being the driest month. Finally, the Higüey station recorded 210.1 mm in the month of May and 74.9 mm in March, which are the months with the highest and lowest precipitation, respectively.

- *Maximum Precipitation in 24 Hours*

The maximum precipitation in 24 hours recorded at the meteorological stations shows the rainfall values that could be expected each month; these values coincide with the periods of highest and lowest precipitation through the year.

The highest rainfalls occur in the months of May through June, with a slight increase in the second rainfall period from August to October, as shown in **Figure 3-3**.

As can be seen in **Table 3-7**, the Punta Cana station shows the highest values of maximum precipitation in 24 hours in the month of May, recording 228.3 mm, exceeding the values of Higüey station, with 172.2 mm for the same month, and the maximum records at La Romana, that was 218.4 mm for October.

FIGURE 3-3 Maximum Precipitation in 24 Hours – multi-annual monthly

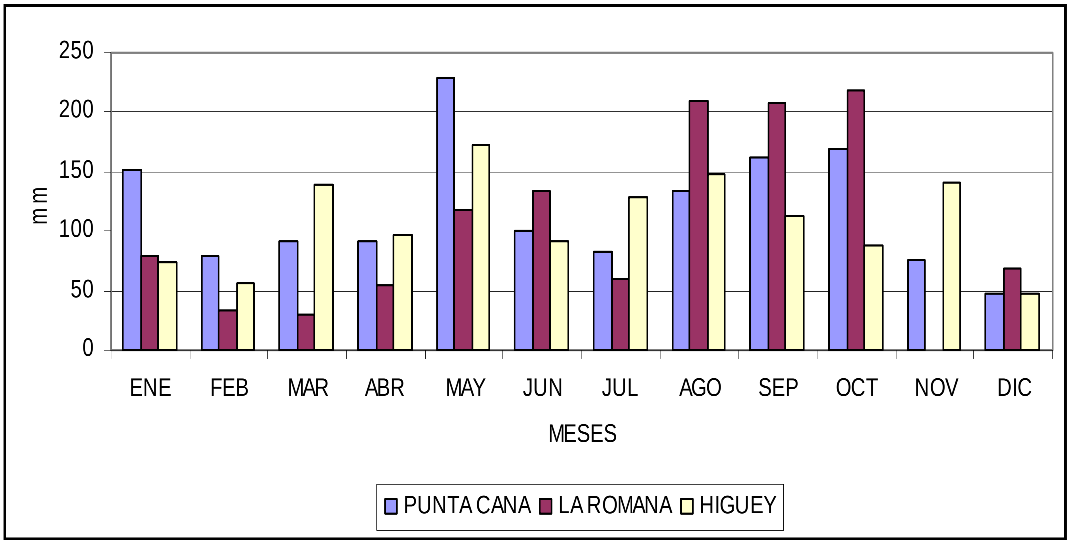


TABLE 3-7 Maximum Precipitation in 24 Hours – multi-annual monthly (mm)

Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
PUNTA CANA	151.4	78.6	92.4	91	228.3	101	83	134.4	162.8	168.2	75.5	47.6
LA ROMANA	78.6	33.4	30.8	55	117.5	133	59.4	209.3	207.8	218.4	0	68
HIGÜEY	73.4	55.8	138.8	96.2	172.2	92.1	129.2	147.8	112.4	88.4	140.0	48.4

- *Temperature*

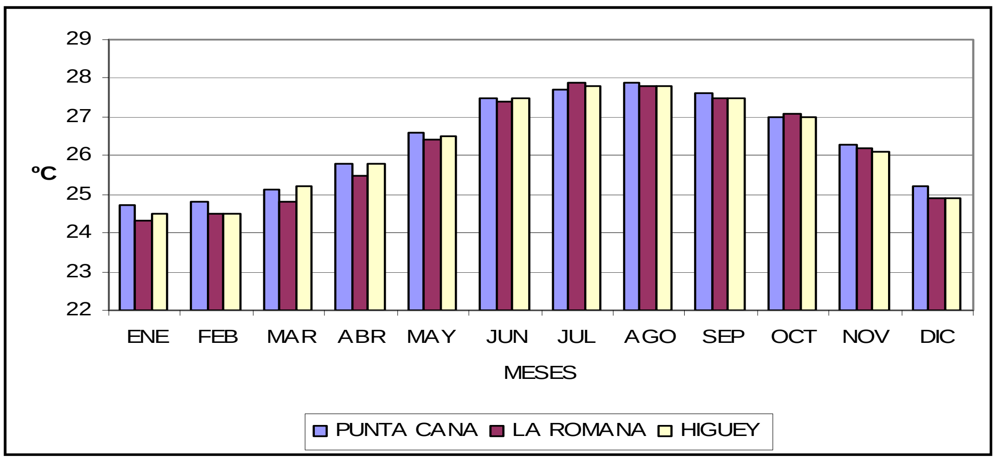
Data collected for the study area (**Table 3-8)**, indicate that Punta Cana station recorded a multi-annual average temperature of 26.4° C, with a minimum temperature of 24.7º C, recorded in the month of February and a 27.9°C maximum for October. La Romana station recorded a multi-annual average temperature of 26.2° C, with minimum between 24.3 and 24.5ºC in the month of January and February, and maximum between 27.5, 27.8 and 27.9ºC in the months of August through September.

Finally, the Higüey station shows a multi-annual average temperature of 26.3 °C, with 24.5°C minimum in January and February and a maximum temperature of 27.8°C in August. Also, as shown in **Figure 3-4**, is the monthly average temperature through the year, which ranges around 26 ºC in the region, according to data from each of the analyzed stations.

TABLE 3-8 Multi-annual Monthly Average Temperature - ºC

Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
PUNTA CANA	24.7	24.8	25.1	26	26.6	27.5	27.7	27.9	27.6	27	26	25.2	26.4
LA ROMANA	24.3	24.5	24.8	26	26.4	27.4	27.9	27.8	27.5	27.1	26	24.9	26.2
HIGÜEY	24.5	24.5	25.2	26	26.5	27.5	27.8	27.8	27.5	27	26	24.9	26.3

FIGURE 3-4 Multi-annual Monthly Average Temperature - ºC



The months of July and August are the hottest, reaching an average value of 27.9 ºC for the three meteorological stations; while the lowest values are recorded in January and February, with a 24.5 ºC average for the three studied meteorological stations.

- *Relative Humidity*

Relative humidity has an inverse relationship with temperature, because a temperature rise reduces the atmospheric capacity to retain water vapor.

According to **Figure 3-5**, average relative humidity is above 60% all year long for the three analyzed stations; during the rainiest months humidity rises staying above 70%, while in the dry seasons it falls up to 63%. The minimum average values are observed in August, with 69%, and the maximum average occurs in the month of May, with 79.7% (**Table 3- 9**).

FIGURE 3-5 Multi-annual Monthly Mean Relative Humidity

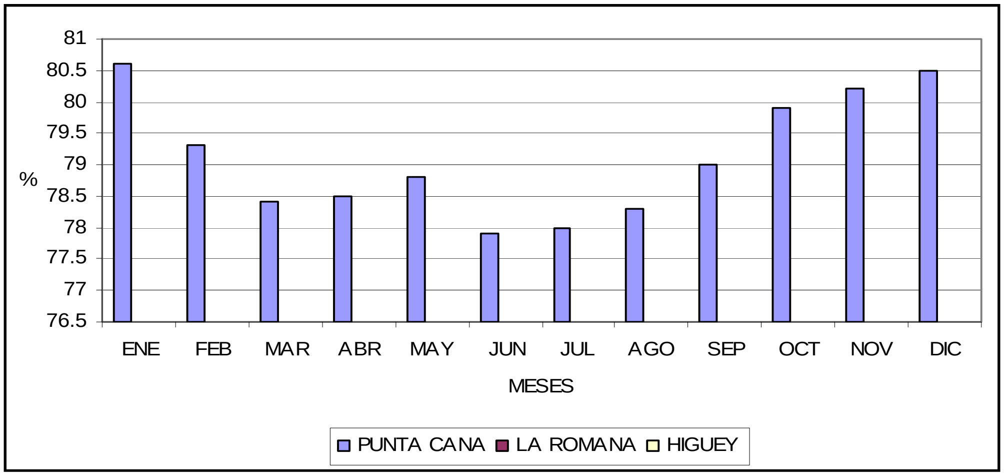


TABLE 3-9 Multi-annual Monthly Mean Relative Humidity - %

Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
PUNTA CANA	80.6	79.3	78.4	78.5	78.8	77.9	78	78.3	79	79.9	80.2	80.5
LA ROMANA	S.I.	S.I.	S.I.	S.I	S.I.	S.I	S.I.	S.I	S.I.	S.I	S.I.	S.I
HIGÜEY	S.I.	S.I	S.I.	S.I	S.I.	S.I	S.I.	S.I	S.I.	S.I	S.I.	S.I

S.I.= DATA UNAVAILABLE.

- *Water Balance and Climate Classification*

METHODOLOGY

The water balance of the study area was conducted using the Thornthwaite water balance formula (1948); comparing potential evapotranspiration to precipitation in order to obtain the humidity index. The Thornthwaite method uses a water balance that simulates the hydrologic cycle, from which parameters such as excesses (EXC) and deficit (DEF) are derived.

To the purpose of this classification, Thornthwaite defined the total humidity index with the following formula:

*THI= Ih– 0.6 Ia = (100*EXCT-60 DEFT)/EVAPT*

where:

THI: Total humidity index

Ih: Humidity index

Ia: Aridity index

EXCT: Total excess of the year [mm]

DEFT: Total deficit of the year [mm]

EVAPT: Total annual evapotranspiration [mm]

Tables 3-10 to **3-13** show the subdivisions of the Thornthwaite classification according to Total Humidity Index (THI). The subdivisions according to the humidity index (Ih) determine the humidity degrees and the subdivisions by the aridity index (Ia) determine the humidity ranges according to the water deficit. If the zone being classified has a wet climate (A, B or C) the aridity table is used; if the zone has a dry climate (C1, D1 or E), the humidity table is employed.

TABLE 3-10 Water Index – Thornthwaite Classification

Symbol	Climate Class	Water Index
A	Hyper-humid	Greater than 100.1
B4	Very humid	80.1 to 100
B3	Humid	60.1 to 80
B2	Moderately humid	40.1 to 60
B1	Slightly humid	20.1 to 40
C2	Semi-humid	0.1 to 20
C1	Semi-dry	0 to -20
D1	Semi-arid	-20.1 to -40
E	Arid	-60 to -40.1

TABLE 3-11 Subclassification According to Aridity Index

Symbol	Degree of Aridity	Aridity Index
R	Little or none	0 to 16.7
S	Moderate in summer	16.7 to 33.3
W	Moderate in Winter	16.7 to 33.3
s2	High in summer	Greater than 33.3
w2	High in winter	Greater than 33.3

TABLE 3-12 Subclassification According to Humidity Index

Symbol	Humidity Degree	Humidity Index
D	Little or none	0 to 10
s’	Moderate in summer	10.1 to 20
w’	Moderate in Winter	10 to 20
s’2	High in summer	Greater than 20
w’2	High in winter	Greater than 20

TABLE 3-13 Subclassification According to Annual Evapotranspiration

Symbol	Thermal Region	Etp (Mm)
A’	Megathermal or warm	1140 and above
B’4	Mesothermal or semi-warm	997 to 1140
B’3	Mesothermal warm temperate	855 to 997
B’2	Mesothermal cold temperate	712 to 855
B’1	Mesothermal semi-cold	570 to 712
C’2	Mesothermal moderate cold	427 to 570
C’1	Microthermal very cold	285 to 427
D’	Tundra	142 to 285
E’	Frost or Icy	Below 142

RESULTS

Available data from La Romana, Higüey and Punta Cana stations were used to determine water availability in the soil as related to the plants' physiological activities, because their geographic location and climate conditions are the closest to those of the direct area of influence; these data permitted determining the surface water balance for the Project's area of influence.

The analysis of the La Romana and Punta Cana meteorological stations data indicate a clear water deficiency almost all year long, from January through September; the breakpoint between precipitation and potential evapotranspiration is located in the month of September. After that, scarce humidity availability is observed in the soil and plants for the same month of September, as can be seen in **Tables 3-14 and 3-15 and Figures 3-6 and 3-7**.

TABLE 3-14 Water Balance Calculation according to Thornthwaite - La Romana Station

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
TEMPERATURE (°C)	24.70	24.90	25.30	25.80	26.70	27.60	28.10	28.00	27.70	27.30	26.30	25.20	26.47
PRECIPITATION (mm)	32.70	27.80	27.60	45.20	91.00	57.10	61.00	105.30	116.90	164.60	96.20	47.60	873.00
POTENTIAL EVAPO-TRANSPIRA-TION	100.43	96.09	115.38	125.27	150.47	167.07	183.53	176.23	159.92	150.03	124.17	107.08	1655.67
USEFUL WATER STORAGE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.57	0.00	0.00	0.00
WATER EXCESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WATER DEFICIT	67.73	68.29	87.78	80.07	59.47	109.97	122.53	70.93	43.02	0.00	13.40	59.48	782.67
ACTUAL EVAPO-TRANSPIRATION	32.70	27.80	27.60	45.20	91.00	57.10	61.00	105.30	116.90	150.03	110.77	47.60	873.00
HUMIDITY INDEX	-0.67	-0.71	-0.76	-0.64	-0.40	-0.66	-0.67	-0.40	-0.27	0.10	-0.23	-0.56	0.00

(1) ANNUAL AVERAGE VALUE (%) *HUMIDITY INDEX (IH) 0.00*
(2) CUMULATIVE ANNUAL VALUE (MM) *ARIDITY INDEX (IA) 47.27*
(3) AVERAGE VALUE (UNITLESS) *HUMIDITY FACTOR (IM) -28.36*

TABLE 3-15 Water Balance Calculation according to Thornthwaite - Punta Cana Station

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
TEMPERATURE (°C)	24.90	24.80	25.10	25.70	26.50	27.30	27.60	27.80	27.70	27.20	26.50	24.90	26.33
PRECIPITATION (mm)	66.40	54.20	54.30	69.30	124.40	103.90	78.40	103.20	101.70	152.10	116.60	78.50	1103.00
POTENTIAL EVAPO-TRANSPIRATION	103.99	95.15	112.54	123.91	146.63	160.54	171.73	171.57	159.91	148.13	127.97	102.93	1624.99
USEFUL WATER STORAGE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.97	0.00	0.00	0.00
WATER EXCESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WATER DEFICIT	37.59	40.95	58.24	54.61	22.23	56.64	93.33	68.37	58.21	0.00	7.39	24.43	521.99
ACTUAL EVAPO-TRANSPIRATION	66.40	54.20	54.30	69.30	124.40	103.90	78.40	103.20	101.70	148.13	120.57	78.50	1103.00
HUMIDITY INDEX	-0.36	-0.43	-0.52	-0.44	-0.15	-0.35	-0.54	-0.40	-0.36	0.03	-0.09	-0.24	0.00

(1) ANNUAL AVERAGE VALUE (%) *HUMIDITY INDEX (IH) 0.00*
(2) CUMULATIVE ANNUAL VALUE (MM) *ARIDITY INDEX (IA) 32.12*
(3) AVERAGE VALUE (UNITLESS) *HUMIDITY FACTOR (IM) -19.27*

FIGURE 3-6 Climate-Water Balance - La Romana Station

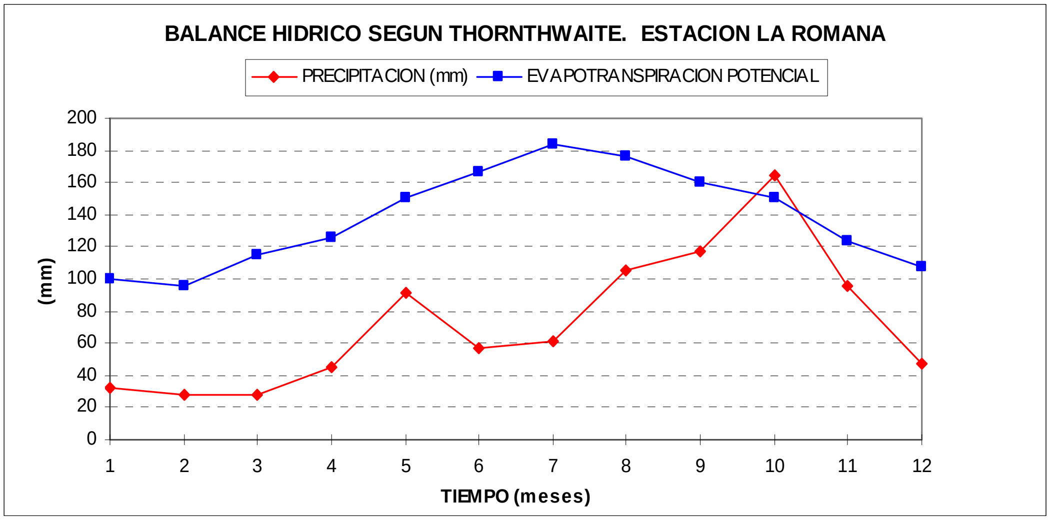
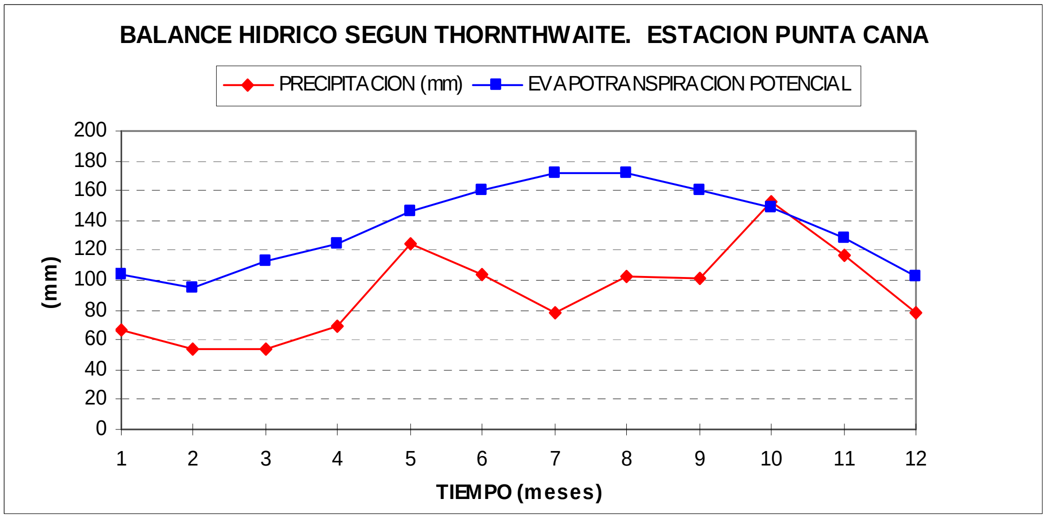


FIGURE 3-7 Climate-Water Balance - Punta Cana Station



The results of the water balance for the Higüey station, show a slight variation with respect to the two stations shown above, because, as shown in **Table 3-16 and Figure 3-8**, the first half of the year has a humidity deficit during the months of January, February and March, and from April on, the precipitation begins to increase the water reserves, and in May they exceed evapotranspiration, generating a water surplus period, which only lasts until the month of June.

In the second half of the year, the humidity deficit period occurs in the month of June through September; both periods are similar in their water deficit.

Similarly, the month of June shows the lowest precipitation value, which causes the water deficit to reach its highest level in this month during this part of the year (**Table 3-16**).

TABLE 3-16 Water Balance Calculation according to Thornthwaite – Higüey Station

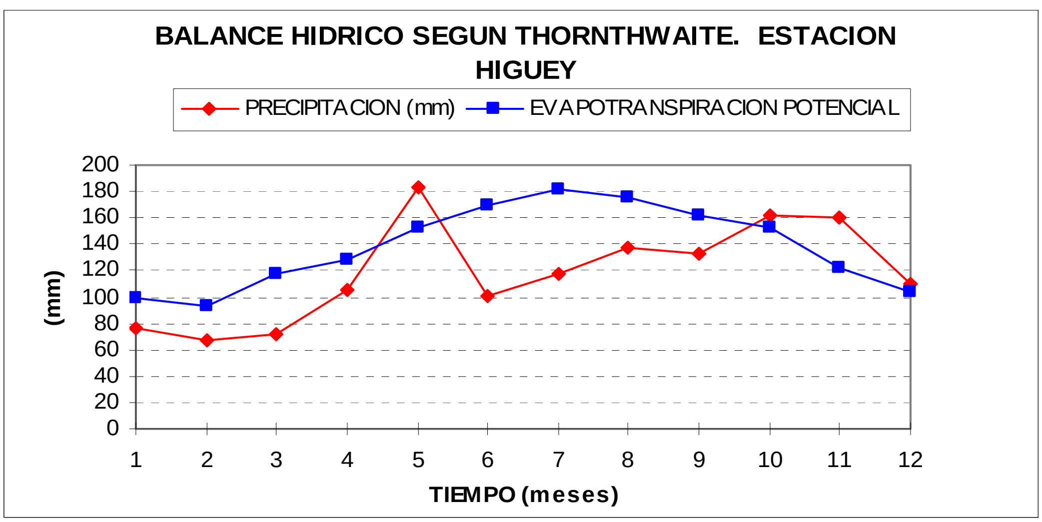
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
TEMPERATURE (°C)	24.60	24.70	25.40	26.00	26.80	27.70	28.00	28.00	27.80	27.40	26.20	25.00	26.47
PRECIPITATION (mm)	75.60	66.90	71.70	105.40	183.10	101.40	117.50	137.00	133.10	161.40	159.80	109.70	1422.60
POTENTIAL EVAPO-TRANSPIRATION	98.93	93.25	117.08	128.91	152.57	169.32	181.12	176.23	162.07	152.08	122.43	103.95	1657.94
USEFUL WATER STORAGE	29.12	2.76	0.00	0.00	30.53	0.00	0.00	0.00	0.00	9.32	46.69	52.44	0.00
WATER EXCESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WATER DEFICIT	0.00	0.00	42.62	23.51	0.00	37.40	63.62	39.23	28.97	0.00	0.00	0.00	235.34
ACTUAL EVAPO-TRANSPIRATION	98.93	93.25	74.46	105.40	152.57	131.93	117.50	137.00	133.10	152.08	122.43	103.95	1422.60
HUMIDITY INDEX	-0.24	-0.28	-0.39	-0.18	0.20	-0.40	-0.35	-0.22	-0.18	0.06	0.31	0.06	0.00

(1) ANNUAL AVERAGE VALUE (%) *HUMIDITY INDEX (IH) 0.00*

(2) CUMULATIVE ANNUAL VALUE (MM) *ARIDITY INDEX (IA) 14.19*

(3) AVERAGE VALUE (UNITLESS) *HUMIDITY FACTOR (IM) -8.52*

FIGURE 3-8 Climate-Water Balance –Higüey Station



Also in the second part of the year, the highest rainfall period is found between the months of October and November; this increases the water availability, allowing a recovery in the soil and the physiological conditions of the vegetation, as well as aquifer recharge following the deficit period.

According to the values of the humidity index, aridity index and Thornthwaite indices obtained for La Romana, Punta Cana and Higüey meteorological stations, and considering their type of climate, it can be concluded that the water index classification is semi-dry (C1), with a little or no (R) degree of aridity, and a megathermal or warm type (A`) according to the annual evapotranspiration recorded at these stations.

3.1.4 Hydrology

The hydrographic characteristics of the main water bodies in the study area are described below.

The road corridor proposed for the Autopista del Coral crosses the Chavón River in its lower basin and the Duey (or Yuma) River in its middle basin, as illustrated on **Map EIAALR-06.** Both rivers belong to the South or Caribbean Watershed (Vertiente Sur o del Caribe); their general characteristics are described below:

- *Chavón River Basin*

The Chavón River has an approximate length of 84 kilometers and flows into the Caribbean Sea east of La Romana. A sand barrier isolates its estuary from the Caribbean Sea.

This river rises in the Cordillera Oriental in El Seibo province, next to Nisibón and receives waters from its tributaries, Sanate and Quisiban, reaching a maximum annual mean level of 7.9 m^3/s; its hydrographic basin has about 40,000 hectares. The Chavón River serves as boundary between the provinces of La Romana and La Altagracia.

The water flow of the Chavón River was obtained from 39 years of statistics from the Instituto Nacional de Recursos Hidráulicos (INDRHI), from 1956 to 1994, at the Santa Lucia station (Code 260001, Type QD1, Lat: 184110; Long: 685610; Elev: 59 m). Analyses of these statistics show an average water flow of 5.24 m^3, with the lowest values recorded in the months of March and July (2.81 and 3.22 m^3, respectively), and the highest water flows in November and October.

- *Duey (or Yuma) River Basin*

The Duey or Yuma River has an approximate length of 49 kilometers and flows into the Bay of Yuma in the Caribbean Sea.

This river rises in the foothills of the Cordillera Oriental in La Altagracia province and has a hydrographic basin of approximately 41,243 hectares (412 km^2). The Duey River crosses La Altagracia province diagonally in the Northwest – Southeast direction.

The water flows of the Duey (or Yuma) River were obtained from 27 years of historic records of INDRHI, from 1968 through 1994, at the El Maney station (Code: 240001; Type QD4; Lat.:183946; Long.: 684451; Elev.:117). Analyses of these records show a multi-annual average water flow of 1.47m^3, with low water flows in April and August and higher values in November and December.

According to above description, of the water courses in the road corridor's area of influence, the Chavón River shows the most constant water flow, with 5.24 m^3/s; while the Duey River flow is below 1.5 m^3/s, which shows a low water potential from this river at the point it crosses the Project's area of influence.

3.1.5 Hydrogeology

The objective of hydrologic study was to categorize the aquifer potential of a zone depending on its geological units, its permeability, and its capacity for storing and/or permitting the surface or subsurface water flow. The characterization of the hydrogeological units present in the study area was conducted using secondary data and direct observation regarding the unit's lithology.

The hydrogeological units are classified into: Aquifers, which are those geological units that permit ground water storage and flow; Aquitardes, the geological units that can store water, but permit a very slow flow compared to the aquifers and; Aquicludes, including those geological units that do not permit ground water flow and which are considered impermeable.

Hydrogeological Characterization

Within the regional and local evaluation area there are: aquifers (rocks or geological units capable of storing water and permitting its flow through them relatively ease), aquitardes (rocks that can store large water volumes but do not allow an easy flow through them), and aquicludes (rocks that can store significant water volumes, but they lack the capability for transmitting it or allowing its flow).

According to the hydrogeological map of the Dominican Republic (1989, included in the Hydrographic Atlas of the Caribbean prepared by UNESCO), hydrogeological units are grouped according to the types of rock present in the soil stratigraphy and the soil permeability associated with these types of rock, which were classified using the nomenclature employed in the international hydrogeological program (**Map EIAALR-07)**.

Based on the field observations and the secondary data gathered, the hydrogeological units shown on **Map EIAALR-07** were identified with the symbols A2, B1, B3, B5 and C3. Characteristics of each of the soil units are described below:

UNIT A2

This unit corresponds to a continuous aquifer with regional to limited regional extension, free and/or confined, composed of consolidated clastic sediments. High to medium permeability and generally good chemical quality; it is considered a unit of high hydrogeological importance.

UNIT B1

This unit comprises a local aquifer restricted to fractured zones, extended generally due to karstic dissolution, free and/or confined; it is constituted by calcareous rocks, basically of reef rocks. Generally, it has high to medium permeability and usually hard waters. This is a unit of high hydrogeological importance.

UNIT B3

This unit corresponds to a local aquifer restricted to fractured zones, free and/or confined, constituted basically by marly-calcareous rocks; generally low permeability and hard waters. This unit has high hydrogeological importance.

UNIT B5

This unit includes local aquifers restricted to fractured zones, extended sometimes by interconnection systems, free or confined and constituted by basic extrusive rocks and intrusive rocks. Their permeability is generally medium to low and typically good chemical quality waters. It is considered a unit of medium to low hydrogeological importance.

UNIT C3

This unit corresponds to practically absent aquifers; composed of intrusive and extrusive rocks associated, and evaporites from the southwest. They have good to low chemical quality waters in the evaporites. It is considered a unit with very low hydrogeological importance.

The route proposed for the Autopista del Coral passes mainly on hydrogeological units types B1 and A2. The alignment in the cliffs section (escarpment) is considered to be more sensitive, because it combines rocks of high porosity and fractured, with the vicinity to a lagoon system of emerging waters located south of the reef terrace.

3.1.6 Water Quality

The analyses of the physical and chemical (organic and inorganic) and bacteriological characteristics of the water bodies intercepted and located in the area of influence of the road corridor are described below. The analysis of the physical and chemical and bacteriological characteristics conducted in the

Chavón River, Santa Clara Stream and Duey River, allow establishing a reference of present quality of these bodies of water, which will help in the future determination of possible changes introduced by the project development or other anthropic activities conducted in areas in vicinity of the Project.

The term Water Quality implies a judgment regarding a particular use, agricultural, industrial, or potable. The natural water quality is associated with the chemical characteristics of the soil the water goes through, the air surrounding it, climate conditions, its volume, length of its trajectory, and its regeneration capacity. The natural water quality is changed by anthropic activities occurring in these water bodies or drainage basins, or due to the use by such activities. Consequently, the Secretariat of State for Environment and Natural Resources of the Dominican Republic has established the Standard for Water Quality and Discharge Control AG-CC-01. This standard establishes the quality of surface waterbodies and the maximum values for the quality parameters that these water bodies must meet according to their use classification (Table 4.1 of Standard AG-CC-01).

Point and surface water samples were taken to analyze the physical, chemical and bacteriological parameters in order to determine the water quality in the water bodies crossed by the proposed road corridor. Samples were collected according to the requirements of each test and the samples were refrigerated until their arrival at the laboratory in the City of Santo Domingo. INTEC conducted the sample analyses. The analytical results reported by INTEC are presented in **Table 3- 17**.

TABLE 3-17 Water Quality Analytical Results - Autopista del Coral (April 2007)

Physical-Chemical and Bacteriological Parameters	Units	Chavón River	Duey River	Santa Clara Stream	Water Classification according to SEMARN - Class B
Water flow	(m^3/s)				
pH		8.1	7.74	7.7	6.5-9.0
Temperature	(TºC)	26.6	25.5	25	
Conductivity	µS/cm	1414.62	336.9	386.3	
Turbidity	NTU	5.73	5.54	18.06	
Color	units Pt Co	55	57	162	50
Dissolved Oxygen	(DO)	0.299	0.282	2.94	≥70
Salinity	(SAL) ppt	0.7	0.2	0.2	
Suspended Solids	(SS) mg/L	8	5	4	
Dissolved Solids	(DS) mg/L	687.3	156.6	191.4	1000
Biochemical Oxygen Demand	(BOD) mg/L	26	22.5	29	5
Chemical Oxygen Demand	(COD) mg/L	24.73	20.61	70.09	

Physical-Chemical and Bacteriological Parameters	Units	Chavón River	Duey River	Santa Clara Stream	Water Classification according to SEMARN - Class B
Oil and Grease	(O&G) mg/L	0.789	0.156	0.023	1
Hardness				24	
Alkalinity				270	
Nitrates	($N-NO_3$) mg/L	0.6	0.8	0.4	10
Nitrites	($N-NO_2$) mg/L	2	4	2	10
Sulfates	(SO_4^{-2}) mg/L	59	5	18	400
Chlorides	(CL_2) mg/L	364.42	49.63	48.21	250
Iron	(F_e) mg/L	0.075	0.025	0.8238	0.3
Chromium	(Cr) mg/L	0.0218	0.0191	<0.001	0.05
Phenols		<0.002	<0.002	<0.002	1µg/L
Lead	(Pb) mg/L	0.02	0.027	<0.001	0.05
Arsenic	(As) mg/L	<0.001	<0.001	<0.001	
Barium	($B_a +^2$) mg/L	2	<1	1	2
Total Mesophilic Aerobic Count	UFC/100 ml	790	340	Data to Verify*	
Most probable Number of Total Coliforms	Density/100 ml	350	150	750	1000
Most probable Number of Fecal Coliforms	Density/100 ml	120	50	220	1000
STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, YEAR 1989, 17th EDITION.					

The characteristics of the sampling sites corresponding to Chavón River, Duey River and Santa Clara Stream are described below:

- *CHAVÓN RIVER*

The water sampling site is located at the intersection with the route proposed for the Autopista del Coral project, approximately at the abscissa K6+340. The Chavón River is a permanent water course; the sample collection site is located approximately 200 m downstream from the existing bridge and the small dam for hydroelectrical power generation. The characteristics of the sampling site can be seen on **Photos 3-1 and 3-2,** and the analytical results from the water samples are included in Table 3-17.

Photo 3-1
PANORAMIC VIEW OF SAMPLING SITE ON CHAVÓN RIVER

Photo 3-2
LOCATION OF SAMPLING STATION ON CHAVÓN RIVER

According to SEMARN's classification, the Chavón River belongs to class B, destined for preservation of the fauna and flora; the waters are suitable for crop irrigation, aquatic sports without direct contact, in some industrial and stockbreeding processes; and for drinking water, after a treatment process.

The Chavón River is affected by activities such as:

- Recreational activities, such as swimming and boating.
- Fishing (local subsistence)
- Agricultural and stockbreeding activities
- Aggregates mining

- *DUEY OR YUMA RIVER*

The water sampling site is located at the crossing of the route proposed for the Autopista del Coral project, approximately at the abscissa K36+350. The Duey River is a permanent water course; the sample collection site is located approximately 50 m downstream from the road crossing. The characteristics of the sampling site can be seen on **Photos 3-3, 3-4 and 3-5,** and the analytical results from the water samples are included in Table 3-17.

Photo 3-3
PANORAMIC VIEW OF ACCESS TO WATER SAMPLING SITE

Photo 3-4 **Photo 3-5**
DUEY RIVER BED AND CHARACTERISTICS OF ITS BANKS

According to SEMARN's classification, the Duey River belongs to class B, destined for preservation of the fauna and flora; its waters are suitable for crop irrigation, aquatic sports, without direct contact, in some industrial and stockbreeding processes; and for drinking water, after a treatment process

The Duey River is affected by activities such as:

- Upstream waste discharges from the city of Higüey.
- Agricultural and stockbreeding activities

- *SANTA CLARA STREAM*

The water sampling site is located at the crossing of the route proposed for the Autopista del Coral project, approximately at the abscissa K30+500. The Santa Clara stream is an intermittent water course, without water most of the year, except for the periods of highest precipitation in the zone. The characteristics of the sampling site can be seen on **Photos 3-6 and 3-7,** and the analytical results from the water samples are included in Table 3-17.

Photo 3-6 **Photo 3-7**

APPEARANCE OF SANTA CLARA STREAM BED AND ITS LOW WATER FLOW, MAINTAINED AFTER THE HIGHEST PRECIPITATION PERIOD

According to SEMARN's classification, the Santa Clara Stream belongs to class B, destined for preservation of the fauna and flora; its waters are suitable for crop irrigation, aquatic sports, without direct contact, in some industrial and stockbreeding processes; and for drinking water, after a treatment process

The Santa Clara Stream is affected by activities such as:

- Upstream waste discharges from the city of Higüey.
- Agricultural and stockbreeding activities

In general, the analytical results show that all of the samples are alkaline waters with high organic matter content, probably due to the contribution of waste waters without treatment. The Chavón River has high chlorides and the conductivity parameter is also very high, which are indicators of the influence of sea water at the sampling site. The Santa Clara stream shows the highest concentration of coliforms, probably due to the contribution of the stockbreeding activity occurring very close to the sampling site and the direct disposal of human waste on the soil and subsoil (septic systems). In the Duey River, the highest values are found in the parameters related to organic nutrients, most likely associated with the sugar cane agricultural activity which is concentrated along the middle basin of this river.

In conclusion, the analytical results for the Chavón and Duey Rivers and the Santa Clara stream correspond to the CLASS B classification of the Secretariat of State for Environment and Natural Resources. These water can be used for recreational activities not requiring direct contact, also for agricultural and stockbreeding activities, and finally, for human consumption, after treatment.

3.1.7 Air Quality

The road corridor proposed for the Autopista del Coral passes through an entirely rural area, devoted mainly to sugar cane farming and semi-intensive agricultural and stockbreeding activities (small lots for subsistence crops and cattle fields); there is no industrial pollution source in vicinity of the road corridor.

However, there are some sources that contribute to temporary deterioration in air quality, such as: generation of particulate material (dust) due to non-paved roads and combustion gas emissions produced by burning of vegetation by inhabitants of this region, either for cooking or for clearing the lands for farming, cropping or stockbreeding. Also, waste disposal practices include open burning of any type of waste.

3.1.8 Natural Hazards

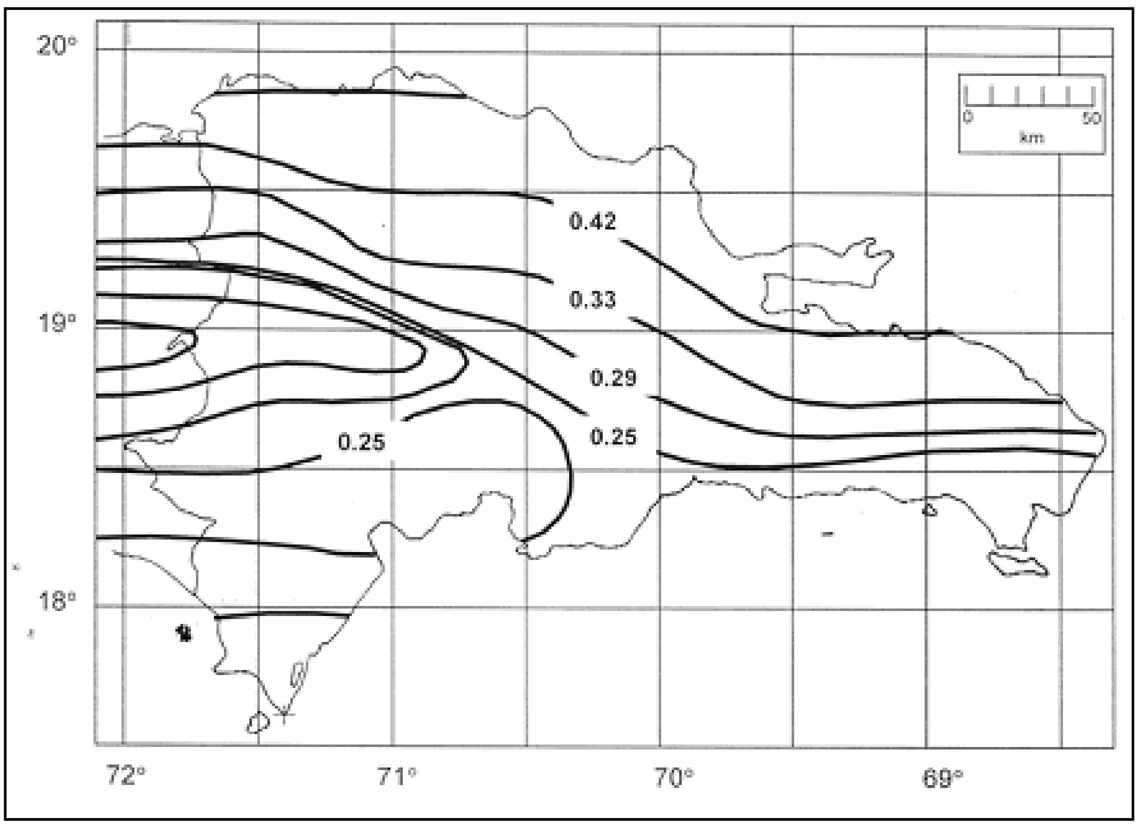
The Dominican Republic's geographic position, within the Caribbean tectonic plate, gives the country a natural hazard potential associated with telluric and hydro-meteorological phenomena, such as:

earthquakes, tsunamis, hurricanes, tropical storms, flooding, collapses, landslides, erosion and droughts.

Seismic Hazard

The seismic hazard analyses conducted for the country show maximum isoacceleration curves for the proposed road corridor of 0.25 g (g= gravity), with a 10% probability of exceedance over 50 years, equivalent to a return period of 475 years of the Provisional Recommendations for Seismic Analysis of Structures- RPAS, in Spanish- as shown in **Figure 3-9.** However, according to the Dominican Society of Seismology and Seismic Engineering - (SODOSISMICA, 2002) these curves must be revised, because they surpass approximately 60% of the acceleration anticipated by the Dominican Standard, 2002. However, recent research proves the possibility of a Magnitude 8 earthquake in the northern fault, an event that would surely produce a higher acceleration than those proposed by the Dominican Republic.

FIGURE 3-9 Isoacceleration Curves, RPAS for 10% exceedance over 50 years



According to the Seismotectonic Zoning Map shown in **Figure 3-10** prepared by the SYSMIN program in 1998, the area of La Romana and La Altagracia provinces where the road corridor for

Autopista del Coral (La Romana – Punta Cana Highway) is located, belongs to Area 8: zone of distributed seismicity without apparent relationship to well-known structures.

Table 3-18 presents the return period calculated based on the criteria for zone identification.

TABLE 3-18 Return Period for Seismic Zone Identification

Range of Magnitude	Return Period	Magnitude Interval	Return Period
2 < = M < 3	2 Months	5 < = M < 6	6 Years
3 < = M < 4	7 Months	6 < = M < 7	18 Years
4 < = M < 5	2 Years	7 < = M < 8	56 Years

***Source**: Geological Risk (seismic risk) Prevention Study, 1999, SYSMIN Programme-European Union.*

The seismic hazard zoning in the Dominican Republic also considers tsunamis because of the extensive coasts, and they are likely to penetrate inland; in 1946 this type of phenomenon produced serious damage and numerous victims in the country.

Flooding

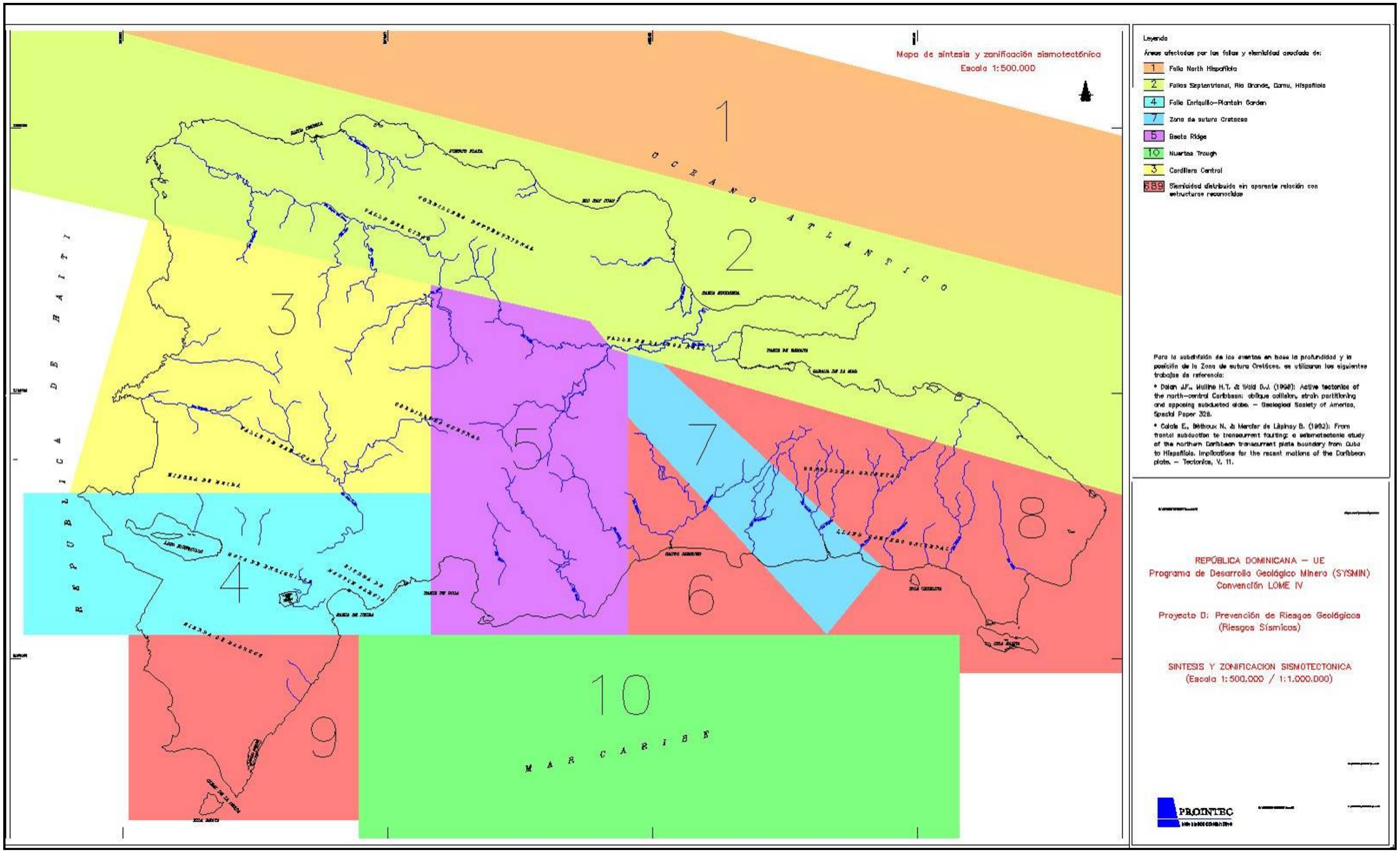
Floods are the main phenomena that have historically threatened the Dominican Republic and they are generally produced by:

- Torrential rains (usually occurring in the months of May - June).
- Hurricanes and tropical storms (generally occurring in the months of June - November).

The alteration of hydrographic basins produces frequent overflows of brooks, rivers and streams; also, floods occur due to improper waste disposal on the stream banks which contributes to sedimentation of waterbodies.

The swells produced as a consequence of hurricanes, tropical storms and earthquakes cause flooding in coastal towns. According to **Map EIAALR-05**, the proposed Project corridor is partially located on a zone considered as vulnerable to flooding by precipitation and low permeability of the soils of these zones.

FIGURE 3-10 Seismotectonic Zoning Map



3.2 Biological Environment

3.2.1 Terrestrial Flora

A description of the terrestrial biota conditions of the study area is given below; these conditions will allow classification of areas within a specific ecosystem according to the classification system established for the country by Hartshorn (1981).

Life Zones

The study area for the Autopista del Coral route is an approximately 70km corridor, stretching from the vicinity of the City of La Romana up to Punta Cana, in Higüey. This zone belongs to the Llanura Oriental or Llanura del Caribe (Eastern or Caribbean Plain), that stretches from Punta Palenque, in San Cristóbal, to Punta Nisibón, in Higüey (Rodríguez, 1976; De La Fuente, 1976; Troncoso, 1986). It corresponds to the Sub-Tropical Moist Forest Life Zone (Bh-S), according to Hartshorn et al. (1981). See **Map EIAALR-08** and **Photo 3-8**.

Photo 3-8

PANORAMIC VIEW OF PUNTA CANA ZONE

However, there are sections where the vegetation is not characteristic of moist forest, but dry forest. This is not due to the precipitation level but to the type of substrate, which is composed of a very porous limestone, which does not retain water. Therefore, physiological drought occurs, giving a xeromorphous aspect to the vegetation. However, most of the studied area possesses clayey and humic soil, deep and with high fertility, and almost entirely occupied by sugar cane crops.

In general, this zone has high degree of disturbance due to diverse human activities: agriculture (especially the extensive monocultures of sugar cane), stockbreeding, timbering for different uses, advance of human settlements, road construction and tourist facilities; consequently, only small patches of forest cover remain, almost all of them with second growth vegetation, bushes and fallow lands.

Conservation Status

Native vegetation has been destroyed in almost the entire study area, its structure and composition being nearly totally modified. This condition is due mainly to native vegetative cover destruction for agricultural and livestock practices, lumber extraction that has been conducted for many years, conversion of areas for sugar cane agriculture and pasture for stockbreeding of buffalos to pull the carts to transport sugar cane to the train wagons, and for extensive cattle breeding (white Zebu).

The Project route is crossed by two rivers (Chavón and Duey or Yuma) and two streams or brooks (Santa Clara stream and the Limón brook), where narrow vegetation buffers are found, and some areas without any vegetation in certain sections.

Vegetation

- *Methodology*

This study was conducted in an area of the Caribbean Coastal Plain (Llanura Costera del Caribe or Llanura Oriental in spanish), in the Eastern region of the Dominican Republic, from Cacata (in La Romana) to Punta Cana (in Higüey). For the purpose of environmental description and floristic inventory, the total length of approximately 70km, was divided into sections, according to the type of substrate and vegetation composition.

The first section has xeromorphous vegetation on rocky substrate with high percolation, which produces a physiological drought. Secondary vegetation remains here as well as the vegetation along the Chavón River. This first section is located between the Cacata crossing and areas in vicinity of the Magdalena village, where the sugar cane plantations occur.

The second section starts at the Magdalena village and it stretches up to the villages of Campo Nuevo, Los Burritos and San Francisco, which is where the sugar cane plantation area ends. The soils are deep and highly fertile. In this section, except for small pasture fields and the forest buffers of the two water bodies, all the land is committed to sugar cane cultivation.

The third section starts where the sugar cane plantations end and terminates at Punta Cana, near the airport. Here, the soil type completely changes compared to the previous one, being similar to the first section, although rougher. Also, more vegetation occurs within this zone.

In the first two sections, although limited field surveys were conducted, the study was based mainly on secondary data gathered by the author and by other botanists. Systematic sampling was not conducted in these two sections because they are highly impacted, and except for the water bodies, there is no critical environment within the sections

In the third and last section, primary data gathering was carried out by means of survey of the zones, including approximately 500 meters on both sides of the route's centerline. An area located between La Jarda and Punta Cana harboring the main vegetation locations where important endangered and protected plants have been reported, was extensively surveyed.

In other cases, site sampling was conducted following the modified Matteucci & Colma (1982) system, employing the methodology usually adopted in the Dominican Republic for environmental impact floristic studies, which consist of conducting linear, continuous transects and documenting everything observed to achieve a complete inventory.

During the survey, in addition to documenting and/or collecting specimens of all the vascular plant species found, the different vegetation environments or associations were described Protected species were geo-referenced and marked with flagging tape. Plants were identified on site based on flora specialist's knowledge. To confirm some specific epithets, bio-geographic statuses and other issues, Liogier (1982, 1983, 1985, 1989, 1995 y 1996) was consulted.

The common names used in this report correspond to the designations given to the plants in the region, according to *Diccionario Botánico de Nombres Vulgares de La Española* (Liogier, 2000), Peguero & Salazar (1986), Peguero (2000, 2004, 2005 and 2006) and by local inhabitants (Don Yuyo, personal communication, 2007).

The level of presence or degree of abundance was determined according to field observation of the populations of each species. Four categories were established: very abundant, abundant, scarce and rare.

To generate a list of endangered and/or protected plants, the following documentation was consulted: General Law on Environment and Natural Resources-64-00-(National Congress of the Dominican Republic, 2000); the compilation of environmental laws (Russo, 1999); the List of Endangered Species in the Dominican Republic, prepared by the Law-Project on Biodiversity Peguero et al., 2003); the List of the Convention on International Trade in Endangered Species of Wild Fauna and Flora -Cites- (World Conservation Monitoring Center, 1998), and the Red List of the International Union for Conservation of Nature -UICN- (Walter et al.,1997).

The data base is presented in Table 1 of Appendix 3.2, which contains a list of all the vascular plants discovered within the study area; it is organized in alphabetical order by Family, Genus and species. It also includes the vernacular names, biological types, bio-geographic status, protection or threat level, and level of presence.

Several sources on floristic resources of the Dominican Republic were reviewed, particularly regional data, such as: Hager & Zanoni (1993), Hartshorn et al. (1981) and various studies conducted by Peguero (1986, 2003, 2004, 2005 and 2006)).

- *Vegetation Coverage Units*

The vegetation coverage units within the study area have different degrees of development and/or disturbance, floristic composition and vertical structure. They are defined as cartographic units considering their size with respect to the scale used.

The vegetation coverage units include not only natural vegetation but also the new elements that are incorporated to the landscape, especially those associated with agricultural and livestock activities and other anthropomorphic elements.

Ten vegetation coverage units were identified within the study area and are classified according to the predominant vegetation type as: arboreal coverage, shrub coverage, pasture fields, agricultural lands, and areas without vegetation.

Table 3-19 shows the different coverage units for the study area. The degree of disturbance is evident, with the lands covered by sugar cane, scrublands and pasture fields with trees being the most dominant.

TABLE 3-19 Vegetation Coverage Units Present in the Study Area

Symbol	Coverage Unit	Percentage Area (%)
Bl	Broadleaved secondary growth forest on limestone rock	14.4
Brc	Riverside vegetation, along the Chavón River	0.8
Pa	Pasture fields with trees	23.8
Bn	Native forest	2.2
Ca	Sugar cane fields	27.9
Br	Riverside vegetation	0.1
Bs	Secondary forest in advanced regeneration	3.5
Pr	Scrublands or fallow lands	26.5
Cu	Small farming or crops	0.7
Za	Urban zones without vegetation cover	0.1

The relicts of arboreal vegetation and scrublands are located mainly in the zone with higher slope and associated with the riversides. These units of forest relicts are of varied size and have been left as protecting vegetation for the existing river banks. They also correspond to units with native arboreal vegetation associated with shade-grown crops such as fruits and cacao.

A description of each of the vegetation coverage units or association types is given below, and **Map EIAALR-09** shows their location within the road corridor.

SECTION I

In general, the following types of environments or vegetation associations can be found in the first section:

SECONDARY GROWTH BROADLEAVED FOREST ON LIMESTONE ROCK

A low to medium size vegetation, with xeromorphous appearance. The main arboreous species include: caya amarilla (*Sideroxylon foetidissimum*); caya roja (*Sideroxylon salicifolium*); cigua blanca (*Ocotea coriacea*); bayahonda negra (*Acacia macracantha*); caimito de perro, (*Chrysophyllum oliviforme*), and quiebrahacha (*Krugiodendron ferreum*). Among the bushes are: buzunuco (*Hamelia patens*) palo de cotorra (*Randia aculeata*), escobón (*Eugenia foetida)*, and rompezaragüey (*Eupatorium odoratum*) (**Photo 3-9**).

Photo 3-9

GENERAL VIEW OF A SECONDARY FOREST

Also a few palm trees, such as: corozo (*Acrocomia quisqueyana)*, and guano (*Coccothrinax argentea*). There are numerous herbaceous species, including guáyiga (*Zamia debilis*), and invasive gramineous and ruderal species, as well as vines, and a few cactuses and epiphytes.

RIVERSIDE VEGETATION ALONG CHAVÓN RIVER

This river has areas of vegetation on its banks that include relicts of the original forest. Due to substrate conditions, the vegetation is xeromorphous, with individuals of low height and small diameter. The main arboreal species are: quiebrahacha (*Krugiodendron ferreum*); jobo de puerco (*Spondias mombin)*; arraiján (*Eugenia pseudopsidium)*; cigua blanca (*Ocotea coriacea)*; and, caya amarilla (*Sideroxylon foetidissimum*) (**Photo 3-10**).

The main shrub species are: quina (*Exostema caribaeum)*; escobón (*Eugenia foetida*); and, palo de cotorra (*Randia aculeata)*. There are various herbaceous and climbing species; including an abundance of bejuco de indio or bejuco de jabón (*Gouania lupuloides* and *G. polygama)*; pega palo (*Macfadyena unguis-cati*), bejuco de costilla (*Serjania polyphylla*); bejuco caro (*Cissus verticillata*), and guatavo (*Ipomoea indica*).

Several herbaceous are found in the river's floodplain, mostly gramineous and cyperaceous.

Photo 3-10
GENERAL VIEW OF VEGETATION ALONG THE CHAVÓN RIVER

PASTURE FIELDS WITH TREES

This environment is found in the vicinity of the intersection of La Romana-Higüey highway with the Bayahibe highway up to an area close to the Magdalena village, where the sugar cane plantation area begins. The floristic landscape is dominated by gramineous forage, mainly the invasive types, pitted beardgrass (*Bothriochloa pertusa*) and Guinea grass (*Panicum maximum*). Trees are scarce and located in the live fences, including species such as: piñón cubano (*Gliricidia sepium*) and jobo dulce (*Spondias purpurea)* (**Photo 3-11**).

Photo 3-11
GENERAL VIEW OF A PASTURE FIELD

SECTION II

Two types of vegetation associations are dominant in this section:

SUGAR CANE FIELDS

The species dominating the floristic landscape is, obviously, sugar cane (*Saccharum officinarum*). Beside sugar cane, numerous species of weeds grow, mainly gramineous, as well as vines. Sporadically, a tree or a tree row is left among the sugar cane, as in vicinity of División Bayguá of the Central Romana Sugar Mill.

RIVERSIDE VEGETATION

This type of environment is found along the Santa Clara and Caño El Limón streams and in the Duey or Yuma River. In each, it is represented by a narrow tree row with herbaceous understory and vines. The main arboreal species are the following: jabilla criolla (*Hura crepitans*); guama (*Inga vera*); anón de río (*Lonchocarpus domingensis)*; guasuma (*Guazuma tomentosa*); chácaro (*Cassia grandis*); palo amargo (*Trichilia pallid*), and jobobán (*Trichilia hirta*).

The main shrub species are: caimoní (*Wallenia laurifolia*); palito de leche (*Tabernaemontana citrifolia)*; guayabo (*Psidium guajava)*; escobón (*Eugenia monticola*) and primavera (*Samyda* *dodecandra*). The principal herbaceous species present are gramineous and cyperaceous. The most notable vines include various specimens of the *Ipomoea* Genus, uña de gato (*Pisonia aculeata*); bejuco de indio (*Gouania polygama*); pega palo (*Macfadyena unguis-cati*); bejuco caro (*Cissus verticillata*); and, bejuco de costilla (*Serjania polyphylla* and *Paullinia pinnata*).

SECTION III

In this section, which is in the Verón-Punta Cana coastal zone, the following types of vegetation associations are found:

SECONDARY FOREST IN ADVANCED REGENERATION

Is a broadleaved forest on limestone rock substrate, whose original vegetation was removed and then activities ceased in this zone; therefore, a natural regeneration process is occurring, generally with the same species that existed here and with others that arrived with the human activities. Generally, individuals are less than four meters, but some individuals may grow higher (**Photo 3-12**).

Photo 3-12
GENERAL VIEW OF A SECONDARY FOREST IN THE ZONE OF VERÓN

The main arboreal species include: higo cimarrón (*Ficus mammillaria*); almácigo (*Bursera simaruba*); grayumbo (*Cecropia schreberiana*); capá de sabana (*Petitia domingensis*); capá (*Cordia alliodora)*; bayahonda negra (*Acacia macracantha)*; zapotillo (*Pouteria dictyoneura*); canelilla (*Myrcianthes montana*); caimito de perro (*Chrysophyllum oliviforme*); sauna (*Ziziphus rignoni)*; vera (*Guaiacum sanctum*); guayacán (*Guaiacum officinale);* jobo de puerco (*Spondias mombin)*; yaya blanca (*Antirhea lucida)*; guasuma (*Guazuma tomentosa)*; quiebrahacha, (*Krugiodendron ferreum*);

guao (*Comocladia cuneata*); cigua blanca (*Ocotea coriacea*); penda (*Citharexylum fruticosum*); arraiján (*Eugenia rhombea*); and, guázara (*Eugenia pseudopsidium*) (**Photo 3-13**).

Photo 3-13
SECONDARY FOREST IN ADVANCED REGENERATION IN VICINITY OF VERÓN

The bushes include: margarabomba (*Casearia aculeata*) palo de tabaco (*Gymnanthes lucida)*; palo de cotorra (*Randia aculeata*); buzunuco (*Hamelia patens*); escobón (*Eugenia foetida)*; quina (*Exostema caribaeum)*; huesito (*Gyminda latifolia)*; palito blanco (*Crossopetalum rhacoma*); aguedita (*Picramnia pentandra)*; leucaena (*Leucaena leucocephala*); paría (*Allophylus cominia*); caraga agua (*Erythroxylum brevipes*); cabra cimarrona (*Schaefferia frutescens*); aniceto (*Piper amalago*); and, cafetán (*Psychotria nervosa*, *P. nutans*, *P domingensis* and *P. microdon*). In some areas there is campanita criolla (*Cubanola domingensis).*

Among the herbaceous species, the most abundant and frequent is guáyiga (*Zamia debilis)*. Also, there is maguey (*Agave antillarum*); maya (*Bromelia pinguin)*; maya de burro (*Bromelia plumierii*); bruja (*Bryophyllum pinnatum*); caimonicillo (*Rivina humilis*); lengua de vaca(*Niphidium crassifolium*); molleja (*Iresine diffusa)*; and, lengua de suegra (*Oeceoclades maculata*).

Since the forest has not closed and still allows light to enter the understory, numerous vines are present, including: timacle (*Chiococca alba*); pica-pica (*Dalechampia scandens*); pabellón (*Trichostigma octandrum*); Jaquimey (*Hippocratea volubilis*); maravedí (*Securidaca virgata*); pega palo (*Macfadyena unguis-cati*); pitajaya (*Hylocereus trigonus*); nigua (*Tournefortia volubilis*); guatavo (*Ipomoea indica*); barrezuela (*Oplonia spinosa*); oreja de ratón (*Cissampelos pareira*); and, bejuquito de caro (*Cissus trifoliata*).

BROADLEAVED FOREST, RELICT OF ORIGINAL VEGETATION

This type of environment is found only on the slopes of a deep depression located near the road to Hoyo Azul and Hoyo Claro. Although it has been disturbed by cutting, it still contains elements of the primary forest. Tree specimens within the area are small to medium, with a few of them emerging to significant heights.

The main arboreal species are: zapotillo (*Pouteria dictyoneura*); anicillo (*Celtis trinervia*); tarana (*Chionanthus ligustrinus*); lirio (*Chionanthus domingensis)*; grayumbo (*Cecropia schreberiana*), and almácigo (*Bursera simaruba)* (**Photo 3-14**).

Photo 3-14
RELICT OF ORIGINAL FOREST IN THE ZONE OF VERÓN

Also present are: muñeco (*Guapira fragrans*); mora (*Maclura tinctoria*); palo amargo (*Trichilia pallida*); bija macho (*Alchornea latifolia*); quiebrahacha (*Krugiodendron ferreum*); vera (*Guaiacum sanctum)*; caya amarilla *(Sideroxylon foetidissimum*); caya colorada (*Sideroxylon salicifolium*); uvero (*Coccoloba diversifolia*); copey (*Clusia rosea)*; cuerno de buey (*Exothea paniculata)*. Existing, but scarce are cuero de puerco (*Ottoschulzia rhodoxylon*) and maba (*Diospyros domingensis)*.

The most notable shrub species include escobón (*Eugenia foetida)*; huesito (*Gyminda latifolia)*; cafetán (*Psychotria domingensis*); aguedita (*Picramnia pentandra*); cabra cimarrona (*Schaefferia frutescens*), and on some ocassions pringamoza (*Urera baccifera*). Herbaceous species are scarce here because the light can not enter openly, but is filtered, except in some cleared zones. The most common is lengua de vaca (*Niphidium crassifolium*).

The principal climbing species in this environment are uña de gato (*Pisonia aculeata*); bejuco de riñón (*Smilax populnea*); alcarrizo (*Lasiacis divaricata)*; pega palo (*Macfadyena unguis-cati*); timacle

(*Chiococca alba*), and guaraguao (*Celtis iguanaea)*. Although scarce, tratrá (*Phyllodendron lacerum*) is also present.

There are a few epyphites, including barba de viejo (*Tillandsia usneoides*) and flor de mayo (*Broughtonia domingensis*).

PASTURE FIELDS WITH TREES

In these environments, the gramineous forage predominate, such as yerba de guinea (*Panicum maximum*); yerba estrella (*Cynodon nlemfuense*); yerba de zorra (*Digitaria insularis*); and, others such as yerba de agua (*Callisia repens*) and guáyiga (*Zamia debilis)*. Some bushes are present including, margarabomba (*Casearia aculeata*); leucaena (*Leucaena leucocephala*); primavera (*Samyda dodecandra*); buzunuco (*Hamelia patens*); escobón (*Eugenia foetida)*; rompezaragüey (*Eupatorium odoratum)*; quina (*Exostema caribaeum*); albahaca (*Ocimum gratissimum*); and, palo de cotorra (*Randia aculeata*) (**Photo 3-15**).

Among the main trees are: higo cimarrón (*Ficus* spp.); jobo de puerco (*Spondias mombin*); guasuma (*Guazuma tomentosa*); almácigo (*Bursera simaruba*); zapotillo (*Pouteria dictyoneura)*; guao (*Comocladia cuneata*); guárana (*Cupania americana*); vera (*Guaiacum sanctum*); bayahonda negra (*Acacia macracantha*); tarana (*Chionanthus ligustrinus)*; penda (*Citharexylum fruticosum)*; grayumbo (*Cecropia schreberiana*); caimito de perro (*Chrysophyllum oliviforme*); córbano (*Albizia berteroana*); caya amarilla (*Sideroxylon foetidissimum*), and, quiebrahacha (*Krugiodendron ferreum*) (**Photo 3-16**).

Photo 3-15
PASTURE FIELD WITH TREES IN THE ZONE OF VERÓN

Photo 3-16
LIVESTOCK ACTIVITY IN THE ZONE OF VERÓN

Less abundant or frequent are: ceiba (*Ceiba pentandra)*; samán (*Samanea saman*); anón cimarrón (*Annona dumetorum*); palo de leche (*Rauvolfia nitida*); jabilla criolla (*Hura crepitans*); jabilla extranjera [*Aleurites fordii* (one individual)]; capá (Petitia domingensis); espino blanco (*Zanthoxylum martinicense*); espino amarillo (*Z. elefantiasis* and *Z. caribaeum*); caracolí (*Abarema glauca*); jobobán (*Trichilia hirta*), and sauna (*Ziziphus rignoni*) (**Photo 3-17**).

Photo 3-17
PASTURE FIELD WITH TREES AND CATTLE IN ACTIVITY

A few fruit trees remain after crop abandonment or occur in natural reproduction, such as bitter lemon (*Citrus aurantifolia*); bitter orange (*C. aurantium*); china (*C. sinensis*); and, mango (*Mangifera indica)*. Also found here are palm trees: corozo (*Acrocomia quisqueyana)*; palma de lluvia (*Gaussia attenuata)*; guano (*Coccothrinax argentea* and *C. barbadensis*); palma real (*Roystonea hispaniolana)*, and, cana (*Sabal domingensis*).

SCRUBLANDS OR FALLOWLANDS

This environment is found in several areas, occupying a large portion of the study area, but is mainly found in the vicinity of Punta Cana. Human activity took place in these areas, butthey are now abandoned. The arboreal vegetation is not established; the main species here are herbaceous plants, shrubs and vines.

Among the herbaceous plants, the most abundant or frequent are: yerba de guinea (Guines grass) (*Panicum maximum)*; molenillo (*Leonotis nepetifolia)*; panchita (*Leonorus sibiricus)*; juana la blanca (*Spermacoce assurgens*); bleo (*Amaranthus spinosus)*; moquito de pavo (*Celosia nitida*), and, aguacero (*Pilea microphylla)* (**Photo 3-18**).

Also present are: mastuerzo (*Lepidium virginicum*); yerba de agua (*Callisia repens*); yerba de leche (*Euphorbia heterophylla*); guáyiga (*Zamia debilis*); pata de conejo (*Paspalum fimbriatum*); natal or celadillo (*Melinis repens*); bruja (*Bryophyllum tubiflorum* and *B. pinnatum*); periquito (*Ruellia tuberosa)*; caimonicillo (*Rivina humilis*); anamú (*Petiveria alliacea*); túa-túa (*Jatropha gossypiifolia)*; alacrancillo (*Heliotropium angiospermum*); escoba (*Sida* spp.), and, algodón de seda (silk cotton) (*Asclepias nivea*).

Photo 3-18
GENERAL VIEW OF A SCRUBLAND

The principal bushes present include: tabacón (*Solanum rugosum)*; buzunuco (*Hamelia patens*); salvia (*Pluchea carolinensis*); mala mujer (*Cordia polycephala*); cafetán (*Psychotria nervosa)*; and, margarabomba (*Casearia aculeata*). The most abundant climbing species are: Jaquimey (*Hippocratea volubilis*); guatavo (*Ipomoea indica*); bejuco de indio (*Gouania lupuloides* and *G. polygama*); bejuco caro (*Cissus verticillata*); bejuco de costilla (*Serjania polyphylla*); morita (*Passiflora suberosa*); cascarita (*Stigmaphyllon emarginatum*); zarza (*Mimosa domingensis*)*;* bejuco de manteca (*Stigmaphyllon angulosum*); and, totico (*Centrosema pubescens*).

SMALL AGRICULTURAL FARMS

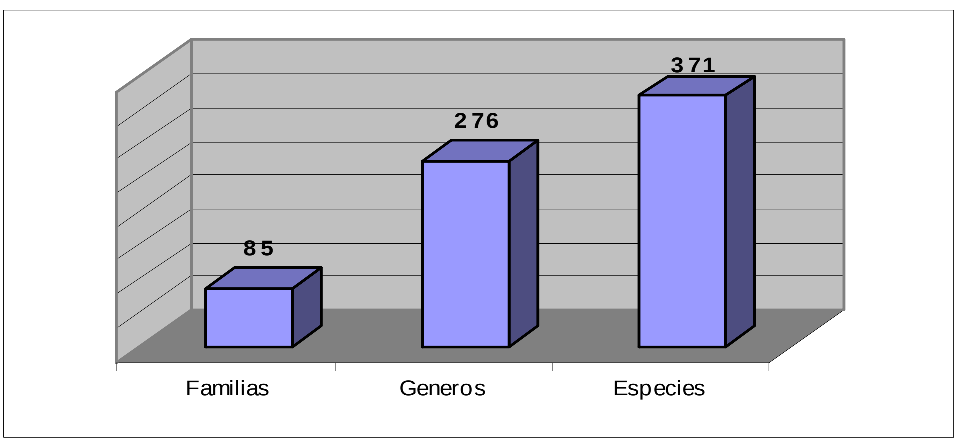
In the last section, there are small agricultural land properties or "conucos", which are cultivate mainlywith minor fruit crops. The main species are: plantain [*Musa paradisiaca (Musa* AAB*)]*; ñame (*Dioscorea alata*); yucca (*Manihot esculenta*); batata (sweet potato) (*Ipomoea batatas*); molondrón (*Abelmoschus esculentus*); and, guandul (*Cajanus cajan*). On some properties, there are fruit trees such as citrus (*Citrus* spp.) and avocado (*Persea americana*) (**Photo 3-19**).

Photo 3-19
A TYPICAL "CONUCO" IN THE ZONE OF VERÓN

Floristic Composition

The vascular flora within the study area is comprised of 371 species, belonging to 276 genera in 85 families (**Table 1 of Appendix 3-2 and Figure 3-11**). The families represented by the highest numbers of species are the following: Poaceae (Gramineous) with 29, Euphorbiaceae with 24, Asteraceae (Compositae) with19, Fabaceae with 14, Mimosaceae and Rubiaceae with 12 each, Malvaceae with 11, and Cyperaceae and Verbenaceae 10 species each (**Table 1 Appendix 3-2).**

FIGURE 3-11 Floristic Composition of Observed Species

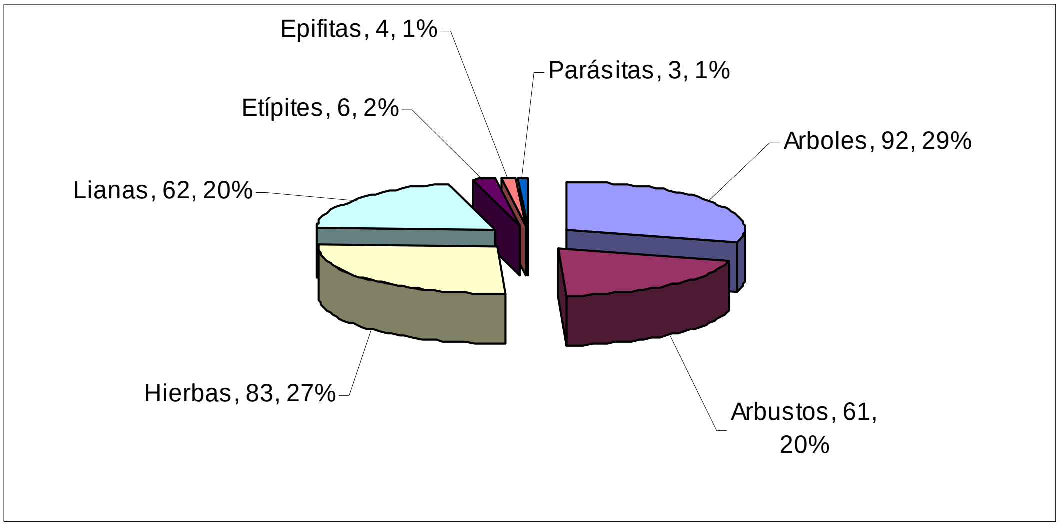


The fact that these families have greater numbers of species is an indicator of the conditions of the environments within the study area. Families such as Poaceae, Asteraceae and Fabaceae are characteristic of, or reach their greatest diversity in sunny, open and disturbed environments. In fact, the gramineous species are almost all heliophilous. The Malvaceae has many species, mostly of the *Sida* genus, which are typical of disturbed areas.

- *Biological Types*

The 371 species found are distributed as follows: 92 trees or arboreous, 143 herbaceous, 62 vines (climbing or reptant), 61 bushes or shrubs, 6 stipes or palm trees, 4 epyphites, and 3 parasitic (**Table 1 of Appendix 3-2 and Figure 3-12**).

FIGURE 3-12 Biological Types of Observed Species



The disturbed character of the coastal fringe is also evident here. The herbaceous species and vines, which are the groups that best represent open and sunny areas, represent 205 species, almost two thirds of the total. The climbing species grow in search of the sunlight. Although the percentage of arboreal species is significant, they are more abundant in the last section, as can be seen in Table 1 of Appendix 3.2, where the level of disturbance is lower.

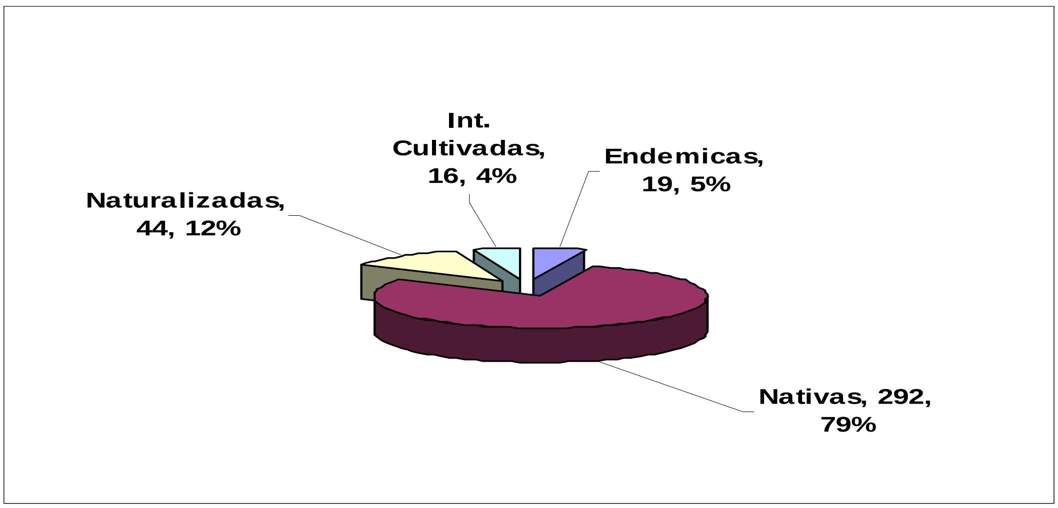
<u>Biogeographic Status</u>

According to their biogeographic status or original distribution, the species included in this report are distributed as follows: 19 are endemic to the Hispaniola Island; 292 are native; and, 60 are exotic or introduced, 44 of which are naturalized; the remaining 16 are under cultivation and depending on human intervention for their persistence (**Table 1 of Appendix 3-2 and Figure 3-13**).

Although the percentage of autochthonous plants (endemic and native) is high, it is notable that there are species introduced for different purposes, such as forage (several gramineous), ornamental or shade plants, edible, timber use and others. Weeds, such as ruderals are also present, and others that always accompany human activities, escape from cultivation and become naturalized and even invasive. This is the case with leucaena or lino criollo (creole flax) (*Leucaena leucocephala)*, which is invading almost all the ecosystems in Hispaniola and particularly in the Dominican Republic.

Among the cultivatedspecies, sugar cane (*Saccharum officinarum)*, dominates the floristic landscape in most of the study area, as well as the other edible species, planted in small agricultural farms or "conucos", such as yam(*Dioscorea alata*); yucca (*Manihot esculenta)*; plantain [*Musa* x *paradisiaca* (*Musa* AAB)]; guandul (*Cajanus cajan*); and, oregano (*Lippia micromera*); there are also a few arboreal fruits: avocado (*Persea americana*); mango (*Mangifera indica*); bitter orange (*Citrus aurantium*); bitter lemon (*Citrus aurantifolia)*; and, china or sweet orange (*Citrus sinensis)*. Some ornamental or shade trees are: casuarina or Australian pine (*Casuarina equisetifolia*); flamboyant (*Delonix regia*), and poppy (*Spathodea campanulata*).

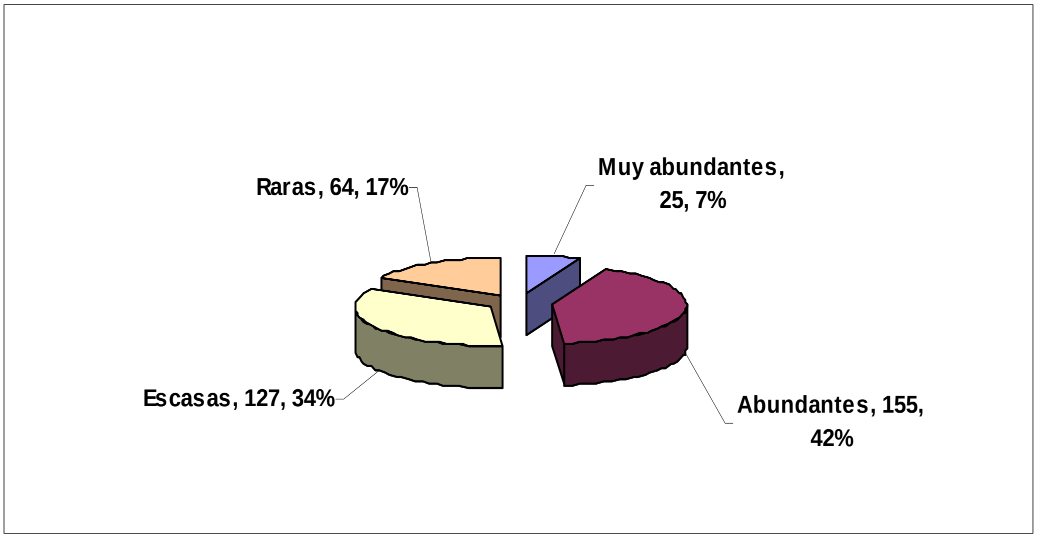
FIGURE 3-13 Biogeographic Status of Observed Species



Level of Presence or Degree of Abundance

The categories established here for the degree of abundance or levels of presence of species are: very abundant, abundant, scarce and rare. The criteria for determining the category of each species was field observation and comparison of the populations or richness of each taxon. These categories are only refer to the study site and do not necessarily apply to other zones or regions of the Dominican Republic or Hispaniola. A species that is rare in this area could be abundant in other areas, and vice versa. According to these criteria, there are 25 very abundant species, 155 abundant species, 127 scarce species, and 64 rare species **(Figure 3-14).**

FIGURE 3-14 Level of Abundance of Observed Species



Very abundant species include mainly the gramineous and other herbaceous species, vines and some bushes. Some arboreous species, such as those from the *Ficus* genus, have populations with high numbers of individuals. But, those with the highest abundance include: sugar cane (*Saccharum officinarum*), with extensive plantations; Guinea grass (*Panicum maximum*); bejuco Jaquimey (*Hippocratea volubilis*); guatavo (*Ipomoea indica*); and, some weeds.

The scarce and rare species include some exotic plants, such as puppy (*Spathodea campanulata*); mango (*Mangifera indica*); and, avocado (*Persea americana*). Scarce and rare species also include autochthonous species with very low populations, such as corozo (*Acrocomia quisqueyana*), palma de lluvia (rain palm) (*Gaussia attenuata*); cuero de Puerco (pig skin)(*Ottoschulzia rhodoxylon*); campanita criolla (*Cubanola domingensis)*; ceiba (*Ceiba pentandra*),; and, mahogany (*Swietenia mahagoni*), among others.

Endangered or Protected Plants

In the coastal fringe portion of the study area, there are 18 endangered or protected species, either by national legislation or by international conventions (**Table 1 of Appendix 3-2 and Table 3-20**). Among these species, there are six arboreal, four stipes or palm trees, two succulent shrubs, two herbaceous, two climbing vines, and two epiphytes. Five of these are endemic (**Photo 3-20**), 11 are native, and two are naturalized (**Table 3-20**).

TABLE 3-20 Endangered or Protected Species

Scientific Name	Common Name	Family	Tb	S	A/P
Agave antillarum	Maguey	Agavaceae	H	E	L
Annona dumetorum	Anón cimarrón	Annonaceae	A	E	L
Acrocomia quisqueyana	Corozo	Arecaceae	Et	E	L
Gaussia attenuata	Palma de lluvia	Arecaceae	Et	N	L
Roystonea hispaniolana	Palma real	Arecaceae	Et	E	L
Sabal domingensis	Cana, palma cana	Arecaceae	Et	E	L
Ceiba pentandra	Ceiba	Bombacaceae	A	N	L
Cereus hexagonus	Cayuco	Cactaceae	Ar-s	Na	C
Hylocereus trigonus	Pitajaya	Cactaceae	L	N	C
Pereskia aculeata	Cardón	Cactaceae	L	N	C
Pilosocereus polygonus	Cayuco	Cactaceae	Ar-s	N	C
Rhipsalis baccifera	Fruta de culebra,	Cactaceae	Ep-s	N	C
Ottoschulzia rhodoxylon	Cuero de puerco	Icacinaceae	A	N	L
Swietenia mahagoni	Caoba	Meliaceae	A	N	C,L,U
Broughtonia domingensis	Flor de mayo	Orchidaceae	Ep	N	C, L
Oeceoclades maculata	Lengua de suegra	Orchidaceae	H	Na	C
Guaiacum officinale	Guayacán	Zygophyllaceae	A	N	C,L
Guaiacum sanctum	Vera, guayacancillo	Zygophyllaceae	A	N	C,L

LEGEND:
TB = BIOLOGICAL TYPE: A = TREE, AR = BUSH, S = SUCULENT, ET = STIPE OR PALM, L = LIANA OR BEJUCO, H = HERB OR HERBACEOUS, EP = EPYPHITE.
S = BIOGEOGRAPHIC STATUS: E = ENDEMIC, N = NATIVE, NA = NATURALIZED
A/P = PROTECTION INSTRUMENT OR LEGISLATION: C = CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA (CITES), L = LIST OF THREATENED PLANTS IN THE DOMINICAN REPUBLIC, UICN = RED LIST OF THE INTERNATIONAL UNION FOR CONSERVATION OF NATURE.

Photo 3-20
MAGUEY, AGAVE ANTILLARUM; PROTECTED ENDEMIC SPECIES

Two naturalized -non autochthonous- species have been included (*Cereus hexagonus* and *Oeceoclades maculata*) among the protected species because the CITES Convention has included in its list the whole families of these two species, Cactaceae and Orchidaceae. But actually these plants are not threatened in the Dominican Republic, on the contrary, *Oeceoclades maculata* is expanding rapidly in the natural environment.

Photo 3-21
COROZO, ACROCOMIA *QUISQUEYANA*, PROTECTED ENDEMIC SPECIES

The list of endangered plants in the Dominican Republic, prepared for the Law Project on Biodiversity (Peguero et al., 2003) includes 12 of the species observed in this study, three of which are also found in the List of the Convention on International Trade in Endangered Species of Wild Fauna and Flora -CITES- (World Center for Conservation Monitoring, 1998) and one of them (*Swietenia mahagoni*), in addition to being on the National Red List and the CITES list, is also included in the Red List of the International Union for Conservation of Nature -UICN- (Walter et al., 1997). Six species are only in the CITES List, and they belong to the Cactaceae and Orchidaceae families.

Of these plants, those seriously threatened and that could be affected by the Project are: palma de lluvia (rain palm) (*Gaussia attenuata*) (**Photo 3-23**) and corozo (*Acrocomia quisqueyana*) (**Photo 3-21**). Only three individuals palma de lluvia (rain palm) were found; they are located exactly on the road centerline at the following coordinates: 555545 and 2053386, at K60+358 and situated 192m from the proposed road centerline (a mature, well developed individual, approximately 10 meters in height); 554606 and 2053315 at K 59+546 and 169 m away from the road centerline (two individuals about 3 meters high, apparently not yet bearing fruits). These locations were marked with colored tape.

Photo 3-22
CEIBA, CEIBA PENTANDRA, PROTECTED NATIVE SPECIES

Photo 3-23
IN THE MIDDLE, PALMA DE LLUVIA, *GAUSSIA ATTENUATA*, PROTECTED NATIVE SPECIES

This plant, known only in Puerto Rico, was discovered in the Parque Nacional del Este (Mejía, 2000). Other individuals have been found in the same zone, in the third section of the Autopista del Coral motorway.

This palm, seeming to inhabit a rare habitat, undoubtly used to be more abundant in the zone, but destruction, fragmentation and dissection of its habitat by different anthropic activities have caused a drastic reduction of its population.

The corozo (*Acrocomia quisqueyana*) is found in the first and the third sections of the proposed highway. This species, one of the most ornamental palms in Hispaniola, that until about two decades ago was very abundant, has also decreased in numbers rapidly for the same reasons indicated for the *Gaussia attenuata*.

The first section is between the Chavón River and Bayahíbe. In this zone the right-of-way has already been cleared; but there are some individuals that would be affected. However, in the second section no individuals were observed at area to be cleared; but if present route is changed there will be some individuals that can be potentially affected.

In the last section, other scarce and rare species exist that could be affected, such as cuero de Puerco (pig skin) (*Ottoschulzia rhodoxylon*); campanita criolla (*Cubanola domingensis*); guayacán (*Guaiacum officinale*); and, vera or guayacancillo (*Guaiacum sanctum*). *Ottoschulzia rhodoxylon* only exists in Hispaniola and Puerto Rico. In Puerto Rico, it was declared endangered many years ago, and in the Dominican Republic, except for this zone, is very rare. *Cubanola domingensis* is endemic to the Cumayasa-Macao karstic strip in the Eastern region, with a small disjunct population in El Choco, Sosúa, and Puerto Plata in the Northern region.

Guaiacum officinale (**Photo 3-24**) and *G. sanctum* are two native species, whose wood is in very high demand, because they are among the hardest in the world. Additionally, these plants have had medicinal usage since pre-Columbian times and when the conquerors arrived they extracted and took away large quantities from the country. The exploitation has continued, together with the destruction of the coastal forests where these plants grow. Some individuals of ceiba (*Ceiba Pentandra*) (**Photo 3-22**), which has a special protection, exist in vicinity of the road route, but it appears they would not be affected, unless there was a change in the route.

Photo 3-24
FOREGROUND, GUAYACAN, GUAIACUM OFFICINALE, PROTECTED NATIVE SPECIES

Swietenia mahagoni, which is the National Flower of the Dominican Republic, also known as famous caoba (mahogany) of Santo Domingo or caoba antillana (West Indies mahogany), whose wood was used for constructing palaces in Europe, has been also exploited due to the quality of its precious wood. Few individuals of this species are found in the highway route. Likely the only area where some of these specimens could be affected is the Higüey-San Rafael del Yuma crossing, where a row of these trees were planted in the 1970s on the East side when the existing road was constructed.

The other endangered or protected plants included in this report, such as palms, the Cactaceas and orchids, will be affected on a lesser extent, and also their degree of threat is lower.

<u>Synthesis</u>

Most of the area within the proposed route of the Autopista del Coral has been widely anthropized for many years. Its original vegetation was replaced by different human activities. Only the last section, in the coastal zone of Punta Cana, has some patches of vegetation, but these are mostly second growth.

Regarding ecosystems, there is none, except in the river crossings. The river crossings are highly sensitive and deserve special treatment. It is necessary to take pertinent measures to avoid unnecessary impacts, for instance, prohibiting vegetation clearing further than strictly required by the construction works.

There are some threatened or protected species that could be affected, especially in the first and third sections, as is the case of *Gaussia attenuate*. It is necessary to establish and implement the required measures to avoid their felling.

3.2.2 Fauna

Ichthyofauna

The proposed road corridor for the Autopista del Coral passes through some drainages that are mostly seasonal and hardly perceptible during rainy seasons. The main water courses with permanent flow and conditions for maintaining fish populations are the Chavón and Yuma Rivers (the last one also known as Duey River).

Review of data on the Dominican Republic's ichthyofauna and species' habits indicated the potential presence in these rivers of at least 38 fish species, 16 of which are introduced species. Of the remaining 22 species, 7 are endemic and the other 15 are native species.

Species introductions occurred at different times. Objectives of the introductions were control of insects or aquatic weeds, or aquaculture. The presence of such species in natural waterbodies are a consequence of the escape or release of fish embryo eggs or youngs from their artificial environments. These species have found appropriate conditions in the natural environment and have populated lotic environments. **Table 3-21** presents a list of potential species that can be found in the rivers of this region.

TABLE 3-21 Species Reported in the Chavón and Yuma (Duey) Rivers, in the middle and lower basins

Family	Scientific Name	Common Name	Status
Centrarchidae	*Lepomis auritus*		Introduced
Centrarchidae	*Micropterus salmoides*		Introduced
Cichlidae	*Cichla ocellaris*	Mojarra	Introduced
Cichlidae	*Oreochromis aureus*	Tilapia azul	Introduced

Family	Scientific Name	Common Name	Status
Cichlidae	*Oreochromis mossambicus*	Tilapia Mozambica	Introduced
Cichlidae	*Oreochromis niloticus niloticus*	Tilapia Nilo	Introduced
Cichlidae	*Oreochromis urolepis hornorum*	Tilapia Wami	Introduced
Cichlidae	*Tilapia rendalli*	Tilapia roja	Introduced
Cyprinidae	*Cyprinus carpio carpio*	Carpa Común	Introduced
Cyprinidae	*Hypophthalmichthys molitrix*	Carpa plateada	Introduced
Cyprinodontidae	*Cyprinodon bondi*	Hispaniola pupfish	Native
Cyprinodontidae	*Cyprinodon higüey*		Endemic
Cyprinodontidae	*Cyprinodon nichollsi*		Endemic
Characidae	*Colossoma macropomum*	Tambaqui	Introduced
Engraulidae	*Anchoa parva*	Anchoa	Native
Gobiidae	*Awaous banana*	Gob. de río	Native
Gobiidae	*Sicydium buscki*		Native
Gobiidae	*Sicydium gilberti*		Native
Haemulidae	*Pomadasys crocro*	Burro grunt	Native
Ictaluridae	*Ictalurus punctatus*	Pez gato	Introduced
Mugilidae	*Agonostomus monticola*		
Mugilidae	*Joturus pichardi*	Bobo	Native
Osphronemidae	*Betta bellica*	Betta	Introduced
Osphronemidae	*Betta splendens*		Introduced
Osphronemidae	*Trichogaster trichopterus*	gourami	Introduced
Poeciliidae	*Gambusia dominicensis*	Gambusia dominicana	Native
Poeciliidae	*Gambusia hispaniolae*	Gambusia hispaniola	Native
Poeciliidae	*Limia dominicensis*	Tiburon limia	Native
Poeciliidae	*Limia melanonotata*	Limia	Native
Poeciliidae	*Limia perugiae*	Limia	Endemic
Poeciliidae	*Limia sulphurophila*	Limia	Endemic
Poeciliidae	*Limia tridens*		Native
Poeciliidae	*Limia versicolor*	Limia de colores	Endemic
Poeciliidae	*Limia zonata*	Limia	Endemic
Poeciliidae	*Poecilia hispaniolana*	Hispaniola molly	Nativ
Poeciliidae	*Poecilia nicholsi*		Nativ
Rivulidae	*Rivulus roloffi*	Rivulus hispaniola	Endemic
Salmonidae	*Oncorhynchus mykiss*	Trucha	Introduced

Of the total species reported in the above list, thirty eight (38) species belong to sixteen (16) families and twenty four (24) genera. Some of the species are more typical of estuarine environments, although, in some occasions they may ascend through the rivers.

The *Poecilidadae* family is the most abundant, with the greatest number of species, the majority of which are native or endemic species; followed by the *Ciclidae* or mojarras family, which are introduced species.

Wild Fauna

The wild fauna is a very important component of the ecosystems due to their ecological functions. These functions include seed spreading, pollination, and control of other animal populations and maintenance of the vegetation structure, among others. Also, the wild fauna contributes to the species diversity in a region and it is utilized by human communities. Therefore, it is important to consider this component in the environmental impact assessment, especially when the proposed infrastructure works can temporarily or permanently modify the habitat.

The wild fauna involves all the animal species that have not been subject to domestication. In the context of the present evaluation, the term wild fauna refers to the terrestrial vertebrates, specifically amphibians and reptiles (herpetofauna), birds (avifauna) and mammals (mammalian fauna).

The objective of this study was to evaluate the wild fauna present and potentially occurring in the area of the Autopista El Coral (La Romana – Punta Cana) project. This evaluation includes species composition and diversity of amphibians, reptiles, birds and mammals, and a community approach to these groups. This study also analyzed the presence of endemic species or species with limited distribution and species with extinction risk or threatened.

Methods

The inventories of fauna were conducted according to rapid biological assessment methods (RAP) developed by Conservation International. RAP methods are useful for preliminary identification of areas or habitats with high biological richness, biodiversity variations along ecological gradients or vegetation mosaics, and zones of marked endemism. These techniques allow for standardization of the methods used for each group, maximization of the results obtained during short duration sampling, and they permit comparison, identification and selection, from a biological perspective, of priority areas for conservation, vulnerable areas, or areas with special ecological interest (Conservation International, 1991, 1993; Heyer et al., 1994).

Secondary data sources were also gathered and reviewed, including theses, technical publications and reports, and a faunal bibliography related to the insular and Caribbean ecosystems present in the study area, which is located within the biogeographic units Caribbean Coastal Plain and Cordillera Oriental (southern foothills), defined by Hedges (1999). Additionally, informal chats were held with inhabitants of the area in order to determine their level of knowledge, uses, vernacular names, and the local inhabitants' relationship with the fauna species present in this area.

Herpetofauna

The capture methods used included transects that were searched during daytime and nighttime (VES: Heyer et al., 1994), including manual capture for individuals and netting for immature forms (tadpoles); transects of variable lengths were search following pathways, vegetation borders and ecotones.

The inventory resulting from the field survey and the data obtained by means of interview and bibliographic consultation is presented as a catalogue, in which the supraspecific categories are organized according to the classification system used by Hedges (op cit.) for amphibians and Schwartz and Henderson (1991) for reptiles.

The analysis of the herpetological communities present in the study area took into account some biological aspects of the species found, such as the microhabitat, which was defined as the physical place location were species conduct the majority of their vital activities and spend most of their time.

Mammalian Fauna

Non-systematic surveys were conducted in different types of habitat looking for trails and traces (footprints, scats, burrows, feeding sites, etc.) indicating presence of mammalian species.

Avifauna

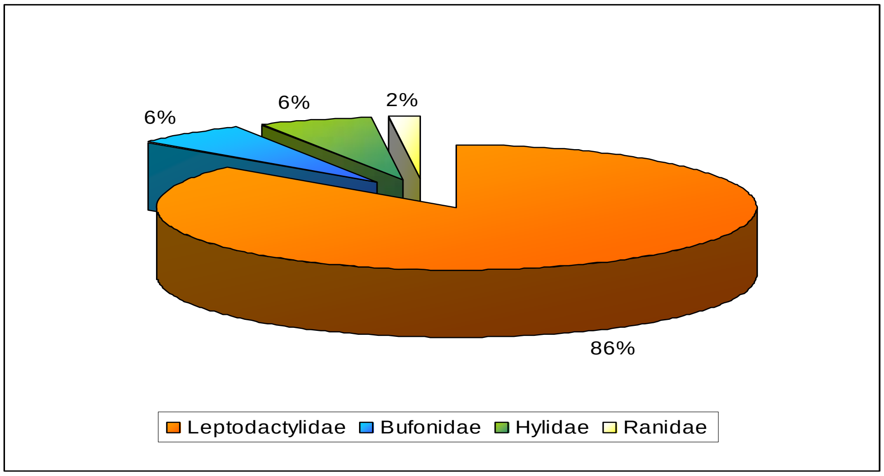
To detect birds, non-systematic searching was conducted at fixed points and line transects with variable width. These searches were carried out during morning and afternoon hours, using pathways, non-paved roads and ecotones as transects of variable length.

The birds observed were identified with the help of illustrated guides (Latta et al, 2006). For the analysis, the common names and nomenclature proposed thereof were used; the ecological parameters considered in the analysis of communities were assessed according to Latta et al, op cit and, Stotz et al., (1996).

- *Amphibians*

In Hispaniola (Dominican Republic and Haiti), 63 native and 2 introduced amphibian species have been reported to date. All the amphibians of the island belong to the Anura order (frogs and toads), dominant among them is the Leptodactylidae family with 86%, 6% is represented by species from the Bufonidae and Hylidae families, and the Ranidae, has only one species (**Figure 3-15).**

FIGURE 3-15 Percentage of Amphibian Families Present in La Hispaniola



The Leptodactylidae family is distributed throughout most of South America, North America and the Antilles. Duellman & Trueb (1986), suggest that the northern part of the Andes, like the Antilles, are secondary distribution centers of this family, especially the Eleutherodactylus genus, which, per Lynch (1986), is dominant in South America due to its abundant number of species, contributing more than 20% of the herpetological diversity of the Andes. In the West Indies (the Antilles) and specifically in Hispaniola, it is more remarkable because this genus represents nearly 85% of the island's amphibian fauna with more than 470 species.

The greatest species concentration on this island is found towards the Central and Western mountainous regions, in the biogeographic units of Massif de la Horte (32 species, 50% regional endemic), Massif de la Selle - Sierra de Baouruco (26 species, 39% regional endemic) and the Cordillera Central (20 species, 30% regional endemic).

According to Hedges (1999), the Project is located in the Caribbean Coastal Plain (Llanura Costera Caribe) and the southeastern portion of the Cordillera Oriental, characterized by being almost at the sea level, with a maximum elevation of 200 m.a.s.l.

In these regions, considering the known distributions for the amphibian species present on the island (Hedges, op cit., and Schwartz and Henderson, 1991), it is possible to find at least 13 taxa (20% of the island's amphibian fauna: Table 3-1), of which only two are endemic on the lower zones of the Coastal Plain : *Eleutherodactylus pictissimus* and *E. probolaeus*.

As expected, the percentage of exclusivity (regional endemism) of the species present in the lower zones is very low compared to the areas located in mountainous zones (e.g.: Cordillera Central: 39% regional endemic vs. Caribbean Coastal Plain: below 17%).

In this sense, of the amphibian species living in these two biogeographic zones (**Table 3-22**), that cover nearly the entire Eastern part of the island, only 3% of those considered as endemic are found exclusively in these regions, confirming the low regions' paucity not only in species richness but also in endemic fauna

TABLE 3-22 Amphibians reported for the biogeographic units where the Project is located

Family	Species	Biogeographic Unit	
		Cordillera Oriental	Caribbean Coastal Plan
Bufonidae	*Bufo guentheri*		X
Hylidae	*Hyla heilprini*	X	
	Hyla pulchrilineata	X	X
	Hyla vasta	X	X
	Osteopilus dominicensis	X	X
Leptodactylidae	*Eleutherodactylus abbotti*	X	X
	Eleutherodactylus flavescens	X	X
	Eleutherodactylus inoptatus	X	X
	Eleutherodactylus pictissimus		X
	Eleutherodactylus probolaeus		X
	Eleutherodactylus ruthae	X	X
	Eleutherodactylus weinlandi	X	X
	Leptodactylus dominicensis	X	

SENSU BIOGEOGRAPHIC UNIT: HEDGES (1999).

In the project's direct area of influence, during the field work verified the existence of six species of amphibians native of the island (**Table 3-23**) and two introduced species.

The Hylidae family (*Sensu lato*) is native in the Greater Antilles except in Puerto Rico. Among them, the Osteopilus genus is endemic to the West Indies (Antilles) and the *O. dominicensis* species is endemic to Hispaniola, where it is widely distributed from the sea level up to almost 1200 m.a.s.l (Schwartz and Henderson, 1991).

TABLE 3-23 Amphibians observed during the field survey

Family	Species	Common Name
HYLIDAE	*Hyla pulchrilineata*	Rana arborícola
	Osteopilus dominicensis	Rana arborícola
LEPTODACTYLIDAE	*Eleutherodactylus abbotti*	Calcalí
	Eleutherodactylus flavescens	Calcalí
	Eleutherodactylus inoptatus	Calcalí
	Leptodactylus dominicensis	Calcalí

The Hyla genus (*Sensu lato*) is widely distributed, especially in the Neotropic ecozone. Apparently, frogs from this genus living in the West Indies are more closely related to their Central American peers than to the South Americans, where the richnes of species is undoubtly greater. In the study area, the tree frog (*H. pulchrilineata*) was observed. This species is closely associated with permanent and occasionally temporary waterbodies, because all of the members of this family (at least the Caribbean ones), need this environment for eggs laying and larval development.

Among the terrestrial frogs present in this region is the calcalí (*Leptodactylus dominicensis*: **Photo 3-25**), the only representative of this genus on the island. It inhabits terrestrial environments and is moderately water dependent. Egg laying is generally in the form of a “foam nest” situated in surface excavations, close to temporary or permanent waterbodies. These nests, composed of a mucous secretion, provide the eggs with thermal stability, humidity, asepsy, and protection against predators during their development.

Photo 3-25
CALCALÍ (*LEPTODACTYLUS DOMINICENSIS*)

Eleutherodactylus is the amphibian genus with the greatest number of species and most widely distributed throughout the Caribbean. Many species are terrestrial; others are partially or predominantly tree species, especially those from the Eastern Caribbean (Puerto Rico and the Lesser Antilles).

This frog group is characterized by having direct development, that is, they don't pass through larval stages (tadpoles). Eggs are laid in moist microhabitats; typically on the fallen leaves, holes in rotting logs, or under rocks.

During field surveys the presence of three species of this genus was observed within the project's area of influence, all of them in the third section. All species are well known for being common and relatively abundant in the Caribbean Coastal Plain. An example of the environmental tolerance shown by all the recorded taxa is evident in the surface distribution estimated by Hedges (1999): *E. abbotti* occupies about 67,555 km^2, *E. flavescens* 22730 km^2 (**Photo 3-26**) and *E. inoptatus* 69.580 Km^2, which are, together with the tree frogs reported in this study (*Hyla pulchrilineata*: 35.500 Km^2 and *Osteopilus dominicensis*: 70.690 Km^2) the areas of amphibian distribution on the island.

Photo 3-26
CALCALÍ: *ELEUTHERODACTYLUS FLAVESCENS*, COMMON SPECIES AND WIDELY DISTRIBUTED IN THE CARIBBEAN COASTAL PLAIN -LLANURA COSTERA CARIBE-.

The two amphibian species introduced into the island were observed during the field study: the maco or bullfrog (*Rana catesbeiana*: **Photo 3-27**) and the maco pempén (*Bufo marinus*: **Photo 3-28**).

- *NOTES ON COMMUNITIES*

The concept of community suggests a group of populations living in a particular area and exploiting the existing resources and niches, assessed in terms of habitats, microhabitats, type of reproductive activity and/or diets. Since they are secondary consumers, the majority of the reported amphibian fauna (in adult status) eat insects and arthropods, which results in a marked overlap of trophic niches.

Photo 3-27
BULFROG: *RANA CATESBEIANA*, INTRODUCED SPECIES

Photo 3-28
MACO PEMPÉN (*BUFO MARINUS*)

Except for the exotic bullfrog (*Rana catesbeiana*), which is a predator that eats any kind of organism it can ingest (selection by size) such as fish, small birds, amphibians, invertebrates, etc., all of the amphibian species observed in the field survey have an arthropod based diet. Thus, at first sight a strong competition for this resource could be supposed, but this is attenuated by the space–time segregation, that is, one of the adaptations of the species for avoiding or eliminating these interactions is the differential occupation of niches concerning time and/or strata. For these reasons, amphibians are widely known as habitat specialists and good habitat indicators.

The niche partioning by presence alternation occurs mainly among terrestrial species with tree species. An example of spatial segregation is shown by the Hylidae species (*Sensu lato*), observed in the field survey: the tree frog *Hyla pulchrilineata* lives mainly in the middle and high strata of arboreal vegetation, while the *Osteopilus dominicensis* prefers the medium-low strata and bushes.

Among individuals of the terrestrial amphibian community such as *Bufo marinus*, *Leptodactylus dominicensis* and *Eleutherodactylus spp*., the segregation appears in the size of the prey they eat and the areas where they forage. The maco pempen is clearly terrestrial and due to its size; it is capable of eating medium to big preys in any type of environment, even in populated places. On the other hand, the *L. dominicensis* is also terrestrial but small, it consumes small insects at the ground level among the herbaceous and shrub vegetation (preferred habitat, due to its reproductive form) and the calcalies eat much smaller prey (due to their small size), and are typically found perched on grass or bushes at heights not greater than 1.5 m on average.

It is worth noting that in the project's direct area of influence, the predominant and most common community are the terrestrial amphibians, which are best represented in section three where there are still relicts of natural vegetation. Also, except for the maco pempén (*Bufo marinus*) that reproduces in temporary and seasonal ponds, the calcalíes, which do not depend on this environment for reproduction, use any type of environment and reproduce at almost any time of the year.

The hylidae and the bullfrog (Ranidae), depend on waterbodies to reproduce because they lay eggs in the water; for this reason, their presence in the study area is very localized and is limited to sections one and two to ecosystems associated with the Chavón and Yuma Rivers and their tributaries, in section three they are found near small permanent water sources such as Hoyo Claro and Hoyo Hondo, where they were observed during the field survey.

Endemic Species

All the amphibian native species of the island are endemic, most of these taxa area adapted to living in humid environments, preferably in mountainous zones and generally associated to broadleaved forests. Consequently, it is necessary to refine the endemism resolution up to the regional level. As noted before, two amphibian species are exclusive to the Coastal Plain: *Eleutherodactylus pictissimus* and *E. probolaeus*, neither of which was observed within the project's area of influence.

Threatened Species

Of the amphibian species reported from the island, 29 have been classified as endangered (EN: their populations have been reduced between 50% and 70% in the last decade), 20 are critically endangered (CR: between 80% to 90% of their populations have been reduced in the last decade), five are considered as vulnerable (VU: 50% of their populations have disappeared over the last 10 years) and one is considered extinct: *Eleutherodactylus semipalmatus*.

Review of the conservation status of the species reported for the project's area of influence, found that none of them is included in the above extinction threat categories, because all the taxa show extensive distribution areas and are common elements in the low lands of Hispaniola.

- *Reptiles*

In Hispaniola, about 170 reptile species have been reported, represented by the Orders Squamata (lizards, serpents and amphisbaenias), Testudinata (turtles) and Crocodylia (crocodiles). Among them, more than 70% are small lizards or lizards (lucías, geckos, mariguanitas, etc.), about 33 are serpent species, four are marine turtles and two continental turtle species, one species of crocodile, and seven species are amphisbaenids (Schwartz y Henderson, 1999).

Among the lizards (Squamata: Sauria), the richness of the Polychrotidae family stands out, with more than 50 species of the Anolis genus (29.5% of the insular reptile fauna). In the Western Antilles, where they are the most common and abundant reptiles, they are diurnal animals and live from the sea level to the high mountains in all type of environments, from very disturbed areas to dry forests, broadleaved and pine forests, and in all the available strata and microenvironments (from the ground to the overstory). The rain frogs (Eleutherodactylus) and the Anolis are the vertebrates generas with the highest number of species in the Antilles and almost at the world level.

Other important species belong to the Gekkonidae family (geckos: 26.4% of the island's reptiles) among this is the Sphaerodactylus genus with at least 35 described taxa (20.6% of Hispaniola's total). These small lizards possess crepuscular to nocturnal habits and, in general, occupy microenvironments associated with fallen leaves and/or rocks where they find shelter; this is why they are called fossorial.

Taking into account the known distributions of the species present in the Dominican Republic (per Schwartz and Henderson, 1999), 24 species are potentially present, representing 14 genera, 11 families and two Orders (**Table 2, Appendix 3-2**).

Two of the Orders present on the island are potentially present in the Project are: Testudinata and Squamata. The crocodiles, represented by the American crocodile (*Crocodylus acutus*) are currently found only in localized areas in the central and western parts of the island.

Proportionally to the island's composition, 63.5% of these species are lizards (Squamata: Sauria), the Anolis (Polychrotidae) represent 20% of the region, and geckos (Gekkonidae) represent 12.5% (**Table 1, Appendix 3-2**).

The group of taxa potentially present in the study area is characterized by being composed of species with broad distributions in the lowlands of the Dominican Republic and they are considered as common, and in some cases relatively abundant species in the Caribbean Coastal Plain. During field survey, nine reptile species were observed (**Table 3-24**) of which 66% were lizards. The Polychrotidae family is represented in the zone by four species, all of them very common and abundant, some, like *A. distichus* (**Photo 3-29**) and *A. cybotes* (**Photo 3-30**) are typical of open and disturbed areas.

TABLE 3-24 Reptiles observed during field surveys

Order	Sub-order	Family	Species	Common Name
SQUAMATA	Sauria	Polychrotidae	*Anolis baleatus*	Saltacoco
			Anolis cybotes	Lagartija común
			Anolis distichus	Lagartija común
			Anolis semilineatus	Lagartija
		Tropiduridae	*Leiocephalus personatus*	Mariguanita
		Teiidae	*Ameiva taeniura*	Lucía
	Serpentes	Colubridae	*Antillophis parvifrons*	Serpiente Sabanera
			Uromacer catesbyi	Culebra verde
TESTUDINATA		Emydidae	*Trachemys stejnegeri*	Jicotea

Photo 3-29
COMMON SMALL LIZARD: *ANOLIS DISTICHUS* (LEFT: MALE, RIGHT: FEMALE)

Photo 3-30
COMMON SMALL LIZARD: *ANOLIS CF. CYBOTES* (MALE)

Other species such as saltacoco (*Anolis baleatus*) prefer moderately conserved environments, because they live in medium and upper strata of natural vegetation; *Anolis semilineatus* (**Photo 3-31**) is common in shrub and understory, where they occupy the medium to low layers.

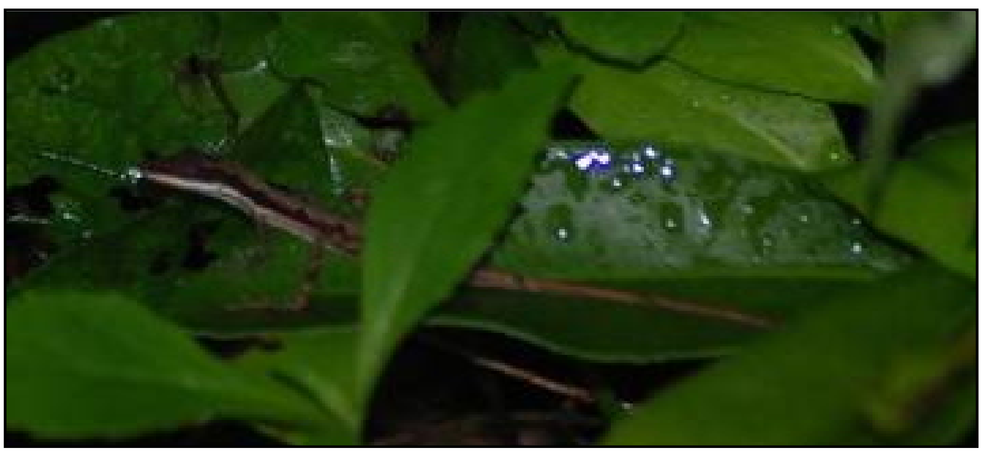


Photo 3-31 **COMMON SMALL LIZARD: *ANOLIS SEMILINEATUS***

Other terrestrial and heliophile lizards reported in open environments were the mariguanita (*Leiocephalus personatus*) and the lucía (*Ameiva taeniura*). Both are common and relatively abundant in the first and third sections of the project.

The savannah serpent (serpiente sabanera) is a common element in the eastern lowlands of the island; it was observed in section three of the Project, together with the green snake (culebra verde) (*Uromacer catesbyi*). These species are relatively abundant, according to data from inhabitants of the region. Similarly, the icotea turtle (*Trachemys stejnegeri*) was observed in the marshes neighboring Hoyo Claro and Hoyo Hondo (section three) where they were abundant decades ago.

Notes on Communities

The main groups of species observed in the field survey were classified according to their preferred microhabitat:

Terrestrial Communities

This community is characterized by conducting the majority of their activities on the ground. It includes four of the recorded species: the serpents and the lizards, *A. taeniura* and *L. personatus*.

The four species of this community are essentially diurnal, heliophilic and are active predators. During evolution, they have segregated by differentiating in the size and type of prey and the habitats they occupy. The serpents travel diverse habitats looking for different prey, of medium to large size, such as birds, lizards and eggs. The lizard luciass prefer open sites and eat insects and anthropods of smaller size, and the mariguanita (*Leiocephalus personatus*), searches for insects in the early morning hours among the fallen leaves and in holes.

Arboreal Communities

This community includes the group of species that evolutionarily have adapted to living, or at least conducting the majority of their activities in the trunks or foliage of shrub or arboreal vegetation. The more common morphological adaptations in the sauria are strong nails and scales widened in the abaxial part of the digits (Polychrotidae and Gekkonidae families, respectively).

Competition between this group of species is attenuated by the time-space distribution, since at the trophic level their niches considerably overlap, because they eat medium-to-large size insects.

Three of the four *Anolis* species (**Table 3, Appendix 3-2**) are diurnal and arboreal, and with small to large size; they stay active in thick trunks at low height where they search for insects. As mentioned above, *A. baleatus* prefers upper strata and thanks to their large size they are able to eat medium size prey.

The gecko (*Hemidactylus brooki*: **Photo 3-32**) belongs to this community and has a similar with forage strategy and similar habitat to the Anolis. The gecko is an introduced species that is currently common in the eastern lowlands of the Dominican Republic.

It is estimated that in the Dominican Republic (CAMP, 2000), three reptilian species are critically endangered (CR), one endangered (EN) and one is vulnerable (VU). None of the species recorded within the study area are considered as regional endemic or is categorized under any of the extinction threat criteria.

Photo 3-32
BECKO: (*HEMIDACTYLUS BROOKI)*

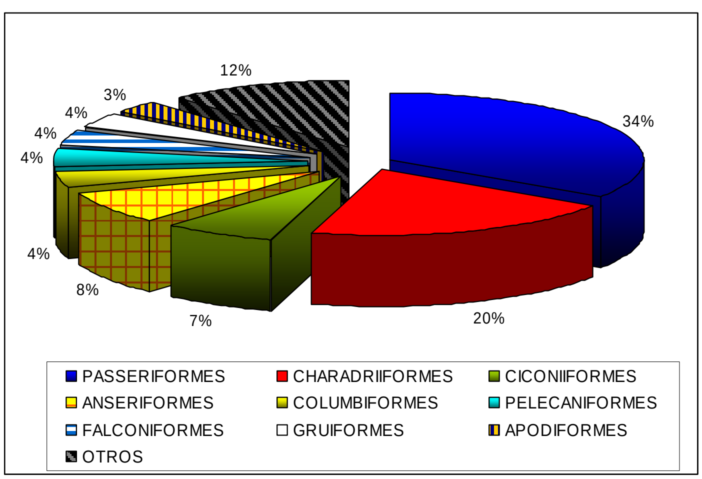
- *Birds*

A biodiversity status assessment is useful for identifying priority species and areas for conservation. Birds possess a series of characteristics that make them optimum indicators for conducting inventories of the majority of their communities and provide reliable information to characterize ecosystems and their habitats..

The contribution of Hispaniola to global biodiversity has been acknowledged in the world bird protection priority with a high rank (Stattersfield et al., 1998). In general, the problems for bird conservation on the island are identical to those that are widely known and discussed: natural habitat loss and habitat degradation due to diverse factors of anthropic origin.

The most recent review of the avifauna of Hispaniola (Latta et al., 2006), acknowledges the presence of 306 bird species, of which practically 100% occur in the Dominican Republic. Among them, and coinciding with the expected composition at the Order level for insular and Caribbean territories, there is a broad dominance of the Passeriformes (Sensu lato), with approximately 34% of the nation's taxa (**Figure 3-16**).

FIGURE 3-16 Percentage Distribution of Bird Orders in Hispaniola



A great portion of the passerine (at least 40 species) species belong to the Parulinae subfamily, a group of migrants common and abundant in the Caribbean islands, principally in the northern Antilles where their occupation is usually greater in taxa and individual numbers. According to Stotz et al (1996), the passerine migrants are disproportionally concentrated in Central America and the West Antilles.

A significant group is composed of birds closely associated with water, in this case, with coastal ecosystems such as beaches, coastal lagoons, mangroves, and to a lesser extent, rivers and tributary streams. Altogether, this group comprises 43% of the regional avifauna and it includes representatives of the following Orders: Charadriformes (beach birds and plovers), Ciconiformes (herons and similar), Anseriformes (ducks), Pelecaniformes (pelicans, tendrils and bubíes) and Gruiformes (Coots and bronze-winged jacana): **Table 2 - Appendix 3-2 and Figure 3-14**.

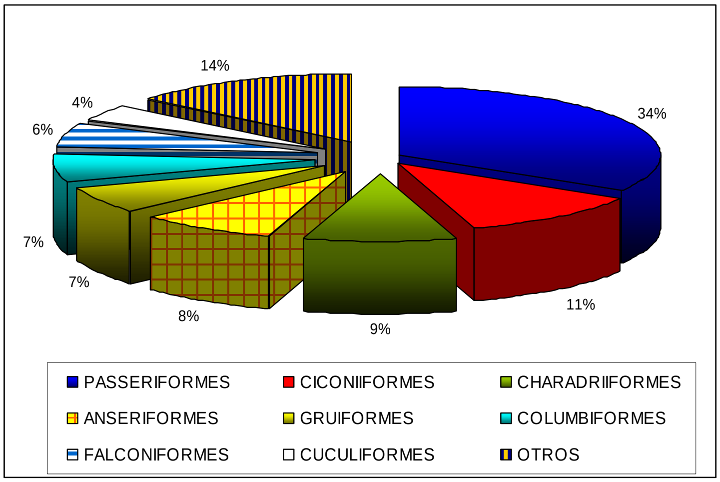
Aquatic birds are considered poor indicators of the condition of the ecosystems they occupy, due to their ability to live in many environments and their great tolerance to water conditions and, to a lesser extent, to water-related habitats.

For these reasons they possess an extraordinary colonization capacity and in general, they have wide distribution; consequently, their endemicity levels are extremely low compared to the group of birds associated with terrestrial environments, especially the middle and high lands.

Taking into account the distribution of bird species present in Dominican Republic, it is estimated that within the project's direct area of influence there are potentially 106 wild bird species: of which, 70 are reproductive residents, 8 are passing migrants, 26 are non-reproductive visitors and 2 are reproductive visitors (**Table 3, Appendix 3-2**). This group is represented by 15 Orders, 34 families and 75 genera; five species are classified as threatened and eleven are considered endemic (**Table 2, Appendix 3-2**).

As mentioned before, the Project is in the biogeographic units of the Cordillera Oriental (southeastern foothills) and Caribbean Coastal Plain. In these regions, although the waterbodies are not numerous, aquatic birds are still present in the regional composition (**Figure 3-17**); this can be seen in the structure at the Order level, since the Ciconiformes, Caradriformes, Anseriformes and Gruiformes constitute 35% of this region's potential avifauna.

FIGURE 3-17 Distribution of bird Orders present in the project's area of influence



A similar percentage is represented by the Paseriformes and, among them, the Parulinae predominate with nearly 50% of this Order. Similarly, at the insular and national levels, this composition is typical of the lowlands where deciduous and dry forests and scrublands predominate. The higher representation of non-passerine birds, such as the pigeons (Columbiformes), birds of prey (Falconiformes) and pájaro bobo (Cuculiformes), indicate that most of the available habitats are terrestrial environments.

In the study area, natural habitat loss is due to implementation of extensive cultivation areas, conucos (small farms) and pasture fields for grazing. Thus, the species richness and diversity have been significantly reduced. The bird population is composed mostly of generalist species, with wide distribution and high tolerance to disturbed environments.

Table 4, Appendix 3-2 presents a list of the species observed in the field study. The presence of 50 species representing in 44 genera, 17 families and 12 orders were verified. At this level, the dominance of species typical of terrestrial environments is most evident, because only eleven taxa associated with aquatic environments were observed. This result is due, undoubtedly, to the almost total absence of wetland ecosystems along the project route; except for some remaining along the main rivers, such as the Chavón and the Yuma Rivers and a few tributaries.

<u>Notes on Communities</u>

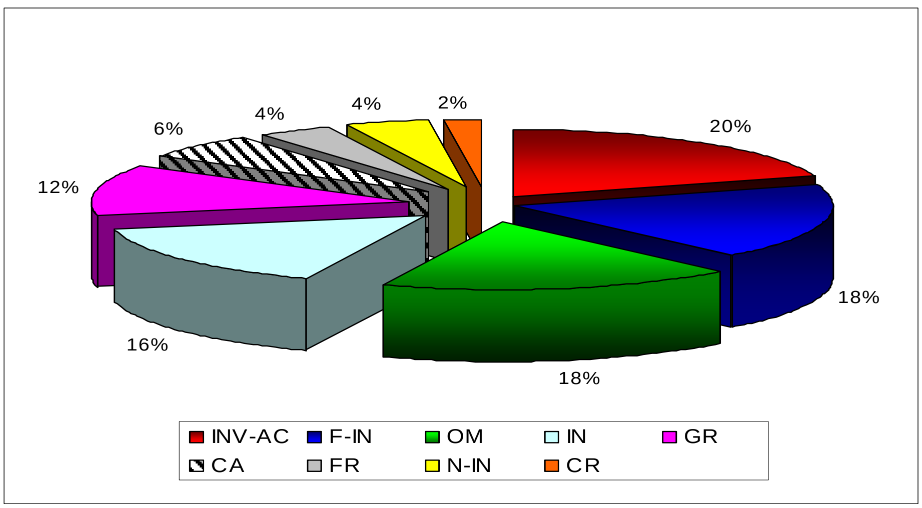
Trophic Guilds and Foraging Strategy

Trophic guilds are groups of closely related (phylogenetically or not) species, that are artificially established according to the way they use a food resource. The structure and natural composition of the ecosystems (fauna and flora) and their conservation status, determine the availability of resource variety and abundance. These factors, combined with the natural history of the species, directly affect a community's composition at the level of the trophic guild and foraging strategy.

Removing the original vegetative cover of an area creates changes in the structure and composition of both the vegetative communities and the animals living there; then, one of the short term consequences is that the disturbed zones are colonized by species with "generalist habits", while the "specialist" populations are negatively affected by the quick depletion of the resources that they are able to use.

For the purpose of this study, the foraging guilds were defined generally, grouped mainly by the type of food consumed and preference. The foraging techniques are discussed in some cases. The analysis was conducted only for the group of species observed during the field survey (**Table 4, Appendix 3-2, and Figure 3-18**).

FIGURE 3-18 Foraging guilds defined for birds present in the study area



INV-AC: AQUATIC INVERTEBRATES; F-IN: FRUGIVORES – INSECTIVORES; OM: OMNIVORES; IN: INSECTIVORES; GR: GRANIVORES; CA: CARNIVORES; FR: FRUITS; N-IN: NECTAR – INSECTS; CR: CARRION.

The group that is best represented in the regional avifauna is that of the aquatic invertebrates consumers (INV-AC: 20%); it is comprised by birds associated with waterbodies. As previously indicated, this is common in areas close to wetland ecosystems with predominance of birds of the Orders Ciconiformes, Charadriformes, Anseriformes and Gruiformes (**Table 4, Appendix 3-2**).

In the study area, this trophic community is well represented in section 1, locally in the Chavón and Yuma Rivers and partially in the small tributaries.

The main diet was considered to define the guild, however, numerous species show variations in the resource and foraging strategy that permit attenuating possible competition. Some examples are:

A few herons (Ardeidae) also eat small vertebrates such as fish and amphibians, capture in shallow and clear waters. The Cra crá (*Butorides virescens*) prefer to stay in areas with tall aquatic vegetation, contrasting with those that use open areas and even less flooded areas such as grazing and pasture fields, like the cattle heron (*Bubulcus ibis*), etc.

With a beak shape developed during the evolution process for removing soft mud and consuming crustaceans, the coquitos (Threskiornithidae: *Eudocimus albus*) are among the most common and abundant aquatic birds in the region. Although they are found in the main water bodies, they prefer flooded areas.

With the exception of the búcaro (*Burhinus bistriatus*), the Charadriformes reported in the area (**Table 4, Appendix 3-2**), are a species group that eat mainly in vegetation-free beaches, where they wading and search for invertebrates and small crustaceans carried by currents and waves.

Some species, though not insectivores, also consume the available soft fruits; this is common among the migratory Passeriformes (Parulinae). In the study area, 18% (nine of the observed species) belong to this guild. They are represented by the cigüitas (*Parula americana, dendroica discolor, D. palmarum, Seiurus motacilla, Vireo nanus and Geothlypis trichas*) and (warbler) reinita (*Protonotaria citrea*).

The cuatro ojos -black-crowned palm-tanager- (*Phaenicophilus palmarum*: Thraupinae, **Photo 3-33**) is basically a frugivore, although it also eats seeds and is an active insect hunter.

Photo 3-33
CUATRO OJOS (*PHAENICOPHILUS PALMARUM*: THRAUPINAE

The guild defined as insectivores (IN) includes all the species observed in the area that eat mainly insects and that catch them in areas different from the aquatic environment. This group represents 16% of the regional avifauna (eight species: **Figure 16, Appendix 2**), and is composed mainly of taxa of the Passeriformes and Piciformes Orders, typical of areas with a high degree of deforestation.

The flycatcher (Tyrannidae: 38% of the guild) stands out among the Passeriformes. Although some studies describe the foraging strategies of this group, it can be said that, in essence, they fly through the medium to high layers; generally stay on a perch from where they watch and, catch their prey (small and medium size insects) on the fly and then come back to same place. It is a bird group that is very conspicuous, abundant, generally solitary and typical of open and disturbed environments, to which they adapt successfully.

Various taxa get their food mainly in the understory and canopy of the remaining vegetation patches, for instance the woodpeckers (Picidae: *Melanerpes striatus*, **Photo 3-34**) and the barrancolí (*Todus subulatus*: Todidae).

Photo 3-34
WOODPECKER (*MELANERPES STRIATUS*), MALE

Among the most specialized of this trophic guild are the barn swallow (*Hirundo rustica*: Hirundinidae) and the palm swift (*Tachornis phoenicobia*: Apodidae), which use their wide mouths to catch insects on the fly; that is why they are normally segregated as “aerial”. A similar strategy is used by the Don Juan (*Caprimulgus carolinensis*), which in addition to possessing a very wide mouth cavity, also uses long barbicels to catch insects on the fly under bad lighting conditions, since it has crepuscular and nocturnal habits.

Nine species (18% of the recorded avifauna) are considered omnivores (OM: Figure 3-16). Among them, the icterides predominate, including the cowbird (*Molothrus bonariensis*), the Greater Antillean Grackle (*Quiscalus niger)* and the Greater Antillean Oriole (*Icterus dominicensis*: **Photo 3-35**), which successfully use various resources: plant material, fruit, insects, and small vertebrates. This condition has permitted various species, such as those observed in the field survey to benefit from human activities and extend their activity areas; therefore, they are common, relatively abundant and above all, very conspicuous.

Another important group in this guild is comprised of the pájaros bobos (*Coccyzus americanus*, *Saurothera longirostris*: **Photo 3-36**) and the Smooth-billed Ani (*Crotophaga ani*: **Photo 3-37**), which are species typical of deforested environments, with terrestrial and arboreal habits. In the study area they were classified as very abundant.

Photo 3-35
GREATER ANTILLEAN ORIOLE (*ICTERUS DOMINICENSIS*)

Photo 3-36
PÁJARO BOBO: *SAUROTHERA LONGIROSTRIS*

Photo 3-37
SMOOTH-BILLED ANI (*CROTOPHAGA ANI*)

This guild also includes the double-striped thick-knee (*Burhinus bistriatus*: Burhinidae) which is considered as treatened by extinction, partly because it nests is laid at soil level and is predated by ferrets.

The guild of Granivores (GR: Figure 3-16) includes those species that consume mainly naked seeds and it is represented in the area by six species. These birds generally forage in open zones and pasture fields, many of them are terrestrial and generally look for their food on the soil and herbaceous layers. This guild is composed mainly of species of the Columbidae family (*Patagioenas leucocephala*: white-crowned pigeon, *Zenaida aurita*: Zenaida dove, *Z. macroura*: mourning dove and *Columbina passerina*: common ground-dove) and Emberizinae (*Tiaris bicolor*: black-faced grassquit and *T. olivaceus*: yellow-faced grassquit), which also play an important role in the ecosystem as seed dispersors.

In the study area it was determined that 6% of the bird species (3 bird species) are active predators of small vertebrates, mainly. They are considered as CA (Carnivores: Figure 3-16) and may be divided as diurnal and nocturnal predatory birds:

The diurnal predators include two species typical of open and disturbed areas; the American kestrel (*Falco sparverius*: **Photo 3-38**) a generalist predator and opportunistic consumer of almost anything edible , and the red-tailed hawk (*Buteo jamaicensis)* which is an active predator of many insect varieties and small vertebrates.

Photo 3-38
AMERICAN KESTREL (*FALCO SPARVERIUS*), MALE

The nocturnal predators are represented in this region by the barn owl (*Tyto alba*: Tytonidae).

Frugivore birds are usually indicators of environmental degradation because their presence or absence indicates the quality of the habitat where they can take the basic resources for their feeding (Naranjo, 1994). This group has spatial differences in fruit abundance and are susceptible to the absence of fruit; consequently, a low representation from this guild may indicate unavailability of resources in time, due to the phenological cycle of plants or disappearance of resources due to environment disturbance. On the other hand, frugivore species, especially birds, play an important role in forest stability, because they disperse the seeds of many plants they feed on..

In the study area, only two bird species were observed (10% of total) that are essentially fruit eaters; it is worth noting that this is an unusually low result, typical of regions where the forest cover percentage is very low compared to that of open and very disturbed areas. The first species is the Hispaniolan parrots (Psittacidae family), which specialize in eating fruits and hard seeds they can open with their strong beaks.

It is worth remarking that various groups of this species (*Amazona ventralis*: **Photo 3-39**) were observed within the study area because, according to the distribution given by Latta et al., (2006), Hispaniolan parrots occurrence is rare or occasional and in the southeastern region of the island it only appears in the relict forests of the East National Park. As stated previously, these are individuals or groups that travel a great distance to obtain food resources. It is likely that those Hispaniolan parrots found in the study area occupy zones neighboring East National Park where they are reported as abundant.

Photo 3-39
HISPANIOLAN PARROT: (*AMAZONA VENTRALIS*), ENDEMIC SPECIES AND REGARDED AS THREATENED WITH EXTINCTION

The other species, the palm chat (*Dulus dominicus*: Dulidae), is very common, abundant and has few specific ecological requirements. It, in general, adapts itself well to open sites and even to populated areas (Photo 3-40).

Taking into account the plant-bird relationship, it is said that co-evolution among some groups gave rise to specialization. One of the most recognized specialized groups is the hummingbirds that have specialized on eating the nectar of some flowers, creating an almost exclusive trophic category. Hummingbirds are very important due to the close relationship they maintain with plants as effective pollinators. Four percent of the avifauna observed in the field survey belongs to this category (Trochilidae) and, although they are essentially nectarivores, occasionally they eat small insects (**Photos 3-41 and 3-42**).

The so-called turkey vulture (*Cathartes aura*: **Photo 3-43**) of the Cathartidae family represents the taxa on the island with excellent scavenging habits (2% of the total observed). This species exhibits one of the more specialized trophic strategies and is situated in the highest hierarchy of the food chain because it has no competitors. Turkey vultures are a common species, relatively abundant and occupy extensive habitat use areas and distribution areas.

All the guilds considered, except for the bird species associated to aquatic ecosystems, are well represented in sector three of the project because in the middle of lands prepared for livestock grazing and in a lesser percentage for agriculture, relicts of vegetation such as scrublands and dry scrublands are found, which offer some habitat conditions for those avian communities.

Photo 3-40
PALM CHAT (*DULUS DOMINICUS*: DULIDAE)

Photo 3-41
VERVAIN HUMMINGBIRD (*MELLISUGA MINIMA*)

Photo 3-42
ANTILLIAN MANGO (*ANTHRACOTHORAX DOMINICUS*)

Photo 3-43
TURKEY VULTURE (*CATHARTES AURA*)

In section two, where sugar cane cultivation predominates and occupies most of the study area (approximately 75%), some avian communities are poorly represented. Even guilds such as the insectivores that tolerate environmental degradation exhibit small populations and communities with low species richness. In this extensive zone, remaining natural vegetation is scarce or non-existent, and when present, are extremely poor examples of gallery forest. These are found mainly along small streams and tributary rivers, which offer very few resources and scarce possibility for settlement of trophic chains of medium complexity.

As could be expected, in these areas with a lack of resources, the communities of frugivores, frugivore–insectivores, nectarivores and carnivores, are not represented. Concerning granivores, incidental reports of individuals from declining populations might occur.

Introduced Species

In addition to the 50 wild species observed, eight bird species introduced on the island with reproductively active populations were also observed in the area of interest (**Table 3-25**).

TABLE 3-25 Introduced bird species observed in the project area

Family	Species	Common Name
Phasianidae	*Gallus gallus*	Gallina
	Numida meleagris	Guinea
Odontophoridae	*Colinus virginianus*	Codorniz
Columbidae	*Columba livia*	Paloma doméstica
Ploceidae	*Ploceus cucullatus*	Madam sagá
Estrildidae	*Lonchura punctulata*	Cigüita pechijabao
	Lonchura malacca	Monjita tricolor
Passeridae	*Passer domesticus*	Gorrión doméstico

Those belonging to the Estrilidae and Passeridae families constitute feral populations, which are common and numerous in the lowlands. Some species, such as the nutmeg manakin (*Lonchura punctulata*), invade crops as well as outcompete and displace some native species.

Endemic Species or Species with Restricted Distribution

Regarding biodiversity conservation, endemism is an important criteria, because species with restricted distribution ranges are more susceptible to extinction. In the case of birds, an endemic species is a species that is restricted to a 50.000km range (Stattersfield et al, 1998). Consequently, disruption or disturbance to ecosystems from human activities within these ranges makes endemic species particularly vulnerable.

It must be also considered that within this group it is possible to find species with very specific ecological requirements that depend on a particular habitat and therefore are more likely to be vulnerable to extinction.

To identify priority areas for bird study and conservation, a series of regions or zones have been delineated, which are known as Endemic Bird Areas –EBA-. They are defined as spaces containing the nesting ranges of at least two endemic species or species with restricted distribution. A large number of the EBAs are found in tropical countries, which harbor the majority of species with restricted distribution that are threatened or have a high risk of extinction (Birdlife International, 2006).

According to Latta et al., (2006), in Hispaniola and adjacent islands 31 endemic species are present, and per Dickinson (2003) and Keith et al (2003), 50 endemic subspecies are known from these areas. Although the concept of a subspecies is not universally accepted, it is useful as a measure of the species' geographic variation and, consequently, of their special features (expressed in phenotype). Subspecies designation gives special importance to such populations in terms of conservation.

Within the project area, eight bird species were observed (**Table 3-26**) with distributions restricted to Hispaniola. All of them, except the Hispaniolan parrot (cotorra) can be considered as common and even abundant elements in the island's lowlands.

TABLE 3-26 Endemic bird species observed during the field survey

Order	Family	Species	Common Name
PSITTACIFORMES	Psittacidae	*Amazona ventralis*	Cotorra
CUCULIFORMES	Cuculidae	*Saurothera longirostris*	Pájaro bobo
CORACIIFORMES	Todidae	*Todus subulatus*	Barrancolí
PICIFORMES	Picidae	*Melanerpes striatus*	Carpintero
PASSERIFORMES	Tyrannidae	*Contopus hispaniolensis*	Maroíta
	Thraupinae	*Phaenicophilus palmarum*	Cuatro ojos
	Vireonidae	*Vireo nanus*	Cigüita juliana
	Icteridae	*Icterus dominicensis*	Cigua canaria

The presence of the broad-billed tody (*Todus subulatus*) is worth noting because this is a monotypical family in genus and species, which gives it an important singularity. Although its usefulness has been broadly discussed, it has the advantage of being very tolerant to deforestation and even using such areas to extend its distribution and increase its local populations.

Migratory Birds

The Neotropical migratory birds are those species from the western hemisphere that reproduce north of the Tropic of Cancer and spend the winter season south of this line (Rappole et al, 1993). The majority of these birds are songbirds (passeriformes in general), but can also be coastal, predatory and aquatic birds.

The bird migration phenomenum occurs due to food abundance, to avoid the seasons or places in which resource are scarce due to the winter season in the northern countries (Birdlife International, 2006).

These birds have a very complex life cycle, because they must exploit geographicaly separated habitats in order to survive and reproduce. This may increase their reproductive potential, but it also increases the possibility of exposure to multiple environmental and anthropic hazards at the sites they visit and during their travels (Degraaf R. & Rappole J. 1995).

The presence of three species of plovers and sandpipers (Scolopacidae) in this group is remarkable. During migration these species may form large groups, but in their environments they are solitary or in small groups.

Six species were observed in the field survey that are considered residents of the Dominican Republic but which, to date, have not been observed reproducing on Hispaniola (**Table 3-27**).

TABLE 3-27 Migratory bird species observed in the field survey

Order	Family (S)	Species	Common Name
CAPRIMULGIFORMES	Caprimulgidae	*Caprimulgus carolinensis*	Don Juan
PASSERIFORMES	Parulinae	*Parula americana*	Cigüita parula
		Dendroica discolor	Cigüita de los prados
		Dendroica palmarum	Cigüita palmar
		Seiurus motacilla	Cigüita del río
		Geothlypis trichas	Cigüita enmascarada

Additionally, four observed species are considered as passing migrants (Latta et al., 2006), that is, they migrate to the Hispaniola seasonally and generally do not live on the island for long periods of time. Among them there are three sandpipers and a swallow (**Table 3-28**).

TABLE 3-28 Passing migratory birds observed during the field survey

Family (S)	Species	Common Name
Charadriidae	*Tringa melanoleuca*	Patas amarillas mayor
Scolopacidae	*Tringa solitaria*	Playero solitario
	Actitis macularius	Playerito manchado
Hirundinidae	*Hirundo rustica*	Golondrina cola de tijera

Threatened species and with extinction risk

The main threats to avifauna are deforestation, expansion of the agricultural and livestock frontier, and urbanization (Latta et al., 2006; Keith et al., 2003; Ottenwalder, 1999). Other threats are hunting and ornamental uses. Currently, other threats also being discussed and proposed are pollution of aquatic ecosystems and proliferation of invasive and/or introduced species.

According to a compilation by Latta et al., (op cit.), 38 of the bird species present on the island are considered under some type extinction threat criteria. Of particular concern is that nearly half of the endemic species are regarded as threatened by extinction.

Within the project's area of influence, two species classified as threatened were observed: the double-striped thick-knee (*Burhinus bistriatus*: Burhinidae) and the Hispaniolan parrot (*Amazona ventralis*: Psittacidae).

- *Mammals*

Approximately 37 mammals species are estimated to currently live in Hispaniola, which makes this group less represented in the island's fauna. Among them, there are only a few studies for those with aquatic habitats (Order Sirenia: Manatees, and Order Cetácea: dolphins and whales), and terrestrial habitats (Order Insectivore: Solenodon, and Order Rodentia (Jutía). It is surprising the incipient data available on Chiroptera (bats) that constitute almost 50% of the mammal species in the island (Alvover et al., 1998; Tejedor et al., 2005; Iturralde-Vinent y MacPhee, 2006).

Bats are the only mammals exclusively adapted to flying. They have a close phylogenetically relationship to primates, because both groups possess slow evolutionary rates associated with their longevity, birth breeding, two axillary mammary glands and a long postnatal growing and learning period for breed (parental care). All bats are nocturnal and they use a great variety of diurnal shelters, including dense foliage, holes and cavities in fallen trees, natural caverns and cracks, tunnels, and house roofs. They have an amazingly varied diet, which includes insects, arthropods, small vertebrates (frogs, fish, lizards and small mammals), fruits, pollen, nectar, etc.

In Hispaniola, bats are represented by the following families: Noctilionidae, Mormoopidae, Phyllostomidae, Natalidae, Vespertilionidae and Molossidae.

The Phyllostomidae family is known only from the Neotropic. The first fossils appeared in the Late Miocen and they were very diverse during the Quaternary. They are usually common elements with abundant populations in the lowlands. Within the study area it is possible to find at least three species that possess broad distributions and are typical of moderately conserved to very disturbed environments: the frugivore, *Artibeus jamaicensis*, and the insectivores, *Macrotus watterhoussi* and *Monophyllus redmani*.

3.3 Social-Economic Environment

This section describes the social characteristics currently observed in the area of influence of the proposed road corridor for the Autopista del Coral and its associated construction works, such as distributors, camp zones and material sources. This aspect incorporates an interdisciplinary and integrated concept of the environment, evaluating the human environment conditions and its interaction with the natural environment elements which may potentially be disturbed by the Project.

3.3.1 Social-Economic Aspects

The social aspect integrates and updates the elements of anthropic origin present in the zone of interest in order to determine and assess those elements that might be affected by the construction of the Autopista del Coral or those require change or improvement based on the social management; this constitutes the social management plan.

The social area of influence was defined considering the location of the road corridor for the Autopista del Coral (La Romana – Punta Cana Highway). Thus, the area of influence is: regional area (the political and administrative zone of the provinces where the project will take place); local area (includes the towns or provincial capitals close to the road corridor's route where some kind of interaction will likely occur with the different project phases), and, direct area (refers to the surface of land that will be used by the road corridor and to locate the construction camps).

Methodology

The methodology used for this work included the following activities:

- Delineation of social interest area for the study based on the project scope and review of mapping and secondary data, which was validated with field visits.

- Direct observation of ecosystems, landscapes and social dynamics.

- Collection and review of secondary data from public and private institutions, at the regional and national levels.

- Identification and interviews with "key informants" in the zone of interest, including merchants, the Mayor, teachers, community leaders, and religious or business leaders, among others.

During field visits to the project's social area of influence, a previously prepared field guide was used to direct data collection during the interviews of "key informants". The list of informants and the guide for field data collection is included in **Tables 5 and 6, Appendix 3.2.**

Social Characterization

This section seeks to characterize the demographic, political, economic, cultural and infrastructure aspects of the project's area of influence. The demographic analysis will quantify the population living in the area; the economic analysis, will analyze the human-resources relationship in the zone. The cultural aspect will examine the way the population relates with the environmental context. The political analysis will assess the existing power structure and the dynamics of the conflicts and the infrastructure analysis will describe the communities' living conditions.

- *Definition of Area of Influence*

CRITERIA FOR DEFINING AREAS OF INFLUENCE

Regional Area of Influence: involves the provincial political and administrative zone where the existing social relationships might be affected, modified or disturbed by the proposed project.

Local Area of Influence: refers to the provincial capitals and towns that could be affected, according to the location of these communities and the project activities development.

Direct Area of Influence: the area that is directly disturbed by the Project's construction and where it is necessary to determine the social relationships that will be directly affected by the actions and activities under study.

POLITICAL AND ADMINISTRATIVE LOCATION

The proposed corridor's route for the Autopista del Coral involves the province of La Romana in the first 6 kilometers, and the province of La Altagracia in the remaining 64 kilometers, , as shown on **Map EIAALR-01.** The corridor passes through uninhabited lands, which are used for sugar cane plantations and stockbreeding, as shown on **Map EIAALR-010** and **Photos 3-44, 3-45** and **3-46.**

From the viewpoint of the local area of influence, the proposed corridor for the Autopista del Coral Project is associated with the current road corridor linking La Romana with Higüey and Punta Cana. Some sections of the proposed corridor parallel the existing highway and in some areas they intersect. Human settlements located along the proposed corridor include the following: The Casa de Campo Tourist Complex, La Romana airport, the villages of El Limón and Bocas de Chavón, Benedicto or Benerito, Batey[1] Cuesta Caribe, Batey La Ceja, Batey La Magdalena, La Piñita, the municipality of Higüey, Batey Palo Bonito and Verón. Verón was recently promoted to the category of Municipal District, an intermediate level between a village and a municipality.

Photo 3-44 **Photo 3-45**

VIEWS OF EXTENSIVE STOCKBREEDING PRACTICED IN THE PROPOSED ROAD CORRIDOR

[1] *Batey: is the territorial unit equivalent to a village, is the basic cell of the political and territorial división in the Dominican Republic. It differs from the village in its origin as it is associated with the sugar cane plantation and its socio-economical and ethnical-cultural structure,which is different from the other populated areas.*

Photo 3-46
THE MAIN ACTIVITY WITHIN THE ROAD CORRIDOR IS SUGAR CANE FARMING.

General Characteristics of La Romana Province

The project's area of influence within La Romana territory is located at the start of the road corridor, between the kilometers 0 and 6 of the route. La Romana International Airport and the Casa de Campo Tourist Complex are located in this area. The two areas constitute the base of tourism in La Romana, and their connection to the new highway will ease developments of tourism in both areas: La Romana and Punta Cana.

The province of La Romana, located in the country's Eastern region, is bounded to the North with El Seibo province and the Chavón River and to the South with Isla Catalina and Isla Saona. The eastern boundary is La Altagracia province and the Chavón river and the western boundary is the San Pedro de Macorís province.

La Romana has a total area of 653.95 km^2 and, according to the national population census of 2002, its population is 219,812 inhabitants. Of which, 22,762 live in rural zones and 197,050 in urban zones. The province is comprised of the municipalities of La Romana and Guaymate.

The province's economic activity is based on the Central Romana Corporation, a foreign sugar cane company. The province also has an industrial tax-free zone with 19 companies, tourism and stockbreeding.

In recent years, tourism has grown in this province, due to the adjacent beaches and islands, and by means of the Casa de Campo and Altos de Chavón infrastructure. An important tourist attraction is the Parque Nacional del Este, a protected area that includes a coastal fringe and the Catalina and Saona islands; Catalina Island belongs to the province's territory.

The main rivers of this province are Cumayasa, Río Dulce, Chavón and Arroyo Hondo, among others.

General Characteristics of La Altagracia Province

The province of La Altagracia is bounded on the North with the Atlantic Ocean; on the South with Isla Saona and the Caribbean Sea; on the East with La Mona channel, and on the West with the provinces of El Seibo and La Romana. Its total area is 2,474.3 km^2.

Higüey, the provincial capital, takes its name from an ancient indigenous kingdom. The colonizers founded a fortress in 1503 which was declared a villa in 1506 with the name Salvaleón de Higüey. During the colonial and the republican era, this territory was part of El Seibo and/or the department of Ozama, until its present declaration as the capital of La Altagracia province.

According to the Central Planning System (Law 2465 of 1981) this province belongs to the Subregion of Yuma, which also includes the provinces of El Seibo (also called Seybo), Hato Mayor, La Romana and San Pedro de Macorís. For the public health system, these provinces constitute Region V. The Yuma Subregion together with the Valdesia Subregion forms the Southeastern Region; the other planning regions are the Northern Region or Cibao and the Southwestern Region.

The main economic activities in the Southeastern Region are "the industrial and commercial activities, prevailing industrial activities such as the tax-free zones or "maquilas"[2], the sugar cane industry and tourism companies" (Endesa, 2002:2). Also, in the Yuma Subregion extensive stockbreeding is important. This subregion includes important natural resources, such as, some of the main protected areas: the National Park Los Haitises, the Hoyo Claro Natural Monument, and the Parque Nacional del Este, among others; the last two are located within La Altagracia territory.

The majority of the province is in the Caribbean Coastal Plain. Its territory is distributed into the following municipalities: Salvaleón de Higüey, provincial capital; San Rafael del Yuma and Lagunas de Nisibón; and, the Municipal Districts of Otra Banda, Boca de Yuma and Bayahibe. It also includes 10 sections and 297 villages, the last two demarcations are applied to rural zones. A list of the places or points of interest to the project and their corresponding municipalities is given in **Table 3-29**.

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2 Tax-free zone company: generally a foreign capital company, installed in the country under a special legal regime, principally on tax and labor matter.

TABLE 3-29 List of places or points of interest to the project at municipal level

Municipality	Town or Village
Salvaleón de Higüey	Higüey, urban zone
San Rafael del Yuma	Boca de Chavón Batey Cuesta Caribe Batey La Ceja Batey La Magdalena El Limón Benerito (also Benedicto) La Piñita Batey Palo Bonito
La Otra Banda (Municipal District)	Verón (*)

Source: Oficina Nacional de Estadística, División Política Territorial República Dominicana, 2002. (*) Recently designated as Municipal District.

In the case of the bateyes, which in the political and administrative division set by the National Statistics Office (Oficina Nacional de Estadística in Spanish) are a considered as villages (parajes), within the territory under control of the Central Romana (sugar industry company) they are grouped or classified with a special nomenclature for the purpose of administration by that sugar cane corporation.

RESOURCES OF NATURAL OR CULTURAL INTEREST

In addition to the Parque Nacional del Este and the Hoyo Claro National Monument, other sites of interest exist in the communities located within the area of influence of the project's road corridor, as indicated in **Table 3-30**.

TABLE 3-30 Sites of interest in the communities

Place	Resources
El Limón	Boca de Chavón Dam
Bocas de Chavón	Chavón river and stream. 3 caverns: Del Agua, La Lechuza and Agapito.
La Piñita	Caliche mine. Duey river and stream.
Benerito	Gato River. Caliche Mine. Chavón River. The Dam
Verón	Caliche mine, sand. Two caverns. Charco azul Resort (Hoyo Claro)
Higüey	Hoyo Claro Natural Monument, el Farallón de La Jarda (Cliff), Higüey River. Sanate stream and brooks. Anamuya waterfall. Rivers Duey, Mana, Nisibón, Yuma and Quisibán. Caverns. Guacara de Bávaro. Hoyos Yauya (Punta Cana). Limestone Mine.
La Romana	Chavón river, Casa de Campo, International Airport

POPULATION

As indicated in **Table 3-31**, according to the national census of 2002, the population of La Altagracia province is 182,020 inhabitants, distributed as follows: 92,703 men and 89,317 women. Of which, 119,733 live in urban zones (57%) and 62,287 (43%) occupy rural zones.

TABLE 3-31 Total population by gender and zone; according to region, province, municipality, municipal district, section, quarter or village

Region, Province, Municipality	Total			Urban			Rural		
Quarter or Village	Total	Men	Women	Total	Men	Women	Total	Men	Women
COUNTRY TOTAL	8.562.541	4.265.215	4.297.326	5.446.704	2.648.064	2.798.640	3.115.837	1.617.151	1.498.686
EASTERN REGION	880.468	441.397	439.071	653.861	318.116	335.745	226.607	123.281	103.326
LA ROMANA PROVINCE	202.488	98.113	104.375	191.303	92.460	98.843	-	-	-
LA ROMANA MUNICIPALITY	191.303	92.460	98.843						
LA ALTAGRACIA	182.020	92.703	89.317	119.733	58.763	60.970	62.287	33.940	28.347
SALVALEON DE HIGÜEY	141.751	71.494	70.257	103.502	50.692	52.810	38.249	20.802	17.447
Villages									
BATEY CUYA	651	369	282	-	-	-	651	369	282
BOCA DE CHAVÓN	614	327	287	-	-	-	614	327	287
BATEY CUESTA CARIBE	42	26	16	-	-	-	42	26	16
BATEY LAS CEJAS	463	265	198	-	-	-	463	265	198
BENERITO	1.378	699	679	-	-	-	1.378	699	679
EL LIMÓN	18	7	11	-	-	-	18	7	11
BATEY MAGDALENA	1.155	660	495	-	-	-	1.155	660	495
LA PIÑITA	204	117	87	-	-	-	204	117	87
BATEY PALO BONITO	999	553	446	-	-	-	999	553	446
VERÓN	1.294	673	621	-	-	-	1.294	673	621

Source: National Statistics Office, National Population and Housing Census, 2002

The towns located in the project's area of influence, except for the municipal capital, have low populations as shown in Table 3-31. The most populated municipality is Benerito, with 1,378 inhabitants and the least populated is El Limón, with 18. The field reconnaissance of El Limón suggests a greater number of inhabitants, which could be an indicator of migratory movement between 2002 and present days.

The proportion of inhabitants by gender for the province, the municipality and some towns is very similar to the national and regional average, with an average of 49.8 women; however, this proportion is extremely unbalanced for the bateyes, which range from 42.7% (Las Cejas) to 43% (Cuyá). This phenomenum is related to the settlement pattern followed in the bateyes as concentration centers of agricultural workers coming from Haiti, basically represented by a male population. The municipal capital, Salvaleón de Higüey has 141,751 inhabitants, all the villages (parajes) total about 6,891 inhabitants, for a grand total of 148,642 inhabitants. **Table 3-32** indicates that the Economically Active Population (EAP) of the province totals 84,395 inhabitants, of which 51,357 are men and 33,038 women.

TABLE 3-32 Economically Active Population by gender and zone, according to region, province, and village

Region, Province, Municipality and Village	Total			Urban			Rural		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
COUNTRY TOTAL	3.684.190	2.142.282	1.541.908	2.413.204	1.339.471	1.073.733	1.270.986	802.811	468.175
EASTERN REGION	393.243	228.818	164.425	296.042	162.441	133.601	97.201	66.377	30.824
LA ROMANA PROVINCE	99.845	54.831	45.014	90.234	48.484	41.750	9.611	6.347	3.264
LA ROMANA MUNICIPALITY	92.859	50.135	42.724	87.891	47.181	40.710	4.968	2.954	2.014
LA ALTAGRACIA	84.395	51.357	33.038	55.897	31.989	23.908	28.498	19.368	9.130
SALVALEON DE HIGÜEY	66.911	39.937	26.974	49.106	28.014	21.092	17.805	11.923	5.882
Villages									
BATEY CUYA	306	230	76	-	-	-	306	230	76
BOCA DE CHAVÓN	227	150	77	-	-	-	227	150	77
BATEY CUESTA CARIBE	20	14	6	-	-	-	20	14	6
BATEY LAS CEJAS	204	147	57	-	-	-	204	147	57
EL LIMÓN	6	5	1	-	-	-	6	5	1
BENERITO	614	383	231	-	-	-	614	383	231
BATEY MAGDALENA	518	383	135	-	-	-	518	383	135
LA PIÑITA	1.992	1.542	450	-	-	-	1.992	1.542	450
LA PIÑITA	101	75	26	-	-	-	101	75	26
BATEY PALO BONITO	387	294	93	-	-	-	387	294	93
VERÓN	663	375	288	-	-	-	663	375	288
LOS MANANTIALES	31	16	15	-	-	-	31	16	15

Source: National Statistics Office, National Population and Housing Census, 2002

The civil status of the majority of the population includes free union and unmarried, the number of married people is low and ranges from between 5.5% (Cuyá Batey) and 19.8% (in Benerito). The national average for married people is 23.1% and the regional average is 22.0% (**Table 3-33**).

Table 3-33 Population aged 15 years or above by civil status, according to region, province and village

Region, Province, Municipality and Village	Civil Status							
	Total	Married	Free Union	Widow	Divorced	Legally separated	Separated from free union	Unmarried
COUNTRY TOTAL	5.657.425	1.307.678	1.843.859	248.114	121.203	52.777	285.765	1.798.029
EASTERN REGION	570.291	125.799	187.482	23.556	10.532	5.367	29.195	188.360
LA ROMANA PROVINCE	142.375	36.528	41.572	5.491	2.827	1.613	6.609	47.735
LA ROMANA MUNICIPALITY	131.818	34.508	37.996	5.127	2.670	1.524	6.253	43.740
LA ALTAGRACIA	121.170	26.694	45.550	4.726	2.070	892	5.613	35.625
SALVALEON DE HIGÜEY	94.854	20.677	35.511	3.705	1.761	716	4.640	27.844
Villages								
BATEY CUYA	436	24	183	30	5	3	29	162
BOCA DE CHAVÓN	374	71	151	16	6	3	19	108
BATEY CUESTA CARIBE	28	9	10	-	-	-	1	8
BATEY LAS CEJAS	296	51	95	14	8	1	3	124
EL LIMÓN	14	1	7	1	-	-	-	5
BENERITO	860	171	355	18	6	9	40	261
BATEY MAGDALENA	736	132	242	21	4	3	20	314
LA PIÑITA	138	23	45	2	-	1	8	59
BATEY PALO BONITO	602	118	223	22	3	-	23	213
VERÓN	857	94	501	21	13	6	31	191

Source: National Statistics Office, National Population and Housing Census, 2002

ECONOMY

Income distribution among the EAP is shown in **Table 3-34.** The majority of the population receives salaries up to 3,300 pesos per month. However, a high number of citizens did not declare the amount of their income (44% in Verón), which become a sub-record when this variable was evaluated.

TABLE 3-34 Population aged 10 years and above, economically active and occupied; by monthly income, according to region, province and villages

Region, province, municipality and villages	Total	Monthly Income								
		Below 1,000	From 1,000 to 1,999	From 2,000 to 3,299	From 3,300 to 4,699	From 4,700 to 6,599	From 6,600 to 11,399	From 11,400 to 16,999	17,000 and above	Not declared
COUNTRY TOTAL	3.174.594	400.272	338.068	519.799	396.460	170.397	152.972	53.770	68.116	1.263.152
EASTERN REGION	339365	51766	39283	61002	40974	16557	13199	4336	3929	128911
LA ROMANA PROVINCE	87764	10923	9547	17843	12392	4877	3782	1490	1167	31482
LA ROMANA MUNICIPALITY	81688	9323	8478	16987	11906	4691	3668	1469	1146	29557
LA ALTAGRACIA	72810	9343	8014	12334	10734	4909	3408	1047	897	27817
SALVALEON DE HIGÜEY	57981	6990	5926	10049	9016	4310	2925	878	811	21883
Villages										
BATEY CUYA	256	92	43	17	2	3	1	0	0	100
BOCA DE CHAVÓN	206	31	30	29	26	11	3	0	2	88
BATEY CUESTA CARIBE	18	6	4	1	3	1	0	0	0	3
BATEY LAS CEJAS	164	34	23	21	9	3	0	0	4	77
EL LIMÓN	6	0	0	0	0	0	0	0	0	6
BENERITO	545	68	100	120	106	15	10	1	1	182
LA PIÑITA	90	29	17	7	5	1	2	0	0	32
BATEY PALO BONITO	341	89	78	66	33	12	5	1	1	72
VERÓN	551	26	72	82	87	32	26	19	3	244

Source: National Statistics Office, National Population and Housing Census, 2002

The distribution of the EAP according to economic condition shown in **Table 3-35;** indicates the behavior among the groups in active condition and in passive condition. It is worth noting the high levels of employment in all the towns, which is an indicator of the region's dynamic economy.

The list by occupational category included in **Table 3-36**, shows the importance of the independent worker, which is an indicator of the magnitude of the informal economy in the country represented by the micro, small and medium size enterprises. This occupational category represents 14.3% at the national level and 13% for La Altagracia province. The salary or wage values indicate an important capacity for labor absorption exists in all the communities.

TABLE 3-35 Total population aged 10 years and above by economic condition, according to region, province and villages

Region, Province, Municipality, Villages	Economic Activity Condition										
	Total	Economically Active Pop.			Economically Inactive Population						
		Occupied	Unem-ployed	Looking for job for 1st Time	Domestic works	Students	Rentist	Retired Pensioner	Disabled Old people	No activity	Other activity
COUNTRY TOTAL	6.616.763	3.174.594	286.013	223.583	543.451	1.921.068	2.924	16.034	177.048	166.839	105.209
EASTERN REGION	670.925	339.365	32.355	21.523	52.834	180.113	389	1.849	16.985	15.094	10.418
LA ALTAGRACIA	140.118	72.810	6.815	4.770	13.617	31.788	115	230	3.808	3.464	2.701
SALVALEON DE HIGÜEY	109.472	57.981	5.449	3.481	9.879	24.846	95	178	3.064	2.479	2.020
Villages											
BATEY CUYA	483	256	22	28	60	72	-	3	24	11	7
BOCA DE CHAVÓN	454	206	16	5	49	147	-	-	8	19	4
BATEY CUESTA CARIBE	31	18	1	1	2	5	-	-	-	4	-
BATEY LAS CEJAS	349	164	21	19	32	70	-	4	18	10	11
EL LIMÓN	17	6	-	-	6	4	-	-	-	-	1
BENERITO	1.000	545	35	34	127	199	-	1	9	22	28
BATEY MAGDALENA	864	430	34	54	115	194	-	1	8	13	15
LA PIÑITA	158	90	4	7	17	28	-	1	3	-	8
BATEY PALO BONITO	706	341	20	26	104	139	1	4	24	35	12
VERÓN	967	551	57	55	65	190	-	-	11	34	4

Source: National Statistics Office, National Population and Housing Census, 2002

TABLE 3-36 Population aged 10 years and above by occupational activity, according to region, province and village

Region, Province, Municipality, Village	Occupational Category							
	Total	Employee w/ Salary or Wage	Employer or Boss	Family non-paid worker	Independent Worker	Cooperative Member	Other	Not Declared
COUNTRY TOTAL	3.460.607	1.407.109	157.530	81.703	456.155	7.927	73.795	1.276.388
EASTERN REGION	371.720	160.264	16.255	8.548	47.283	1.213	7.465	130.692
LA ROMANA PROVINCE	95360	46153	3684	1421	10255	249	1664	31934
LA ROMANA MUNICIPALITY	88785	42687	3470	1282	9695	234	1528	29989
LA ALTAGRACIA	79.625	32.416	4.235	2.182	11.417	328	1.669	27.378
SALVALEON DE HIGÜEY	63.430	26.336	3.468	1.632	8.841	263	1.176	21.714
Villages								
BATEY CUYA	278	100	3	1	59	1	5	109
BOCA DE CHAVÓN	222	76	9	11	37	1	7	81
BATEY CUESTA CARIBE	19	8	2	4	2	-	-	3
BATEY LAS CEJAS	185	73	4	1	22	-	5	80
EL LIMÓN	6	-	-	-	-	-	-	6
BENERITO	580	253	26	19	83	7	12	180
HATO BONITO	8	3	-	1	3	-	-	1
BATEY MAGDALENA	464	278	8	5	24	3	16	130
LA PIÑITA	94	40	4	-	13	-	3	34
BATEY PALO BONITO	361	183	12	8	20	1	57	80
VERÓN	608	231	51	43	45	3	22	213

Source: National Statistics Office

MAIN ECONOMIC ACTIVITIES

Table 3-37 includes the main economic activities conducted in the different areas. The dominant sectors are agriculture, stockbreeding and silviculture; commerce and hotels, construction, transportation, communications, social services, and real state.

In the small towns, the main economic activities include agriculture, commerce and manufacturing. In the bateyes, agriculture is dominant and manufacture is also important, which suggests daily movement of a significant segment of people from the bateyes to the urban centers where the "tax-free zones" and other companies are located. Commercial activity is notable in Verón (16:5%) and in Benerito (13.7%).

The employed population according to occupation type is presented in **Table 3-38**.

Commerce and agriculture are an important activity everywhere (**Photos 3-47 and 3-48**).

Photo 3-47

Photo 3-48

COMMERCE AND AGRICULTURE, TYPICAL ACTIVITIES OF THE PROJECT'S AREA OF INFLUENCE

In Higüey, the basic economic activity is stockbreeding, followed in recent years by tourism, which has great potential in this zone.

TABLE 3-37 Population aged 10 years and above, economically active and occupied, by activity branch, according to region, province, municipality and villages

Region, province, municipality and village	Population with 10 years and above, economically active and occupied																		
	Total	Agriculture, stockbreeding, hunting and silviculture	Fishing	Explotation of mines and quarries	Manufacturing Industries	Electricity, gas and water supply	Construction	Whole sale and retail commerce; repairs of vehicles, cars, motorcycles, and domestic devices	Hotels and restaurants	Transportation, storage and communications	Financial intermediation	Real property, business and rental activities	Public administration and defense, obligatory social security plans	Education	Social services and health care	Other activities related to community, social or personal services	Private homes with domestic service	Extraterritorial organizations and organs	Undeclared activity
COUNTRY TOTAL	3.174.594	158.718	3.209	2.559	303.442	14.944	123.128	446.873	67.337	125.284	30.509	72.007	124.803	94.678	53.428	132.707	120.146	-	
EASTERN REGION	339.365	19.165	637	159	47.308	1.162	13.642	40.718	16.684	15.646	1.592	5.370	7.434	7.938	4.682	13.858	11.811	-	
LA ROMANA PROVINCE	87764	2204	75	18	16371	279	3966	10347	4318	4580	604	1815	1215	1763	1195	3172	3262	-	32580
LA ROMANA MUNICIPALITY	81688	1020	75	18	15232	261	3816	9794	4224	4441	598	1747	1135	1674	1081	3018	3051	-	30503
LA ALTAGRACIA	72.810	4.972	210	93	3.819	167	2.883	10.554	7.311	3.874	331	1.234	1.187	1.258	806	3.346	2.566	-	28.199
HIGÜEY	57.981	2.748	113	92	2.913	123	2.385	9.056	6.126	3.198	304	1.122	925	1.020	672	2.707	2.053	-	22.424
Villages																			
BATEY CUYA	256	89	-	-	8	-	5	14	5	6	-	1	2	-	-	5	2	-	119
BOCA DE CHAVÓN	206	5	6	-	4	-	8	15	22	28	-	1	1	-	1	10	8	-	97
BATEY CUESTA CARIBE	18	5	-	-	-	-	-	6	3	-	1	-	-	-	-	-	-	-	3
BATEY LAS CEJAS	164	34	-	-	23	-	2	5	5	7	-	-	1	-	1	1	5	-	80
EL LIMÓN	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
BENERITO	545	36	-	-	21	3	17	75	112	30	1	6	8	2	1	17	15	-	201
BATEY MAGDALENA	430	151	-	-	69	-	5	42	5	8	-	-	7	4	-	7	7	-	125
LA PIÑITA	90	22	-	-	11	-	10	7	2	1	-	1	-	-	-	3	1	-	32
BATEY PALO BONITO	341	152	-	-	44	4	5	19	2	1	-	1	3	1	4	4	7	-	94
VERÓN	551	7	4	-	15	-	42	91	74	45	2	5	6	-	3	21	19	-	217

Source: National Statistics Office, National Population and Housing Census, 2002

TABLE 3-38 Employed population by type of occupation, according region, province, municipality and village

Region, province, municipality and village	Total	Armed Forces	Members of the executive or legislative powers, administration and company leaders.	Professionals, scientific and intellectuals	Medium Level Technicians and Professionals	Office Employees	Service workers and vendors in shops and markets	Agricultural workers and qualified agricultural and livestock, and fishing personnel.	Masters, operators, and artisans of mechanical arts and other trades.	Operators and installers of facilities and machinery.	Non-qualified workers	Undeclared
COUNTRY TOTAL	3.460.607	25.139	65.327	178.709	129.009	177.025	398.267	145.142	381.792	265.596	492.070	1.202.531
EASTERN REGION	371.720	1.010	5.364	13.371	11.848	15.769	47.844	15.422	42.823	40.142	55.872	122.255
LA ROMANA PROVINCE	95360	196	1235	3762	3733	4527	12359	2143	13414	12388	12557	29046
LA ROMANA MUNICIPALITY	88785	192	1201	3661	3559	4367	11817	1494	12827	11978	10507	27182
LA ALTAGRACIA	3.294	2	24	106	145	133	628	67	457	171	430	1.131
HIGÜEY	63.430	101	1.370	1.944	1.974	3.321	11.470	2.802	7.327	4.232	8.342	20.547
Villages												
BATEY CUYA	278	-	4	-	-	4	17	76	5	15	55	102
BOCA DE CHAVÓN	222	1	-	2	17	5	28	20	14	18	36	81
BATEY CUESTA CARIBE	19	-	-	-	-	1	8	3	-	1	3	3
BATEY LAS CEJAS	185	-	1	-	1	2	6	13	9	10	63	80
EL LIMÓN	6	-	-	-	-	-	-	-	-	-	-	6
BENERITO	580	1	3	2	13	27	129	45	61	32	99	168
BATEY MAGDALENA	464	1	3	2	5	4	37	29	25	17	218	123
LA PIÑITA	94	-	-	-	-	-	8	10	8	3	36	29
BATEY PALO BONITO	361	1	-	4	2	5	23	85	19	22	120	80
VERÓN	608	-	4	5	15	17	104	7	78	40	122	216

Source: National Statistics Office

The main job source in Limón and Bocas de Chavón is tourism that is conducted in Bayahibe, Dominicus, Bávaro, Punta Cana, Casa de Campo, and Central Romana. There is also fishing activity, agriculture and motoconcho (passenger transportation by motorcycle).

In Boca de Chavón, most of the inhabitants work in tourism, especially as captains of tourism boats; fishing and agriculture are also developed.

In La Piñita, most of the population works in agriculture (sugar cane plantations), stockbreeding and a few people work in hotels.

In Benerito, the main job sources are hotels (Bayahibe and Casa de Campo), agriculture and motoconcho.

For Verón, tourism is the main activity (Bávaro and Punta Cana), followed by construction, commerce, fishing and public transport service (taxi and motoconchos).

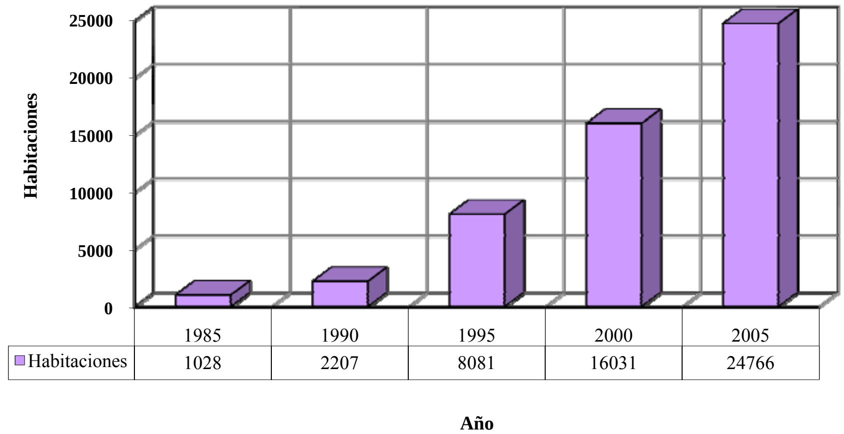
Statistical data on dominant economic activities was compared to information provided by the people interviewed in each of the communities.

TOURISM IN THE ZONE

The tourism area with the highest growth in the country is situated in this province; it is comprised of Bávaro and Punta Cana, with more than 27,700 hotel rooms. In Bayahibe, in the municipality of San Rafael del Yuma, there are more than 700 meters of beach and Saona Island, and important Protected area. In the zone of Bayahibe and Dominicus there are more than ten hotel projects of significant magnitude.

It is worth noting here the perspective of tourism activity in the zone, given the specific weight it is has in the region and the country, while the traditional sugar industry has been declining since the middle of the 1990s. During an interview with Mr. Ernesto Veloz, president of the Association of Hotels and Tourism Projects in the Eastern Zone, important data was obtained on this activity in Punta Cana. In this town, the number of rooms available has experienced a significant growth, mainly from the year 1995 on, as can be seen in **Figure 3-19.**

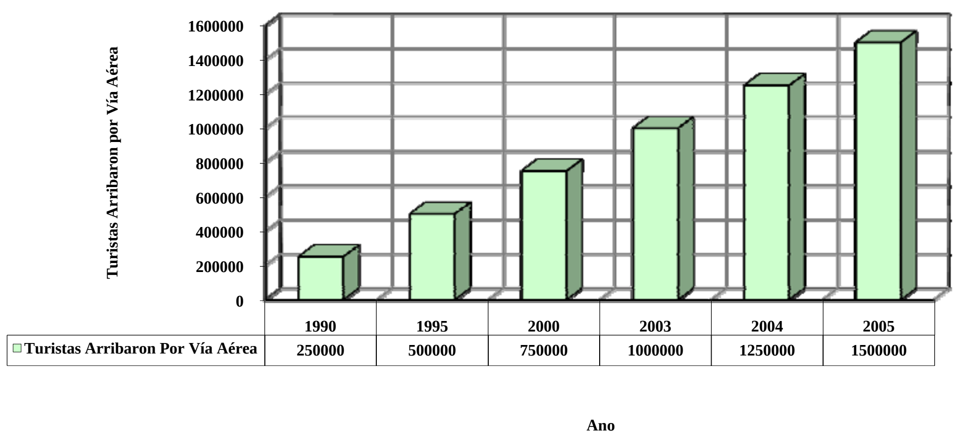
FIGURE 3-19 Growth of Hotel Room Availability in Punta Cana



Source: Conference by Mr. Ernesto Veloz on September 14, 2006, at the Higüey Mayor's Office.

The growth in tourist arrivals to Punta Cana in the last fifteen years is shown in **Figure 3-20**. The impact caused by tourism development in this zone is expressed in the 30 thousand direct jobs generated by the hotel sector and the same quantity of jobs generated indirectly.

FIGURE 3-20 Growth in tourist arrivals to Punta Cana

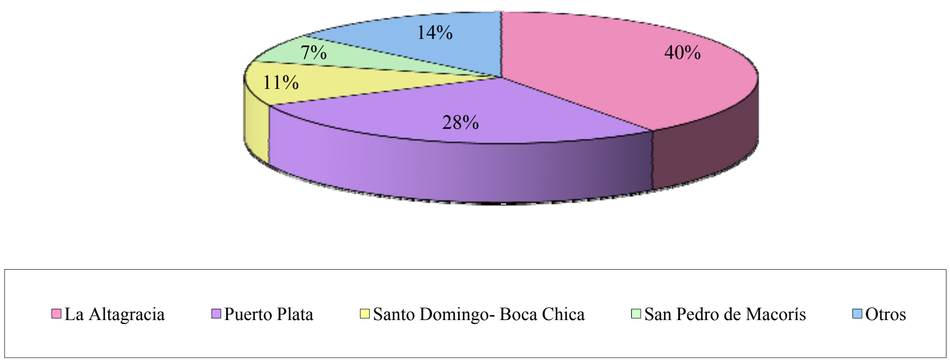


Source: Conference by Mr. Ernesto Veloz on September 14, 2006, at the Higüey Mayor's Office.

The hotel executives projected income for 2005 in the amount of US 3,500 million, based on figures from the World Travel and Tourism Council for goods and services, which is an indicator of tourism impact on the regional and national economy. During 2004, the distribution of hotel rooms available in the country is shown in **Figure 3-21**.

These data confirm the predominance of this tourist area over the others, because double the number of rooms that Santo Domingo and San Pedro de Macorís has, and it amply surpasses Puerto Plata, which during the 1980s was the country's most important tourist area.

FIGURE 3-21 Hotel rooms available by tourist province

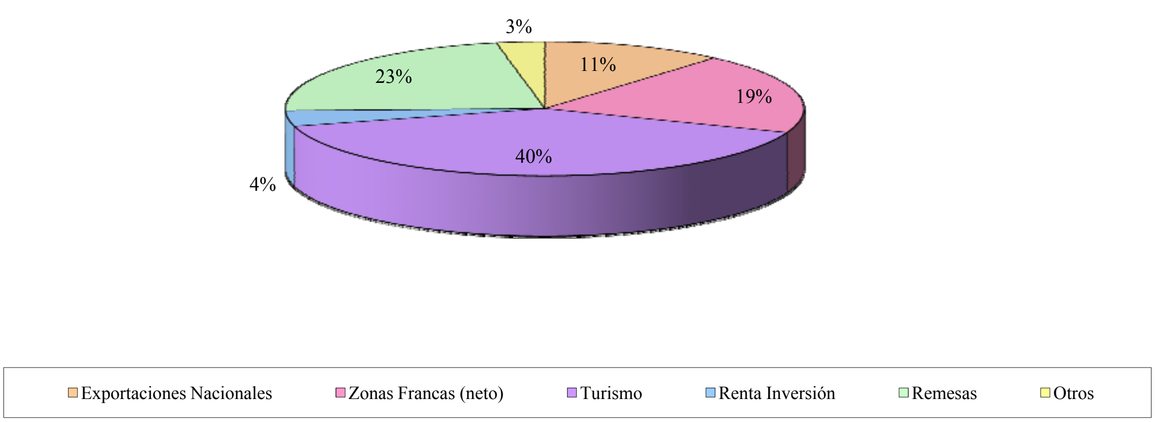


Source: Veloz, 2006

During 2005, Punta Cana received 48% of the total tourists that arrived in the country and contributed with revenues of 51.4% (in foreign currency) of the sector's total at the national level (Veloz, 2006).

Tourism is the main source of economic growth and the principal generator of foreign currencies, contributing 40% to the national economy. It represents 22% of the GDP and generates 19.2% of direct and indirect jobs (**Figure 3-22**).

FIGURE 3-22 Foreign currency income (participation in the total)



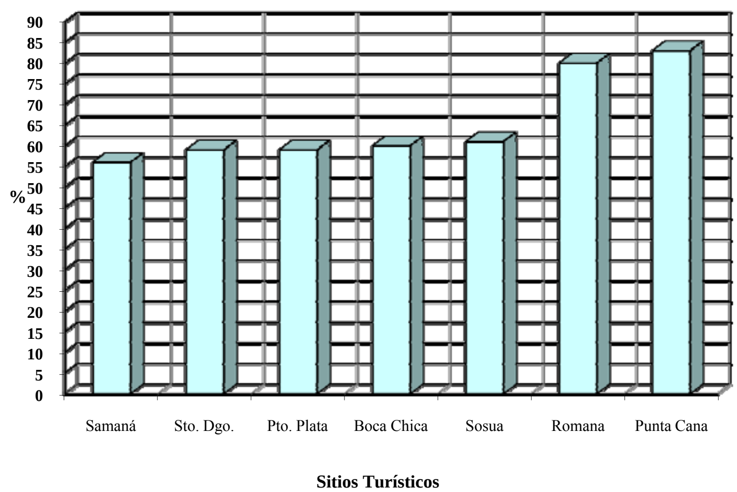
Source: SEOPC, Presentation in Public Hearings, 2007

The Dominican Republic's tourism sector had the highest growth in Latin America in 2005, with 7.5%.

The tourist areas situated in the country's Eastern Region (Romana, Bayahibe, Dominicus, Punta Cana, Bávaro, Macao, Uvero Alto) concentrate nearly 60% of the 60,000 rooms that are available in the country. This areas had an average occupancy rate of 82% in 2005 (**Figure 3-23**).

An increase of 10,000 hotel rooms is predicted for the next three years in the zone of Bávaro, Punta Cana and Cap Cana.

FIGURE 3-23 Hotel Occupancy Rate (by Zone, in %)



Source: SEOPC, Presentation in Public Hearings, 2007

DEVELOPMENT ACTIVITY IN THE ZONE

The development of new projects in this province is associated with tourist activity. Among the main infrastructure works are:

- Four golf courses under construction and 3 new course projects
- Hotels under construction: Rocco Ki with a US$122 million investment, in phase one; Altabela with a US$ 150 million investment; Moon Palace with US $250 million and Sunscape Uvero Alto with US $50 million.
- The Tourist Boulevard is currently under construction and the Cruce del Isleño-Macao highway was recently opened.
- Other announced projects include hotels, golf courses, and construction of a second runway at the international airport.

- In Bocas de Chavón rumors persist about a marina with apartments.
- The prospective projects for Benerito are construction of a police station and an aqueduct, and,
- Plans for a wind farm, known as Consorcio Energético Punta Cana -Macao, a controversial Project that has generated conflicts between its promoters and tourist businessmen, according to reports of the local newspaper El Cometa.

EDUCATION

The literate population over three years of age for this province is 65,510 and the illiterate population is 39,201, which is equivalent to 23.2% of the population. This is similar to the national average of 21.8%. The provincial capital, Salvaleón de Higüey, has a similar record with 21.7%. The highest illiteracy figures are found in the bateyes, reaching 51.5% in the Palo Bonito batey and 53.7% in the Cuyá batey (**Table 3-39**).

The population distribution according to education level is shown in **Table 3-40,** where it is obvious that the human resources concentration is in the capital municipality, Higüey. Among the towns, the university graduates are found in Verón, Benerito and Bocas de Chavón. The presence of a few university graduates in some bateyes is an indicator of the transition being experienced by these settlements, which tend with time to be receptors of international immigrants that consequently diversify the economic and social activity within these communities.

In El Limón, Bocas de Chavón, Benerito and Verón a basic public education infrastructure exists and in Benerito there is a secondary school. Verón possesses three public schools and a semi-private polytechnic school.

TABLE 3-39 Population aged 3 years and older by education condition, according to region, province and village

Region, province, municipality, quarters or village	Total			Literate			Illiterate		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
COUNTRY TOTAL	7.977.075	3.967.306	4.009.769	6.235.154	3.081.210	3.153.944	1.741.921	886.096	855.825
EASTERN REGION	817147	409564	407583	632882	314536	318346	184265	95028	89237
LA ROMANA PROVINCE	203675	99280	104395	162154	78664	83490	41521	20616	20905

Region, province, municipality, quarters or village	Total			Literate			Illiterate		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
LA ROMANA MUNICIPALITY	187945	90862	97083	152311	73465	78846	35634	17397	18237
LA ALTAGRACIA	168776	85990	82786	129575	65510	64065	39201	20480	18721
SALVALEON DE HIGÜEY	131354	66219	65135	102773	51394	51379	28581	14825	13756
Villages									
BATEY CUYA	601	354	247	278	174	104	323	180	143
BOCA DE CHAVÓN	561	301	260	416	226	190	145	75	70
BATEY CUESTA CARIBE	40	25	15	22	15	7	18	10	8
BATEY LAS CEJAS	425	247	178	254	152	102	171	95	76
EL LIMÓN	18	7	11	16	6	10	2	1	1
BENERITO	1262	636	626	918	479	439	344	157	187
LA PIÑITA	189	113	76	105	50	55	84	63	21
BATEY PALO BONITO	912	519	393	442	256	186	470	263	207
VERÓN	1159	591	568	862	472	390	297	119	178

Source: National Statistics Office, National Population and Housing Census, 2002

TABLE 3-40 Population aged 3 years and older by education level, according to region, province and village

Region, Province, Municipality, Villages	Education Level									
	Total	None	Pre-school	Elementary	Secondary	High school	Specialty	Master	Doctorate	Unknown
COUNTRY TOTAL	6.923.397	91.440	313.985	3.881.885	1.725.042	782.027	43.817	26.500	11.450	47.251
EASTERN REGION	703.022	9.398	29.844	429.846	172.198	49.289	3.286	1.424	1.275	6.462
LA ROMANA PROVINCE	96626	714	7951	58504	22673	6129	150	78	67	360
LA ROMANA MUNICIPALITY	89852	636	7461	53623	21582	5924	148	75	67	336
LA ALTAGRACIA	142.967	2.020	5.801	92.393	31.358	8.695	538	249	220	1.693
SALVALEON DE HIGÜEY	113.128	1.682	4.621	70.282	26.386	7.758	486	232	212	1.469

Region, Province, Municipality, Villages	Education Level									
	Total	None	Pre-school	Elementary	Secondary	High school	Specialty	Master	Doctorate	Unknown
Villages										
BATEY CUYA	338	9	16	280	32	1	-	-	-	-
BOCA DE CHAVÓN	463	2	17	364	65	14	1	-	-	-
BATEY CUESTA CARIBE	28	-	1	19	7	1	-	-	-	-
BATEY LAS CEJAS	282	6	11	206	56	2	1	-	-	-
EL LIMÓN	16	4	-	9	3	-	-	-	-	-
BENERITO	1.038	13	35	802	150	31	1	-	-	6
BATEY MAGDALENA	756	3	39	579	125	8	-	-	-	2
LA PIÑITA	118	3	5	96	11	2	-	-	-	1
BATEY PALO BONITO	541	-	34	439	51	-	1	-	-	16
VERÓN	916	5	20	721	139	19	-	2	-	10

Source: National Statistics Office, National Population and Housing Census, 2002

HOUSING

The number of houses and the construction materials are indicated in **Table 3-41**. Three of the towns have less than 100 dwellings; Batey Cuesta Caribe, El Limón and La Piñita.

TABLE 3-41 Individual Houses by type of construction materials, according to region, province, municipality and village

Region, Province, municipality and village	Predominating material in outer walls						
	Total	Blocks or concrete	Wood	Wooden plank	Tejamanil (wooden tiles)	Yagua (royal palm)	Other
COUNTRY TOTAL	2.181.149	1.449.414	535.225	138.932	12.074	7.189	38.315
EASTERN REGION	234356	145581	63863	15023	248	476	9165
LA ROMANA PROVINCE	57824	42819	11687	514	61	23	2720
LA ROMANA MUNICIPALITY	53191	40817	9227	423	61	1	2962
LA ALTAGRACIA	51145	29548	15968	3863	105	45	1616
SALVALEON DE HIGÜEY	39824	24994	10752	2622	101	33	1322

Region, Province, municipality and village	Predominating material in outer walls						
	Total	Blocks or concrete	Wood	Wooden plank	Tejamanil (wooden tiles)	Yagua (royal palm)	Other
Villages							
BATEY CUYA	171	164	7	0	0	0	0
BOCA DE CHAVÓN	186	43	134	2	2	0	5
BATEY CUESTA CARIBE	10	3	7	0	0	0	0
BATEY LAS CEJAS	138	54	81	0	0	0	3
EL LIMÓN	4	0	4	0	0	0	0
BENERITO	382	49	284	42	0	0	7
BATEY MAGDALENA	273	236	36	0	0	0	1
LA PIÑITA	67	36	22	5	0	0	4
BATEY PALO BONITO	235	150	83	0	0	0	2
VERÓN	373	142	211	12	0	0	8

Source: National Statistics Office, National Population and Housing Census, 2002

In the bateyes Magdalena, Palo Bonito and Cuyá houses built in blocks or concrete predominate; in the other areas, wood is the prevailing construction material. House construction materials different from blocks or wood are scarce in the zone, except in the municipal capital, where there are 131 houses constructed with tejamaníl[3] and 33 with yagua.

Table 3-42 showing the dwelling types, indicates that the individual house model is predominant, except in Verón and Higüey where apartment houses appear. It is worth noting that in Benerito, Verón and in some of the bateyes, there are dwellings called backyard cuarterias[4]. In the bateyes and communities that are not identified as bateyes, there are houses called “barracón” (derived from barracks), that is a typical dwelling in the batey.

[3] *Tejamaníl or tejamaní: a country house built in materials taken from the surrounding environment; consisting on the use of interweaved wood (sticks or rods) used for weaving the walls, which are then covered with “caliche”, a mix of earth and cow manure; the roof is made in cana or yagua and the floor is bare ground (Paulino y Castro, 2005: 389).*

[4] *Cuartería: a room or section beside another one within the same house, used as an independent dwelling, generally located in the back side of or backyard of another (main) house which, unlike the cuarteria, it does have direct access from the street.*

TABLE 3-42 Houses by type of occupation, according to region, province, municipality and village

Region, Province, Municipality, Village	Total	House Type													
		Independent House	Apartment	Room in cuarteria or Backyard	Barracón	Room not destined to living	Houses under construction	Shared House, Business	Other houses	Hotel, Guesthouse, etc.,	Barracks	Jail	Hospital, Health Center	Religious Institution or boarding school	Other Collective Dwelling
COUNTRY TOTAL	2.182.764	1.785.288	146.641	138.330	21.962	8.115	24007	40928	15878	894	95	34	54	261	277
EASTERN REGION	234.521	175.624	12.592	26.784	8.368	1.046	2667	5068	2207	90	19	6	7	14	29
LA ROMANA PROVINCE	57856	40058	4044	9719	1005	327	790	1280	611	14	5	1	1	2	9
LA ROMANA MUNICIPALITY	53221	37015	4008	8991	347	277	772	1191	590	13	4	1	1	2	9
LA ALTAGRACIA	51.197	37.694	3.995	5.773	1.115	358	457	1118	635	35	5	1			
SALVALEON DE HIGÜEY	39.874	28.291	3.715	5.161	485	309	387	926	550	35	5	1	1	3	5
Villages															
BATEY CUYA	171	136	-	-	32	-	1	2	0	0	0	0	0	0	0
BOCA DE CHAVÓN	186	173	-	5	2	-	5	1	0	0	0	0	0	0	0
BATEY CUESTA CARIBE	10	10	-	-	-	-	0	0	0	0	0	0	0	0	0
BATEY LAS CEJAS	138	63	-	-	72	2	0	1	0	0	0	0	0	0	0
EL LIMÓN	4	3	-	-	-	-	0	1	0	0	0	0	0	0	0
BENERITO	382	292	-	60	21	2	4	3	0	0	0	0	0	0	0
BATEY MAGDALENA	273	175	1	7	77	-	1	6	6	0	0	0	0	0	0
LA PIÑITA	67	33	-	-	34	-	0	0	0	0	0	0	0	0	0
BATEY PALO BONITO	235	180	-	3	49	1	0	1	1	0	0	0	0	0	0
VERÓN	373	226	42	86	-	7	5	5	2	0	0	0	0	0	0

Source: National Statistics Office, National Population and Housing Census, 2002

SERVICES

Garbage collection service is provided in most of the towns by the Mayor's Office together with private companies. The communities lacking this service are Limón, Batey Cuesta Caribe and La Piñita. In the areas where garbage collection operates, it is inefficient, evidenced by the great number of houses that dispose garbage by alternate methods, such as burning, dumping in the backyard, in a dump, or in a river or stream, as shown in **Table 3-43**.

Electricity service reaches 86% of the houses in the province. In the Higüey municipality, the service coverage is 90.2 %. data on this service's coverage is included in **Table 3-44**.

TABLE 3-43 Domestic garbage disposal method, according to region, province, municipality and village

Region, Province, municipality and village		Garbage Disposal Method						
	Total	Collected by Mayor's Office	Collected by private companies	Burning	Thrown to backyard	Thrown to Dumps	Dumping to river or stream	Other
COUNTRY TOTAL	2.193.848	1.224.081	80.818	519.014	118.348	131.206	81.431	38.950
EASTERN REGION	235.925	124.697	14.971	61.466	10.745	17.780	3.012	3.254
LA ROMANA PROVINCE	58181	33719	5540	10800	2002	5159	219	742
LA ROMANA MUNICIPALITY	53501	32248	3408	10127	1817	4976	199	726
LA ALTAGRACIA	51.653	28.674	3.826	14.332	1.553	1.521	1.180	567
SALVALEON DE HIGÜEY	40.012	24.021	2.733	9.617	1.021	1.078	1.064	478
Villages								
BATEY CUYA	179	52	95	29	-	3	-	-
BOCA DE CHAVÓN	186	1	2	114	1	68	-	-
BATEY CUESTA CARIBE	10	-	-	8	-	-	-	2
BATEY LAS CEJAS	148	27	117	4	-	-	-	-
EL LIMÓN	4	-	-	3	-	1	-	-
BENERITO	388	281	2	86	8	9	-	2
BATEY MAGDALENA	299	8	164	46	65	12	4	-
LA PIÑITA	68	-	-	30	30	7	-	1
BATEY PALO BONITO	297	2	99	155	10	28	-	3
VERÓN	379	47	22	252	16	17	-	25

Source: National Statistics Office, National Population and Housing Census, 2002

TABLE 3-44 Type of power source utilized for domestic lighting, according to region, province, municipality and village

Region, Province, Municipality, Quarter or Village	Total	Type of Lighting power source				
		From Electrical Distribution Network	Own Power Generator	Propane Gas Lamp	Kerosene Lamp	Other
COUNTRY TOTAL	2.193.848	2.035.415	6.517	26.092	98.480	27.344
EASTERN REGION	235.925	208.533	1.167	4.707	18.393	3.125
LA ROMANA PROVINCE	58181	54712	128	604	2246	491
LA ROMANA MUNICIPALITY	53501	51899	91	402	726	383
LA ALTAGRACIA	51.653	44.451	600	1.670	4.242	690
SALVALEON DE HIGÜEY	40.012	36.127	380	1.043	2.142	320
Villages						
BATEY CUYA	179	28	2	-	146	3
BATEY CUESTA CARIBE	10	-	2	-	-	8
BATEY LAS CEJAS	148	32	5	2	107	2
EL LIMÓN	4	2	-	-	1	1
BENERITO	388	326	5	10	29	18
BATEY MAGDALENA	299	90	11	69	119	10
LA PIÑITA	68	9	2	20	26	11
BATEY PALO BONITO	297	78	4	45	155	15
EL CUYA	49	12	17	12	5	3
VERÓN	379	360	1	1	12	5

Source: National Statistics Office, National Population and Housing Census, 2002

The available infrastructure for health care is located in Higüey, Yuma, and in the neighboring province of La Romana. In Higüey, the health infrastructure consists of a public hospital of the Secretariat of State for Public Health, a policlinic of the Social Security, a health sub-center and about 20 private health facilities. In Bocas de Chavón there is a rural clinic and in Verón, besides the rural clinic of the Public Health system, there is a private health center, and a policlinic in Benerito.

All the interviewed persons reiterated the critical condition of the drinking water supply in this zone, including the provincial capital. In different communities the water service is supplied by small aqueducts or tubular wells.

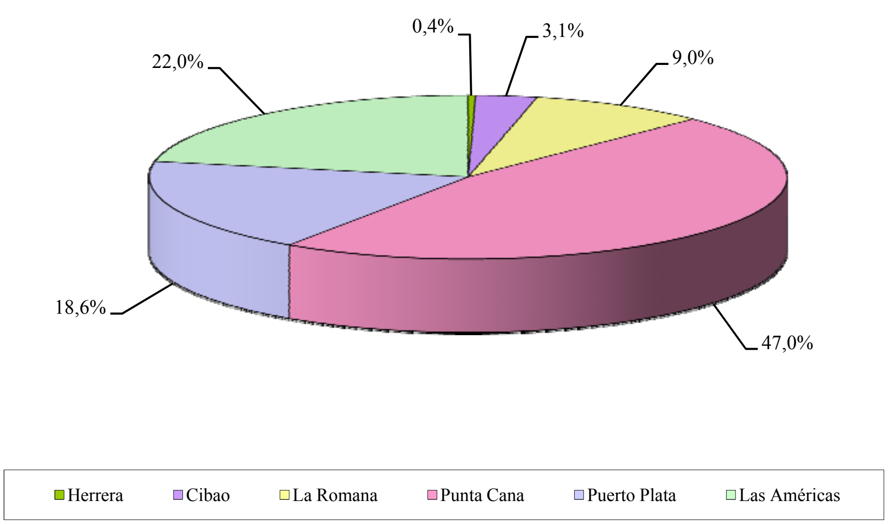
Telephone service in the rural zone is based on mobile phones. the traditional land telephone service has broad coverage in Higüey.

Transportation

A road network links this province with the Eastern Region and the rest of the country, including the Santo Domingo – Higüey highway. The international airport is located in Punta Cana, offering "charter" flights and contributing to the dynamics of the tourist market. Various companies have developed telephone communications in the zone.

The International Airports located in the Eastern corridor (Las Américas, Romana, Punta Cana), receive more than 75% of the foreign visitors to Dominican republic every year (**Figure 3-24).**

FIGURE 3-24 Passengers Arrival by Airport (in %)



Source: SEOPC, Presentation in Public Hearings, 2007

The Punta Cana Airport had the highest movement and growth in the country during 2005.

Land transportation service is supplied by private companies by buses, minibuses and taxis. They cover the different routes that interconnect the towns in this region. From Higüey they connect to Santo Domingo and the other regions of the country.

Social and Economic Synthesis

A summary of the aspects considered relevant in the characterization of the area of influence is included below:

Most of the project will be located in La Altagracia province (from kilometer 6 to 70), however, it will pass through La Romana, in a very sensitive zone in the strategic sense, due to the vicinity of the access road to Casa de Campo and La Romana International Airport.

Data on the area's social and economic condition confirms the current dynamic economy in the subregion comprised of the provinces of La Altagracia and La Romana. In spite of the differences between the two provinces, both have the majority of their Economically Active Population employed, which is in contrast with the rest of the country, given the existing high unemployment levels.

Tourism is a significant portion of the area's economic activity, surpassed in Higüey only by commerce and in La Romana by the manufacturing industry; transportation is also important in La Romana.

Agricultural and livestock activity are still important in this region, especially stockbreeding.

It is important to note the number of literate people employed in economic areas where some education level is required.

There are differences between the two provinces, for instance, the illiterate population percentage is greater in La Altagracia, because although the quantity of illiterate in both provinces is similar (39,201 in La Altagracia and 41,521 in La Romana), the population of La Romana is higher..

Both provinces possess a series of natural and cultural resources whose characteristics provide the opportunity to complement the economic dynamics, especially in the tourism market context. In that sense, the availability of a faster access way may contribute to encouraging the zone's development.

The majority of the communities within the area of influence are situated adjacent or in vicinity of the current road. The present state of the inter-regional and intra-regional infrastructure for passenger and freight transportation is unsafe for passers-by in various sections of the road, especially in the zone of Benerito, Higüey, La Otra Banda-Verón. This circumstance and the growth of the tourism market in the Punta Cana-Bávaro-Uvero Alto area, have generated a great interest in the Project by the community of the zone and the region.

3.3.2 Cultural Aspects

In this study, the cultural issues assessed included the identification and characterization of cultural patrimony or areas of archaeological interest that might be present in the corridor that will be disturbed by the construction of the Autopista del Coral project.

The main objective of this investigation was to determine if archaeological sites exist within the study corridor; locate their geographic position, assess the potential impact that the road construction could generate, and propose, if necessary, strategies for their protection and possible recovery.

This survey was conducted in compliance with existing laws on archaeological sites: Law No. 318, of April 26, 1972, Law No. 564, of September 27, 1973, Decree No. 297-87, of June 3, 1987 and General Law on Environment and Natural Resources, No. 64-00, of August 18, 2000.

During the survey, three (3) sites with archaeological material were identified and inventoried. They are located outside the road corridor study area, but are relatively close to it.

Archaeological Background

In order to contextualize the archaeological survey to be conducted in the corridor of the Autopista del Coral project, a bibliographic review was conducted to locate the different archaeological deposits reported in the provinces of La Romana and La Altagracia. Additionally, the “Archaeological Sites Index” of the Department of Archaeology of the National Museum of the Dominican Man was reviewed, as well as the “Inventory of Archaeological Material Deposits” of this museum, to verify the potential presence of registered deposits not yet published in a near area closer to the area of interest to the Project.

This bibliographic archaeological background review conducted to prepare a list of main archaeological sites located in vicinity of the Autopista del Coral project, which is presented in **Table 7 of Appendix 3.2**. This list resulted in 90 records; of which, three (3) correspond to La Romana province and the remaining (87), are located in the Altagracia province. The location of the archaeological sites identified in the list shows a distribution pattern of the first human settlements in this zone of the island highly tied to coastal areas. This is probably due to the rivers that come down from the mountain chains and the food availability in estuarine zones, as well as the ease of travel by sea and the relationship with other human groups in neighboring islands.

Archaeological Survey

- *Methodology*

The archaeological survey considered the spatial location of the archaeological vestiges identified in the national registry and the general settlement pattern observed in these records as the basic criteria. Additionally, this information was considered in a regional context that allowed analysis of possible interactions and the relationship of these cultural groups with other groups or regions.

The process of identification and assessment of archaeological deposits in the project's corridor, was conducted as follows:

Secondary Data Gathering

This activity included the following aspects:

- *BIBLIOGRAPHIC REVIEW*. Different publications, newspapers, books and bulletins of the Museum of the Dominican Man were consulted for data on archaeological studies conducted in these zones and, in general, the Hispaniola Island, in order to evaluate the archaeological implications and characteristics of the sites.

- *CARTOGRAPHY REVIEW*. Included study of topographic maps of 1:50,000 scale and photogrammetric, with the object of identifying, based on the relief, the characteristics of the different zones, as well as the geomorphologic aspects; the review also included the relationship with the water sources and their location with respect to specific areas for the environment exploitation and gathering of resources, as well as raw materials; this permitted inferring suitable places for occupation by human groups.

Personal Communication with Specialists and Inhabitants of the zone

During the survey phase, in both the field and the office work, direct contact was established with other archaeologists, documental researchers, speleologists and historians that have worked in the area concerning their specialty within the wider study zone (La Romana and La Altagracia provinces) and in the strict zone (specific area of the proposed project corridor).

Archaeological Survey within the Study Area

A reconnaissance of the zone was conducted to determine the areas to include in the archaeological survey based on their history and the activities previously conducted.

The definition of areas was based on the study of indicators that permitted inferring the location of archaeological sites; these indicators, isolated or related, permitted directing the search towards the sites considered more suitable for historical occupation or exploitation. The criteria used are associated with the location of dwellings and settlement patterns, possible areas of activity, natural resource locations and access to ecosystems, as well as communication and circulation between regions.

The following indicators were evaluated:

- *RELIEF*. The relief characterization located terraces in flat lands, and zones with potential for caves, petroglyphs and pictography.

- *PROXIMITY TO WATER SOURCES*. Zones close to rivers and water bodies were located.
- *SOIL TYPE*. It is associated with areas with potential for agricultural activity or other types of exploitation such as raw material sources or resource gathering.
- *VICINITY TO AREAS WITH NATURAL RESOURCES*. They are related to the presence of ecological niches and forest vegetation zones.
- *STRATEGIC POSITION*. Sites with a view of a vast territory; also places located in zones of natural passage, or limits between regions with different characteristics that give access to a greater variety of resources.
- *RELATIONSHIP WITH ARCHAEOLOGICAL SITES ALREADY IDENTIFIED AND REGISTERED*. The location of archaeological sites already reported is an important indicator and served as reference for observing settlement patterns and as a guide for locating other potential deposits.

According to the above indicators, an archaeological survey was conducted from kilometer 58 (inclusive) to kilometer 66 (exclusive) of the road corridor established for construction of the Autopista del Coral in a 100 m wide strip along this corridor.

Table 3-45 presents the abscissa and coordinates for each of the 85 surveyed sites and the corresponding location is shown on **Map EIAALR-011.**

TABLE 3-45 Location of surveyed sites along the project's road corridor

Site No.	Km	Coordinates	Surface Results.	Remarks
1)	58.0	19Q 05 53 227; UTM 20 53 050	Negative	Pasture field
2)	58.1	19Q 05 53 336; UTM 20 53 094	Negative	Pasture field
3)	58.2	19Q 05 53 462; UTM 20 53 114	Negative	Pasture field
4)	58.3	19Q 05 53 554; UTM 20 53 168	Negative	Pasture field
5)	58.4	19Q 05 53 659; UTM 20 53 181	Negative	Pasture field
6)	58.5	19Q 05 53 727; UTM 20 53 213	Negative	Pasture field
7)	58.6	19Q 05 53 817; UTM 20 53 273	Negative	Pasture field
8)	58.7	19Q 05 53 928; UTM 20 53 320	Negative	Pasture field
9)	58.8	19Q 05 53 997; UTM 20 53 337	Negative	Pasture field
10)	58.9	19Q 05 54 122; UTM 20 53 340	Negative	Pasture field
11)	59.0	19Q 05 54 180; UTM 20 53 594	Negative	Pasture field
12)	59.1	19Q 05 54 294; UTM 20 53 457	Negative	Pasture field
13)	59.2	19Q 05 54 400; UTM 20 53 469	Negative	Pasture field
14)	59.3	19Q 05 54 490; UTM 20 53 483	Negative	Pasture field
15)	59.4	19Q 05 54 579; UTM 20 53 515	Negative	Pasture field
16)	59.5	19Q 05 54 677; UTM 20 53 528	Negative	Pasture field
17)	59.6	19Q 05 54 780; UTM 20 53 544	Negative	Pasture field
18)	59.7	19Q 05 54 876; UTM 20 53 552	Negative	Pasture field
19)	59.8	19Q 05 55 002; UTM 20 53 558	Negative	Pasture field
20)	59.9	19Q 05 55 066; UTM 20 53 557	Negative	Pasture field
21)	60.0	19Q 05 55 158; UTM 20 53 598	Negative	Pasture field
22)	60.1	19Q 05 55 287; UTM 20 53 606	Negative	Pasture field
23)	60.2	19Q 05 55 378; UTM 20 53 608	Negative	Pasture field

Site No.	Km	Coordinates	Surface Results.	Remarks
24)	60.3	19Q 05 55 471; UTM 20 53 599	Negative	Pasture field
25)	60.4	19Q 05 55 584; UTM 20 53 593	Negative	Pasture field
26)	60.5	19Q 05 55 658; UTM 20 53 598	Negative	Pasture field
27)	60.6	19Q 05 55 788; UTM 20 53 591	Negative	Pasture field
28)	60.7	19Q 05 55 890; UTM 20 53 608	Negative	Pasture field
29)	60.8	19Q 05 56 021; UTM 20 53 602	Negative	Pasture field
30)	60.9	19Q 05 56 101; UTM 20 53 598	Negative	Pasture field
31)	61.0	19Q 05 56 181; UTM 20 53 600	Negative	Pasture field
32)	61.1	19Q 05 56 304; UTM 20 53 590	Negative	Pasture field
33)	61.2	19Q 05 56 387; UTM 20 53 564	Negative	Pasture field
34)	61.3	19Q 05 56 495; UTM 20 53 512	Negative	Pasture field
35)	61.4	19Q 05 56 577; UTM 20 53 507	Negative	Pasture field
36)	61.5	19Q 05 56 656; UTM 20 53 502	Negative	Pasture field
37)	61.6	19Q 05 56 771; UTM 20 53 493	Negative	Pasture field
38)	61.7	19Q 05 56 913; UTM 20 53 480	Negative	Pasture field
39)	61.8	19Q 05 57 005; UTM 20 53 470	Negative	Pasture field
40)	61.9	19Q 05 57 060; UTM 20 53 435	Negative	Pasture field
41)	62.0	19Q 05 57 171; UTM 20 53 382	Negative	Pasture field
42)	62.1	19Q 05 57 248; UTM 20 53 377	Negative	Pasture field
43)	62.2	19Q 05 57 337; UTM 20 53 329	Negative	Pasture field
44)	62.3	19Q 05 57 626; UTM 20 53 252	Negative	Road
45)	62.4	19Q 05 57 535; UTM 20 53 339	Negative	Pasture field
46)	62.5	19Q 05 57 648; UTM 20 53 326	Negative	Pasture field
47)	62.6	19Q 05 57 764; UTM 20 53 300	Negative	Pasture field
48)	62.7	19Q 05 57 882; UTM 20 53 230	Negative	Pasture field
49)	62.8	19Q 05 57 916; UTM 20 53 273	Negative	Top of hill
50)	62.9	19Q 05 58 064; UTM 20 53 230	Negative	Cliff
51)	63.0	19Q 05 58 140; UTM 20 53 205	Negative	Pasture field
52)	63.1	19Q 05 58 273; UTM 20 53 200	Negative	Pasture field
53)	63.2	19Q 05 58 354; UTM 20 53 196	Negative	Pasture field
54)	63.3	19Q 05 58 391; UTM 20 53 180	Negative	Pasture field
55)	63.4	19Q 05 57 600; UTM 20 53 319	Negative	Pathway
56)	63.5	19Q 05 58 607; UTM 20 53 124	Negative	Pasture field
57)	63.6	19Q 05 58 675; UTM 20 53 305	Negative	Pasture field
58)	63.7	19Q 05 58 794; UTM 20 53 107	Negative	Pasture field
59)	63.8	19Q 05 58 930; UTM 20 53 069	Negative	Pasture field
60)	63.9	19Q 05 59 037; UTM 20 53 048	Negative	Pasture field
61)	64.0	19Q 05 59 088; UTM 20 53 028	Negative	Pasture field
62)	64.1	19Q 05 59 180; UTM 20 53 010	Negative	Pasture field
63)	64.2	19Q 05 59 330; UTM 20 52 999	Negative	Pasture field
64)	64.3	19Q 05 59 366; UTM 20 52 984	Negative	Pasture field
65)	64.4	19Q 05 59 511; UTM 20 52 940	Negative	Pasture field
66)	64.5	19Q 05 59 628; UTM 20 52 922	Negative	Pasture field
67)	64.6	19Q 05 59 760; UTM 20 52 919	Negative	Pasture field
68)	64.7	19Q 05 59 819; UTM 20 52 892	Negative	Pasture field

Site No.	Km	Coordinates	Surface Results.	Remarks
69)	64.8	19Q 05 59 956; UTM 20 52 874	Negative	House
70)	64.9	19Q 05 60 049; UTM 20 52 872	Negative	Pasture field
71)	65.0	19Q 05 60 112; UTM 20 52 845	Negative	Pasture field
72)	65.1	19Q 05 60 215; UTM 20 52 820	Negative	Pasture field
73)	65.2	19Q 05 60 269; UTM 20 52 859	Negative	Pasture field
74)	65.3	19Q 05 60 406; UTM 20 52 768	Negative	Pathway
75)	65.4	19Q 05 60 500; UTM 20 52 762	Negative	Pasture field
76)	65.5	19Q 05 60 607; UTM 20 52 761	Negative	Pasture field
77)	65.6	19Q 05 60 634; UTM 20 52 695	Negative	Pathway
78)	65.7	19Q 05 60 794; UTM 20 52 709	Negative	Pasture field
79)	65.8	19Q 05 60 924; UTM 20 52 620	Negative	Pathway
80)	65.9	19Q 05 61 004; UTM 20 52 680	Negative	Pasture field
81)	66.0	19Q 05 61 070; UTM 20 52 733	Negative	Pasture field
82)		**19Q 05 57 197; UTM 20 53 822**	**Positive**	**Indigenous Ceramic**
83)		**19Q 05 57 332; UTM 20 53 672**	**Positive**	**Indigenous Ceramic**
84)		**19Q 05 57 912; UTM 20 52 123**	**Positive**	**Indigenous Ceramic – Hoyo Claro**
85)		19Q 05 58 467; UTM 20 51 753	Negative	Hoyo Azul (Fresh Water Source)

Coordinates in bold letters are archaeological sites detected during the archaeological prospection; they are close to the Project route but out of it.

At least 3 sites with archaeological material were discovered during the survey. These areas are outside the Project corridor, but very close to it. None of these deposits had been previously reported.

This survey identified the precise location of the archaeological sites with respect to the studied zone; also, it identified their conservation status and, preliminarily, the expected impacts during the road construction. The available mapping data and the use of GPS (Georeferencial Position System), facilitated geo-referencing each of the potential sites and the identified deposits, which were recorded using the UTM UPS positioning format, in WGS84 mapping Datum.

The cultural material obtained was placed in plastic bags, marked with basic identification data, such as the deposit coordinates and corresponding remarks. Additionally, a photographic record was taken. All the material collected during the archaeological survey was duly registered in the Museum of the Dominican Man in the city of Santo Domingo.

Archaeological Evidence

During the survey, three sites with archaeological material were identified in areas in vicinity of the project's road corridor, as shown in **Map EIAALR-011.** A brief description of each of the sites with positive evidence of archaeological material is given below:

Archaeological Site No. 1

Location

It was registered during this survey as Site No. 82. It is located at the following coordinates: 19Q 05 57 197 and UTM 20 53 822. Its approximate location with respect to the road corridor is 420 m north of K62+000.

Description

It has a rocky soil and is close to lowlands suitable for cultivation. Four fragments of buren and nine fragments of indigenous ceramic were discovered.

None of these ceramic traces has any decoration and they are part of a vessel body. One of the buren fragments has a direct border, slightly thickened. Three of the ceramic fragments possess direct borders, one of them with rounded lip and two with beveled lips.

The use of buren indicates the presence of a human group with agricultural and ceramic activity.

This site was probably used for farming and dwellings. A detailed investigation is required for a more precise diagnostic.

Conservation Status

The site is in good conservation condition. No evidence of destruction or plundering was found (**Photo 3-50**).

Photo 3-50
FRAGMENTS OF INDIGENOUS BUREN AND CERAMIC COLLECTED IN SITE 1.

Archaeological Site No. 2

Location

It was recorded during this survey as Site No. 83. It is located at the following coordinates: 19Q 05 57 332 and UTM 20 53 672. The approximate location in reference to the road corridor axis is 302 m north of K62+000.

Description

It has a rocky soil and is located next to a water reservoir for animal consumption and for supplying a small house, apparently in disuse. In this site only two small fragments of indigenous ceramic were collected; they have neither decoration nor borders, and they are part of a vessel's body. It is not diagnostic material. This site was possibly used as a farming area. Further research is needed for a better knowledge of this zone.

Conservation status

The site has good conservation conditions. No evidence of destruction or plunder was found (**Photo 3-51**).

Archaeological Site No. 3

Location

Recorded during the survey as Site No. 84. It is located in the village (paraje) of Hoyo Claro at the following coordinates: 19Q 05 57 912 and UTM 20 52 123. The approximate location in reference to the corridor axis is 1121 m south of K63+000.

Photo 3-51
FRAGMENTS OF INDIGENOUS CERAMIC LOCATED AT SITE 2.

Description

It is a black earth site, good for cultivation; a plantain plantation is currently located on it.

Nine fragments of indigenous ceramic were collected here. One of them corresponds to fine buren with slightly thickened border. Five of the fragments are part of the body of pots and the others three belong to plates or round vessels, possibly used for containing or serving food. One of these borders has incised decoration at the chicoide style, which belongs to the taíno ethnic group. Also, 5 snail fragments were collected (4 terrestrial: *Caracolus excellent*, *Plydonte sp*, etc. and 1 marine: *Cittarium pica*), as well as a fish vertebra.

This site was likely used as a dwelling area and for cultivation. Further research is needed for a better knowledge of this zone.

Conservation Status

The site is in good conservation conditions. No evidence of destruction or plunder was found (**Photos 3-52 and 3-53**).

Photo 3-52
VIEW OF ARCHAEOLOGICAL SITE 3, LOCATED AT HOYO CLARO.

Photo 3-53
FRAGMENTS OF INDIGENOUS CERAMIC AND BUREN FROM THE TAINO CULTURE; AND A FISH VERTEBRA, SNAIL SHELL FRAGMENTS, PROBABLY USED FOR FOOD

CONCLUSION

The archaeological survey carried out in the area of kilometers 58 (inclusive) to 66 (exclusive) of the corridor proposed for the construction of the Autopista del Coral (La Romana - Punta Cana Highway)identified 3 sites with archaeological evidence corresponding to indigenous groups. These sites were located outside of, but immediately adjacent to the road corridor.

This document constitutes the first report of these three archaeological sites or deposits. They are open areas that apparently were used for agricultural and dwelling purposes.

Field data and the additional secondary data collected (bibliographic review) served to determine the importance of the discoveries, define strategies for their assessment and for their recovery, in some cases, and preserve information and historical patrimony that could be affected by the project.

The location of the three archaeological sites, situated outside the corridor established for the motorway construction, implies that the degree of impact on them is considered slightly negative or nonexistent. Nevertheless, it is deemed appropriate that during the earthworks or soil preparation in this area monitoring will be conducted by an archaeological team duly trained for conducting rescue operations.

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4.0 INSTITUTIONAL AND LEGAL FRAMEWORK

4.1 Introduction

This section identifies the institutional and legal framework with regard to current environmental regulations in the Dominican Republic under which the Autopista del Coral project will be developed.

The Autopista del Coral project -La Romana – Punta Cana Highway- will consist of the construction and operation of a 70km long motorway with a 70m Right of Way, involving the provinces of La Romana and Altagracia. The design, in its current basic engineering phase, is for four (4) lanes 3.65m wide each and a 100 km/h speed limit. Construction is estimated to last two (2) years during which all the activities related to the road construction and complementary projects will be completed, as detailed in Section 3 “Project Description”.

The Secretariat of State for Public Works and Communications (SEOPC) is the project promoter, through the General Directorate for Investment Planning and Programming and the Department of Environmental Management and Irrigation. The Moya – Odebrecht Consortium will be in charge of the project construction, operation and maintenance, under a Public-Private Participation financing arrangement. The process of land negotiations and expropriations for implementing the project will be conducted by the SEOPC.

In 2005, SEOPC started the environmental management process for the Autopista del Coral project by means of the “Preliminary Analysis of Environmental Assessment”, submitted to the Secretariat of State for Environment and Natural Resources (SEMARN). On August 26, 2005, SEMARN established the Dossier Code No. 2336 and issued the Terms of Reference for developing the Environmental Impact Assessment (EIA) required for the Autopista del Coral (La Romana – Punta Cana Highway) project. Later, by notice dated March 21, 2007, SEMARN renewed the Terms of Reference for the EIA, which were valid for one year.

4.2 Institutional Framework

The current administrative structure in the Dominican Republic is organized into 17 Secretaries of State. The ruling, regulatory and control functions concerning environmental protection are the responsibility of the ***SECRETARIAT OF STATE FOR THE ENVIRONMENT AND NATURAL RESOURCES*** (Law 64-00 “General Law on Environment and Natural Resources”, Articles 17 and 18). This governing body is the national environmental authority and ruling entity of the national environmental management system. It is responsible for preparing the national environmental policy, executing and controlling this policy, administrating the resources, and supervising the preservation, protection and sustainable use of the environment and the natural resources.

A brief description of the institutions that may be involved in the Project during its different phases and/or in the EIA review and approval process is given below.

4.2.1 Secretariat of State for Public Works and Communications (SEOPC)

This institution was created by Decree No. 5406 on December 28, 1959. SEOPC's mission includes planning, designing, constructing and conserving the necessary public works for the country's sustainable economic growth, ensuring their adequate and safe operation, respecting the environment, and introducing modern technology and administration systems.

One of SEOPC's main objectives is to provide a network of roads sufficient to connect principal populated centers in the country's different regions. This includes constructing, extending, repairing and maintaining the transportation infrastructure, achieving maximum transit safety, and improving use of existing roads to optimize transportation efficiency.

SEOPC consists of the following offices: General Directorate of Land Transit, General Directorate of Regulations and Systems, General Directorate of Building Works, General Directorate of Investment Planning and Programming, General Directorate of Control, Maintenance and Supervision of the National Toll System, General Directorate of Highways and Minor Roads, General Directorate of Highways and Minor Roads Maintenance, General Directorate of Supervision and Control of Construction Works, General Directorate of Equipment and Transportation, the Department of Environment and Risk Management and the Unit for Special Projects Execution.

The following offices from SEOPC are expected to be involved in the Autopista del Coral project:

General Directorate of Investment Planning and Programming

This office includes the sector planning unit and its main functions are:

- To conduct socio-economic and technical studies for planning the construction works and projects to be executed under the responsibility of the Secretariat for Public Works
- To ensure project completion according to accepted standards and technical specifications, and within the planned schedule and budget

- To formulate, based on planning studies, the infrastructure improvement projects and programs for the short, medium and long terms, and their development and monitoring according to current technical criteria
- To establish the budget requirements for the transportation sector, in order to prepare the SEOPC's overall budget
- To recommend policies and prioritization for road maintenance.

General Directorate of Supervision and Control of Construction Works

This office is responsible for technical supervision of all road construction and maintenance by SEOPC. This includes the following specific responsibilities:

- To enforce the contract specifications for construction and maintenance projects,
- To contract the State's construction projects conducted by contractors,
- To oversee the State's construction projects to verify compliance with budgets, and prepare monthly budget statements for projects being developed,
- To conduct inspections and supervisory visits to the State's construction projects, oversight of external inspectors (supervising companies) on existing projects,
- To provide verbal and written notice to contractors concerning any violation of specifications that have been identified, in order to correct them within the established terms,
- To notify contractors, in writing, of any modification or recommendation to improve a construction project, prior to approval by the Secretariat of State for Public Works,
- To investigate complaints received regarding construction conducted by the contractors,
- To monitor, during and after the construction process, the topographical and soil studies, to ensure quality of construction work.

Department of Environment and Risk Management

The objective of this office is to lead environmental and risk management in the state institutions that administer policies for construction projects that affect the environment. Functions include supervision, coordination and follow-up to environmental policies, plans, programs, projects and actions within the SEOPC, to ensure compliance with environmental regulations.

4.2.2 Secretariat of State for the Environment and Natural Resources

Created by Law 64-00 on August 18, 2000 of the Dominican Republic Congress (*GENERAL LAW ON ENVIRONMENT AND NATURAL RESOURCES*), the ***Secretariat of State for Environment and***

***Natural Resources** is the leading organization on environmental, ecosystems and natural resources management. (Article 17, Law 64-00).*

The mission of this Secretariat is to apply an integrated State policy for the conservation, protection and regulation of natural resources and the environment, to achieve sustainable development in the Dominican Republic. Its functions (Law 64-00, Art. 18) include: adopting the national policy on the country's environment and natural resources; enforcing the national policy on the environment and natural resource; administration of the State's natural resources under its jurisdiction; ensuring the preservation, protection and sustainable use of the environment and the natural resources; the progressive improvement of the management, administration and regulations concerning soil, air and water pollution, preserving and improving the quality of the environment; promoting and ensuring conservation and sustainable use of forest resources and supervising the application of the State's forest policy and standards regulating its use; preparing and updating standards and supervising the efficient application of the legislation for ensuring conservation and sustainable use of the natural resources and improving environmental quality; preparing and ensuring the proper application of standards for conservation, preservation and management of protected areas and wildlife; evaluating the economic impacts of the deterioration of the environment and natural resources, in order to include them in operational costs and the national budgets; controlling and preventing environmental pollution at the emission sources.

SEMARN is organized in the following offices, which are expected to have direct importance to and involvement in the Autopista del Coral Project development:

- Sub-Secretariat of Environmental Management
- Sub-secretary of Soils and Waters
- Sub-Secretariat of Forest Resources
- Sub-Secretariat of Protected Areas and Biodiversity

Sub-secretary of Environmental Management

This Sub-Secretariat has the mission of ensuring a healthy and safe environment for present and future generations. Its main functions are: A) ensuring that development in the country complies with the environmental quality standards and regulations; B) implementing a system for damage and disaster prevention and mitigation. This Sub-Secretariat is in charge of issuing environmental permits and licenses to new projects and environmental permits to existing facilities; receiving and dealing with complaints concerning environmental damages and emergencies (spills, gas leaks, explosions, etc.) and conducting inspections for preventing damages, and certifying environmental service providers.

The Sub-Secretariat of Environmental Management consists of the Directorate of Environmental Quality, the Directorate of Environmental Evaluation, and the Directorate of Environmental Protection. Each Directorate has a mission according to its functions:

- The Directorate of Environmental Quality is responsible for ensuring that the human activity in the country complies with applicable environmental quality standards and regulations.
- The Directorate of Environmental Evaluation must ensure that the environmental impact assessments, the environmental impact evaluations and the environmental impact declaration of both public and private projects are conducted according to applicable regulations.
- The Directorate of Environmental Protection is responsible for implementing a damage and disaster prevention and mitigation system.

Sub-Secretariat of Soils and Waters: the mission of this office is the integrated and sustained management of soil and water resources, for improving the conditions and quality of life of the people of the Dominican Republic. Its main functions are: Controlling material extraction from the earth's crust, such as sand, gravel and stones -Law 64-00 repealed Law No. 127, re-assigns authority for such functions from the mayor's office where those extraction activities were developed; developing and administering the national policy on use and management of the soil and water resources, according to requirements of Law 64-00; involving rural communities in plans, projects and programs related to watershed management, renewable natural resources and agriculture; determining mechanisms and standards for regulating extraction of raw materials and establishing the necessary infrastructure for adequate planning for the use and management of soils and waters, by using the existing agro-physical and socio-economic data.

The Sub-Secretariat of Soils and Waters is composed of the Directorate of Hydrographic Basins and the Directorate of Aggregate Extraction and Inventory.

- The Directorate of Hydrographic Basins has the mission of administering the integrated and sustained management of soil and water resources, for improving the quality of life of the people in the watersheds. This Directorate is in charge of the following services: Well

Exploitation Permits, Soil Use Change, Discharge Permits (liquid discharges) and the Permit for Ground Water Well Construction.

- The Directorate of Aggregate Extraction and Inventory has the mission of exploiting the mineral deposits on the earth's crust, without affecting the course of rivers or aquifers. This Directorate is in charge of the following services: transitory authorizations for aggregates extraction from the earth's crust, permits for aggregates extraction from the earth's crust and concession for aggregates extraction from the earth's crust.

Sub-Secretariat of Forest Resources: its mission is promoting and ensuring reforestation and a sustainable management of forest resources within the framework of the State's forest policy and the standards governing its use; and promoting current scientific thinking on forest management obtained from research conducted in the country and abroad, which could be applied to the Dominican Republic. Its functions are to: collaborate in the formulation of the national forest policy; promote planting in the high basins aimed at conserving soils and waters; encourage development of commercial forest plantations for lumbering, energy, industrial, food and decorative uses; authorize installation and operation of sawmills and industrialization of forest products; provide technical assistance to the development and execution of work plans associated with protection, conservation, use and industrialization of forest resources; approve, evaluate and supervise the forest management plans for private lands; develop and implement work plans concerning protection, conservation, and use of forest resources in public owned lands; establish the standards and requirements of a registry of forest professionals for preparing, advising and implementing forest management plans; coordinate actions for forest management with the communities, municipalities, associations of forest producers and non-profit organizations; promote, together with the municipal authorities, the implementation and adequate management of urban reforestation; update criteria and standards for the development and implementation of forest projects, and revising and approving forest projects and programs to be implemented in the country.

This Sub-Secretariat provides, among other services, the Felling Authorization.

Sub-Secretariat of Protected Areas and Biodiversity: its mission is contributing to the conservation of biodiversity in all the national territory for supporting sustainable development and improving quality of life, administering a national system of protected areas and the application of standards and regulations in the Dominican Republic. The key functions of this sub-Secretariat include: coordinating the formulation and implementation of the national policy on the development of protected areas and conservation of biological diversity in the country; preparing and implementing the standards, regulations and procedures required for the sustainable management of protected areas and biodiversity; regulating the use and activities related to biodiversity resources; promoting the development, conservation and management of the wild flora and fauna; administration of the national system of protected areas in order to ensure the integrity thereof, providing environmental services and an environmentally healthy interaction with users, and encouraging the rural community's participation in plans, programs and projects for the conservation of biodiversity and protected areas. This Sub-Secretariat is composed of the following directorates: the Directorate of Protected Areas and the Directorate of Biodiversity and Wildlife.

The Directorate of Protected Areas is composed of the Department of Protected Areas and the Department of Follow-up. This Sub-Secretariat provides the following services: Certificates of land properties within or outside of Protected Areas, Concession Permits for Soil Use within a Protected Area, Concession Permits for Ecotourism Operation within a Protected Area and Permits for Construction of Facilities Compatible with Protected Area Management.

4.2.3 Secretariat of State for Culture

The Secretariat of State for Culture is the entity in charge of coordinating the National System of Culture of the Dominican Republic and is responsible for the implementation of policies, plans, programs, and projects for cultural development. This Secretariat's mission is integrating the multiple elements of the cultural process into a national cultural system, for developing the different cultural expressions that create and recreate the Dominican nation's cultural identity.

This Secretariat is composed of the Sub-secretary of State of Cultural Patrimony, which is the highest level of direction, supervision and control of policies aimed at the protection, conservation, evaluation, and dissemination of the Nation's material and immaterial heritage, as a basic element of the Dominican identity. Its functions include establishing the necessary measures for ensuring adequate protection, conservation and restoration of those assets declared as part of the National Cultural Heritage; also, approving authorization for conducting renovation, modification, restoration or any kind of change or alteration of the assets considered as National Heritage.

4.3 Legal Framework

The environmental legal framework in the Dominican Republic is based on Law 64-00 "General Law on the Environment and Natural Resources". This law has been emended with the following resolutions:

- Resolution 05-2002 and Resolution 06-2004, which established the environmental license and permit system for projects, through the following processes:
    - Regulations of the Permit and License System;
    - Environmental Permit Application Procedures for Existing Facilities;
    - Environmental Impact Assessment Procedure
    - Explanatory Nomenclature for Construction Works, Activities and Projects
- Resolution No. 10-2003, establishing the following standards:
    - Environmental Standard for Air Quality (NA-AI-001-03);
    - Environmental Standard for Control of Air Pollution Emissions from Vehicles (NA-AI-003-03), and
    - Environmental Standard for Control of Air Pollution Emissions from Point Sources (AR-FF-01).
- Resolution No. 09-2003, issuing the Environmental Standard on Water Quality and Discharge Control (NA-AG-001-03).
- Resolution No. 08-2003, setting the following standards:
    - Environmental Standard for Noise Protection (NA- RU-001-03)
    - Standard establishing a Reference Method for Measuring Noise from Point Sources (NA-RU-002-03)
    - Standard establishing a Reference Method for Measuring Noise from Vehicles (NA-RU-003-03)
    - Standard for Environmental Management of Non-Hazardous Solid Wastes (NA-RS-001-03), according to articles 106 to 108 of General Law on Environmental and Natural Resources (Law 64-00).

Additionally, the specific legal framework of the Autopista del Coral project includes the following:

- Law No. 202-04 “Sector Law on Protected Areas”, concerning the protected areas system and its interaction with the project activities.

- Law 318-1972, Law 564-1973 and Decree 297-87, concerning protection of the Archaeological and Cultural Heritage of the Dominican Republic and its interaction with the project activities.

- Law 4378 of February 10, 1956, Gaceta Oficial No. 7947 of February 18, 1956, creating the Organic Law of the Secretariats of State, including the SEOPC.

- Decree No. 1489 of February 11, 1956, setting the functions of the Secretariat of State on Public Works.

- Decree No. 5406 of December 28, 1959, designating the Secretariat of State for Public Works as Secretariat of State for Public Works and Communications, in charge of the development and construction of projects for roads and transportation, police, airports, communications, meteorological services, official time, merchant navy, land, maritime and air transportation, Aeronautical Commission, and the Maritime Mission.

- Law 165 of March 28, Gaceta Oficial 8977 of September 30, 1966, creating the General Directorate of Land Transit, belonging to the Secretariat of State for Public Works and Communications, with the functions of study, organization, planning and control of transit and transportation throughout the country.

- Decree No. 326-87 of June 18, 1987, Gaceta Oficial No. 9713 authorizing modifications in the structure of the Secretariat of State for Public Works, creating the General Directorate of Investment Planning and Programming and the General Directorate of Supervision and Control of Public Works.

4.3.1 Environmental Evaluation

Law 64-00 “General Law on Environment and Natural Resources” establishes, in articles 38 to 48, the management instruments that constitute the environmental permit and license system. This system will be applied to both new projects and existing facilities in the country. The environmental management instruments established for the environmental permit and license system is based on Resolution 05-2002 and Resolution 06-2004, which issued the following:

- Regulations of the Environmental Permit and License System;
- Environmental Permit Application Procedures for Existing Facilities;
- Environmental Impact Assessment Procedure
- Explanatory Nomenclature for Construction Works, Activities and Projects

The above documents introduce Environmental Evaluation concepts to the permit and license process for new projects and existing facilities, such as:

Environmental Impact Declaration (DIA, Declaración de Impacto Ambiental in Spanish): This document outlines a proposed project's effects (both positive and negative) on the environment and natural resources as well as the necessary prevention, mitigation, and compensatory measures. It establishes the project's Environmental Management and Adaptation Program.

Environmental Report (IA, Informe Ambiental in Spanish): It's the result of a multi-disciplinary investigation, describing the Project and its key impacts, both environmental and socio-economic. It identifies the necessary mitigation measures and establishes the Environmental Management and Adaptation Plan. This type of study will be required for existing facilities.

Environmental Impact Assessment (EsIA, Estudio de Impacto Ambiental in Spanish): A series of technical and scientific investigations aimed at identifying, predicting and controlling the environmental impacts of project activities. The EsIA is presented as a technical report and conducted according to criteria established by the existing regulations. It is an interdisciplinary and reproducible study and it includes measures for preventing, mitigating and/or compensating the indentified impacts, establishing the necessary management and adaptation program to allow project implementation, as well as the monitoring plan.

Additionally, this study incorporates a Project rating according to three categories, and the required level of study is determined by a combination of the project's intrinsic characteristics and the sensitivity of the area where it is located. The matrix shown in **Table 4-1** describes the rating to be adopted by the projects (according to "Explanatory Nomenclature of Construction Works, Activities and Programs").

TABLE 4-1 Project Rating Matrix

Category	Description
A	These are projects, works or activities with a complex environmental impact, which may have regional to national effects. They require conducting an Environmental Impact Assessment and designing an Environmental Management and Adaptation Program (EMAP). This study will be conducted based on the Terms of Reference.
B	These are projects, works or activities with significant environmental impact, but limited to the project zone and its direct area of influence. They will be subjected to the evaluation process trough an Environmental Impact Declaration (DIA); they might require an EsIA or EAC.
C	These are projects, works or activities with potentially moderate environmental impacts that may be easily identified and corrected with appropriate practices.

Considering the above classification, all the projects in the transportation sector whose objective is the construction and extension of highways and motorways, are rated as category A and they are required to follow the Environmental Impact Assessment process. Consequently, the "Autopista del Coral" Project (La Romana – Punta Cana Highway) is rated as a Category A project and the Terms of Reference issued by SEMARN in August 2005 and renewed in March 2007, demand conducting an Environmental Impact Assessment (EsIA).

According to the "Environmental Impact Assessment Procedure", the Autopista del Coral project, developed the following phases in 2005:

- Phase 1 – Environmental License Application
- Phase 2 – Preliminary Analysis

In 2007, the Project developed the following phases:

- Phase 3 – Environmental Impact Assessment, by the Project proponent
- Phase 4 - Revision of the Environmental Impact Assessment by SEMARN
- Phase 5 – Decision Making by SEMARN

The proponent is responsible for all the costs associated with environmental studies, implementation of the mitigation measures and the environmental management and adaptation program, required publications, communications and public consultations; also, the proponent shall cover the cost of delivery of the Environmental License. The cost of the Environmental License is an amount proportional to the estimated Project cost, weighted by the expected magnitude of the project's impact and subject to a multiplier (Environmental Impact Assessment Procedure, Section 6 “Cost of Environmental Permits and Licenses”).

Law 64-00, in its article 47, requires the Project to pay a performance bond equal to ten percent (10%) of the total cost of construction or project investment, in order to ensure compliance with the environmental license and implementation of the environmental management and adaptation program. Also, the “Regulations of the Environmental Permit and License System”, in its article 43, indicates that the project requires an EsIA due to the magnitude of their projected impacts. The project proponents must contract an environmental risk insurance policy covering the civil responsibility and the repair cost of environmental impacts for possible damages caused by unforeseen events or negligence during project implementation.

According to the “Regulations of the Environmental Permit and License System”, the following conditions must be considered during the Environmental Licensing process:

- The Environmental Licenses and Permits are contractual in nature, they will be issued only once during the Project life. Nevertheless, their validity will depend on the results of the follow-up to the Environmental Management and Adaptation Program (EMAP), which will be audited in the periods established in the corresponding Permit or License (Article 8).

- The Secretariat of State for Environment and Natural Resources will conduct periodic inspections and audits to verify fulfillment of the stipulations in the EMAP, the conditions and requirements in the Environmental Permit or License, and in general the compliance with current environmental legislation (Article 34).

- When the results of the periodic inspections and audits show that the Project complies with the requirements of Law 64-00, its current Regulations and Environmental Standards, and with the EMAP and the conditions established for the Environmental Permit or License, the Secretariat of State for Environment and Natural Resources will issue a Certificate of Environmental Compliance (Article 35).

- Without prejudice to civil and/or penal responsibilities that the compliance with this Regulation, its Procedures or the Terms in the EMAP and the Environmental Permit or License could imply, the Secretariat of State for Environment and Natural Resources could apply, by an administrative proceeding, the corresponding sanctions (Article 37).

- As a condition of the Environmental License or Permit granted, once the process described in this Regulation is completed, the Project proponent shall make a payment whose amount will be calculated proportionally to the estimated Project investment, plus a weighted value depending on the magnitude of the expected impacts, according to the respective Procedure (Article 41).

- Once the requested permit or license is approved, the Project proponent shall contract an insurance policy for the amount of the performance bond (10% of the investment required for executing the EMAP), as established in Article 47 of Law 64-00. In the event that non-compliance with the terms established in the EMAP is detected, this policy will be make payments to the Secretariat of State for Environment and Natural Resources (Article 42).

Public Consultation

According to articles 38 and 43 of Law 64-00, public consultation and citizen participation are incorporated as elements of the environmental evaluation and environmental permit and license process for the Project.

The Regulations of the Environmental Permit and License System provide the following definitions on this matter:

PUBLIC CONSULTATION: It is the process by means of which the opinion of all those interested or not interested in the Project implementation is collected.

PUBLIC AUDIENCE OR HEARING: A public consultation tool where all those interested in a Project or activities are allowed to participate in the evaluation process. The term “Audience” (Audiencia, in Spanish) is used when it is coordinated by the Secretariat, and “Hearing” (Vista, in Spanish) when it is coordinated by the Project proponent, as part of the environmental impact assessment study (EsIA).

Also, the Regulations of the Environmental Permit and License System in Title VI, articles 25 to 33 describe the procedure to be followed by the Project Proponent for developing the public consultation during the development of the environmental impact assessment and its revision by SEMARN.

Article 28 of this Regulation stipulates that in the Terms of Reference SEMARN shall indicate how many public hearings the Project proponent shall hold during the Environmental Impact Assessment development. Article 29 states that during the Environmental Impact Assessment revision phase, SEMARN may determine whether a Public Audience is necessary for the project.

4.3.2 Environmental Permits

Law 64-00, in article 43, establishes that the environmental permit and license process will be administered by the ***Secretariat of State for Environment and Natural Resources*** which will be obliged to provide the environmental impact assessments to competent sector organizations and with municipal authorities for comment, ensuring citizen participation and corresponding distribution of information.

Based on these issues and according to the project characteristics and required activities for its development during the construction and operation phases, the issuing agencies, environmental permits, and the legal basis supporting the respective permit, are listed below:

Sub-Secretariat of Environmental Management

- Environmental License, legal basis: Law 64-00, articles 38 to 48; Resolution 05-2002 and Resolution 06-2004.

Sub-Secretariat of Soils and Waters

- Discharge Permit (Liquid Discharges), legal basis: Law 64-00, article 135.
- Permit for Ground Water Well Construction and Well Operation Permit, legal basis: Law 64-00, articles 127 to 128.
- Soil Use Change, legal basis: Law 64-00, article 123.
- Permits for Aggregates Extraction from the Earth's Crust and/or Transitory Authorizations for Aggregates Extraction from the Earth's Crust, legal basis: Law 64-00, Law 123 of 1971 and Resolution 05-2004.

Sub-Secretariat of Forest Resources

- Authorization for Felling, legal basis: Law 64-00.

4.4 National Standards for Air Quality

The national standards for environmental quality in the Dominican Republic are in Law 64-00 (General Law on Environment and Natural Resources), Title III "On the Protection of Environmental

Quality", articles 79 to 115. Consistent with the stipulations of Law 64-00, the State has issued the following environmental quality standards:

- Resolution No. 08 – 2003, issuing the noise protection standard.
- Resolution No. 09 of 2003, issuing the standard for water quality and discharge control (liquid discharges).
- Resolution No. 10 of 2003, issuing the air quality standard.

Following is a detailed description of the national standards relevant to the evaluation of environmental issues during the EIA, which will help later in determining the project's compliance benchmarks according to the National environmental regulations.

4.4.1 Air

The "Air Quality Standard" (NA-AI-001-03), establishes maximum permissible values for air pollutant concentrations. The main objective of this standard is the protection of the health of the population in general and of the more susceptible groups in particular. The standards also include a margin of safety, applicable to all the national territory, taking into account the meteorological and topographic conditions of each region.

Table 4-2 shows the air quality standards stipulated by Standard AR-CA -01".

TABLE 4-2 Air Quality Standards

Pollutant	Average Time	Permissible Limit ($\mu G/M^3$)
Total suspended particles	Annual	80
	24 hours	230
Particle fractions (PM10)	Annual	50
	24 hours	150
Sulphur Dioxide (SO_2)	Annual	100
	24 hours	150
	1 hour	200
Nitrogen Dioxide (NO_2)	Annual	100
	24 hours	300
	1 hour	400
Ozone (O_3)	8 hours	160
	1 hour	250

Pollutant	Average Time	Permissible Limit ($\mu G/M^3$)
Carbon Monoxide (CO)	Daily mean	-
	8 hours	10000
	1 hour	40000
Non-Methane Hydrocarbons (CH)	3 hours	160
Lead	Quarterly	1.5
	Annual	2.0

Source: Table 3.1 of NA-AI-001-03 Standard

Concerning the "Standard for Control of Emissions from Vehicles" (NA-AI-003-03), the standards for air emissions are those listed in Tables 3.1 and 3.2 of the regulation, and they are presented in **Tables 4-3** and **4-4** below:

TABLE 4-3 Maximum Opacity Limits for Smoke Emitted by Diesel-Engine Vehicles

Vehicle Manufacturing Year	Smoke Emissions
Before or during 2000	80% opacity
After or during 2001	70% opacity

Source: Table 3.1 of NA-AI-003-03 Standard

TABLE 4-4 Maximum Emission Limits for Gasoline-Engine Vehicles

Vehicle Manufacturing Year	CO (%Vol.)	CO2 (%Vol.)	CH (Ppm)
Before or during 1980	6	8	1200
1981 – 1999	4.5	10.5	600
After or during 2000	0.5	12	125

Source: Table 3.2 of NA-AI-003-03 Standard

4.4.2 Noise

The "Environmental Standard for Noise Protection" (NA-RU-001-03 replaces the RU-CA-01), establishes the maximum permissible levels and general requirements for protection against noise generated by point and mobile sources.

For this regulation, the relevant standard values are specified in Table 4.1 "Continuous Noise Levels and Their Effects on Humans", Table 4.2 "Maximum Permissible Noise Levels, in decibels –dB(A)", Table 4.3 "Regulation for Specific Activities" and Table 4.4 "Permissible Noise Levels for Vehicles According to Weight/Cylinder Capacity", and they are presented in **Tables 4-5, 4-6, 4-7** and **4-8** below**:**

TABLE 4-5 Continuous Noise Levels and Their Effects on Humans

Noise Level	Effects on Humans	Range, in dB (A)	Time Range
A: Moderate	Common Pain	50 to 65 40 to 50	Daytime (7 a.m. – 9 p.m.) Night (9 p.m. – 7 a.m.)
B. High	Grave Pain	65 to 80 50 to 65	Daytime (7 a.m. – 9 p.m.) Night (9 p.m. – 7 a.m.)
C. Very High	Risks	80 up to 90	In 8 hours
D: Deafening	Grave risks of hearing loss	Greater than 90 up to 140	At least 8 hours

TABLE 4-6 Maximum Permissible Noise Emission Levels, in decibels (dB) (A).

Area Category	Outside Noise, dB(A)	
	Daytime (7 a.m. - 9 p.m.)	Night (9 p.m. - 7 a.m.)
Area I: Tranquility Zones		
• Hospitals, health centers, libraries	55	50
• Offices and schools	60	55
• Zoos and Botanical Gardens	60	55
• Tranquility areas for Habitat Conservation	60	50
Area II: Residential Zone		
• Residential area	60	50
• Residential area with neighboring industries or commercial shops	65	55
Area III: Commercial Zone		
• Industrial Area	70	55
• Commercial Area	70	55
Area IV		
a) Highways with one or more lanes and one Way		
• Crossing Area I	60	50
• Crossing Area II	65	55
• Crossing Area III	70	60
b) Highways with two or more lanes and two Ways		
• Crossing Area I	65	55
• Crossing Area II	65	60
• Crossing Area III	70	65

TABLE 4-7 Regulations for Specific Activities

Activity	Areas	Period	Parameter (Db) A
Vehicle horns	All the areas	Day time Night	70 70
Loudspeakers	All the areas, except for tranquility areas Tranquility areas	Day time Night	70 Forbidden Forbidden
Music Sound Equipment	All the areas Tranquility areas	7:00a.m. 7:00p.m. Night	60 40 Forbidden
Public or private construction work equipment	In all areas	7:00a.m. 7:00p.m. Night	95[1] Forbidden

1 This is an average value, permitted to the equipment or machinery; protection and mitigation measures shall be taken for maintaining the area levels established by this Standard.

TABLE 4-8 Permissible Noise Levels for Vehicles According to Weight/Cylinder Capacity

Vehicle Type	Cylinder Capacity (cc)/Weight	Permitted Noise Level, dB(A)
Motorcycles	< 80 cc 81-125 cc 126 - 350 cc > 351 cc	78 80 83 85
Vehicles with 5 to 8 passenger capacity	Light	75
Vehicles with more than nine seats, including driver	Weight ≤ 3,5 ton.	80
Freight vehicles	Weight ≤ 3,5 ton.	81
Passenger vehicles, with more than nine seats, including driver	Weight > 3,5 ton.	83
Freight vehicles	Weight > 3,5 ton.	86

** The noise levels produced by vehicle traffic depend on the speed developed by the vehicle in motion; therefore, these values are applicable to vehicles moving at a speed range from 35 to 80 Km/h.*

4.4.3 Water and Discharges

The “Environmental Standard on Water Quality and Discharge Control” (NA-AG-001-03) classifies the surface and coastal waters according to their use. Its objective is protecting water quality by controlling liquid effluents, whether industrial, municipal, public or private. Specifically, this standard establishes the requirements to be fulfilled by persons responsible for (point or non-point) water discharges to receiving bodies.

This standard classifies surface waters as follows:

CLASS A: Public and industrial drinking water supply without need for prior treatment, water for agricultural and recreation use.

CLASS B: Water critical to preserving the flora and fauna, useful for crop irrigation, aquatic sports and potable water supply after a treatment process.

CLASS C: Navigable waterways.

CLASS D – 1: Surface waters to be preserved in natural conditions, due to their exceptional quality or high ecological value.

This standard stipulates that the maximum pollutant load shall not exceed the water quality limits established for the receiving body, which are shown in **Table 4-9**. Additionally, this standard establishes that these values will be employed for classifying the water body, depending on the use thereof. According to this standard, the water bodies are classified as follows:

TABLE 4-9 Maximum Values for Physical, Chemical and Biological Parameters present in Surface Water Bodies and Coastal Waters

Parameters	Unit	Surface Waters			Coastal Waters
		Class A	Class B	Class C	Class E
General Parameters					
Tensoactive agents	mg/l	0.15	0.5	2	-
Chlorides	mg/l	250	250	1000	-
Fecal coliforms	NMP/100 ml	400	1000	4000	400
Total coliforms	NMP/100 ml	1000	1000	10000	1000
Color	U.Pt-Co	15	50	200	Natural Condition
BOD	mg/l	2	5	100	-
Fluorides	mg/l	0.7	1	3	1.5
Phosphorus PO_4-P	mg/l	-	-	-	0.4
Total Phosphorus	mg/l	0.025	0.025	0.1	-
Grease and Oils	mg/l	Absent	1	20	1
Ammonia (NH_3-N)	mg/l	0.5	0.5	-	0.5
Nitrates + Nitrites	mg/l	10	10	-	15
Dissolved Oxygen	% Satur.	>80	>70	>50	>60
pH	mg/l	6.5 – 8.5	6.5 – 9.0	5.0 – 7.0	7.5 – 8.5
Dissolved solids	mg/l	1000	1000	5000	-
Floating solids	-	Absent	Absent	Absent	Absent
Sulfates	mg/l	400	400	5000	-
Sulfides	mg/l	0.002	0.002	-	0.01
Delta of Temperature	ºC	±3	±3	±3	±3

Parameters	Unit	Surface Waters			Coastal Waters
		Class A	Class B	Class C	Class E
Metals					
Arsenic	mg/l	0.05	0.05	1	0.15
Barium	mg/l	1	2	10	1
Boron	mg/l	0.5	0.5	5	5
Cadmium	mg/l	0.005	0.005	0.05	0.005
Cyanide	mg/l	0.1	0.1	0.5	0.02
Nickel	mg/l	0.1	0.1	-	0.008
Copper	mg/l	0.2	0.2	2	0.05
Total Chromium	mg/l	0.05	0.05	1	0.1
Hexavalent chromium	mg/l	0.01	0.01	0.1	0.05
Iron	mg/l	0.3	0.3	3	0.3
Manganese	mg/l	0.5	1	5	0.1
Mercury	mg/l	0.001	0.001	0.005	0.001
Lead	mg/l	0.05	0.05	0.5	0.05
Cobalt	mg/l	0.2	0.2	0.5	-
Silver	mg/l	0.01	0.01	0.1	0.01
Selenium	mg/l	0.01	0.01	0.5	0.01
Zinc	mg/l	0.05	0.05	0.1	0.05
Organic Substances					
Phenolic substances	µg/l	1	1	-	10

Source: Table 4.1 of Standard for Water Quality and Discharge Control -NA-AG-001-03.

During the Project construction phase, camps and production plants will be equipped with temporary administration facilities; also during the Motorway operation phase, personnel will be temporarily lodged at the highway control toll facilities. Management of domestic waste water from these facilities will take in to account the standards presented in **Table 4-10**.

TABLE 4-10 Limits for Waste Water Discharges to Surface Water Bodies and Subsoil, for a Population under 1000 Inhabitants

Parameter	Unit	Standard
pH	Unit	6 – 8.5
BOD	mg/l	50
COD	mg/l	160
Suspended solids	mg/l	50
Residual Chlorine	mg/l	0.05
Total coliforms	NMP/100 ml	1000

Source: Table 5.1 of Standard for Water Quality and Discharge Control -NA-AG-001-03.

Additionally, according to the Standard for Water Quality and Discharge Control, the industrial liquid discharges from construction material production plants, will be within the water quality standards as presented in **Tables 4-11 and 4-12**.

TABLE 4-11 Maximum Limits for Industrial Discharges

Parameters (mg/L, except otherwise indicated)	General Guideline
General Parameters	
pH (no units)	6~9
BOD	50
COD	250
TSS	50
Grease and oils	10
Phenols	0.5
Cyanide	0.1/1.0 (free, total)
Ammonia	10
Total Phosphorous	2
Flourides	20
CI	0.2
Coliforms	400
(NMP/l00 ml) delta of Temperature (°C)	3
Sulfur	l.0
Metals	
Silver	0.5
Arsenic	0.1
Cadmium	0.1
Hexavalent Chromium	0.1
Total Chromium	0.5
Iron	3.5
Mercury	0.01
Nickel	0.5
Lead	0.1
Selenium	0.1
Zinc	2
Total metals	10

Source: Table 5.5 of Standard for Water Quality and Discharge Control -NA-AG-001-03.

TABLE 4-12 Reference Values for Discharges to Subsoil and Sewers.

Parameters	Unit	Discharge Maximum Limit	
		Subsoil	Sewers
General Parameters			
Tensoactive agents	mg/L	0.5	10
Chlorides	mg/L	500	-
Fecal coliforms	NMPI100 mL	500	-
Total Coliforms	NMP/100 mL	2,500	-
Color	U.Pt-Co	20	-
Conductivity	mS/cm	1,000	2,000
BOD	mg/L	50	350
COD	mg/L	200	900
Phenols	mg/L	0.002	0.5
Fluorides	mg/L	0.7	-
Total Phosphorus	mg/L	5	10
Grease and oils	mg/L	absent	20
Total Nitrogen	mg/L	50	40
Nitrates (N03-N)	mg/L	4	-
Dissolved Oxygen	% sat.	80	-
pH	-	6.5-9.0	6.0-9.0
Dissolved solids	mg/L	1,200	1,200
Floating solids	-	Absent	Absent
Sedimentable solids	ml/l	1	-
Suspended solids	mg/L	150	400
Total solids	mg/L	-	1,600
Sulfates	mg/L	200	400
Sulfides	mg/L	0.05	2
Temperature	°C	-	40
Delta of Temperature	°C	±3	-
Metals			
Arsenic	mg/L	0.1	0.5
Barium	mg/L	1	5
Boron	mg/L	0.1	-
Cadmium	mg/L	0.1	0.2
Cyanide	mg/L	0.05	0.2
Copper	mg/L	1	-
Total Chromium	mg/L	0.5	2
Hexavalent Chromium	mg/L	0.05	-
Iron	mg/L	0.5	25
Manganese	mg/L	0.5	10
Mercury	mg/L	0.005	0.01

Parameters	Unit	Discharge Maximum Limit	
		Subsoil	**Sewers**
Nickel	mg/L	2	2
Lead	mg/L	0.1	0.5
Silver	mg/L	-	0.1
Selenium	mg/L	0.01	0.2
Vanadium	mg/L	-	5
Zinc	mg/L	10	10
Radioactivity			
α Activity	Bq/L	N	0.1
β Activity	Bq/L	N	1
Biocides			
Organochlorides	mg/L	0.05	0.05
Organophosphates	mg/L	0.1	0.25

Source: Table A.2 of Standard for Water Quality and Discharge Control -NA-AG-001-03.

4.4.4 Solid Wastes

The "Standard for Environmental Management of Non-Hazardous Solid Wastes" (NA-RS-001-03 that replaced RE-DM-01) is based on articles 106, 107 and 108 of the General Law on the Environment and Natural Resources (Law 64-00).

This standard states that waste materials coming from construction or maintenance of streets, etc., shall be removed from the public roads daily as they are generated. These materials shall be stored in locations with sufficient capacity, as ordered by the mayor's offices. It is forbidden to dump solid wastes or construction debris in the shorelines, mangroves, rivers, protected areas and wetlands. In short, this standard dictates that all the solid waste management processes follow the adequate technical procedures for impact prevention and ensuring environment protection. It also prohibits disposal or dumping of any kind of solid waste on roads or public areas, land areas, empty properties, sewers, wells or any other open or closed space of state or private property, without prior approval from the appropriate authorities. Additionally, this standard states that the Secretariat of State for the Environment and Natural Resources, as ruling entity on this matter (Solid Wastes), also delegates to the municipalities the regulation, enforcement, training, implementation, communication and inspection functions pertaining to solid waste disposal.

4.5 Road Design and Construction

For the road design and construction, the Project will adopt the guidance established by the Secretariat of State for Public Works and Communications, according to the following list:

- M-011 Basic Criteria for Highway Geotechnical Study
- M-012 Basic Criteria for Highway Geometrical Design
- M-014 General Specifications for Highway Construction
- M-019 Provisional Recommendations for Design and Construction of Highway Drainage Systems
- M-020 Environmental Manual for Design and Construction of Road Projects

These manuals will be used together with the internationally accepted design and construction manuals and standards for highway design and construction.

The lands that will be affected by the project will be acquired by the State, according to the procedure for land negotiation and expropriation currently applied by SEOPC, as detailed below:

Expropriation Procedure in force in SEOPC

1. *The Supervisor, in coordination with the Operational Group from SEOPC in charge of the Project, proceeds to conduct a survey along the proposed route of the road to be constructed.*
2. *The Operational group informs the Department of the Valuation Commission about the new project and its location.*
3. *The Supervisor determines and demarcates the area to be expropriated.*
4. *After receiving the project route plans, the coordinator of the Valuation Commission, through the Secretariat of State for Public Works and Communications of SEOPC, requests to the General Directorate of the National Cadastre to officially determine the Price Index of the properties to be affected,.*
5. *The project Supervisor will identify all the properties to be affected along the road and obtain, in coordination with local authorities:*
    a. *Topographic survey of the area to be expropriated*
    b. *Individual verification of plantations, improvements and/or buildings located within the area to be expropriated.*
6. *The authority (a representative from the army) representing the Valuation Commission of SEOPC will go to project site and proceed with a survey of the property owner's documents, such as:*
    a. *Copy of the identity and electoral card of the proprietor or occupant, in*

case he (she) is not the property owner.

b. *Copy of the official documentation that proves that he (she) is the property owner, such as: property title, including its cadastral plan.*

7. *The Valuation Commission surveys the Project site, in order to appraise the houses or any other existing improvements. Photographic documentation of the surveyed area should be included.*
8. *The Valuation Commission, with the field data, conducts the valuation of the property to be expropriated, which consists of three main parts:*

   a) Land: The Price Index previously determined by the Cadastre Commission is applied on an areal basis to the properties identified by the Supervisor.

   b) Plantations: Trees or other crops reported by the Supervisor are valued according to the prices determined by the Secretariat of State for Agriculture, clearly indicating their condition or productivity

   c) Improvements and Buildings: Structure will be valued based on type of construction and condition. The value is generally based on calculation of replacement costs.

9. *The Valuation Commission issues an appraisal form for each property to be expropriated. This list, supported with the property's legal documentation, is sent to SEOPC's administrative section, in order to request the corresponding funding.*
10. *The SEOPC's administrative section proceeds to issue the corresponding payments to the landowners.*
11. *Once the payments are available, the Valuation Commission in coordination with an auditor and a representative from SEOPC, will deliver them to the affected landowners. Such payments are completed by a lawyer who receives the Property Titles corresponding to the properties purchased by SEOPC.*
12. *The authority (a representative from the army) in charge of Project safety, together with the Supervisor, informs the affected residents of the timeline for re-location from the project area.*
13. *When the stipulated term for re-location is over, the Supervisor authorizes the contractor to go proceed with the Project, using the expropriated areas.*
14. *The Property Titles are delivered to the lawyer of the Valuation Commission in order to proceed with the Project activities in the area purchased by the Dominican State.*

Note: In some cases, the occupants of the properties to be expropriated cannot present the necessary documents proving ownership. The Valuation Commission conducts a case by case *determination to resolve these situations and facilitate the advance of the Project. Generally, these residents are compensated for the improvements on the land.*

4.6 International Agreements

Table 4-13 includes a list of the international agreements or conventions ratified by the Dominican Republic that could be relevant to environmental management during the project.

TABLE 4-13 International Agreements Ratified by the Dominican Republic

Agreement	Ratification Date
Convention on nature protection and wildlife preservation in the western hemisphere	June 3, 1942
Convention concerning the protection of the world cultural and natural heritage	February 12, 1985
Convention on international trade in endangered species of wild fauna and flora (CITES)	March 17, 1987
Convention on the protection of the archaeological, historical and artistic heritage of the American nations	June 16, 1976
Convention on biological diversity	November 25, 1996
United Nations framework convention on climate change	January 5, 1999
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	March 10, 2000
Rio Declaration on Environment and Development	June 14, 1992

Source: Convenios Internacionales Medio Ambiente (Recopilación) por Geraldino González. Editora El Nuevo Diario 2002.

4.7 International Standards

The following international standards will apply during EsIA development and the construction and operation phases of the Autopista del Coral Project:

- "THE EQUATOR PRINCIPLES" A financial industry benchmark for determining, assessing and managing social & environmental risk in project financing – JULY 2006.
- ENVIRONMENTAL, HEALTH AND SAFETY GENERAL GUIDELINES, The World Bank Group April 30, 2007.

- ENVIRONMENTAL, HEALTH AND SAFETY GUIDELINES FOR TOLL ROADS, The World Bank Group April 30, 2007.

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5.0 STAKEHOLDER CONSULTATION

5.1 Introduction

During the Environmental Impact Assessment (EsIA) for the Autopista del Coral project (La Romana – Punta Cana Highway), a Citizen Participation Plan (PPC, Plan de Participación Ciudadana in Spanish) was designed and developed, which established the mechanisms of information disclosure and dialogue with the communities located in vicinity of the project area. This plan was developed along the EsIA's basic phases: Baseline Study, Environmental Assessment and Environmental Management and Adaptation Program (EMAP). The Participation Plan facilitated the acquisition of public perception and opinion, which was incorporated into the EsIA content in the respective interaction stages.

According to the Terms of Reference provided by SEMARENA in August 2005 and renewed in March 2007, information disclosure with stakeholders was required at the beginning of the EIA process to introduce the project to the stakeholders and at the end to present the environmental assessment results. The environmental consultant, by common consent with the Project promoter, adopted a Citizen Participation Plan specific for the Autopista del Coral Project (La Romana – Punta Cana Highway), which included three public hearings ("vistas públicas" in Spanish) during the environmental impact assessment process to facilitate more interaction between the project promoters, the environmental specialists and the communities in the project's local area of influence.

5.2 Legal Framework

The Citizen Participation Plan (PPC) for the Autopista del Coral project (La Romana – Punta Cana Highway) was structured and developed as stipulated by Law 64-00, articles 38 and 43, Resolution 05-2002 and the "Regulations for the Environmental Permits and Licenses System", articles 25 to 33.

The PPC was based on the following definitions:

PUBLIC CONSULTATION: The process aimed at obtaining and collecting opinions from those interested or not in a project's execution.

PUBLIC HEARING: It is a public consultation tool that allows broad participation of the parties interested in a Project or activity within the evaluation process. The "Public Hearing" –Vista Pública, in Spanish- is coordinated by the Project promoter as a part of the environmental impact assessment (EsIA).

5.3 Design of the Participation Plan

The design of the Citizen Participation Plan was organized with the following considerations:

- The characteristics of the interest groups identified for the Project;
- The communication strategies required for transmitting information to the identified interest groups;
- The appropriate locating and timing for holding meetings with the different groups, depending on the group's characteristics;
- The notification strategies for conducting the meetings and,
- The content, structure and management of each of the meetings with the groups.

The Citizen Participation Plan was structured in participation workshops conducted in synchronization with the development of the EIA phases. Consequently, the following workshops were developed:

First Public Hearing – Project Presentation on the Scope and Methodology proposed for conducting the EIA. The workshops were held on the following dates:

- May 4, Benedicto, at 5:00 PM at the Community Center.
- May 5, Verón, at 10:00 AM on the porch of the church “Assembly of God”.
- May 5, Higüey, at 5:00 PM at the Hall of the Catholic University.

Second Public Hearing – Progress on Project Description, Characterization of Study Area and Preliminary Environmental Assessment. Workshops were held on the following dates:

- June 1, Higüey, at 7:00 PM at the Assembly Hall of the Mayor's Office.
- June 2, Benedicto, at 10:00 AM at the Community Center.
- June 2, Verón, at 5:00 PM at the Hall of the Polytechnical School.

Third Public Hearing – Progress on Project Description, Impact Rating in Environmental Assessment and Environmental Management and Adaptation Program. The workshops were held on the following dates:

- June 15, Verón, at 5:00 PM at the hall of the Polytechnical School.
- June 16, Higüey, at 10:00 AM at the CURE - UASD University Theatre.
- June 16, Benedicto, at 4:00 PM at the Community Center.

The dates and locations of the above workshops were arranged with community representatives and those participating in the workshops.

The notification strategies consisted of:

- Direct invitation by means of letters to representatives of local communities and organizations, and to representatives of institutions of the local, regional and national government.
- Announcement of the invitation on radio and television advertising.
- Spreading the invitation by means of an announcement using a speaker mounted on a pick up truck travelling thru townships (called “guagua anunciadora” in Dominican Republic).
- Phone calls to representatives of local communities and organizations.

At the beginning of each of the public hearings an attendance record of the participants in the workshops was generated and a meeting agenda was delivered, which contained a space for writing concerns, comments or suggestions.

Each of the workshops was composed of five parts, as follows:

- Introduction of the speakers.
- Project Presentation - a presentation with audiovisual support conducted by the Project promoter.
- Environmental Studies - a presentation with audiovisual support conducted by the representative of the Project environmental consultant.

- Question and Answer Session - a session open to the audience for written or verbal questions, comments or suggestions. The responses were provided by the speakers belonging to the project promoter's team or the environmental consultant's team, according to the nature of the question.

- Snack Break - final session with a snack open to all the workshop attendees. This session allowed for open interaction between the public, speakers, promoter's team and environmental consultants.

During the development of each of the workshops, a photographic and video record was produced.

Additionally, a communication channel was established to allow those participating in the workshops or the general public to express their concerns after the public hearings. Communications were channeled through the telephone numbers of the General Directorate of Investment Planning and Programming and the Department of Environmental Management and Risk of the Secretariat of State for Public Works and Communications.

All of the data documenting the process conducted during the execution of the Citizen Participation Plan is included in an appendix.

5.4 Development of the Participation Plan

The following is a brief description of each of the public hearings conducted in the context of the Citizen Participation Plan. In the appendices of this chapter documentation of the workshops development is presented, including: attendance record, invitations, workshops agenda, comments and remarks from the attendees, PowerPoint™ files used for the presentations and the corresponding video and photographic record.

5.4.1 First Public Hearing

During the first public hearing the following workshops were carried out:

- May 4, Benedicto, at 5:00 PM at the Community Center.

- May 5, Verón, at 10:00 AM on the porch of church "Assembly of God".

- May 5, Higüey, at 5:00 PM at the Hall of the Catholic University.

The following presentations in PowerPoint™ were prepared for these workshops (see Appendix 5-1):

- Project Presentation - describing the project promoter, project background and general description, and basic engineering elements of the project.

- Presentation of Environmental Studies - discusses responsibility for the environmental studies, the relationship between the environmental consultant and the Project promoter, the Environmental Impact Assessment, and the scope and methodologies proposed for the project's Environmental Impact Assessment.

A brief description of each of the workshops is presented below.

Benedicto

The first public hearing had 35 attendees, representing social and productive associations, religious entities, local government entities, large companies, the health sector, and the community in general. The attendance list is shown in **Table 5-1**.

TABLE 5–1 Attendance Record – First Public Hearing in Benedicto

Attendee Name	Institution / Origin
Bélgica Bastardo	Catholic Church
Víctor Martínez	Mayor
Germania Cayetano	Asociación Mujeres Benerito (women's association)
Eliana Balbuena José	
Mauricio Martínez	Red Cross
Clarisa Mabel Pérez Rijo	
Maura de Lozano	
Gilberto Antonio Rosario	Red Cross
Santos Gregorio	
Ing. Pedro Martínez	Central Romana (sugar mill)
Freddy de la Cruz	Central Romana (sugar mill)
Miguelina Guerrero	
Sirilo Morla	
Manuel A. Ruiz	Pastor
Felicita Vásquez	
Lucrecia Linárez	
Teresa Tuzen	
Primitivo Vásquez	
Filomena Félix	
José del Carmen Castillo	
Lauterio Bernal	Asociación Campesinos La Esperanza (farmers association)
Darío López	

Attendee Name	Institution / Origin
Fausto Santilla	
Jhan Arlinton de aza	
Francisco Montaño	
Orlando Martínez	
Xiomara Chevalier	
Zaide Rijo	
Gilberto Rigo Morales	Asociación de Agricultores (agricultural workers association)
Luz María Caridad	
Antonio Rijo	
Miriam Martínez	
Patricia Medina Polanco	Public Health
Cesarina Martínez	
Maura de los Santos Núñez	

The workshop started at 5:30 PM and finished at 7:30 PM. The Project Presentation was conducted by Eng. Ana Nadal, representative of SEOPC, supported during the question- answer session by technical personnel from TECNOAMERICA company (Eng. Keveen Peña and Eng. Leonardo Borrely) and the Moya – Odebrecht Consortium (Eng. Edmilson Quirino and Eng. Elvis Suazo). The session on Environmental Studies was conducted by the Environmental Specialist, René Lozada, representative of Golder Associates and supported during the question-answer session by environmental specialists from the companies Golder Associates and RCMA Geoingeniería Ltda. (Eng. Bernardo Susi, Anthropologist Teodora de La Hoz and Chemist July Montaña).

Table 5-2 summarizes the concerns and suggestions expressed by the attendees of this first meeting.

TABLE 5–2 Questions and Suggestions from the Attendees

Name	Concern	Suggestion / Commment
Fausto Abel	- When will the Project begin? - Will the Project reduce value to Benedicto?	
Darío López	-	Placing emergency phones and first aid every few kilometers and presence of many animals in the Benerito zone.
Xiomara Chevalier	- What will happen to the persons living near this area? - When this Project is finished, the other highway will not operate?	It is a very important Project that will provide a better landscape to the country. Thank you for including us during the project construction.

Name	Concern	Suggestion / Commment
Zaide Rijo	- What will happen to the private land properties located within the Coral motorway area?	
Germania Cayetano Calderón	- What will happen to the persons that possess land properties or real properties situated near or within the highway side?	It is a very important project, but we wish to know more details, by holding more extensive workshops with the participation of other sectors of the area.
Gilberto Antonio Rosario	- What will you do for controlling the transit during the new highway construction?	Need for paving the streets of Benerito; it is very useful to the community, improving its living conditions.
Clarisa Mabel Pérez Rijo	- What will you do to control the transit during the new highway construction?	Paving the streets of Benerito, because it is a community need.
Felicita Vásquez	- What will you do with the houses located within area?	Founded that there are many good aspects of the project.
Víctor Martínez Rosario	- What will you do with the persons whose properties are crossed by the motorway?	
Manuel A. Ruiz	-	We appreciate that you considered this community for presenting the project.
Primitivo Vásquez	-	The Project is good for the community.
Gilberto Rijo Morales	- Is there any social investment plan for the communities located in vicinity of the Project?	The Project should include a workshop and technical course program in nearby communities, in order to take more benefits and advantages from the project.
Luz María Caridad	- I would like to know how long will project construction last and when will it be finished?	
Miguelina Guerrero	- The current highway will be removed? - Are there livestock properties? - Is there production on those areas?	A motorway in the Eastern region is very important to the country's progress due to tourism, and for the benefit of many workers and saving time.
Miriam Martínez	-	It is a significant contribution to this community.
Lucrecia Linárez	- How long will the Project last?	The Project seems very good to me, because it will mean a lot of benefits to us.

Name	Concern	Suggestion / Commment
Mauricio Martínez	- What are you planning to do for improving transportation during the construction period?	Paving the streets of Benerito
Santos Gregorio	- How many times will the motorway cross the La Romana – Higüey highway?	
Patricia Medina Polanco	- Where will the motorway be located? - How long will the construction last? - When will the construction begin? - Who to contact in case of trouble? - How may the community be affected?	Keeping hygiene and cleanliness Keep the order Signalizing the danger and risk sites
Bélgica Bastardo	- I live in Limón, by the Romana – Higüey highway; if (the new motorway) goes by the other one, what will happen to me? Shall I move away from there?	
Jhan Arlinton	- When will this Project start? - When will this Project finish? - Will the Project harm those living in the alignment?	I think it is OK; we needed a Project of this magnitude in this region.
Sirilo Morla	-	Excellent

Other concerns and comments from those participating in this workshop can be found on the video recording included in **Appendix 5-1**.

Verón

The first public hearing had an attendance of 25, with representatives of board of neighbors, religious entities, local government entities, large companies and the community in general. The attendance record is shown in **Table 5-3.**

TABLE 5–3 Attendance Record – First Public Hearing in Verón

Attendee Name	Institution / Origin
Luis A. Abreu	Neighbors Board
Petronila Rincón	Neighbors Board
Gelson Rodríguez	Civil Defense
Rosana R. Sánchez	Neighbors Board

Attendee Name	Institution / Origin
Marino Rodríguez	
Rafael García	Mayor
Jorge Marte	Neighbors Board
Pedro Rodríguez	Sports
Félix Rodríguez	Sports
Thelma Alcántara	
Pablo Ovalle	Civil Defense
Winston F. García	Civil Defense
Andre A. Rodríguez	Neighbors Board
Ing. Pedro Martínez	Romana Sugar Mill
Ing. Jorge L. López	CAP CANA S.A.
Mariana Corporan	Church
Isidro de Rosario	Neighbors Board
Pastor Elio	
Jenifer de la Rosa	
Andy S. Valdes Ramírez	
Ana Rosa Hernández	
Kasimiro Amecielo	
Federico de Peña	
Nelson	
Llena Sanz	

The workshop started at 10:30 PM and finished at 12:00 PM. T Project Presentation was conducted by Eng. Ana Nadal, representative of SEOPC, supported during the question- answer session by technical personnel from TECNOAMERICA company (Eng. Keveen Peña and Eng. Leonardo Borrely) and the Moya – Odebrecht Consortium (Eng. Edmilson Quirino and Eng. Elvis Suazo). The session on Environmental Studies was conducted by the Environmental Specialist, René Lozada, representative of Golder Associates and supported during the question-answer session by environmental specialists from the companies Golder Associates and RCMA Geoingeniería Ltda. (Eng. Bernardo Susi, Anthropologist Aquiles Castro and Chemist July Montaña)

Table 5-4 summarizes the concerns and suggestions expressed by the attendees to this first meeting.

TABLE 5–4 Questions and Suggestions from the Attendees

Name	Concern	Suggestion / Comment
Llena Sanz	- Isn’t it a very long straight section from Higüey – Punta Cana? - Will it have elements allusive to corals? - Is there forest area that will be disturbed? - Is placement of commercial establishments (gas stations, cafeterias, etc.) along the road anticipated? - The participation of the Secretariat for Environment was not mentioned. They will not take part?	
Thelma Alcántara	-	I agree with everything because it is a benefit for the people.
Jenifer de la Rosa	- What is a motorway? - What does coral mean? - How long will it last?	I like the project; it’s good.
Marino Rodríguez	- How will the land owners enter their properties if they place side protections in the highway; will they put an entrance? - How far will it be from our town? Will we be affected with evacuation?	
Pedro Rodríguez	- What access or link will the community have to the motorway? - Trough where will continue the normal public transportation?	
Andy S. Valdes	-	I like the Project; it’s good and I liked everything about the motorway. We want the highway repaired because it’s a tourist zone.
Rosana R. Sánchez	-	Everything was OK; we want the motorway repaired and help with garbage collection.
Jorge Marte	- How long will it take to finish the Coral motorway? - What plans the environmental authorities have against poor quarter’s proliferation?	

Name	Concern	Suggestion / Comment
Andrés A. Rodríguez	-	We need the septic pits removed We need to eliminate garbage burning We need (public) lighting in the quarters because of crime.
Luis A. Abreu	-	Boards of neighbors, eliminate black waters, provide garbage disposal sites, forbid garbage burning everywhere, remove some huts, repair a few streets, electricity supply, drinking water supply, adequate signposting.
Rafael García	- What safety precautions will be instituted for property owners crossing from one site of the motorway to the other?	
Pablo Ovalle	-	I want to know whether it is possible to place two road humps in the street crossing by the school; the vehicles pass too fast. Ask the mayor's office to collect garbage more often.

Other concerns and comments from those participating in this workshop can be found on the video recording included in **Appendix 5-1**.

Higüey

The first public hearing had 16 attendees, including representatives of social and productive associations, religious entities, local government entities, large companies and the community in general. The attendance list is shown in **Table 5-5.**

TABLE 5–5 Attendance Record – First Public Hearing in Higüey

Attendee Name	Institution / Origin
Antonio de los Santos	Altagracia Association Board
Ramón A. Pérez	Altagracia Association Board
Ernesto de R. Castro	Altagracia Association Board
Maritza A. Martínez	Altagracia Association Board
Francisco Villa	Neighbors Board
Alex Martínez	El Cometa Newspaper
Anacleta Jiménez	Altagracia Association Board

Attendee Name	Institution / Origin
Fredy Varela	Neighbors Board
Basilio del Rosario	Neighbors Board “La Unión” Rosales
Rafael Montas	Central Romana (sugar mill)
Ing. Pedro Martínez	Central Romana (sugar mill)
Ing. Ma. Salomé Peña	ANPA
Fausto Tejada	ANPA
Juan José Daniel	Music Game
Doris A. Rigo	
Francisco Villa R.	

The workshop started at 5:25 PM and finished at 6:45 PM. The Project Presentation was conducted by Eng. Ana Nadal, representative of SEOPC, supported during the question- answer session by technical personnel from TECNOAMERICA company (Eng. Keveen Peña and Eng. Leonardo Borrely) and the Moya – Odebrecht Consortium (Eng. Edmilson Quirino and Eng. Elvis Suazo). The session on Environmental Studies was conducted by the Environmental Specialist, René Lozada, representative of Golder Associates and supported during the question-answer session by environmental specialists from the companies Golder Associates and RCMA Geoingeniería Ltda. (Eng. Bernardo Susi, Anthropologist Aquiles Castro and Chemist July Montaña).

Table 5-6 summarizes the concerns and suggestions expressed by the attendees to this first meeting.

TABLE 5–6 Questions and Suggestions from the Attendees

Name	Concern	Suggestion / Comment
Juan José Daniel	- How many years will the Project last?	
Anacleta Jiménez	-	The Project is very good because it has benefit for all; thank you for taking us into account; it’s a very valuable work.
Maritza A. Martínez	- What will the Project impact be on the flora and fauna of this zone, which is very important in our country?	
Basilio del Rosario	- He made a comment not pertaining to the Project.	
Freddy Varela	- How many kilometers from dowtown Higüey will the motorway pass?	
Francisco Villa	- Why some people are interested in locating the Coral motorway far from Higüey?	- Hiring more engineers and specialists from the zone. - Give more advance notice for the second Public Hearing.

Other concerns and comments from those participating in this workshop can be found on the video recording included in **Appendix 5-1**.

5.4.2 Second Public Hearing

During the second public hearing the following workshops were held:

- June 1, Higüey, at 7:00 PM at the Mayor's Office Auditorium.
- June 2, Benedicto, at 10:00 AM at the Communityl Center.
- June 2, Verón, at 5:00 PM at the Hall of the Polytechnical School.

The following presentations in PowerPoint™ were prepared for these workshops (see Appendix 5-2):

- Project Presentation - including background, general description, and basic engineering elements of the project.
- Presentation of Environmental Studies - describing the Project area characteristics (environmental baseline study results), identification of environmental issues (resulting from preliminary environmental evaluation) and the public consultation process development.

A brief description of each of the workshops is presented below:

Higüey

The second public hearing had 19 attendees, including representatives of social and productive associations, religious entities, local government entities, large companies, and the community in general The attendance list is shown in **Table 5-7**.

TABLE 5–7 Attendance Record – Second Public Hearing in Higüey

Attendee Name	Institution / Origin
Manolo Ramírez	CASC
Ramón Antonio Acosta	Asociación de Ferreteros (hardware-store owners association)
Elvis Hernández	CODIA
Gabino Santana	CODIA
Francisco Villa	Federación Juntas Vecinos (Neighbor's Board Association)
Félix Rodríguez	Asesor Asociación Ganadera Nisibon (Advisor, Nisibon Stockbreeder's Association)
Eufemio Reyes	Asociación de Ferreteros (hardware-store owners association)
Antonio Santana	Asociación de Ferreteros (hardware-store owners association)

Attendee Name	Institution / Origin
Ing. María Salomé Peña	ANPA
Prof. Merkis Méndez	Liceo Juan Bosch (school)
Enrique Cedeño	Primi Taxi
Fausto Tejada	ANPA
Juan Rijo	Cámara de Comercio y Producción (Chamber of Commerce and production)
Pedro Martínez	Central Romana (sugar mill)
Rafael López	UASD – CURE
Ing. Pantaleón Villegas	SEOPC
Bienvenido Carpio	Journalist from Channel 12-10
JJD	Music game
Rafael Lebrón	Neighbor

The workshop started at 7:30 PM and finished at 10:05 PM. The Project Presentation was conducted by Eng. Ana Nadal, representative of SEOPC, supported during the question- answer session by technical personnel from SEOPC (Eng. Arelys Marzán) and TECNOAMERICA company (Keveen Peña) and the Moya – Odebrecht Consortium (Eng. Ruy Poletto, Evoir Palma and Eng. Edmilson Quirino). The session on Environmental Studies was conducted by the Environmental Specialist, René Lozada, representative of Golder Associates, supported by environmental specialists from the companies Golder Associates and RCMA Geoingeniería Ltda. (Anthropologist Aquiles Castro and Chemist July Montaña).

Table 5-8 summarizes the concerns and suggestions expressed by the attendees of this second meeting.

TABLE 5–8 Questions and Suggestions from the Attendees

Name	Concern	Suggestion / Comment
Félix Rodríguez,	- Have the Project promoters already informed the land proprietors in the zone, in order for them to take pertinent measures?	
Elvis Hernández,	- Will the project's social impact be further studied? So far, no in depth study has been conducted. The motorway will pass far away (from the Higüey urban zone). In other places (San Pedro de Macorís, La Romana) a beltway is proposed, but not here in Higüey.	

Name	Concern	Suggestion / Comment
	- But, has it been proved convenient? Taking the transit flow away from the city of Higüey will probably affect its economy … - At 8 kilometers from Higüey the soil use is not defined …	
Manolo Ramírez	-	The original highway route has been changed. If it is located 10 kilometers from Higüey many commercial establishments supported by tourism will disappear in La Otra Banda. Workers transportation to La Romana will be easier. Transit in La Otra Banda will probably get better. The Romana sugar mill will profit from it again. The way through Verón is called the death road. This Project may be good for us, but if you do it (considering our suggestions); otherwise, it will (negatively) affect Higüey.
Rafael López	-	In 1990 Higüey looked like a village; if what we have seen here is done, we will go backwards again… This motorway should pass as close to Higüey as possible in order to contribute to the city's development; otherwise, we will keep on developing the capital. We've got to link that zone to the urban zone of the province. The economic aspect is very important. You must consider not only some groups' welfare, but the province's too.

Other concerns and comments from those participating in this workshop can be found on the video recording included in **Appendix 5-2**.

Benedicto

The second public hearing had 28 attendees, including representatives of social and agricultural associations, religious entities, local government entities, large companies, the health sector, and the community in general. The attendance list is shown in **Table 5-9.**

TABLE 5–9 Attendance Record – Second Public Hearing in Benedicto

Attendee Name	Institution / Origin
Ada Bretón	President – Neighbors Board
María Pinales	Community Leader
Bolívar Morla	Mayor - Bocas de Chavón
Eliana Gifle	Neighbor
Elías Rijo	Neighbor
Alcides Rijo	Neighbor
Dionicio Rijo	Neighbor
Antolín Rijo	Community Leader
Ernesto Guerrero	
Germania Cayetano	Neighbor
Edgar Pérez	President - Asociación Mujeres Campesinas (Association of Countrywomen)
Bélgica Bastardo	Bloque comunitario (community block)
Domingo Gómez	Land property owner in La Romana
Patricia Medina	Public Health Employee
Samuel Santana	Asociación Pro Desarrollo Benedicto y PLD (association for development of Benedict and PLD political party)
Mártires Rijo	Owner of Los Limones property
Ramona Ramos	Asociación de Mujeres Luz del Porvenir (women's association)
Felicita Vásquez	Iglesia Asamblea de Dios Pentecostés (Pentecostal Church Assemblies of God)
Mónica Nieves	Bloque Campesino y Desarrollo Comunitario (peasants and community development association)
Marino Morales Ramírez	Bloque Campesino y Desarrollo Comunitario (peasants and community development association)
Santa Rosario	Neighbor
Francisca Morales	Asociación de Mujeres Luz del Porvenir (women's association)
José Jiménez Morales	Neighbor
Julio César Peña	Land property owner in La Romana
Leonfe Rijo	Farmer, neighbor
Víctor Martínez	Mayor of Benerito
Rodolfo de Haza	Neighbor
Pedro Martínez	Central Romana (sugar mill)

The workshop started at 10:45 PM and finished at 12:25 PM. The Project Presentation was conducted by Eng. Ana Nadal, representative of SEOPC, supported during the question- answer session by technical personnel from SEOPC (Eng. Arelys Marzán) and from TECNOAMERICA company (Eng. Keveen Peña) and the Moya – Odebrecht Consortium (Engs. Edmilson Quirino and Ruy Poletto). The session on Environmental Studies was conducted by the Environmental Specialist, René Lozada, representative of Golder Associates and supported during the question-answer session by environmental specialists from the companies Golder Associates and RCMA Geoingeniería Ltda. (Anthropologist Aquiles Castro and Chemist July Montaña).

Table 5-10 summarizes the concerns and suggestions expressed by the attendees to this second meeting.

TABLE 5–10 Questions and Suggestions from the Attendees

Name	Concern	Suggestion/Commment
Mónica Nieves	- I would like to know how long will this important road work last.	My opinion is that this Project means a great step for the progress.
Marino Morales Ramírez	- I would like to know which land properties, and the owner's names, will the Coral Motorway cross.	

Other concerns and comments from those participating in this workshop can be found on the video recording included in **Appendix 5-2**.

Verón

The second public hearing had 17 attendees, including representatives of neighbors' boards, religious entities, local government entities, large companies, and the community in general. The attendance list is shown in **Table 5-11.**

TABLE 5–11 Attendance Record – Second Public Hearing in Verón

Attendee Name	Institution / Origin
Jorge de la Rosa	Adventist Church
Ulises Polo	Catholic Church
Jorge Marte	Vice-president, Neighbors Board
Ceferina Peralta	Neighbor
Winston García	Civil Defense
Dr. Omar Elías Vásquez	Deputy Solicitor from the Mayor's Office

Attendee Name	Institution / Origin
Uridy Marte	Neigbors Board
Henry Marte	Civil Defense
Carmelo Peralta	Club Mediterráneo
Natanael González	Inmobiliaria Marte (real state agency)
Marilyn	Resident
Roberto R de León	Neighbor
Pedro Martínez	Central Romana (sugar mil)
Jackeline King	Cap Cana
Máximo Peña	Cap Cana
Roberto Castillo	Cap Cana
Petronila Rincón	Neighbors Board from Verón

The workshop started at 5:30 PM and finished at 8:00 PM. T Project Presentation was conducted by Eng. Ana Nadal, representative of SEOPC, supported during the question- answer session by technical personnel from SEOPC (Eng. Arelys Marzán) and from TECNOAMERICA company (Eng. Keveen Peña) and the Moya – Odebrecht Consortium (Engs. Edmilson Quirino and Ruy Poletto). The session on Environmental Studies was conducted by the Environmental Specialist, René Lozada, representative of Golder Associates and supported during the question-answer session by environmental specialists from the companies Golder Associates and RCMA Geoingeniería Ltda. (Anthropologist Aquiles Castro and Chemist July Montaña).

Table 5-12 summarizes the concerns and suggestions expressed by the attendees to this second meeting.

TABLE 5–12 Questions and Suggestions from the Attendees

Name	Concern	Suggestion / Comment
Dr. Omar Elías Vásquez	- Access roads from Verón? - Pedestrian bridges? - Water pollution? - Drainage? - Solid waste management?	In general, it's excellent; you can count on us the Mayor's Office.
Natanael González Germán	- When will the La Romana - Punta Cana section will be finished? - How far from Higüey will the Coral motorway pass?	We want the poor quarters from Verón, near the Coral (motorway) removed; to this purpose, the so called *ranchelos* (shanty houses) must be forbidden.

Name	Concern	Suggestion / Comment
Jorge Marte	- The Secretariat for Public Works and Communications is responsible for payment of the land properties occupied by the Coral motorway; when will they effect the payment?	
Henry Orlando Marte	- At what distance from the city of Higüey will the motorway pass? - The community of Verón will have access road to the motorway, or shall we go up to the airport?	
Jorge de la Rosa	- When will the construction works begin? - When will the road construction finish? - What is the construction road cost? - How long will it last?	It's OK, because it will be valuable for the community and economy.
Uridy Marte Cruz	- When will the Project start? - How long will the Project last? - Is it the same Project called the new Boulevard? - Will it be connected to the new Boulevard? - Stockbreeders' access will be permitted? - Are there other foreign companies participating in the project's economy? - What are the plans regarding the owners of land properties crossed by the Coral highway?	I think that this is a very important Project, because our country is heading for progress; we are pleased with this project provided it is aimed at the country's development and welfare.

Other concerns and comments from those participating in this workshop can be found on the video recording included in **Appendix 5-2**.

5.4.3 Third Public Hearing

During the third public hearing the following workshops were held:

- June 15, Verón, at 5:00 PM at the Hall of the Polytechnical School.
- June 16, Higüey, at 10:00 AM at the CURE - UASD University Center.
- June 16, Benedicto, at 4:00 PM at the Community Center.

The following presentations in PowerPoint™ were prepared for these workshops (see Appendix 5-3):

- Project Presentation - a brief explanation of the Project general description (Project location and its relationship to the regional road network) and the progress on the project's design and basic engineering, with emphasis on the traffic distributors and the project's interaction with the existing highway.
- Presentation of Environmental Studies - the objective of the previous public hearings was reviewed, and the results of the impact rating in the final process of Environmental Assessment were addressed, as well as preliminary design of the environmental management measures to be included in the Environmental Management and Adaptation Program (EMAP) for the Autopista del Coral project.

A brief description of each of the workshops is presented below:

Verón

The third public hearing had 19 attendees, representing the neighbors' board, local government entities, large companies, and the community in general. The attendance list is shown in **Table 5-13.**

TABLE 5–13 Attendance Record – Third Public Hearing in Verón

Attendee Name	Institution / Origin
Pedro Martínez	Central Romana (sugar mil)
Joanna Díaz	Neighbor
Kelviana Silvestre	Neighbor
Elermo Obando	National Army
Grethel Castellanos	Cap Cana
Máximo Peña Roca	Cap Cana
Roberto Castillo	Cap Cana
Uridy Marte	Neighbors Board
Antonio Domínguez	Neighbors Board
Octavio García	SEOPC
Hojelis Marte	Neighbors Board
Alberto Cordero	Neighbors Board
Yuridia Tavarez	Colegio Elizabeth (school)
Lesda María Padilla	Colegio Elizabeth (school)
Natanael González	Empresa Marte (company)
Juan Marte	Neighbor
Dr. Omar E. Vásquez	Solicitor from the Mayor's Office
Esther Mercedes	Neighbor
Jorge Marte	Civil Defense

The workshop started at 5:30 PM and finished at 8:00 PM. The Project Presentation was conducted by Eng. Ana Nadal, representative of SEOPC, supported during the question- answer session by technical personnel from SEOPC (Engs. Arelys Marzán and María Solano) and from the Moya – Odebrecht Consortium (Eng. Ruy Poletto). The session on Environmental Studies was conducted by the Environmental Specialist, René Lozada, representative of Golder Associates and supported during the question-answer session by environmental specialists from the companies Golder Associates and RCMA Geoingeniería Ltda. (Anthropologist Teodora de la Hoz and Chemist July Montaña).

The presentations conducted during this workshop and the video recording can be seen on **Appendix 5-3**.

Table 5-14 summarizes the concerns and suggestions expressed by the attendees of this third meeting.

TABLE 5–14 Questions and Suggestions from the Attendees

Name	Concern	Suggestion / Commment
Esther Mercedes	- How long will the road construction last? - What will you do in case of environmental pollution?	We believe the motorways are very important, but we don't want it to damage the environment or the community.
Uridy Marte	- How many centimeters high will the road be? - Is it true that 100 m are added both sides of the road to avoid poor quarter settlement? - Will heavy vehicle transit be permitted?	
Antonio Domínguez	- What benefit and damages will this Project have on our environment? - How much time will we save? - What traffic will it have?	It is a great achievement that will provide security and benefit to the eastern zone and especially to Verón – Punta Cana.
Jorge Marte	- You said that within two years the Coral motorway would be finished; it's been more than one and half years and its progress is less than half. ¿the years are dollars? - I believe that the side 100m will be for commercial areas. Will the Dominicans have access to do business in these areas?	
Yohanna Díaz	- What is the project's exact duration?	This Project is very important for all, particularly for tourists because they will get faster to hotels and others sites, and to people working there; less traffic, faster road.

Other concerns and comments from those participating in this workshop can be found on the video recording included in **Appendix 5-3.**

Higüey

The third public hearing had 15 attendees, representing social and agricultural associations, local government entities, large companies, the health sector, and the community in general. The attendance list is shown in **Table 5-15**.

TABLE 5–15 Attendance Record – Third Public Hearing in Higüey

Attendee Name	Institution / Origin
Arquitecto Elvys Hernández	CODIA
Dr. Teófilo del Rosario Perozo	URPA
Francisco Villa	President, Neighbors Board
Alexander Reyes	Mayor's Office
Félix Rodríguez	Asesor Asociación Ganadera Nisibon (Advisor, Nisibon Stockbreeder's Association)
José Justo Pepén	CASC Federation
Ramón Antonio Pérez	Junta Agropecuaria La Altagracia (local agricultural and livestock association)
Juan Torres Cedeño	Junta Provincial Agropecuaria (provincial agricultural and livestock association)
Félix Vizcaino	UASD
Lic. Eusebio Polanco	Federación de Estudiantes (students' federation)
Deive Morión	Federación de Estudiantes (students' federation)
Raúl Cedeño	Vanguardia
Lic. Ovidio Pérez	Chamber of Commerce and Production
Pedro Martínez	Central Romana (sugar mill)

The workshop started at 10:35 AM and finished at 12:54 PM; the session on Project Presentation was conducted by Eng. Ana Nadal, representative of SEOPC, supported during the question- answer session by technical personnel from SEOPC (Eng. Arelys Marzán) and from TECNOAMERICA company (Eng. Keveen Peña) and the Moya – Odebrecht Consortium (Eng. Ruy Poletto). The session on Environmental Studies was conducted by the Environmental Specialist, René Lozada, representative of Golder Associates and supported during the question-answer session by environmental specialists from the companies Golder Associates and RCMA Geoingeniería Ltda. (Anthropologist Aquiles Castro, Anthropologist Teodora de La Hoz and Chemist July Montaña).

Table 5-16 summarizes the concerns and suggestions expressed by the attendees to this third meeting.

TABLE 5–16 Questions and Suggestions from the Attendees

Name	Concern	Suggestion/Commment
Lic. Ovidio Pérez	-	We believe the motorway must pass not more than 5 km from the main exit towards La Romana. It's an important construction work for mobility, but we think it must not encourage poor quarter proliferation in the head municipality and in the others.
Arq. Elvys Hernández	- Does the Project include a beltway? - How will the intersection and penetration through the Yuma – Higüey highway be (traffic distributor)? - Why are you not considering linking this road to Macao highway through Los Burritos?	We hope the project construction companies will employ a good proportion of professionals from Higüey.
José Justo Pepén	- I am concerned on the expropriation or negotiation with the owners of the land properties to be crossed by the Coral motorway. - We understand that the information on the Coral motorway construction and its Environmental Impact Assessment will ease our awareness on the project.	
Francisco Villa	- How could we ensure a specific quantity of tourist visiting and consuming products and services from Higüey?	Encourage improvement of local roads and highways in La Altagracia province and not relying only on the Coral motorway.
Arq. Alexander Reyes Santana	- What is the slope on the road center area (8 m)? - Will the toll system include automatic collection?	Including a tree strip in the road for reducing the noise and carbon monoxide pollution.

Other concerns and comments from those participating in this workshop can be found on the video recording included in **Appendix 5-3.**

Benedicto

The third public hearing had 20 attendees, representing social and productive associations, local government entities, large companies, the health sector, company leaders, and the community in general. The attendance list is shown in **Table 5-17.**

TABLE 5–17 Attendance Record – Third Public Hearing in Benedicto

Attendee Name	Institution / Origin
Julio Delgadillo	Mayor’s Office of San Rafael del Yuma
Oscar Espinal	Mayor’s Office Solicitor
Félix A. Viloria	Teacher, San Rafael School
Salomé Rosario	Mayor’s Office
Abraham Medina	Mayor’s Office
Mildred Shepard	Women’s Association
Patricia Medina	SESPAS
Gilberto Rijo	Asociación de Agricultores (Agricultural Worker’s Association)
Antonio Rijo	Community Leader from El Limón
Alcides Rijo	Asociación de Campesinos (peasant’s association)
Aurelio Rijo	Neighbor
Dionicio Rijo	Neighbor
Domingo Castillo	Neighbor
Mario de Jesús del Río	Property owner in El Limón
Dominga Rijo Morales	Owner of Mina Caliche (mine owner)
Dra. Deysi	Family lawyer
Leticia Rijo	Women’s Association
Elías Rijo	Neighbor
Domingo Gómez	Stockbreeder
Pedro Martínez	Central Romana (sugar mil)

The workshop started at 4:20 PM and finished at 5:50 PM; Project Presentation was conducted by Eng. Ana Nadal, representative of SEOPC, supported during the question- answer session by technical personnel from SEOPC (Eng. Arelys Marzán) and from the Moya – Odebrecht Consortium (Eng. Ruy Poletto). The session on Environmental Studies was conducted by the Environmental Specialist, René Lozada, representative of Golder Associates and supported during the question-answer session by environmental specialists from the companies Golder Associates and RCMA Geoingeniería Ltda. (Anthropologist Aquiles Castro and Chemist July Montaña).

Table 5-18 summarizes the concerns and suggestions expressed by the attendees to this third meeting.

TABLE 5–18 Questions and Suggestions from the Attendees

Name	Concern	Suggestion / Comment
Félix Andrés Viloria	- Why not locating the road closer to San Rafael del Yuma?	The community of San Rafael del Yuma (municipality) is developing tourism and this will significantly support such development; Higüey is already (a tourist zone).
Antonio Rijo	Has cattle crossing been anticipated? There are cattle at both sides of Bocas de Chavón.	
Mildred Shepard	Why the name of motorway?	
Mario del Río	What are the parameters or means that SEOPC will use for identifying the true proprietors where there is (illegal) land occupation/invasion	

Other concerns and comments from those participating in this workshop can be found on the video recording included in **Appendix 5-3.**

5.5 Conclusions and Recommendations

- During the development of the three public hearings and the three workshops an average 64 person participation was achieved, in spite of the diverse means used to announce the meeting; nevertheless, almost same people participated from the first to the last public hearing held.
- The Citizen Participation process developed during this EIA was positively perceived by all the interest groups called by the Project. In the workshops conducted during this process, the audience expressed its interest that this and other future projects were carried out in the same way, that is, with a transparent disclosure of the projects to be conducted and prior to their implementation.
- The Citizen Participation process took place in an efficient and adequate manner, which allowed gathering the concerns and suggestions from the interest groups related to the project. Relevant data obtained during the workshops, was considered during potential impact

identification; and in designing the Environmental Management and Adaptation Plan for the project's EsIA process.

- Some of those participating in the workshops in Higüey particularly, expressed concern that bypassing the vehicle traffic flow – presently through this city towards Punta Cana could generate negative commercial effects. To evaluate this, a socio-economic evaluation is recommended during the detailed engineering phase, to assess the effects of locating a toll gate on the new road. With respect to the community of Higüey, a post evaluation could be conducted of the economic development of the Higüey community during the first years of operation of the Autopista del Coral, in order to assess impacts and public opinion.

- The development of other road projects in this area and the regional context of the Autopista del Coral Project, tend to create some confusion regarding the type of impact they have generated (on ecosystems and marine species) and the potential impacts that could be generated by the Autopista del Coral.

- The interaction between the Autopista del Coral Project and the current highway, particularly during the construction phase, generates concern for pedestrian and traffic safety.

- Some of the recurring issues from the attendees (mainly in the workshops in Verón) are directly associated with social and environmental problems linked to the current road and development of human settlements and commercial activities around it. They tend to extrapolate these problems as potential impacts associated with the new highway.

- The producers, especially livestock producers in the peripheral zone to the project's area of influence, are interested in ensuring the continuity of their ordinary activities, basically concerning passage and access roads to the markets located in the urban zone of the head municipality (Higüey).

- All of the representative economic agents and institutions acknowledge the need for the Project and they express their support thereof; but they state that although the new highway route is not totally satisfactory for them, it is more favorable to their interests than other alternatives previously proposed.

- Compensation for affected property owners was of interest to the majority of the attendees representing the different sectors.

- There is great anticipation in the region for the start of construction.

- Some of the attendees (mainly in the Higüey workshops) believe that the motivation of the Project is in response to the interests of other specific projects in the region, such as Cap Cana. They do not understand or do not accept the rationale provided by the project promoter, which considers a series of future tourism expectations for the region, its connection to Santo Domingo and current needs for intra-regional, efficient and safe travel routes.

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6.0 ENVIRONMENTAL IMPACT IDENTIFICATION, CHARACTERIZATION AND ASSESSMENT

6.1 Introduction

The environmental assessment of the Autopista del Coral Project considered present characteristics of the environmental components in the road corridor where the Project will be implemented, as well as its interaction with the activities and phases planned for the Project development, according to the following scenarios:

- **Construction Phase**: this scenario includes a time period of approximately 24 months; in this period all the activities associated with detailed engineering and works construction will take place.

- **Operation Phase:** this scenario comprises an estimated 23 year period. This estimate considered the Public – Private Participation (PPP) scheme, under which the motorway will be constructed. During this time, the Moya – Odebrecht Consortium will conduct all maintenance activities to ensure adequate operation of the road.

A detailed description of the above mentioned scenarios is presented in Section 2 of the EIA report.

The objectives of the environmental assessment are, in general terms, the following:

- Identify the environmental and social resources affected or that could be potentially affected during the scenarios object of the environmental evaluation.

- Evaluate the impacts identified in each of the scenarios, considering attributes such as: character, geographic extension, duration, magnitude, probability of occurrence, frequency and the reversibility of these aspects in the natural and anthropic environment of the project and its area of influence.

- Analyze the impacts resulting from the attribute rating for each of the scenarios with respect to data from the study area baseline or the basic engineering for the Autopista del Coral project.

During the Environmental Assessment process, environmental specialists conducted a qualitative and quantitative identification and evaluation of environmental impacts, using modified cause and effect matrices established by Leopold. In identifying each of the impacts, the following aspects were analyzed: 1) the cause, that is, the agent promoting change, represented by those activities determined for each scenario under evaluation; and 2) the effect, those changes that will be observed in the environmental or social component as a reaction to the activities developed in each scenario.

Finally, the results of this chapter will be employed in defining the impact management strategies, such as the control, prevention or mitigation measures that will structure section 7 of the EIA, the "Environmental Management and Adaptation Program" (EMAP).

6.2 Impact Identification

The impact identification consisted of: (1) differentiating the diverse activities that characterize each of the scenarios presented in the environmental assessment, (2) establishing the environmental components and change indicators of the present condition of the resources and their sensitivity to exogenous and endogenous factors and (3) establishing interactions between the activities, differentiating for each scenario and the environmental components and change indicators previously established. This phase of the Environmental Assessment is designated as the Preliminary Environmental Assessment, and its objective is to identify "environmental aspects", which will be evaluated and rated in further stages.

Each of the above mentioned steps for impact identification, developed within the framework of the Environmental Assessment process of the Autopista del Coral Project, are described below:

6.2.1 Project Activities

The activities identified for each of the scenarios considered in the environmental evaluation have been grouped as follows:

Construction Phase:

The Project construction and the previous phase, detailed engineering, have been grouped into the following main activities and sub-activities:

Preliminary Works

- Detailed geological and geotechnical evaluation of the road corridor
- Land negotiations
- Evaluation of access roads, pits and zones for excavation and excess material disposal
- Access road upgrade and construction

Mobilization

- Camp and temporary facility installation
- Location and Lay-out
- Preliminary signposting

Soil and Material Movement

- Overburden removal and grading of the right of way
- Cut and backfill execution
- Management of areas for excavation excess material disposal
- Management of borrow areas and pits
- Industrial plants adaptation and management

Slope Stabilization and Drainage

- Construction of preliminary drainage and stabilization works
- Construction of final drainage and stabilization works

Pavements

- Sub-base and base construction
- Wearing surface construction

Structures

- Construction of complementary infrastructure (bridges, distributors, operational returns, railroad crossing, toll gates, service stations)

Demobilization

- Restoration and revegetation
- Final signposting
- Final cleaning

Operation Phase:

The road operation phase is grouped into the following main activities and their corresponding sub-activities:

Road Operation

This comprises all the activities related to vehicle flow, according to the specifications of the geometric design planned during construction.

Road Maintenance

- Pavement evaluation and maintenance
- Evaluation and maintenance of drainage works
- Evaluation, monitoring and maintenance of slope and hillside stabilization works
- Complementary infrastructure maintenance (bridges, distributors, separators, operational returns, toll gates)

- o Signposting maintenance
- o Evaluation, monitoring and maintenance of road safety

Each of the above activities involves not only the activity itself, but also incorporates other issues linked to its development, including: operation and maintenance of equipment and machinery; fuel management, supply, and generation; and, management and disposal of solid or liquid wastes.

6.2.2 Environmental Components and Change Indicators

According to data collected during baseline studies of the different physical, natural and socio-economic and cultural components present in the project's area of influence (see Section 3), change indicators (events that evidence the occurrence of an effect) were identified based on the component's susceptibility to exogenous agents. This analysis, conducted by different specialists taking part in the environmental impact assessment, is summarized in Table 6-1. A code was assigned to each of the indicators identified for every environmental component analyzed in order to facilitate data management in the impact identification process and ease of representation in the environmental impact evaluation matrix.

TABLE 6-1 Change Indicators

Environmental Component	Code	Change Indicators	Effects
Air	A-1	air quality degradation	Refers to excessive generation of particulate matter (dust) during soil movement and to air emissions produced mainly by mobile sources (equipment, machinery and transport vehicles combustion gases).
Noise	R-1	Increase in noise levels	Considers the rise in environmental noise levels that normally characterize these zones due to temporary introduction of alien noises into the area, or increase of existing levels.
Water	H-1	Sediment transport	Refers to dust generation in areas next to natural or artificial water reservoirs, and direct re-suspension of particulate matter in rivers, streams and irrigation channels, due to erosion of the Right of Way or direct transport of cutting material.
	H-2	Physical and chemical water quality and quantity degradation	Related to changes in physical and chemical appearance or composition due to hydrocarbons (fuels, grease and oils) or others substances associated with accidental discharges that damage the water resource quality. This alteration may occur in both surface and underground water bodies. Also, it considers the supply and demand for this resource with respect to the uses planned for the Project.

Environmental Component	Code	Change Indicators	Effects
Soil	SU-1	Soil structure disturbance	Is associated with exogenous factors that might introduce soil instability elements; such as mixing horizons, compression and soil use change. Also, disturbance of the surface and sub-surface drainage patterns that induce instability problems such as loss of the soils natural drainage capacity and erosion due to a slope and runoff combination.
	SU-2	Susceptibility to erosion	Refers to activation of existing surface erosion problems, produced by wind or hydric phenomena or a combination of both. May also refer to generation of new erosion problems caused by the temporary soil disturbance.
Flora and Fauna	FF-1	Loss of vegetative cover	Related to removal of crops and bushes at different growth stages (secondary growth vegetation) that are present in the Right of Way area.
	FF-2	Disturbance of protected species	Refers to direct disturbance of flora and fauna species with a conservation category or damage to the habitat of a species with conservation category.
Social	S-1	Temporary transit obstruction	Refers to temporary interruption of transit conditions and normal operation of traffic in the area (pedestrian or vehicular), which can introduce risk factors for passersbys and for construction activities associated with the project (road safety during construction).
	S-2	Temporary infrastructure interruption	Refers to temporary interruption of agricultural infrastructure related to sugar cane farming, irrigation channels, fences and livestock lands.
	S-3	Road safety improvement	Refers to road safety on the existing road with respect to the new highway operation. The new highway will separate the traffic of heavy and light vehicles with a specific destination, avoiding high transit speeds in agricultural or urban zones, reducing traffic jams in the urban sectors, and the accumulation of air emissions from cars in the local towns.
Economic	E-1	Job generation	Concerns temporary job generation in the different work fronts, including qualified and non-qualified labor vacancies. This labor may be available at the local or regional level. Also, an increase in demand for local services (consumables, products and services) that will occur during Project construction.
	E-2	Improvement of local and regional tourist mobility	Related to a quick, safe and separated mobility of the local and regional tourism during the road operation and the further generation of direct revenues and benefits to the communities located within the project's local and regional area of influence.
Cultural	AR-1	Disturbance or destruction of cultural heritage	Associated to damage, partial or total destruction that might be caused to cultural patrimony elements located within the Right of Way or nearby.

6.2.3 Interaction of Project Activities with Environmental Components

After identifying the Project activities, the environmental components and their change indicators within the study area, a matrix was prepared to identify those environmental aspects produced by the interaction between the activities characteristic of each evaluated scenario and the environmental components identified. This interaction is shown in **Table 6-2**.

To interpret the above mentioned table it is necessary to consider the codes assigned in Table 6-1.

TABLE 6-2 Matrix of Interactions between Environmental Components and Project Activities

ENVIRONMENT	COMPONENT	PROJECT PHASES								
		Construction							Operation	
		Preliminary Works	Mobilization	Soil and material movement	Slope stabilization and drainages	Pavements	Structures	Demobilization	Road Operation	Road Maintenance
PHYSICAL	Air	A-1	A-1	A-1	A-1	A-1	A-1		A-1	A-1
	Noise	R-1	R-1	R-1	R-1	R-1	R-1	R-1	R-1	R-1
	Water	H-1	H-1	H-1	H-1	H-1	H-1			
		H-2	H-2	H-2	H-2	H-2	H-2	H-2	H-2	H-2
	Soil	SU-1	SU-1	SU-1	SU-1	SU-1	SU-1		SU-1	
				SU-2	SU-2	SU-2	SU-2		SU-2	SU-2
NATURAL	Flora and Fauna	FF-1	FF-1	FF-1	FF-1		FF-1			FF-1
			FF-2	FF-2	FF-2	FF-2	FF-2	FF-2		FF-2
SOCIAL	Social	S-1	S-1	S-1	S-1	S-1	S-1	S-1		S-1
				S-2	S-2	S-2	S-2			S-2
									S-3	
	Economic	E-1	E-1	E-1	E-1	E-1	E-1	E-1	E-1	E-1
									E-2	
	Cultural			AR-1	AR-1		AR-1			AR-1

6.3 Impact Assessment

The definition of Environmental Assessment used in this study refers to the product of the interaction of a Project activity that causes a change on a specific resource existing within the project's area of influence. The changes observed in the resource are the environmental effects, whose probability and significance are determined by means of an evaluation scheme that establishes how important this effect is to the project development.

The impact assessment consisted of defining the attributes to evaluate in each of the impacts to be analyzed and assigning a relative scale of values to each attribute. The process developed until the rating of each impact was generated by the activities in the two analyzed scenarios, as is described below:

6.3.1 Evaluation Criteria

In the environmental impact assessment process for the Autopista del Coral Project, the attributes and scale of values for the impact analysis were defined. The attributes established for the environmental impacts are based on the characteristics, location and time behavior resulting from the interaction project activity – environmental component affected.

The attributes defined for the potential impact rating were the following:

- Character
- Geographic extension
- Duration
- Magnitude
- Probability of occurrence
- Frequency
- Reversibility

This attribute rating is shown in **Table 6-3**. The attribute definition is based on the behavior of known, typical impacts, derived from construction and operation of similar projects.

TABLE 6-3 Rating Criteria

Attribute	Rating	Definition
Character	Positive	Net benefit for the resource
	Neutral	Neither net benefit nor damage to the resource
	Negative	Net damage to the resource
Geographic extension	Direct	Confined to the area directly disrupted by the Project.
	Local	Beyond the directly disrupted areas but within the limits of the study area under evaluation that will be specified for each discipline or indicator.
	Regional	Extends beyond the local or administrative limits specified for each discipline or indicator. It is considered as indirect impact.
Duration	Short term	Less than 1 year
	Medium term	Between 1 and 5 years
	Long term	More than 5 years
Magnitude	None	No change anticipated
	Low	The disturbance is expected to be slightly greater than typical, existing conditions
	Medium	Predicts that the effects are considerably beyond the existing, typical conditions, but without exceeding the criteria established in the permissible limits or without disturbing the economic, social and biological parameters within the ranges of natural variability or social tolerance
	High	The predictable effects exceed the established criteria or permissible limits associated with potential adverse effects or they cause a detectable change in social, economic or biological parameters, beyond the natural variability or social tolerance
Frequency	Permanent	Impacts will be permanent and continual.
	Temporary	Confined to a specific period of time (for instance: during construction)
	Periodic / Occasional	It occurs sporadically but repeatedly at equal time intervals or in irregular intervals of time.
Probability of Occurrence	Low	Little probability
	Medium	Possible or Likely
	High	Certain
Reversibility	Short Term	Impacts can be reversed in one year or less
	Medium Term	Impacts can be reversed in more than one year, but in less than ten.
	Irreversible	Permanent effects

6.3.2 Impact Assessment

The impact rating, carried out by a multidisciplinary team, was developed in a Leopold modified matrix, to represent the potentially affected environmental factors and the Project activities that could induce a potential impact (see section 6.2).

The rating method used for the matrix consisted of assigning values, on a relative scale, to all the attributes of the analyzed impact for each of the project activity - environmental effect interaction.

The relative scale of values, established by the multidisciplinary team for each of the attributes indicated in section 6.2.1, is shown in **Table 6-4**.

TABLE 6-4 Scale of Values for Impact Rating

Character (C)		**Duration (Du)**	
Negative	-1	Long Term	3
Positive	1	Medium Term	2
Neutral	0	Short Term	1
Magnitude (M)		***Frequency (F)***	
High	3	Permanent	3
Medium	2	Periodic	2
Low	1	Temporary	1
None	0		
Probability of Occurrence (Po)		***Reversibility (R)***	
High	1	Irreversible	3
Medium	0,9-0,5	Reversible in medium term	2
Low	0,4-0,1	Reversible in short term	1
Geographic Extension (E)			
Regional			3
Local			2
Direct			1

Assigning values to each interaction analyzed has generated an index according to the following mathematical expression, whose result represents the impact's qualitative and quantitative characteristics:

$$\boldsymbol{Ca = C \times Po \times (M + E + Du + F + R)}$$

To assign values to each of the impacts, according to their attributes, the environmental specialists used data from the baseline study. During the rating process, each of the 14 change indicators (see Table 6-1) were analyzed, as well as their behavior in each of the possible interactions with the activities identified for the different scenarios being analyzed. Section 6.2.1 describes a total of 9 main activities for the two scenarios object of analyzed and Table 6-2 shows the possible interactions with the environmental components.

In order to visualize the quantitative and qualitative characteristics of the impacts analyzed in the interaction matrix, a range of values was established and a color code was assigned to each value range (**Table 6-5**).

TABLE 6-5 Ranges of Values and Color Code

Ranges of Values				
			Predicted effect	**Color Code**
15	A	+1	Positive	
0		0	Neutral	
-5	A	-1	Slightly negative	
-10	A	-5,1	Moderately negative	
-15	A	-10,1	Highly negative	

The results of this rating process (see Appendix 6-1) are reflected in the impact rating matrix for the construction and operation of the Autopista del Coral project, as shown in **Table 6-6** below:

TABLE 6-6 Impact Rating Matrix –Autopista del Coral Project

COMPONENT	CHANGE INDICATORS	Code	PROJECT ACTIVITIES – PHASES								
			CONSTRUCTION							OPERATION	
			PRELIMINARY WORKS	MOBILIZATION	SOIL AND MATERIAL MOVEMENT	SLOPE STABILIZATION AND DRAINAGES	PAVEMENTS	STRUCTURES	DEMOBILIZATION	ROAD OPERATION	ROAD MAINTENANCE
AIR	Air quality degradation	A-1	-0.6	-0.6	-6	-6	-2.4	-6	0	-6	-0.5
NOISE	Increase in noise levels	R-1	-7	-7	-7	-7	-7	-7	-2.8	-11	-0.7
WATER	Transport of sediments to water bodies.	H-1	-0.5	-0.5	-1	-1	-1	-1	0	0	0
	Degradation of water physical and chemical quality and quantity	H-2	-1.2	-1.2	-1.4	-1.4	-1.4	-1.4	-0.6	-1.8	-0.6
SOIL	Soil structure disturbance	SU-1	-2	-2	-14	-14	-13	-14	0	-13	0
	Susceptibility to erosion	SU-2	0	0	-1	-1	-0.5	-1	0	-0.7	-0.7
FLORA AND FAUNA	Loss of vegetative cover	FF-1	-1	-1.4	-13	-13	0	-13	0	0	-11
	Disturbance to protected species	FF-2	0	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	0	-2.4
SOCIAL	Temporary transit obstruction	S-1	-7	-7	-7	-7	-7	-7	-2	0	-2.8
	Temporary infrastructure interruption	S-2	0	0	-7	-7	-7	-7	0	0	-2.8
	Road safety improvement	S-3	0	0	0	0	0	0	0	13	0
ECONOMIC	Job generation	E-1	9	9	9	9	9	9	8	11	9
	Improvement of local and regional tourist mobility	E-2	0	0	0	0	0	0	0	13	0
CULTURAL	Alteration or destruction of archaeological heritage	AR-1	0	0	-0.7	-1.4	0	-1.4	0	0	-1.4

6.4 Impact Analysis

This section analyzes the environmental impacts established according to the above described identification and evaluation process. The impacts analyzed for each environmental component and for each scenario are included in the environmental assessment.

6.4.1 Physical Component

Air Quality

Construction Phase

The potential impact to air quality is considered to be slightly to moderately negative. Impacts are associated with dust generation during construction activities, such as: Soil and Material Movement, Slope and Structure Stabilization and Drainages, mainly in the road corridor disturbance area. Among the above mentioned, the activities with highest potential impact on air quality are: overburden removal and grading in the right of way, cut and backfill execution, management of excavation excess material disposal zones, management of borrow areas and pits and management and adaptation of industrial plants. Fugitive emissions may be controlled by periodic application of construction and activity management procedures in the direct disturbance area. Application of the control measures will consider local climate variables, such as wind direction and speed and temperature, that may influence a rise in the PM-10 parameter, causing an exceedance of the 150 ug/m^3 standard established by Norm NA-AI-001-03 over a 24 hour period or the 230 ug/m^3 value in the Total Suspended Particles (TSP) parameter, for the same period of time.

Gases from combustion of equipment, machinery and vehicles used during the construction phase are considered to be negligible in the environmental assessment, because their effect is reflected in the temporary use of these emission sources and in their mobile.

Operation Phase

The potential impact to air quality is considered to be negative with respect to the traffic volume expected for the new highway, the vehicle type, and the quality of the fuels they will use (engines burning gasoline, diesel, or other alternate fuels available in the country); as well as the periodic maintenance performed on these vehicles (according to regulations or at the owner’s consideration). The motorway operation is expected to contribute to local and regional air quality degradation with pollutants such as CO, VOC, NOx, SOx and Pb, due to the combustion of engines operating with gasoline, diesel and LPG. The regional distribution of these pollutants will be closely related to the predominating climate regime (wind speed and direction, temperature, humidity and precipitation) and the corridor's location in the country's eastern corner (with a temporary influence from the Atlantic or Caribbean climate). The controls that could counteract the predicted potential effects are not related to the company selected for the road operation but they rather are associated with the State's policies on fuel quality, tool requirements for controlling pollution from vehicles, and implementing annual controls and certification of emissions from all kind of vehicles in the country.

The road's geometric design planned during the detailed engineering and construction phases was carefully established in order to counteract events such as acceleration and slow down or high slopes that contribute to gas emissions from the vehicles using the highway. Also, the 100 km/h traveling speed and the absence of traffic jams will allow the vehicles to function more efficiently and with lower emission factors.

Noise

Construction Phase

The potential impact "increase in noise levels" is moderately negative during almost all the activities related to Project construction, mainly when considered from the occupational viewpoint. The work site could reach sound pressure levels close to 85 dBA, according to the type of equipment and machinery used in the construction and the workers proximity to them. On the other hand, the proximity of the corridor to vegetation with a certain density, such as the sugar cane crops or bushes, provide a buffering factor to the distribution of the sound pressure levels perceptible outside the project areas. Although, in some sections during construction there will be a complementary effect from the traffic at nearby sections of existing road. Considering the Standard for Protection Against Noise NA-RU-001-03 (Table 4.2, Maximum Permissible Noise), the sound pressure level environmentally perceptible during daytime and outside the work site could be about 70 to 75 dBA, a value that exceeds the 5 or 10 dBA norm, according to the above mentioned environmental conditions for the project.

Operation Phase

The potential impact "increase in noise levels" is considered highly negative, if according to the NA-RU-001-03 Standard, high traffic levels are maintained in the highway during daytime and night time, with sound pressure levels above 65 dBA. The areas in vicinity of the highway are considered tranquility zones, with sound pressure levels of 60 dBA during daytime and 50 dBA at night.

Soils

Construction Phase

The potential impact “soil structure disturbance”, is considered highly negative, principally due to the mixture and compression of horizons and soil use change within the Right of Way. The original soil structure will be completely changed during construction of the highway. Another factor to consider is that in some sections of the road construction area are “dolines” that are interconnected with ground aquifer systems, which makes the selection of appropriate material cutting methods during construction and the use of equipment on geotechnical unstable areas very important.

The potential impact “susceptibility to erosion” is slightly negative and it is associated with changes in surface and sub-surface drainage patterns and the typical characteristics of the limestone on which the initial and final sections of the highway will be located.

Operation Phase

The potential impact “soil structure disturbance” is highly negative during the road operation due to the permanent change in soil use.

Water Resources

Construction Phase

The potential impact “transport of sediment to water bodies” is considered slightly negative, during the activities related to soil and material movement, slope stabilization and drainages, pavements and structures. The probability of occurrence of this effect is linked to adequate management of the construction procedures used for controlling erosion in the right of way or the management of cut and backfill material next to waterbodies.

During construction, the potential impact “disturbance of water physical and chemical quality and quantity” is slightly negative in all the activities, particularly those conducted near surface water bodies and in those areas where the limestone presents high porosity and provides little protection to the ground aquifers underlying them. The likeliness of hydrocarbons leaks and spills during the construction activities may be controlled by maintaining equipment, machinery and vehicles in optimum working condition, with periodic maintenance and spill prevention, control and cleaning systems, appropriately implemented by the responsible party. Regarding the influence on the water supply (quantity) that the project will employ for its different uses, no competition is predicted with local uses or effects on the water resource availability.

Operation Phase

The potential impact "disturbance of water physical and chemical quality" is considered slightly negative, due to runoff and washing of hydrocarbon wastes on the road pavement (leaks from vehicles) or accidental spills of hydrocarbons or other substances on the road. The presence of limestone with a high porosity and groundwater aquifers under it requires appropriate control of the drainage systems, in order to reduce the probability of pollutant migration towards the subsoil.

6.4.2 Natural Component

Flora and Fauna

Construction Phase

The potential impact "Loss of vegetative cover" is highly negative during the construction phase, because it includes removal of vegetation located in the Right of Way. Some construction activities associated with "Preliminary Works" and "Mobilization" has potential impacts but in a slightly negative extent, because the disturbed area can be restored as soon as the activity is over; this not the case for the other activities derived from the construction of the highway itself. The areas directly affected by the highway construction could not be restored, since the vegetative cover loss within the intervened Right of Way is permanent.

The potential impact "alteration of protected species" is considered slightly negative due to the location of the present route and the presence of protected flora species. During the baseline study, individual Rain Palms -*Gaussia attenuata*- were found at 169 m from the route, south of the abscissa K59+540 and 192 m from the route, south of the abscissa K60+350. Also, near the Bayahibe crossing of the Chavón river and in the same section where the above mentioned palm was observed, individuals from another protected flora species commonly known as Corozo -*Acrocomia quisqueyana*- were reported.

Operation Phase

The potential impact concerning "Loss of vegetative cover" is considered to be highly negative because the required maintenance activities for road operation, will include removing all the vegetation from the Right of Way intervened.

During the road operation, the potential impact "alteration of protected species" is considered slightly negative, because the "protected flora species" identified and located during the construction phase will have the same survival and protection possibilities as in the previous phase.

6.4.3 Social, Economic and Cultural Components

Social

Construction Phase

The potential impact "temporary transit obstruction", is considered moderately negative during all construction activities, except for the final phases, related to demobilization, which is described as slightly negative, because the road that links La Romana – Higüey – Punta Cana and other non-paved access that join it, will be disrupted at least 10 sites, causing a temporary interruption of transit and the normal travel patterns (pedestrian and vehicular). This impact introduces a very important risk factor for the construction work, and will demand a careful evaluation in the detailed engineering phase regarding planning of access roads and traffic towards and away from the roadwork.

The potential impact "temporary infrastructure interruption" is considered moderately negative, considering the direct impact on sugar cane crops, irrigation channels, fences and pasture lands due to the Project. The development and continuity of the agricultural activities in the neighboring areas during and after the roadwork shall be ensured by means of an agreement process with those affected.

Operation Phase

During the road operation, the potential impact "temporary transit obstruction" is considered slightly negative, because the contingency plan to be designed for the highway will include planning temporary access roads for the maintenance activities in those sites considered as sensitive to the operation and likely to need maintenance.

The potential impact "temporary interruption of productive infrastructure" in the operation phase is considered slightly negative, because the probability of occurrence of this impact in road maintenance activities is lower than in the construction phase.

The potential impact "road safety improvement" is perceived as a highly positive effect due to the start up of the road operation. The likely traffic segregation by specific destination, for both heavy and light vehicles, from the road currently communicating La Romana-Higüey-Punta Cana, will reduce traffic jams in agricultural and urban zones and the accident risk associated with such jams.

Economic

The potential impact "job generation" is considered highly positive, considering that within the Project's local area of influence there is a qualified and non-qualified labor supply, which can be affected by the Project by ensuring equitable job conditions and temporary employment opportunities to all the communities. Additionally, another positive effect will be the indirect employment derived from an increase in demand for local goods and services for the roadwork during the construction phase. During operation, although a significant reduction of labor hiring is expected, there will be other types of more periodic local employment opportunities associated with the road operation and maintenance.

The potential impact “improvement of local and regional tourist mobility” is considered highly positive due to the following effects: agile and safe mobilization of different transportation types; reduction in transportation time and costs (fuel and equipment maintenance), generation of direct revenues, and benefits due to improvement of services offered at the local and regional levels.

Cultural

The potential impact “alteration or destruction of cultural heritage” is slightly negative during the project construction due to construction activities such as: Slope and Structure Stabilization and Drainages, considering the sites reported during the archaeological survey. Two of these sites are located approximately 300 m from the route and north from K62+000, and the third one is located 1121 m south of the route, at K63+000. These sites will not be directly impacted by the road works within the 70 m Right of Way; but the complementary works for drainage and structure construction may potentially be close to such sites. Also, the relative proximity of these sites to the highway route implies a general archaeological potential in this sector, therefore, protocols for preservation of any archaeological material that could be discovered during soil movements must be implemented; a similar situation could occur during the road maintenance activities in the above mentioned sector.

6.5 Summary of Qualitative Impact Rating

Table 6-7 shows the qualitative impact rating summary matrix for the project’s construction and operation phases, according to the Terms of Reference. This matrix shows the results obtained following the process described in Section 6-.3 and presented in Table 6-6.

TABLE 6-7 Qualitative Impact Rating Summary Matrix

Impact indicator	Ecosystem element	Type	Intensity	Exten-sion	Moment	Persist-ence	Reversibility	Recoverability	Synergy	Accumulation	Periodicity	Significance
Air quality degradation	Air	Negative	Low	Local	Construction Operation	Short Term	Reversible in Short Term	Recoverable in Short Term	Not Synergistic	Not Accumulable	Temporary	Slightly Negative
Increase in noise levels	Noise	Negative	Low	Local	Construction Operation	Short Term	Reversible in Short Term	Recoverable in Short Term	Not Synergistic	Not Accumulable	Temporary	Slightly to Moderately Negative
Sediments transport	Water	Negative	Low	Local	Construction Operation	Short Term	Reversible in Short Term	Recoverable in Short Term	Not Synergistic	Not Accumulable	Temporary	Slightly Negative
Degradation of water physical and chemical qualities and quantity	Water	Negative	Low	Local	Construction Operation	Short Term	Reversible in Short Term	Recoverable in Short Term	Not Synergistic	Not Accumulable	Temporary	Slightly Negative
Soil structure disturbance	Soil	Negative	High	Direct	Construction Operation	Long Term	Irreversible	Non Recoverable	Not Synergistic	Not Accumulable	Permanent	Moderately to Highly Negative
Susceptibility to erosion	Soil	Negative	Low	Local	Construction Operation	Short Term	Reversible in Short Term	Recoverable in Short Term	Not Synergistic	Not Accumulable	Temporary	Slightly Negative
Loss of vegetative cover	Flora and Fauna	Negative	High	Direct	Construction Operation	Long Term	Irreversible	Non Recoverable	Not Synergicistic	Accumulable	Permanent	Slightly Negative
Disturbance of protected species	Flora and Fauna	Negative	Low	Local	Construction Operation	Short Term	Reversible in Short Term	Recoverable in Short Term	Not Synergicistic	Not Accumulable	Temporary	Slightly Negative
Temporary transit obstruction	Social	Negative	Medium	Local	Construction	Short Term	Reversible in Short Term	Recoverable in Short Term	Not Synergicistic	Not Accumulable	Temporary	Moderately Negative
Temporary infrastructure interruption	Social	Negative	Medium	Local	Construction	Short Term	Reversible in Short Term	Recoverable in Short Term	Not Synergicistic	Not Accumulable	Temporary	Moderately Negative
Road safety improvement	Social	Positive	Medium	Local	Operation	Long Term	Irreversible		Not Synergicistic	Accumulable	Permanent	Highly Positive
Job generation	Economic	Positive	Medium	Local	Construction Operation	Short Term	Irreversible		Not Synergicistic	Not Accumulable	Temporary	Highly Positive
Improvement of local and regional tourist mobility	Economic	Positive	Medium	Local	Operation	Long Term	Irreversible		Not Synergicistic	Accumulable	Permanent	Highly Positive
Alteration or destruction of archaeological patrimony	Cultural	Negative	Low	Local	Construction Operation	Short Term	Irreversible		Not Synergicistic	Not Accumulable	Temporary	Slightly Negative

6.6 References

6.6.1 Water and Air

(1) Resolución No. 09/2003; Norma de Calidad del Agua y Control de Descargas (NA-AG-001-03)

(2) Resolución No. 10/2003; Norma Ambiental de Calidad del Aire (NA-AI-001-03) y Norma Ambiental para el Control de las Emisiones Contaminantes Atmosféricas Provenientes de Vehículos (NA-AI-003-03).

6.6.2 Impact Assessment and General

(3) LEOPOLD, L. B., CLARKE, F. E., HANSHAW, B. B. and BALSLEY, J. R., 1971. "A procedure for evaluating environmental impact, Geological Survey Circular 645, Government Printing Office, Washington, D.C. 13 pp.

(4) CANADIAN ENVIRONMENTAL QUALITY GUIDELINES, update 2002.

(5) INTERNATIONAL FINANCE CORPORATION IFC, 2007. Environmental, Health and Safety Guidelines for Toll Roads and Environmental, Health and Safety General Guidelines.

(6) MINISTERIO DE MEDIO AMBIENTE DE ESPAÑA, 1998. Guía para la Elaboración de Estudios del Medio Físico. Secretaría de Medio Ambiente de España, Madrid.

(7) THE WORLD BANK. 1991. Environmental Assessment Sourcebook, Volumes I (Policies, Procedures, and Cross-Sectoral Issues) and II (Sectoral Guidelines).Technical Papers Number 139 and 140.

(8) THE WORLD BANK. 1997. Technical Paper No. 376. Roads and the Environment, a Handbook; edited by Koji Tsunokawa y Christopher Hoban.

(9) THE EQUATOR PRINCIPLES, July 2006.

6.6.3 Noise

(10) Resolución No. 08/ 2003; Norma Ambiental para la Protección Contra Ruidos (NA-RU-001-03 sustituye a la RU-CA-01.

(11) University of Washington. 2006. Noise Navigator Sound Level Database with over 1700 measurement values. E. Berger, R. Neitzel y C. Kladden.

APPENDIX 6-1

IMPACT RATING INDIVIDUAL MATRICES

A-1: AIR QUALITY DEGRADATION

IMPACT ASSESSMENT PARAMETERS		PROJECT ACTIVITIES – PHASES								
		CONTRUCTION							OPERATION	
		PRELIMINARY WORKS	MOBILIZATION	SOIL AND MATERIAL MOVEMENT	SLOPE STABILIZATION AND DRAINAGES	PAVEMENTS	STRUCTURES	DEMOBILIZATION	ROAD OPERATION	ROAD MAINTENANCE
Character	C	-1	-1	-1	-1	-1	-1		-1	-1
Geographic extension	E	2	2	2	2	2	2		2	1
Duration	Du	1	1	1	1	1	1		1	1
Magnitude	M	1	1	1	1	1	1		1	1
Probability of occurrence	Po	0,1	0,1	1	1	0,4	1		1	0,1
Frequency	F	1	1	1	1	1	1		1	1
Reversibility	R	1	1	1	1	1	1		1	1
Ca = C x Po x (M + E + Du + F + R)		-0,6	-0,6	-6	-6	-2,4	-6	0	-6	-0,5

Appendix 6-1

R-1: INCREASE IN NOISE LEVELS

IMPACT ASSESSMENT PARAMETERS		PROJECT ACTIVITIES – PHASES								
		CONTRUCTION							OPERATION	
		PRELIMINARY WORKS	MOBILIZATION	SOIL AND MATERIAL MOVEMENT	SLOPE STABILIZATION AND DRAINAGES	PAVEMENTS	STRUCTURES	DEMOBILIZATION	ROAD OPERATION	ROAD MAINTENANCE
Character	C	-1	-1	-1	-1	-1	-1	-1	-1	-1
Geographic extension	E	2	2	2	2	2	2	2	2	2
Duration	Du	1	1	1	1	1	1	1	3	1
Magnitude	M	2	2	2	2	2	2	2	2	2
Probability of occurrence	Po	1	1	1	1	1	1	0,4	1	0,1
Frequency	F	1	1	1	1	1	1	1	3	1
Reversibility	R	1	1	1	1	1	1	1	1	1
Ca = C x Po x (M + E + Du + F + R)		-7	-7	-7	-7	-7	-7	-2,8	-11	-0,7

Appendix 6-1

H-1: TRANSPORT OF SEDIMENTS TO WATER BODIES

IMPACT ASSESSMENT PARAMETERS		PROJECT ACTIVITIES – PHASES								
		CONTRUCTION							OPERATION	
		PRELIMINARY WORKS	MOBILIZATION	SOIL AND MATERIAL MOVEMENT	SLOPE STABILIZATION AND DRAINAGES	PAVEMENTS	STRUCTURES	DEMOBILIZATION	ROAD OPERATION	ROAD MAINTENANCE
Character	C	-1	-1	-1	-1	-1	-1			
Geographic extension	E	1	1	1	1	1	1			
Duration	Du	1	1	1	1	1	1			
Magnitude	M	1	1	1	1	1	1			
Probability of occurrence	Po	0,1	0,1	0,2	0,2	0,2	0,2			
Frequency	F	1	1	1	1	1	1			
Reversibility	R	1	1	1	1	1	1			
Ca = C x Po x (M + E + Du + F + R)		-0,5	-0,5	-1	-1	-1	-1	0	0	0

H-2: DEGRADATION OF WATER PHYSICAL AND CHEMICAL QUALITY AND QUANTITY

IMPACT ASSESSMENT PARAMETERS		PROJECT ACTIVITIES – PHASES								
		CONTRUCTION							OPERATION	
		PRELIMINARY WORKS	MOBILIZATION	SOIL AND MATERIAL MOVEMENT	SLOPE STABILIZATION AND DRAINAGES	PAVEMENTS	STRUCTURES	DEMOBILIZATION	ROAD OPERATION	ROAD MAINTENANCE
Character	C	-1	-1	-1	-1	-1	-1	-1	-1	-1
Geographic extension	E	1	1	2	2	2	2	1	2	1
Duration	Du	1	1	1	1	1	1	1	3	1
Magnitude	M	2	2	2	2	2	2	2	2	2
Probability of occurrence	Po	0,2	0,2	0,2	0,2	0,2	0,2	0,1	0,2	0,1
Frequency	F	1	1	1	1	1	1	1	1	1
Reversibility	R	1	1	1	1	1	1	1	1	1
Ca = C x Po x (M + E + Du + F + R)		-1,2	-1,2	-1,4	-1,4	-1,4	-1,4	-0,6	-1,8	-0,6

Appendix 6-1

SU-1: SOIL STRUCTURE DISTURBANCE

IMPACT ASSESSMENT PARAMETERS		PROJECT ACTIVITIES – PHASES								
		CONTRUCTION							OPERATION	
		PRELIMINARY WORKS	MOBILIZATION	SOIL AND MATERIAL MOVEMENT	SLOPE STABILIZATION AND DRAINAGES	PAVEMENTS	STRUCTURES	DEMOBILIZATION	ROAD OPERATION	ROAD MAINTENANCE
Character	C	-1	-1	-1	-1	-1	-1		-1	
Geographic extension	E	1	1	2	2	1	2		1	
Duration	Du	1	1	3	3	3	3		3	
Magnitude	M	1	1	3	3	3	3		3	
Probability of occurrence	Po	0,4	0,4	1	1	1	1		1	
Frequency	F	1	1	3	3	3	3		3	
Reversibility	R	1	1	3	3	3	3		3	
Ca = C x Po x (M + E + Du + F + R)		-2	-2	-14	-14	-13	-14	0	-13	0

Appendix 6-1
SU-2: SUSCEPTIBILITY TO EROSION

IMPACT ASSESSMENT PARAMETERS		PROJECT ACTIVITIES – PHASES								
		CONTRUCTION							OPERATION	
		PRELIMINARY WORKS	MOBILIZATION	SOIL AND MATERIAL MOVEMENT	SLOPE STABILIZATION AND DRAINAGES	PAVEMENTS	STRUCTURES	DEMOBILIZATION	ROAD OPERATION	ROAD MAINTENANCE
Character	C			-1	-1	-1	-1		-1	-1
Geographic extension	E			1	1	1	1		2	2
Duration	Du			1	1	1	1		2	2
Magnitude	M			1	1	1	1		1	1
Probability of occurrence	Po			0,2	0,2	0,1	0,2		0,1	0,1
Frequency	F			1	1	1	1		1	1
Reversibility	R			1	1	1	1		1	1
Ca = C x Po x (M + E + Du + F + R)		0	0	-1	-1	-0,5	-1	0	-0,7	-0,7

Appendix 6-1

FF-1: LOSS OF VEGETATIVE COVER

IMPACT ASSESSMENT PARAMETERS		PROJECT ACTIVITIES – PHASES								
		CONTRUCTION							OPERATION	
		PRELIMINARY WORKS	MOBILIZATION	SOIL AND MATERIAL MOVEMENT	SLOPE STABILIZATION AND DRAINAGES	PAVEMENTS	STRUCTURES	DEMOBILIZATION	ROAD OPERATION	ROAD MAINTENANCE
Character	C	-1	-1	-1	-1		-1			-1
Geographic extension	E	1	1	1	1		1			1
Duration	Du	1	1	3	3		3			3
Magnitude	M	1	1	3	3		3			3
Probability of occurrence	Po	0,2	0,2	1	1		1			1
Frequency	F	1	3	3	3		3			1
Reversibility	R	1	1	3	3		3			3
Ca = C x Po x (M + E + Du + F + R)		-1	-1,4	-13	-13	0	-13	0	0	-11

Appendix 6-1

FF-2: DISTURBANCE TO PROTECTED SPECIES

IMPACT ASSESSMENT PARAMETERS		PROJECT ACTIVITIES – PHASES								
		CONTRUCTION							OPERATION	
		PRELIMINARY WORKS	MOBILIZATION	SOIL AND MATERIAL MOVEMENT	SLOPE STABILIZATION AND DRAINAGES	PAVEMENTS	STRUCTURES	DEMOBILIZATION	ROAD OPERATION	ROAD MAINTENANCE
Character	C		-1	-1	-1	-1	-1	-1		-1
Geographic extension	E		2	2	2	2	2	2		2
Duration	Du		3	3	3	3	3	3		3
Magnitude	M		3	3	3	3	3	3		3
Probability of occurrence	Po		0,2	0,2	0,2	0,2	0,2	0,2		0,2
Frequency	F		1	1	1	1	1	1		1
Reversibility	R		3	3	3	3	3	3		3
Ca = C x Po x (M + E + Du + F + R)		0	-2,4	-2,4	-2,4	-2,4	-2,4	-2,4	0	-2,4

Appendix 6-1
S-1: TEMPORARY TRANSIT OBSTRUCTION

IMPACT ASSESSMENT PARAMETERS		PROJECT ACTIVITIES – PHASES								
		CONTRUCTION							OPERATION	
		PRELIMINARY WORKS	MOBILIZATION	SOIL AND MATERIAL MOVEMENT	SLOPE STABILIZATION AND DRAINAGES	PAVEMENTS	STRUCTURES	DEMOBILIZATION	ROAD OPERATION	ROAD MAINTENANCE
Character	C	-1	-1	-1	-1	-1	-1	-1		-1
Geographic extension	E	2	2	2	2	2	2	1		2
Duration	Du	1	1	1	1	1	1	1		1
Magnitude	M	2	2	2	2	2	2	1		2
Probability of occurrence	Po	1	1	1	1	1	1	0,4		0,4
Frequency	F	1	1	1	1	1	1	1		1
Reversibility	R	1	1	1	1	1	1	1		1
Ca = C x Po x (M + E + Du + F + R)		-7	-7	-7	-7	-7	-7	-2	0	-2,8

S-2: TEMPORARY INFRASTRUCTURE INTERRUPTION

IMPACT ASSESSMENT PARAMETERS		PROJECT ACTIVITIES – PHASES								
		CONTRUCTION							OPERATION	
		PRELIMINARY WORKS	MOBILIZATION	SOIL AND MATERIAL MOVEMENT	SLOPE STABILIZATION AND DRAINAGES	PAVEMENTS	STRUCTURES	DEMOBILIZATION	ROAD OPERATION	ROAD MAINTENANCE
Character	C			-1	-1	-1	-1			-1
Geographic extension	E			2	2	2	2			2
Duration	Du			1	1	1	1			1
Magnitude	M			2	2	2	2			2
Probability of occurrence	Po			1	1	1	1			0,4
Frequency	F			1	1	1	1			1
Reversibility	R			1	1	1	1			1
Ca = C x Po x (M + E + Du + F + R)		0	0	-7	-7	-7	-7	0	0	-2,8

Appendix 6-1
S-3: ROAD SAFETY IMPROVEMENT

IMPACT ASSESSMENT PARAMETERS		PROJECT ACTIVITIES – PHASES								
		CONTRUCTION							OPERATION	
		PRELIMINARY WORKS	MOBILIZATION	SOIL AND MATERIAL MOVEMENT	SLOPE STABILIZATION AND DRAINAGES	PAVEMENTS	STRUCTURES	DEMOBILIZATION	ROAD OPERATION	ROAD MAINTENANCE
Character	C								1	
Geographic extension	E								2	
Duration	Du								3	
Magnitude	M								2	
Probability of occurrence	Po								1	
Frequency	F								3	
Reversibility	R								3	
Ca = C x Po x (M + E + Du + F + R)		0	0	0	0	0	0	0	13	0

Appendix 6-1

E-1: JOB GENERATION

IMPACT ASSESSMENT PARAMETERS		PROJECT ACTIVITIES – PHASES								
		CONTRUCTION							OPERATION	
		PRELIMINARY WORKS	MOBILIZATION	SOIL AND MATERIAL MOVEMENT	SLOPE STABILIZATION AND DRAINAGES	PAVEMENTS	STRUCTURES	DEMOBILIZATION	ROAD OPERATION	ROAD MAINTENANCE
Character	C	1	1	1	1	1	1	1	1	1
Geographic extension	E	3	3	2	2	2	2	2	3	2
Duration	Du	1	1	1	1	1	1	1	2	1
Magnitude	M	1	1	2	2	2	2	1	1	1
Probability of occurrence	Po	1	1	1	1	1	1	1	1	1
Frequency	F	1	1	1	1	1	1	1	2	2
Reversibility	R	3	3	3	3	3	3	3	3	3
Ca = C x Po x (M + E + Du + F + R)		9	9	9	9	9	9	8	11	9

E-2: IMPROVEMENT OF LOCAL AND REGIONAL TOURIST MOBILITY

IMPACT ASSESSMENT PARAMETERS		PROJECT ACTIVITIES – PHASES								
		CONTRUCTION							OPERATION	
		PRELIMINARY WORKS	MOBILIZATION	SOIL AND MATERIAL MOVEMENT	SLOPE STABILIZATION AND DRAINAGES	PAVEMENTS	STRUCTURES	DEMOBILIZATION	ROAD OPERATION	ROAD MAINTENANCE
Character	C								1	
Geographic extension	E								2	
Duration	Du								3	
Magnitude	M								2	
Probability of occurrence	Po								1	
Frequency	F								3	
Reversibility	R								3	
Ca = C x Po x (M + E + Du + F + R)		0	0	0	0	0	0	0	13	0

AR-1: ALTERATION OR DESTRUCTION OF ARCHAEOLOGICAL HERITAGE

IMPACT ASSESSMENT PARAMETERS		PROJECT ACTIVITIES – PHASES								
		CONTRUCTION							OPERATION	
		PRELIMINARY WORKS	MOBILIZATION	SOIL AND MATERIAL MOVEMENT	SLOPE STABILIZATION AND DRAINAGES	PAVEMENTS	STRUCTURES	DEMOBILIZATION	ROAD OPERATION	ROAD MAINTENANCE
Character	C			-1	-1		-1			-1
Geographic extension	E			2	2		2			2
Duration	Du			1	1		1			1
Magnitude	M			0	0		0			0
Probability of occurrence	Po			0,1	0,2		0,2			0,2
Frequency	F			1	1		1			1
Reversibility	R			3	3		3			3
Ca = C x Po x (M + E + Du + F + R)		0	0	-0,7	-1,4	0	-1,4	0	0	-1,4

IMPACT RATING MATRIX - AUTOPISTA DEL CORAL

COMPONENT	CHANGE INDICATORS	Code	PROJECT ACTIVITIES – PHASES								
			CONSTRUCTION							OPERATION	
			PRELIMINARY WORKS	MOBILIZATION	SOIL AND MATERIAL MOVEMENT	SLOPE STABILIZATION AND DRAINAGES	PAVEMENTS	STRUCTURES	DEMOBILIZATION	ROAD OPERATION	ROAD MAINTENANCE
AIR	Air quality degradation	A-1	-0,6	-0,6	-6	-6	-2,4	-6	0	-6	-0,5
NOISE	Increase in noise levels	R-1	-7	-7	-7	-7	-7	-7	-2,8	-11	-0,7
WATER	Transport of sediments to water bodies	H-1	-0,5	-0,5	-1	-1	-1	-1	0	0	0
	Degradation of water physical and chemical quality and quantity	H-2	-1,2	-1,2	-1,4	-1,4	-1,4	-1,4	-0,6	-1,8	-0,6
SOIL	Soil structure disturbance	SU-1	-2	-2	-14	-14	-13	-14	0	-13	0
	Susceptibility to erosion	SU-2	0	0	-1	-1	-0,5	-1	0	-0,7	-0,7
FLORA AND FAUNA	Loss of vegetative cover	FF-1	-1	-1,4	-13	-13	0	-13	0	0	-11
	Disturbance to protected species	FF-2	0	-2,4	-2,4	-2,4	-2,4	-2,4	-2,4	0	-2,4
SOCIAL	Temporary transit obstruction	S-1	-7	-7	-7	-7	-7	-7	-2	0	-2,8
	Temporary infrastructure interruption	S-2	0	0	-7	-7	-7	-7	0	0	-2,8
	Road safety improvement	S-3	0	0	0	0	0	0	0	13	0
ECONOMIC	Job generation	E-1	9	9	9	9	9	9	8	11	9
	Improvement of local and regional tourist mobility	E-2	0	0	0	0	0	0	0	13	0
CULTURAL	Alteration or destruction of archaeological heritage	AR-1	0	0	-0,7	-1,4	0	-1,4	0	0	-1,4

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FIGURES

7.0 ENVIRONMENTAL MANAGEMENT AND ADAPTATION PROGRAM

The Environmental Management and Adaptation Program is a series of environmental measures planned for the phases of detailed engineering, construction and operation of the Autopista del Coral project, which have been designed to prevent, mitigate, control, avoid and/or compensate for the potential negative impacts generated by the project development in its different stages.

The Environmental Management and Adaptation Program (**EMAP**) has been designed with the objective to cover all those Project phases that could impact the environmental resources within the Project's area of influence (physical, biotic and socio-economic environment). The EMAP will contain in a Manual form all management actions required considering the project's basic engineering design and present conditions in the area where the project will take place.

The EMAP corresponds to the commitment of the Secretariat of State for Public Works and Communications (SEOPC) as the project promoter and the Moya – Odebrecht Consortium as the project construction and operation company, in compliance with the environmental norms of the Dominican Republic applicable to this kind of project.

The Environmental Management and Adaptation Program develops a methodology aimed at ensuring the application of the environmental measures and recommendations, and the fulfillment of the proposed objectives in harmony with the natural and anthropic environment.

Key objectives of the EMAP are to:

- Provide the necessary tools to facilitate the compliance with Project specifications during construction, so that all of the involved activities take place in a manner compatible with the natural and anthropic environment of the area of influence, ensuring the proper usage of constructed facilities and compliance with the corporate objectives.

- Provide a coherent action plan that allows development, monitoring and execution of the prevention and mitigation measures according to the impacts identified in the impact assessment.

- Facilitate environmental oversight during the construction schedule development.

- Ensure Project activities are executed in a manner compatible with the natural and socio-economic environment of the area of influence.

- Ensure and control compliance with standing regulations concerning the environment.

- Provide suitable information following disclosure mechanisms to competent authorities and the community.

- Provide appropriate training to personnel involved in the Project, concerning the Environmental Management and Adaptation Program and the Project environmental performance.

7.1 Environmental Management System

An environmental management system will be established to ensure the implementation of the Environmental Management and Adaptation Program (EMAP), during the execution of the Autopista del Coral Project, in the detailed engineering, construction and operation phases,. This environmental management system will be implemented by the Moya – Odebrecht Consortium, a company identified by the Secretariat of State for Public Works and Communications as responsible for the Project execution and by the technical teams that will integrate this organization.

The Moya-Odebrecht Consortium will structure the environmental management system for the Project with corporate elements from the company Constructora Norberto Odebrecht S. A. (Odebrecht), such as: Integrated Health Policy, Occupational Safety and Environment and the Integrated Occupational Health and Safety and Environment Management System (SSTMA Salud, Seguridad en el Trabajo y Medio Ambiente in Spanish).

Odebrecht’s Integrated Occupational Health and Safety and Environment Management Program, which contains the corporate guidelines concerning the indicated issues, is based on the requirements of the following international norms:

- ISO 14001 Standard (NBR ISO 14001- 2004) – Environmental Management Systems, Requirements with guidance for use.

- OHSAS Standard 18001 (1999) – Occupational Health and Safety Management Systems.

- "British Standard" - BS 8800 (1996) - Occupational Health and Safety Management Systems Guide.

7.1.1 Occupational Health and Safety and Environment Corporate Policy

The cornerstone of the SSTMA Integrated Program and the environmental management system for the Autopista del Coral Project, is Odebrecht’s Integrated Policy for Occupational Health and Safety and Environment.

The following text was recently revised and signed by Mr. Marcelo Bahía Odebrecht, Engineering and Construction Corporate Leader, in the city of Sao Paolo, Brazil, on October 28, 2004.

INTEGRATED POLICY FOR OCCUPATIONAL HEALTH AND SAFETY AND ENVIRONMENT

The construction company Norberto Odebrecht, with international presence in Engineering and Construction services, has an Integrated Policy for Occupational Health and Safety and Environment (SSTMA), based on the following principles:

• *compliance with legal norms and other applicable regulations;*

• *adequate supervision and administration of environmental issues and safety and health hazards and risks, with well defined objectives for each project;*

• *continual improvement of results, giving priority to prevention concerning Occupational Health and Safety and Environment;*

• *responsible corporate performance in social and environmental terms.*

The responsibility of putting into practice the SSTMA Integrated Program, through planned delegation and people's awareness corresponds to:

• *Strategic Institutional Responsibility: the President (Corporate Leader) and the Directorate (Superintendent Directors and Dynamic Organization of the Corporate Leader);*

• *Corporate Responsibility: Contract Directors in the projects/contracts;*

• *Operative Responsibility: every member, direct executor of the tasks in all the contract work areas.*

Additionally, the text on HIV/AIDS Policy, also signed by Mr. Marcelo Bahía Odebrecht, Engineering and Construction Corporate Leader, in the city of Sao Paolo - Brazil, on October 28, 2004; is included below.

HIV/AIDS POLICY

Odebrecht's HIV/AIDS Policy seeks to guide the criteria, procedures and behavior on this matter in the Engineering and Construction business. This Policy proves the priority given to protecting every member's health and the acknowledgment of the threat and risks of contamination from AIDS virus. It is applied to all members according to the following principles:

1. Non-discrimination. The HIV carriers or persons with AIDS have the same rights, benefits and opportunities than those persons carrying other serious or chronic illnesses, for instance, on *absenteeism or evaluation issues. The company does not approve or practice any form of discrimination to HIV carriers or persons ill from HIV.*

2. Information and Communication. The Company's Policy and practices concerning AIDS will be communicated in a clear and adequate manner to make it understandable to all members. The company's communication regarding HIV/AIDS must contain precise and updated information, in order to reduce risks of transmission and protecting the people's health.

3. Employment Practices. The personnel employment and contracting practices will comply with local laws and regulations, and with corporate policies and procedures. The company will encourage the voluntary HIV carrier identification testing among members developing activities or in places with contamination risk. The HIV testing will not be required in the obligatory occupational health examination, except for specific circumstances, previously informed to each person. Specific procedures will define the behavior for HIV carrier identification testing and for risk situation treatment, such as blood donors and exposure to blood in the work environment.

4. Confidentiality. The Company will keep confidentiality on the information concerning its member's health. The Company will stimulate the informed and individual decision to protect each Member's health and preventing VIH/AIDS transmission.

5. Management Commitment. The Company's leading teams, together with the Corporate Leader, commit themselves to fulfill the principles of this Policy in all the Engineering and Construction contracts.

7.1.2 Corporate Environmental Objectives and Strategies

According to Odebrecht's corporate policy, the SSTMA Integrated Program has the following managerial objectives for contract and works management:

- Adopt a proactive and distinct position regarding Occupational Health and Safety and Environment;
- Stimulate continual improvement of the SSTMA conditions in the work areas , with internal influence (before the company, suppliers and subcontractors) and external influence (before clients and the community in general);
- Increase competitiveness, strengthen corporate image and face the challenges posed by performance improvement.

Based on the above mentioned objectives, the strategies proposed for the Environmental Management System of the Autopista del Coral Project, are the following:

- Incorporate into the Environmental Management System of the Autopista del Coral Project the following elements: the Integrated Policy and Program for Occupational Health and Safety and Environment (SSTMA) and the project's EMAP.
- Integrate the EMAP into the documentation system of the SSTMA Integrated Program that will rule the Moya – Odebrecht Consortium, in compliance with its corresponding Policy.
- Adopting the EMAP as a live and dynamic document that can be updated and supplemented with new environmental issues that arise due to Project development in its different phases.
- Implement the measures established in the EMAP for preventing, mitigating and/or controlling the environmental issues identified and derived from the Project activities in its stages of detailed engineering, construction and operation.
- Comply with the requirements of standing environmental regulations, and the environmental license and permits established by the competent environmental authority at the national level. The environmental license and permits will be also incorporated into the documentation system of the SSTMA Integrated Program.

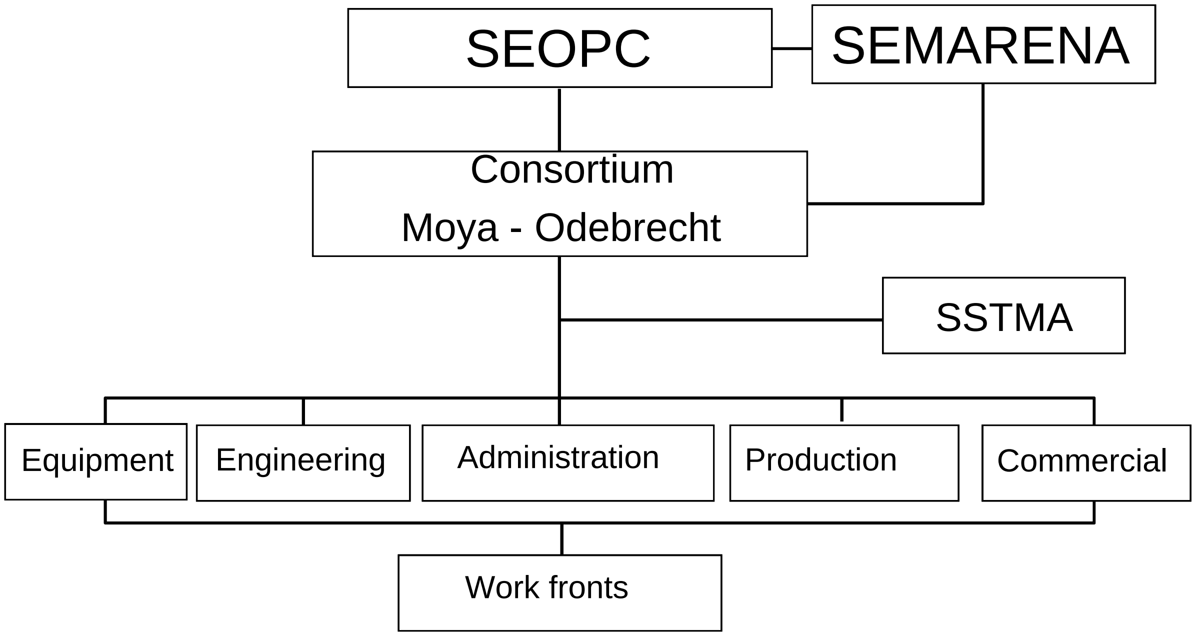
7.1.3 Organization of the Environmental Management System

The organization of the Environmental Management System (SGMA, Sistema de Gestion y Manejo Ambiental in Spanish) developed by the Moya-Odebrecht Consortium for the construction of the Autopista del Coral Project, is illustrated on **Figure 7-1.** A description of the functions and responsibilities of this organization regarding the SGMA is described below.

The Moya- Odebrecht Consortium will lead the organization of the Environmental Management System and will be responsible to SEOPC and SEMARN for the environmental performance of the work, according to the requirements from both institutions, and for implementing the SGMA and its incorporated elements.

The Consortium will appoint the Contract Director, who will be the liaison between the top of the organization and the technical teams integrating the organization in the different operative areas. The Contract Director is responsible for the process of delegation, follow up, evaluation and decision making concerning the implementation of the SGMA and its incorporated elements, such as: Integrated Policy and Program for Occupational Health and Safety and Environment (SSTMA) and the project's EMAP.

FIGURE 7-1 Organization Chart of the Environmental Management System (SGMA)



The Occupational Health and Safety and Environment (SSTMA) group, will be consist of a technical team that will be responsible for preparing, updating, disclosing and supervising the implementation of the SGMA and its incorporated elements in the work. It will act as an implementation activator and facilitator, providing support to the team leading the work in the proactive and reactive actions as required.

The Engineering group will be responsible for planning and ensuring preventative actions by means of:

- Acting in perfect synergy with the SSTMA groups, identifying in advance the risks and potential impacts of proposed actions. Authorizing the projects and defining planning and construction methods, correctly assessing the SSTMA prevention and protection measures;

- Updated and continual communication with the SSTMA area concerning planning and the Project execution Schedule.

The Production group and Equipment group, will be responsible for effectively implementing the SGMA and its elements in the work fronts, aimed at preventing, and when necessary, effectively implementing corrective measures.

The Administration and Commercial areas will provide logistic and financial support for the implementation of the SGMA and its elements.

7.2 Institutional Requirements Program

The Autopista del Coral Project shall comply with the following institutional requirements:

- Signed contract between the Secretariat of State for Public Works and Communications and the Moya – Odebrecht Consortium.
- Environmental License and permits issued by the Secretariat of State for Environment and Natural Resources.
- The regulations described in the "Judicial and Legal Framework" section of the Environmental Impact Assessment.
- Corporate guidelines for Occupational Health and Safety and Environment from the Construction Company Norberto Odebrecht S. A.

7.3 Structure of the Environmental Management and Adaptation Program

The Environmental Management and Adaptation Program is composed of the programs and activities structured on the basis of strategies established for the construction and operation of the highway, and they are organized in environmental sheets. **TABLE 7.1** presents a list of the environmental programs and sheets that are part of the PMAA and they are described below.

TABLE 7-1 Environmental Programs and Sheets

Program	Environmental Sheet
Social Management Program (GS)	**GS-1** Information and Communication to Community
	GS-2 Job Generation
	GS-3 Acquisition of Local Goods and Services
	GS-4 Education and Training on environment and personal safety
Construction Activity Management (AC)	**AC-1** Preliminary works
	AC-2 Mobilization
	AC-3 Soil and Material Movement
	AC-4 Drainage and Slope Stabilization
	AC-5 Road surfaces
	AC-6 Structures
	AC-7 Demobilization

Program	Environmental Sheet
Maintenance Activity Management Program (AM)	**AM-1** Evaluation and Maintenance of Road Surfaces
	AM-2 Evaluation and Maintenance of Drainage Works
	AM-3 Evaluation, Monitoring and Maintenance of Slope and Hillside Stabilization
	AM-4 Complementary Infrastructure Maintenance
	AM-5 Signposting Maintenance
	AM-6 Evaluation, Monitoring and Maintenance of Road Safety
Occupational Health and Safety Program (SST)	**SST-1** Occupational Health and Safety Program
Monitoring Program (SM)	**SM-1** Social Management
	SM-2 Construction Activity Management
	SM-3 Waste Management
	SM-4 Water Quality Monitoring
	SM-5 Air Quality Monitoring
	SM-6 Noise Monitoring
Special Area Management Program (PAE)	**PAE-1** Management of Special Area in Hoyo Claro National Monument section

Social Management Program

It includes measures aimed at informing and communicating to communities and institutions, education and training on environment, employee safety, and guidelines for local services acquisition and job generation.

Construction Activity Management Program

This program is composed of measures applicable to all the Project construction activities, from the right of way clearing to the reclamation of the disturbed areas.

Occupational Health and Safety Program

This program includes guidelines for health and safety management during the Project construction.

Maintenance Activity Management Program

The program comprises the measures to be considered in developing maintenance activities to ensure the motorway's optimum operation.

Monitoring Program

This program incorporates activities for tracking construction activities, social management, waste management and the management of the environmental resources such as water, air and noise.

Additionally, this program includes preparing the Environmental Compliance Report (ICA, in Spanish), which will be submitted twice yearly to Sub-directorate for Environmental Management at SEMARN. This report will compile the results obtained in developing the Monitoring Program and the project's general environmental performance.

Special Area Management Program

The program incorporates the environmental management measures planned for developing the construction and operation activities in the section from kilometers K61+820 to K66+500, located in the northern sector of the Hoyo Claro Natural Monument.

Figure 7-2 shows the structure of the Project's EMAP, and at the end of section 7.4 the environmental sheets from each program that are part of the EMAP are included.

7.3.1 Environmental Sheets Content

All the activities that make up a program have been organized into environmental sheets, organized according the following content:

Objective The purpose of the formulated environmental measures.

Environmental Assessment Summarizes the results of the impact assessment, including the effects to be managed and the importance of the impact and affected components.

Actions to be Developed Describes the actions, procedures, techniques and equipment required for conducting the activity's environmental management.

Phase of Application Indicates the phase of the Project when the proposed environmental measures must be carried out.

Responsibility for Execution Establishes the persons and/or entities in charge of executing or controlling and monitoring the management actions included in the environmental sheet.

Monitoring Parameters Includes the guidelines for evaluating and checking the fulfillment, development and results of the environmental management measures.

Table 7-2 presents a summary matrix of the project's EMAP.

FIGURE 7-2 EMAP Structure

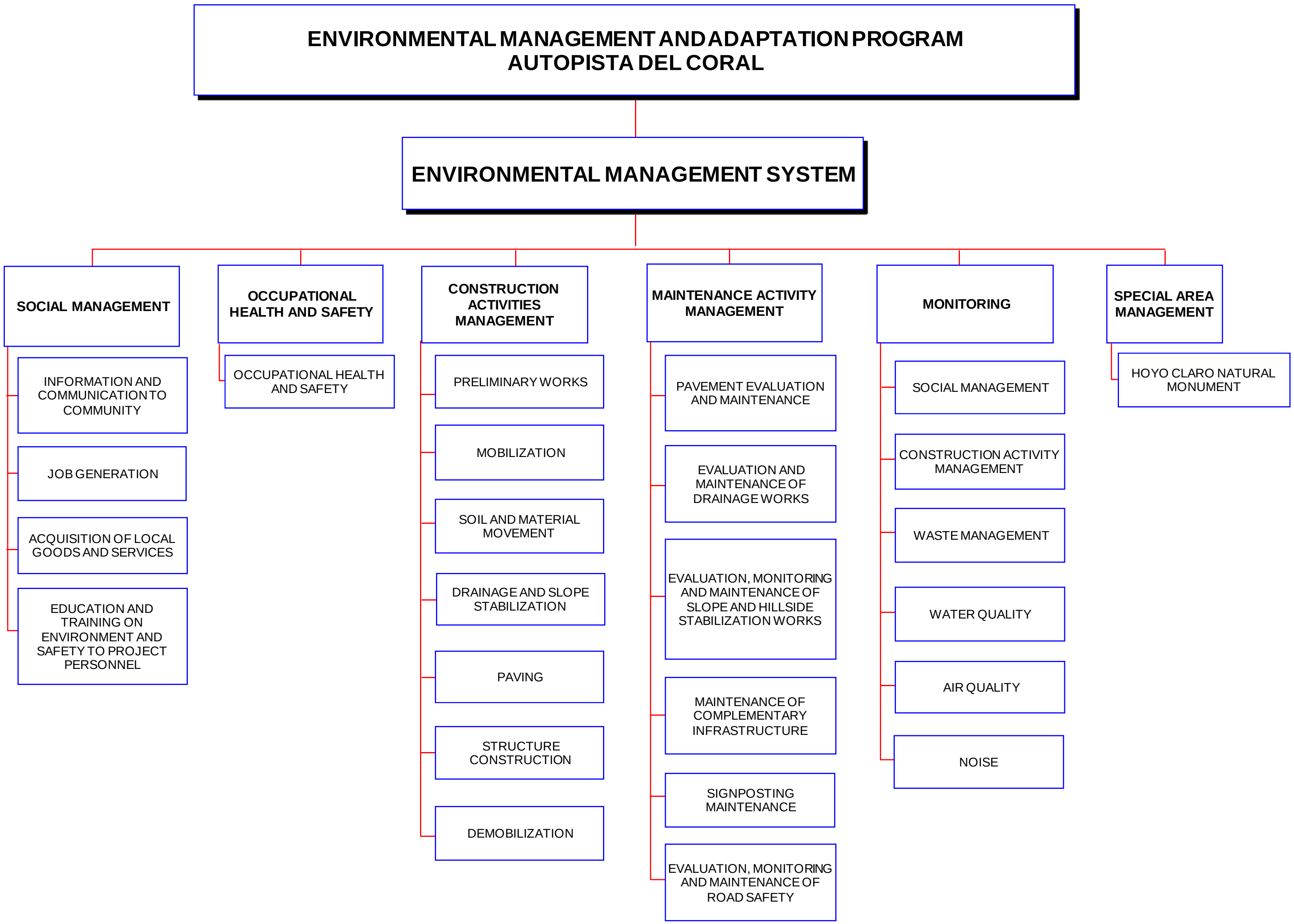


TABLE 7-2 Project Environmental Management and Adaptation Program - Summary Matrix

ENVIRONMENT COMPONENTS	ENVIRONMENT ELEMENTS	IMPACT OR RISK INDICATORS	ACTIVITIES TO AVOID, CONTROL AND MITIGATE IMPACTS	MONITORING PARAMETERS	SAMPLING SITES	MONITORING FREQUENCY	RESPONSIBLE	GENERATED DOCUMENT
PHYSICAL	**Air**	Air quality disturbance	• Moisten surfaces • Periodical maintenance to equipment, machinery and vehicles • Use of Personal Protection Elements (PPE) by personnel	PM-10; SOx; NOx	Industrial plants and material extraction sites	Bi quarterly	• SSTMA Group • Production Group • Equipment Group	PMAA SM-5 AC-3
	Noise	Increase in noise levels	• Periodical maintenance to equipment, machinery and vehicles • Use of PPE by personnel	dBA (Environmental)	Work fronts, industrial plants and material extraction sites	Bimonthly	• SSTMA Group • Production Group • Equipment Group	PMAA SM-6 AC-3
	Water	Transport of sediments to water bodies	Systems for erosion and sedimentation control	SS; SST; BOD; COD; T; Turbidity ; Color and Oil and Grease	Work fronts Bridges	Bi quaterly and during bridge construction	• SSTMA Group • Production Group • Equipment Group	EMAP Construction Activity Management Program SM-4
		Disturbance of water physical and chemical quality and quantity	• Effluent treatment systems • Systems for hydrocarbon spill control, prevention and cleaning • Periodical maintenance to equipment, machinery and vehicles	OD; BOD; COD; pH; SS; Oil and Grease; Nitrites; Nitrates; Orthophosphates; Total Coliforms and Fecal.	Camps, Industrial plants and work fronts	Quarterly	• SSTMA Group • Production Group	EMAP Construction Activity Management Program SM-4

ENVIRONMENT COMPONENTS	ENVIRONMENT ELEMENTS	IMPACT OR RISK INDICATORS	ACTIVITIES TO AVOID, CONTROL AND MITIGATE IMPACTS	MONITORING PARAMETERS	SAMPLING SITES	MONITORING FREQUENCY	RESPONSIBLE	GENERATED DOCUMENT
	Soil	Change of soil structure	• Restriction to Right of Way (RoW) • Construction activity management	70 m of RoW	Work fronts	Construction phase	• SSTMA Group • Production Group	EMAP Construction Activity Management Program Special Area Management Program
		Susceptibility to erosion	Slope and hillside stabilization		Work fronts	Construction phase	• SSTMA Group • Production Group	EMAP Construction Activity Management Program
NATURAL	**Flora and Fauna**	Vegetation cover loss	• Restriction to intervention in RoW • Construction activity management	70 m of RoW	Work fronts	Construction phase	• SSTMA Group • Production Group	EMAP Construction Activity Management Program
		Disturbance to protected species	• Demarcate sensitive areas • Inspection of RoW by specialist	Protected Species	Sections I and III	During the execution of On-site lay out and Location activities; Overburden removal and leveling	• SSTMA Group • Production Group	EMAP AC-2 AC-3 SM-2
SOCIO-ECONOMIC AND CULTURAL	**Social**	Temporary traffic obstruction	• Information and communication to community • Anticipated, Permanent Signposting	• Occupational safety statistics • Information meetings • Publications and notices	Work fronts	Construction phase	• SSTMA Group • Production Group	EMAP GS-1 AC-2 AC-6 SM-1

ENVIRONMENT COMPONENTS	ENVIRONMENT ELEMENTS	IMPACT OR RISK INDICATORS	ACTIVITIES TO AVOID, CONTROL AND MITIGATE IMPACTS	MONITORING PARAMETERS	SAMPLING SITES	MONITORING FREQUENCY	RESPONSIBLE	GENERATED DOCUMENT
		Temporary infrastructure interruption	Agreement with owners and users	Fences, Pasture fields, Farming lands, Canals and Vehicular ways intercepted by the RW	Work fronts	Construction phase	• SSTMA Group • Production Group	EMAP AC-2 SM-1 SM-2
		Road safety improvement		Positive impact on Construction Phase. Statistics of accidents	Local area of influence	Operation phase	• SSTMA Group	EMAP Maintenance Activity Management Program
	Economic	Job generation	• Announcement with priority to local employment • Priority to acquisition of local goods and services	• Number of local jobs contracted • Type and Value of Local Purchases and Hired Services	Work fronts	Construction phase	• SSTMA Group • Administration Group • Commercial Group	EMAP GS-2 GS-3 SM-1
		Improvement in local and regional tourist mobility		Positive impact on Operation Phase. Road Usage Statistics	Local and regional area of influence	Operation phase	SSTMA Group	EMAP Maintenance Activity Management Program
	Cultural	Disturbance or destruction of archaeological patrimony	• Delimit sensitive areas • Monitoring by specialist	Archaeological traces	Section III	During the execution of On-site lay out and Location activities; Overburden removal and leveling	• SSTMA Group • Production Group	EMAP AC-2 AC-3 SM-2

7.4 EMAP Budget and Schedule

The estimated budget for implementing the proposed environmental management measures considered in the EMAP, is presented below. This budget can be adjusted if new aspects come up that need to be incorporated into the EMAP, in order to improve the overall project's environmental performance. Some items in **Table 7-3** also correspond to those included in the construction costs.

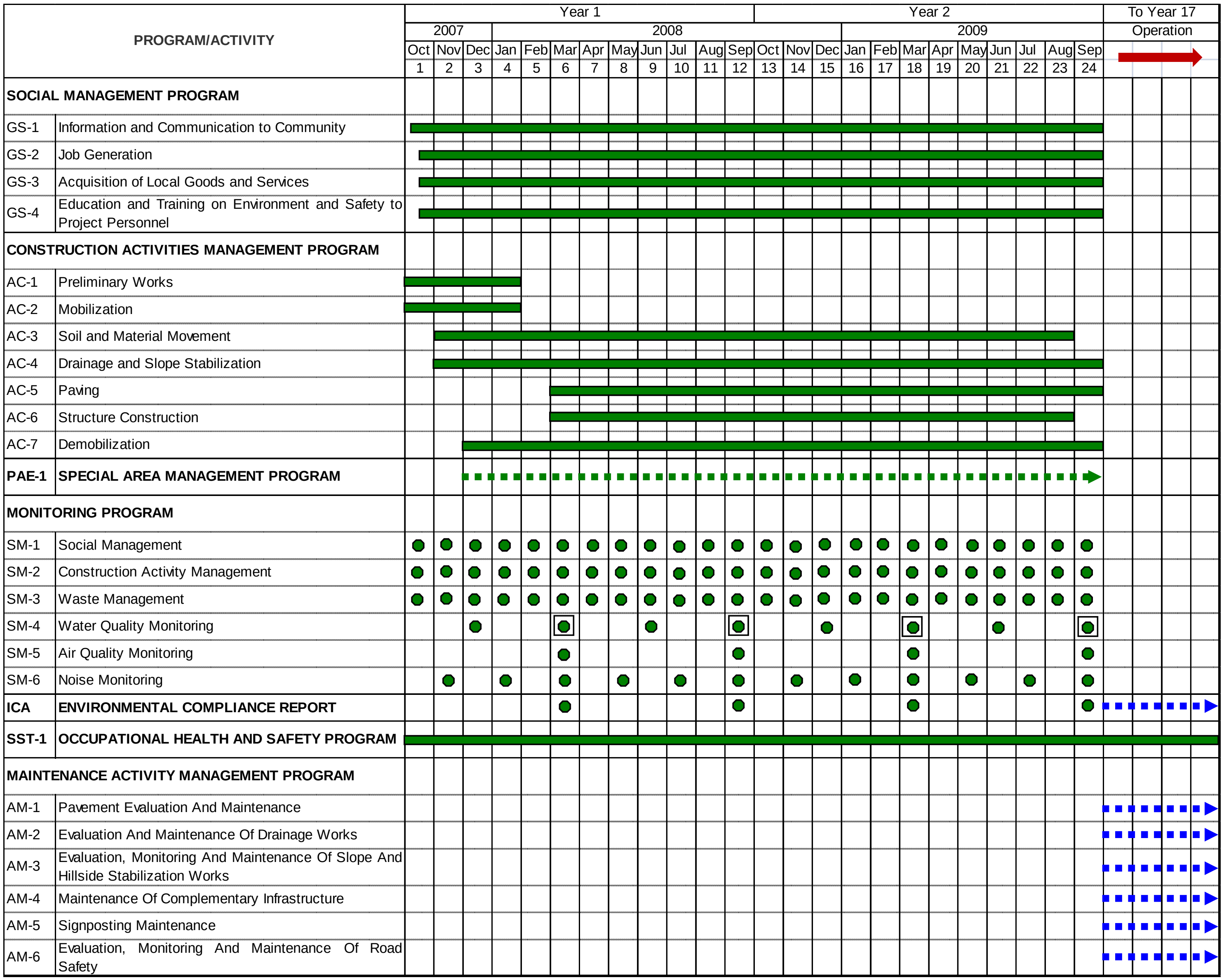
TABLE 7-3 EMAP Estimated Budget

Item	Total Cost RD$
SSTMA Team	**4.320.000**
Social Management Program	**900.000**
GS-1 Information and Communication to Community	450.000
GS-4 Education and Training	450.000
Construction Activity Management Program / Special Area Management Program	**7.380.000**
AC-3 Soil and Material Movement:	
• Flora Specialist	90.000
• Archaeology Specialist	90.000
• Disposal Areas Management	3.800.000
AC-6 Structures:	
• Socio-economic Study	300.000
AC-7 Demobilization:	
• Restoration and replanting	2.200.000
Construction waste management	900.000
Monitoring Program	**3.900.000**
SM-4 Water Quality	2.100.000
SM-5 Air Quality	900.000
SM-6 Noise	900.000
TOTAL EMAP	**16.500.000**

The Schedule (**Figure 7-3**) presents the timetable for implementation of the environmental measures proposed in the EMAP, according to the development of the Detailed Engineering, Construction and Operation phases. The schedule for the project's first two phases is estimated to be 24 months or two years; from that moment the operation phase starts and will last until the year 2025, when the construction Consortium and the operator will hand the infrastructure over to the Dominican state.

It is worth noting that all the construction activities distributed along the two construction years are consecutive, because the construction of the 70 km highway will be divided into four work fronts that will start activities simultaneously, as described in the "Project Description" section.

FIGURE 7-3 EMAP Schedule



SOCIAL MANAGEMENT PROGRAM

GS-1 Information and Communication to Community

OBJECTIVES
• To establish a channel for communication and disclosure of information on the Project with the institutions, authorities and interested sectors at the local, regional and national levels. • To disclose Project information timely and clearly to the communities located within the area of influence and to local and regional authorities, regarding the construction, operation and maintenance activities of the motorway. • To provide timely response to concerns from the communities, institutions, and entities within the project's area of influence.

ENVIRONMENTAL ASSESSMENT	
EFFECTS TO BE MANAGED	**AFFECTED ELEMENTS**
• Prevent spreading of incorrect information regarding the Project. • Avoid conflicts with the communities and risks within the project's direct area of influence. • Reduce expectations within the project's direct area of influence.	• Communities, institutions and authorities within the project's area of influence • Institutions and authorities at the regional and national levels

DESCRIPTION OF MEASURES TO DEVELOP

The information program contains the mechanisms and strategies proposed to provide timely information, create effective communication channels with the community within the project's area of influence, and with the institutions and other entities at the local, regional and national levels, which become stakeholders for the construction and operation of the Autopista del Coral project.

The information program is based on massive information disclosure by means of two key mechanisms: the meetings and the written disclosure; and community attention by installing community attention points that will be designated as PAC (Punto de Atencion a la Comunidad in Spanish).

1. Information meetings regarding Project start, progress and finish with the communities within the direct area of influence.

- Three general information meetings will be held, as follows:

DESCRIPTION OF MEASURES TO DEVELOP
o Start meeting: It will take place fifteen (15) days before the project activities start. o Progress meeting: It will be held when a 50% progress of the construction activities is reached. o Finish meeting: It will take place fifteen (15) days before the work completion. <u>Start meeting</u> In the start meeting, at least, the following information will be provided: o Contractual information on the Contractor and the Supervisor. o Project type and objectives. o Project location. o Introduce the professionals from the companies involved in the Project – contractor and supervisor – and the Project responsible by the Secretariat of State for Public Works and Communications. o Present the standing regulatory framework for works development and for the social and environmental management to be done. o Detailed explanation of the works to be executed (construction process), with plans at the appropriate scale and photomontage. o Present the project execution schedule; explaining estimated start date, works duration and finish date. o Present the Environmental Management and Adaptation Program, discussing the measures for mitigating the influence of the Project activity's impacts, emphasizing on the measures taken for the highway construction and operation, as well as on the integrated program for Occupational Health and Safety and Environment (SSTMA) to be implemented. o Introduce the Social Management Program with emphasis on: - the social development policies from the Secretariat of State for Public Works and Communications as the Project promoter and the Moya – Odebrecht Consortium as the executor and operator of the Autopista del Coral work; - the project's disclosure policy and the communication protocol or procedure; - location and operation of the community attention points (PAC); - personnel requirements and strategies for labor contracting, in order to mitigate expectations regarding the project.

DESCRIPTION OF MEASURES TO DEVELOP

Progress Meeting

In this meeting, the SSTMA responsible from the construction company will explain the project's status concerning technical progress and social and environmental aspects, as well as duration of the remaining tasks. The presentation will be approved by the Supervisor and exposed before the same at least 2 weeks prior to the meeting holding.

During the progress meeting, at least the following information will be provided:

- Project progress status compared to the schedule indicated in the kick-off meeting.
- Evaluation of the community attention at the community attention point - PAC.
- Evaluation of community participation within the project area.
- Recommendations for preventing accidents in the community.
- Progress in the environmental management carried out.
- Concerns and complaints from the community regarding the project's social and environmental performance.

Finish Meeting

In this meeting, the SSTMA responsible from the construction company will discuss the project's final status and will disclose the work finish date; and will gather the concerns from the audience, and travel the work area with persons from the community as part of the work official commissioning.

The concerns, suggestions, complaints and/or claims that come up during the finish meeting, will be addressed, after follow up and verification by Supervisor.

The suggested subjects for this meeting are:

- Technical characteristics of the finished Project; a photographic record from before, during and after the work is suggested for display.
- Evaluation of the environmental management.
- The concerns and complaints from the audience will be gathered. All the concerns must be duly closed to the satisfaction of the community that presented such complaints.

2. Written information disclosure pieces

In order to provide complete information on the development of the construction activities carried out during the Project, posters and fliers will be prepared and distributed.

- The posters must be placed in sites where people gather (schools, community centers, etc.) in the populated areas near the Project

DESCRIPTION OF MEASURES TO DEVELOP
• The fliers will be used to: o Provide information on the Project phases (start, progress and finish) and start-up; o Announce the information meetings (start, progress and finish); o Announce additional meetings and to inform about additional activities. • The fliers must always include data regarding the community attention point PAC, its telephone number, first name and last name of the person leading the meeting 3. Installation of the Community Attention Point – PAC The community attention point –PAC- will be located in the project's camp and offices, with the purpose of receiving and providing response to concerns, claims and/or complaints concerning the Project. At the Community Attention Point, mechanisms will be implemented for documenting claims, suggestions or complaints presented by the community and their corresponding follow up; the SSTMA officers in the Project will be responsible for the implementation of such documentation. In general, the records concerning the "Community Information and Communication" activities, will be conducted using the attached forms (Minutes of meeting with community, Meeting attendance form, Attention to claims and complaints, Attention to claims and complaints consolidation, Control of disclosure pieces delivery); other forms could be adapted to incorporate pertinent data.

MEASURE APPLICATION PHASES
• Detailed Engineering Phase • Construction Phase

RESPONSIBLE FOR AND INVOLVED IN EXECUTION
• SSTMA Group • Engineering Group • Production Group

MONITORING PARAMETERS
Refer to Monitoring Program SM-1 "Social Management"

Hoja ___ de ____		
FECHA		
DD	MM	AA
ACTA No.		

Siendo las _________ se reunieron las personas adjuntas en las listas de asistentes, en _________________________, para tratar los temas relacionados con el proyecto de la referencia.

ORDEN DEL DIA

DESARROLLO DE LA REUNION

INQUIETUDES DE LA COMUNIDAD

COMPROMISOS ADQUIRIDOS		
COMPROMISO	RESPONSABLE	FECHA DE CUMPLIMIENTO

FIRMAS		
NOMBRE	ENTIDAD/CARGO	FIRMA

ANEXOS	SI ☐ NO ☐	TIPO ANEXO		CANTIDAD	

Hoja ____ de _____		
FECHA		
DD	MM	AA

PROYECTO: CONSTRUCCIÓN AUTOPISTA DEL CORAL

PLANILLA DE ASISTENCIA A REUNIONES CON LA COMUNIDAD DEL ÁREA DE INFLUENCIA DEL PROYECTO

No.	NOMBRE	DIRECCIÓN	COMUNIDAD/ INSTITUCIÓN	TELÉFONO	E-MAIL	FIRMA
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						

ELABORÓ:
(Firma)
(Nombre)
Profesional Social - Contratista

APROBÓ:
(Firma)
(Nombre)
Supervisor Social

Original: Dependencia ejecutora del proyecto
1 copia: Secretaría de Estado de Medio Ambiente y Recursos Naturales
2da copia; Supervisión

Hoja ___ de ____		
FECHA		
DD	MM	AA
ACTA No.		

ATENCIÓN DE QUEJAS Y RECLAMOS

PROYECTO: CONSTRUCCIÓN AUTOPISTA DEL CORAL

1. SOLICITUD DE INFORMACIÓN O RECLAMO POR PARTE DEL CIUDADANO

Nombre		**Organizaciòn**	
Direcciòn/Barrio		**Telèfono**	

2. TIPO DE SOLICITUD

Queja	☐	**Reclamo**	☐	**Sugerencia**	☐	**Solicitud informaciòn**	☐	**Otro**	☐

3. FORMA DE SOLICITUD

Personal	☐	**Escrito**	☐	**Telèfonico**	☐	**Otro**	☐

4. DESCRIPCION DEL ASUNTO

5. AREA DE LA SOLICITUD

Ambiental	☐	**Social**	☐	**Seg. Integral**	☐	**Tràfico**	☐	**Construcciòn**	☐	**Otra**	☐

Fecha	Tràmite	Soluciòn

ELABORÓ.

(Firma)______________________
(Nombre)
Profesional Social - Contratista

(Firma)______________________
(Nombre)
Ciudadano

APROBÒ.

(Firma)______________________
(Nombre)
Supervisor Social

Original: Dependencia ejecutora del proyecto

1 copia: Secretaría de Estado de Medio Ambiente y Recursos Naturales

2da copia; Supervisión

Hoja ____ de _____

FECHA		
DD	MM	AA

CONSOLIDADO ATENCIÓN QUEJAS Y RECLAMOS

PROYECTO: CONSTRUCCIÓN AUTOPISTA DEL CORAL

No. CONS	CIUDADANO	TELÉFONO	FECHA ATENCIÓN	ASUNTO	ÁREA DE SOLICITUD					TOPOLOGÍA					SOLUCIÓN					ESTADO			
					A1	A2	A3	A4	A5	T1	T2	T3	T4	T5	S1	S2	S3	S4	S5	SC	SI	IT	

OBSERVACIONES

Área de solicitud	
A1	Ambiental.
A2	Social
A3	Tráfico
A4	Seg. Ind./ Ocup.
A5	Construcción

Topología	
T1	Queja
T2	Reclamo
T3	Observación
T4	Sugerencia
T5	Solicitud de inform

Solución	
S1	Información verbal
S2	Visita
S3	Entrega de información escrita
S4	Reunión
S5	Traslado Autoridad Ambiental
S6	Otra *

Estado	
SC	Solución completa
SI	Solución incompleta
IT	Imposible Tramitar*

ELABORÓ.

(Firma) ____________________

(Nombre)

Profesional Social - Contratista

APROBÒ:

(Vo.Bo.) ____________________

(Nombre)

Supervisor Social

Original: Dependencia ejecutora del proyecto
1 copia: Secretaría de Estado de Medio Ambiente y Recursos Naturales
2da copia; Supervisión

Hoja ____ de _____		
FECHA		
DD	MM	AA

CONTROL DE ENTREGA DE PIEZAS DE DIVULGACIÓN

PROYECTO: CONSTRUCCIÓN AUTOPISTA DEL CORAL

TIPO Y CONTENIDO DE LA PIEZA

No.	NOMBRE	DIRECCIÓN	COMUNIDAD	TELÉFONO	FIRMA	OBSERVACION
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						

ELABORÓ:
(Firma)
(Nombre)
Profesional Social - Contratista

APROBÓ:
(Firma)
(Nombre)
Supervisor Social

Original: Dependencia ejecutora del proyecto
1 copia: Secretaría de Estado de Medio Ambiente y Recursos Naturales
2da copia; Supervisión

GS-2 Job Generation

OBJECTIVE
To favor the population from the project's direct area of influence, giving priority and opportunity to available local labor in hiring.

ENVIRONMENTAL ASSESSMENT	
EFFECTS TO BE MANAGED	**AFFECTED ELEMENTS**
• Local unemployment • Temporary introduction of workers and habits, different from local ones	• Local communities, labor availability and local customs

DESCRIPTION OF MEASURES TO DEVELOP
Employment constitutes an activity that contributes positively to the region's economic component and therefore it is highly valued by the local authorities and community. Also, employment is a factor that can generate false expectations in the community, it may cause conflicts and lead to chaotic migratory processes; therefore, this activity must be controlled according to the following criteria: • Give priority to hiring local qualified and non-qualified labor belonging to the project's direct area of influence, provided they fulfill the medical requirements of the acceptance examination and the qualifications necessary for the type of job offered by the project. • The community will be informed about the required profiles for qualified and non qualified labor, the project schedule, number of vacancies for each activity, contracting time, salaries and form of payment. • Hiring requirements will be disclosed by means of Project related publicity, explaining the qualifications and documents to be presented, certifying that the persons to be contracted live within the local communities. • In spreading the job offer, emphasis will be made on the transitory nature of the work, so that the traditional subsistence sources (agriculture and livestock activities) are not affected by an eventual labor displacement. • The Project will keep a record with the names of contracted persons and their origin, entrance and exit date, type of training received during their stay in the work. • All the contracted persons, from local origin or not, must comply with a conduct code, which dictates the worker's behavior within the area of influence.

MEASURE APPLICATION PHASES
Detailed Engineering and Construction Phases.

RESPONSIBLE FOR AND INVOLVED IN EXECUTION
• SSTMA Group • Administration Group • Engineering Group • Production Group • Equipment Group

MONITORING PARAMETERS
Refer to Monitoring Program SM-1 “Social Management”

GS-3 Acquisition of Local Goods and Services

OBJECTIVES
To favor local economic development within the project's direct area of influence, giving priority and opportunity to local goods and service providers.

ENVIROMENTAL ASSESSMENT	
EFFECTS TO MANAGE	AFFECTED ELEMENTS
Price speculation	Local communities and economy

DESCRIPTION OF MEASURES TO BE DEVELOPED
• During the Project development, in its different phases, preference will be given to available local goods and services, provided it does not interfere with their use by the community. • The community will be informed about the demand for goods and services necessary for the Project construction and the corresponding requirements for their purchasing and hiring. • Goods and services acquisition and hiring will be carried out by means of transparent and fair processes in eyes of the community organizations and the general public. • The type of goods or service, usage time and requirements to be fulfilled, will be established. All of this information will be public and available to the communities. • The goods and services offer within the area of influence shall comply with the following requirements: appropriate quality, required availability and quantity, and competitive prices. • If the service or resource is not available at a competitive price at the local level, the next option will be the regional level and the third option will be the national level. This is the case for safety clothes and gear for construction workers, such as gloves, safety boots and respirators, among others. • Concerning basic needs, they will be acquired from stores and shops in the districts and cities close to the Project site, if the supplies are available in sufficient quantity, at competitive prices and quality, and without interfering local prices and supplies. • All the goods and services acquired by the Project will be included in a record, indicating the type of goods or service purchased, origin, purchase date and any other data showing the process carried out and the economic benefit to the project's area of influence.

MEASURE APPLICATION PHASES
Detailed Engineering and Construction Phases.

RESPONSIBLE FOR AND INVOLVED IN EXECUTION
• Administration and Commercial Groups • SSTMA Group • Engineering, Production and Equipment Groups

MONITORING PARAMETERS
Refer to Monitoring Program SM-1 “Social Management”

GS-4 Education and Training on Environment and Safety to Project Personnel

OBJECTIVES
• To raise awareness among the Project personnel, in the different Project phases, about the Occupational Health and Safety and Environment Policy, so that they may develop positive attitudes regarding each of these areas, both inside and outside the project. • Training to Project personnel (professionals and workers) on occupational health and safety, and environment (SSTMA). • To inform the personnel involved in the different Project phases about the Environmental Management and Adaptation Program (EMAP) and the obligations acquired under the Environmental License and Environmental Permits before the environmental authority, which shall be fulfilled during the project execution.

ENVIRONMENTAL ASSESSMENT	
EFFECTS TO MANAGE	AFFECTED ELEMENTS
• Ignorance about the SSTMA Policy established for the Project. • Ignorance about EMAP and the requirements established in the project's Environmental License and Environmental Permits.	Personnel involved in Detailed Engineering, Construction and Maintenance.

DESCRIPTION OF MEASURES TO BE DEVELOPED
• The work contractor must design and develop a training program for the personnel working in the Project; implementing this program may help developing the Project environmental and social sustainability concept. • The design and development of the induction and training must consider the following issues: topic, duration, date, time, audiovisual support, location and target personnel. • The personnel that will work on the detailed engineering, road construction and maintenance activities will receive inductions prior to their entrance to the Project; these inductions will address occupational health and safety and environment, as well as subjects of social importance in the work site. • The training program shall be implemented periodically and distributed along the different Project activities. Following are some of the topics to be included in the training program, which does not mean excluding other subjects deemed necessary:

DESCRIPTION OF MEASURES TO BE DEVELOPED
<u>Environmental Aspects:</u> o Occupational Health and Safety and Environment Policy established for the project o Programs that integrate the Environmental Management and Adaptation Program, management measures and actions to be applied according to the contracted activity. o Importance of natural resources and their adequate management. o Information on the protected areas and sustainable development. o Preservation of natural resources, with emphasis on endemic and endangered species. o Protection of the wild fauna within the Project zone. o Disclosure of the environmental regulations applicable to the Project and its activities. o Vegetation preservation. o Prohibitions concerning hunting and vegetation removal o Environmental authorities and documents that regulate Project development (Environmental License, Permits and Environmental Management and Adaptation Program). <u>Construction Activity Management:</u> o Management of debris, recyclable and domestic wastes. o Management of construction materials and concrete works. o Management and protection of surface and ground waters. o Liquid waste management. o Management of Maintenance Activities during construction. o Control and management of oil and lubricants spills. o Signposting and traffic management. o Archaeological Heritage Protection. <u>Social Aspects:</u> o Relationship with the Community <u>Occupational Health and Safety:</u> o Training on preventive medicine programs. o Training on occupational medicine programs.

DESCRIPTION OF MEASURES TO BE DEVELOPED
o Risk Prevention. o First Aid – The first-aid brigade must receive intensive training on emergency response, because the contractor is obliged to provide first aid services for the Project. Due to the rural conditions in most of the Project area, this group's reaction is extremely important, because they can make the difference between a person's life or death. o Emergency management; must include the procedure for emergency coordination with the specialized groups. o Use and maintenance of the Personal Protection Elements (EPP, Equipo de Protección Personal in Spanish). o Safe working procedures. o Minor tool management. o And other subjects identified in the risk factor prospect, or specific conditions that might come up during the work activities development, and those issues that the SSTMA Specialist consider necessary.

MEASURE APPLICATION PHASES
Detailed Engineering, Road Construction and Maintenance Phases

RESPONSIBLE FOR AND INVOLVED IN EXECUTION
• SSTMA Group • Production Group • Equipment Group • Engineering Group

MONITORING PARAMETERS
Refer to Monitoring Program SM-1 Social Management

OCCUPATIONAL HEALTH AND SAFETY PROGRAM

SST-1 Occupational Health and Safety Program

OBJECTIVES
The objectives of the Occupational Health and Safety Program are to achieve: • Safe work-sites in compliance with sanitary and environmental requirements applicable to their operation; • Work systems and methods free from risks regarding health, safety and the environment; • Designing, building and operating an accident-free road Project, and • Trained personnel, equipped to identify, evaluate and control risk scenarios during their work activities.

ENVIRONMENTAL ASSESSMENT	
EFFECTS TO MANAGE	**AFFECTED ELEMENTS**
• Personnel health condition • Unsafe conditions in work fronts	Work Personnel

DESCRIPTION OF MEASURES TO BE DEVELOPED
The implementation of the occupational health and safety program (PSST in spanish) will involve training, role and responsibility definition, as well as development an emergency plan to highlight circumstances related to the project. All of the aspects concerning the worker's health and work-site safety will comply, at a minimum, with the standards from the Dominican Republic and they will also be subjected to the Moya – Odebrecht Consortium guidelines. In order to achieve the PSST objectives, the project management shall consider the following recommendations: • Full compliance with all the applicable laws and regulations concerning health and safety. • Use of qualified professional personnel to develop and support the risk management activities and impose the compliance with the safety regulations and norms. • To adopt safety and health methods to avoid loss of human life and protect the project's physical and financial resources. • To value health and safety as much as the economic objectives. • To consider health, safety and environmental criteria when awarding contracts.

DESCRIPTION OF MEASURES TO BE DEVELOPED

- Provide adequate training to employees, contractors and subcontractors, to ensure that all personnel are qualified on health, safety and environmental protection.
- To evaluate progress on safety systems and healthy and safe work-sites.
- To design facilities to high safety standards and operate with the best health and safety practices.

Health Program

The Worker's Health Program shall be developed to satisfy pre-identified and emergency needs of all the Project personnel during construction. It will provide a guideline for maintaining worker's health and attending to minor and emergency injuries.

The Health Program must consider an entrance examination for every worker, in order to ensure suitable health conditions for the work to be conducted. Additionally, workers will be subjected to occupational examinations, such as audiometry, vision screening, and vaccination against specific diseases.

In this program, special attention will be given to those situations that cannot be treated at the camps, such as: fractures, serious cuts and burns, sunstroke, dehydration, diseases, poisonous animal bites, electric shocks and other health risks requiring specialized medical care.

A medical post will be installed at the camps for providing attention to the workers' minor injuries and health conditions. This post will be equipped with all the medical equipment for attending minor accidents and it will possess a professional doctor trained on occupational health.

All the necessary arrangements will be made at the medical posts to have ambulances available during Project construction, in case of emergencies requiring immediate hospitalization.

In visible places at camps, medical posts, work sites and industrial plants, a list of the hospitals and health facilities where to go in case of minor injuries and emergency, must be placed. These centers will be classified according to:

- Types of attention in case of injuries or emergency
- Proximity to the region
- Number of doctors and available beds
- Emergency services

Te hospital list will include phone numbers for regular and emergency attention, address with location plan, medical specialties and facility's resources.

The PSST responsible person will regularly assess the camp's conditions and facilities to determine if there are health hazards such as: stagnant water, non-sanitary waste water disposal, unsafe equipment storage and other issues that deserve attention.

DESCRIPTION OF MEASURES TO BE DEVELOPED

The PSST officer will be responsible for conducting full vaccinations of all the workers involved in Project construction. Valid immunization or vaccination cards will be the only documents for exempting any worker from this preventive activity. The list of diseases and vaccines will be taken from publications from the World Health Organization (WHO) and from the Dominican Republic's health entity.

The PSST officer will verify the drinking water supply to workers consumption according to the following guidelines:

- An adequate potable water supply will be available at all the work areas.
- Portable vessels for water supply must be tightly closed and equipped with a tap. Taking water with a glass directly from the vessel will not be permitted.
- Any vessel used for water distribution shall be clearly labeled indicating its content and will not be used for other purposes.
- The use of a single glass by more than one person will be forbidden.
- Disposable glasses will be available, as well as a place for storing the used glasses and the new ones.

Occupational Health Program

The Occupational Health Program will outline the safety procedures to be implemented during Project construction. Some of this program's components (e.g. information on potential hazards) will indicate specific procedures, while others will include technical specifications.

The occupational safety program will be composed of the following elements:

- General Instructions
- Responsibilities
- Safety Program for Contractor and Subcontractors during Construction
- Accident Prevention
- Hazard Information
- Training and Education on Safety issues
- Personal Protection Equipment
- First Aid
- Rules for Good Order and Cleanliness
- Drinking water
- Toilets

DESCRIPTION OF MEASURES TO BE DEVELOPED
- Noise exposure   - Ionizing radiation   - Lighting   - Gases, Vapors, Smoke, Dust and Fumes   - Ventilation   - Protection with Respirators   - Fire Prevention and Protection   - Combustible and Flammable Liquids   - Signs, Notices and Barricades   - Hand-Operated and Power-Operated Tools   - Blasting and Explosives Use   - Welding   - Material Handling Devices   - Automotive Equipment   - Material Handling Equipment   - Work in or near to Water   - Regulations for Construction   - Spill Response   The measures to be implemented as part of the Occupational Safety Program are: - All the new workers will receive training on: a) use of the personal protection equipment; b) safe vehicle operation; c) fire hazards and fire–fighting; d) emergency response procedures; e) basic first aid; f) hazardous material identification and management; and g) environmental sensitivity awareness.   - Records of training will be kept and signed by the employees to allow verification of training and dates.   - The Moya – Odebrecht Consortium and/or its contractors will conduct, on a periodic basis, “Occupational Health Analyses”, for all the work posts of the construction. These analyses will document the health and safety hazards associated to each work post and the safety procedures to be implemented for reducing work-site accident risks. Data from the “Occupational Health Analyses at Work” will be revised with all responsible workers. Training records will be signed by all the employees in order to verify they received the training.

DESCRIPTION OF MEASURES TO BE DEVELOPED
• The use of personal protection equipment, including safety shoes, helmets, eyewear, respiratory and hearing protection, shall be required for all personnel at the construction sites. • Fire extinguishers, first aid and emergency response supplies will be available at all the work sites, with clear signs identifying their presence. • One or more ambulances will be kept at the work site, appropriately equipped and with trained personnel capable of responding to emergencies. • The noise levels at the work site shall be monitored by the safety inspectors and the use of hearing protection will be encouraged, if necessary. • The Moya-Odebrecht Consortium and its contractors will make sure that the safety signs are visible in all the right places, including signs indicating emergency exit, first aids, fire-fighting equipment and emergency equipment, non-smoking and other danger warnings and traffic control signs. • All workers' injuries will be registered. Time losses due to injuries will be investigated, including the incident's cause and identification of possible prevention measures or changes to safety procedures.

MEASURE APPLICATION PHASES
Detailed Engineering and Construction

RESPONSIBLE FOR AND INVOLVED IN EXECUTION
SSTMA Group

MONITORING PARAMETERS
• PSST Performance Statistics • Health Records • Incident and Accident Records

CONSTRUCTION ACTIVITIES MANAGEMENT PROGRAM

AC-1 Preliminary Works

OBJECTIVE
To establish general environmental criteria to be considered during preliminary works and Detailed Engineering phase, related to: detailed geological and geotechnical evaluation of the road corridor, and evaluation of access roads, quarries and zones for excavation excess material disposal; also during access roads adjustment and land negotiations.

ENVIRONMENTAL ASSESSMENT	
EFFECTS TO MANAGE	**AFFECTED ELEMENTS**
• Air quality degradation • Noise level increase • Sediment transport to water bodies • Disruption of surface and groundwater water physical and chemical quality • Soil structure disruption • Loss of vegetative cover • Temporary transit obstruction • Temporary infrastructure interruption • Job generation	• Air • Noise • Water • Soil • Flora and Fauna • Neighboring Communities and Land Owners • Local economy

DESCRIPTION OF MEASURES TO BE DEVELOPED

1. Detailed geological and geotechnical evaluation of the road corridor

- During the Detailed Engineering phase, a geological and geotechnical assessment of the road corridor will be conducted in order to determine critical sites along the route.
- In those sites identified as critical, detailed soil and hydrogeology studies will be conducted, in order to establish the methods and equipment to be employed in construction, and to design the methods that will ensure the road stability and the surface water and groundwater integrity.
- In those areas with hydro geological sensitivity, special attention will be given to the cutting methods used and their possible effects on secondary fracturing and changes in the aquifers (surface or subsurface) drainage pattern existing in the area of influence. The use of explosives with controlled blasting or any other cutting method selected shall be conducted based on the abovementioned evaluation.

DESCRIPTION OF MEASURES TO BE DEVELOPED

- According to preliminary studies conducted in the road corridor proposed for the route, section III between K34+000 and K70+000 is characterized by the presence of karstic systems, which require geophysical research for determining the presence of caverns under the surface and evaluating the potential collapse risk during construction in this section.
- If the results of the geotechnical research and the hydro geological sensitivity determine a route change, the new route alternatives must consider the potential disruption to protected flora species or a potential disturbance to the archaeological heritage.

2. Evaluation of access roads, quarries and excess material disposal zones

Following are some of the criteria to be considered during the process for selecting access roads, quarries and material disposal sites that will be used in the Project construction phase.

2.1. Access Roads

- The access of personnel, machinery and materials to the project's right of way will be carried out using existing roads and previously constructed approaches.
- The use of existing roads and accesses will take into account the "Plan of Access Roads to be used by the Project". This Plan must ensure their continuous use, without major interruptions during the project construction phase. In private use approaches, the corresponding authorization and the management and delivery agreements established by the owner must be considered.
- The enhancements required for use during the Project construction phase and the maintenance during their use and at Project completion, in order to hand them over to their initial users (public or private), shall be also considered among the access selection criteria and in the "Plan of Access Roads to be Used", which will be developed for the selected accesses.

2.2 Quarries or zones for borrow materials extraction.

- The criteria for selecting borrow pits or quarries must give priority to those located near the work area or in its vicinity, including the inactive or abandoned zones.
- For the sites chosen as potential construction material sources, an evaluation must be made of the soil reserves, material type and its applicability to the highway construction, verifying their legal status before the Directorate of Mines and the SEMARN.
- Whenever the opening of a new borrow pit or mine could be necessary, the contractor shall request an opening permit from the Department for the Earth's Crust Protection (from SEOPC) or to the General Directorate of Mines, which are the authorized agencies for issuing such permits under Law No.123 or Law No.146.
- The opening of new quarries will be conducted in areas where the exploitation activities do not affect wildlife, water courses or other sensitive or fragile features.

DESCRIPTION OF MEASURES TO BE DEVELOPED

- The technical design for the exploitation will be conducted, taking into account the following recommendations:
    - Specifications for slope management, ensuring the zone's stability during the exploitation and after the area abandonment.
    - Designing drainage works for ensuring runoff water drainage and management, in order to avoid erosion or instability problems, as well as preventing sediment transport to the surface bodies of water.
    - Landscape design according to land morphology within the area of influence and vegetation typology and characteristics.
    - When possible, the quarries must be distant from roads and communities, in order to reduce the visual impacts that could arise during their exploitation. Otherwise, the affected area shall be properly restored and revegetated with native species.

2.3. Zones for excess material disposal or dumps

As for quarries, an evaluation must be made of the zones that could be used as material disposal sites, taking into account the following recommendations:

- Location outside of ecologically sensitive areas and/or high economic importance.
- Sites that do not obstruct the natural drainage and are at least 100 m away from any water body.
- When possible, using existing natural, hollow areas or former soil extraction zones (abandoned pits), which in no way might interrupt the surface water flow.
- The final design must consider maximum capacity, shaping (slope stability), soil compression and terraces slopes, as well as the surface and subsurface drainage, and final revegetation.

3. Access Road Adjustment

Evaluation and final selection of the approach roads used during Project construction will be conducted during the Detailed Engineering phase and according to the preliminary study in the "Project Description", section 2.5.8. Based on the results from this final selection, the "Plan of Access Roads to be Used" will be prepared. This Plan will include all of the main and secondary approaches, their use, adjustment and maintenance during the project construction phase and their delivery at the end of the work. The "Plan of Access Roads" must include all those approach roads that will be employed for accessing to the right of way, and to the camp areas, material production plants, excess material disposal sites and pits to be used for the project.

Also, during the enhancement/upgrade and use of access roads for the Project, the following issues must be considered:

DESCRIPTION OF MEASURES TO BE DEVELOPED

- Prior to Project start, an evaluation of all the access roads selected for use during construction must be conducted, in order to perform all the necessary enhancements or upgradesfor withstanding the traffic of the machinery to be used. A photographic/video record shall be prepared to document the initial status of the roads. At the end of the Ptoject, their conditions shall be, at least, similar to those at the Project start and they will be handed over at their user's complete satisfaction.
- During construction, all the access roads will be controlled and demarcated with the corresponding safety signposting to avoid interruptions of vehicular flow in the current highway or in the existing non-paved roads. The roads shall be properly signalized, according to existing standards, also considering technical and ecological factors.
- Improvisation or use of other approach roads not included in the "Plan of Access Roads" will not be allowed.
- On the non-paved roads, drainage works in poor condition will be repaired. The water crossing required for machinery passage will be conditioned with culverts, pontoons or any other passage structure.
- If borrow soil is required for the road enhancement, it will be obtained from borrow pits or sources authorized by the competent authorities.
- As for private access roads, the corresponding passage permit must be obtained.
- Speed limits will be established for vehicle transit through the roads used during Project construction in order to reduce particulate material emissions from the non-paved roads. This measure also seeks to reduce water demand for road wetting.
- The access roads maintenance will be conducted periodically, to ensure their proper use by the Project and by their regular users. Also, in the non-paved roads, dust will be controlled by road wetting.

4. Land negotiations

Land acquisition for the Project construction will be carried out according to the final location and lay-out of the corridor Land negotiation and purchase will be conducted with proprietors who duly certify their ownership of the lands of interest and in accordance with the process for land property purchasing or expropriation, currently developed by the Secretariat of State for Public Works and Communications (SEOPC).

The temporary use of other land properties for camps or other temporary facilities during construction and separate from the Right of Way, will be directly negotiated by the Moya – Odebrecht Consortium with the corresponding land owners. Final devolution of these properties shall be mutually agreed with the land owners prior to their use.

MEASURE APPLICATION PHASES
Detailed Engineering and Construction

RESPONSIBLE FOR AND INVOLVED IN EXECUTION
• Engineering Group • Land Negotiation Team from SEOPC • Production Group • SSTMA Group

MONITORING PARAMETERS
Refer to Monitoring Program SM-2 “Construction Activity Management” and SM- 1 “Social Management”

AC-2 Mobilization

OBJECTIVE
To establish environmental management measures that help to minimize possible impacts generated by mobilization related activities, such as: camps and temporary facilities installation, location and route lay-out, and Right of Way preliminary signposting.

ENVIRONMENTAL ASSESSMENT	
EFFECTS TO MANAGE	**AFFECTED ELEMENTS**
• Air quality degradation • Noise level increase • Sediment transport to water bodies • Disruption of surface and groundwater physical and chemical quality • Soil structure disruption • Protected species disruption • Temporary transit obstruction • Job generation • Cultural patrimony disturbance or destruction	• Air • Noise • Water • Soil • Flora and Fauna • Economic • Cultural

DESCRIPTION OF MEASURES TO BE DEVELOPED

1. Camp and temporary facility installation

According to preliminary studies of the project's Basic Engineering, a main camp and two production camps are planned to be installed during construction. These camps will not lodge the project personnel because the non-local personnel will be staying in Higüey. However, these camps will provide facilities for Project administration, dining, construction material handling, and machinery and equipment storage areas. Table AC-2.1 presents the camp locations in reference to the route axis proposed for the Autopista del Coral.

Table AC-2.1 Construction Camps Location

Section	Camp Type	Approx. abscissa	Nearby town
1	Production	K7+000 by the Chavón River	La Romana
2	Main camp	K34+000 by the Yuma quarry	Higüey
3	Production	K69+000	Punta Cana

DESCRIPTION OF MEASURES TO BE DEVELOPED
The environmental management measures to be considered during camp and temporary facility installation for the Project construction phase, are described below: • The facilities will be planned so that they do not obstruct the passage of vehicles or workers, every day activities of the community or transit of road users, or prevent a quick evacuation. • The facilities plan shall optimize space use, minimize vegetation clearing and avoid large soil excavation • The temporary facilities must possess all the required permits and authorizations before starting operation. • The camps and temporary facilities will be located a 100 meter minimum distance from any body of water and a 200 m minimum radius from any water spring. • The rain and runoff water management shall implement an interconnected, perimeter system of covered channel-ditches, grease traps and a tank or small pit for final sand removal that will allow a controlled discharge from the facilities. All drainage to outside the facility will be controlled and the quality verified through the Monitoring Program. • The water for human consumption will be supplied from sources that ensure service quality and potability; if no such sources are available, a treatment system will be implemented, which will adopt the potability recommendations for human consumption suggested by the World Health Organization (WHO). If an acceptable drinking water supply to the facility is not possible, all the occupants of these facilities must be informed, in order for them to avoid consumption of on-site water and warning them to drink the available acceptable water. • Systems for efficient and rational water use will be implemented in all the temporary facilities. • For managing waste water from the bathrooms, treatment systems will be installed, which will ensure that the final discharge complies with the quality requirements established by the Environmental Standard for Water Quality and Discharge Control, NA-AG-001-03. • In some of the temporary facilities, portable bathrooms will be used, which consist of the toilet, basin and discharge storage tank. This service is supplied by specialized companies that remove the wastes every day by means of vacuum trucks and transport them to treatment and final disposal facilities. The companies hired for this service shall comply with the existing environmental regulations. • The solid wastes generated in the facilities will be separated according to their characteristics and temporarily stored in a suitable site, before their transportation to the agreed final disposal site. The solid waste final disposal will be conducted through agreements with the entities managing the dumps located closest to the facilities, and each delivery will be registered indicating the waste type and quantity.

DESCRIPTION OF MEASURES TO BE DEVELOPED
• Waste collection in the facilities will be carried out daily and the waste will be temporarily stored to be evacuated in a short term to the agreed final disposal site. The temporary waste storage site will possess adequate access, ventilation, surfaces to avoid soil contamination, and control for preventing proliferation of insects, rodents and carrion birds. Solid waste incineration or burning by the personnel will not be permitted. Also, those responsible for waste management will use the personal protection elements suitable for this activity and type of waste being handled. • The equipment oil changes and maintenance must be conducted in workshops of the towns closest to the project area (La Romana, Higüey, Verón and Punta Cana). In case any minor maintenance is required in the production camps, it will be conducted using spill prevention and control systems and the oil and lubricant wastes will be temporarily stored in metal tanks, duly marked and located on surfaces capable of containing a spill of the stored volume, and avoiding soil pollution. These metal tanks will be then transported to service station facilities equipped with used oil treatment system; otherwise, they will be disposed of by a distributor authorized for used oil management. • Car and machinery wash will be carried out only at specific sites that will be equipped with the necessary infrastructure for this purpose. These sites will consist of impermeable areas, with drainage taking water to a grease and sediments interceptor, avoiding leaks of contaminated water to the natural environment. • The power generators used for electricity supply to the camps and temporary facilities will receive periodic preventive maintenance to ensure proper operation and control emissions from the combustion system. • The generator will be located in covered, ventilated areas, situated on confined surfaces that prevent soil contamination in case of a fuel leak during re-fueling or during maintenance activities or system fault. • The fixed equipment using fuel and lubrication systems will be installed on confined surfaces for preventing soil pollution in case of a potential fuel or lubricant leak. • Fuel storage for the electric generators and stationary equipment refueling will be located in covered, ventilated areas and situated on confined surfaces, for preventing soil pollution in case of a potential fuel leak. • The generator areas and those for generator fuel storage will possess all the necessary elements for ensuring the facility safety and fire prevention and fighting. • Refueling of cars will not take place in camps, or in temporary facilities; car refueling and maintenance will be conducted in the service centers, workshops and gasoline stations existing in the towns of the area of influence.

DESCRIPTION OF MEASURES TO BE DEVELOPED

2. Location and lay-out

The location and lay-out activity implies the route demarcation in the field. For the purpose of conducting a proper RoW delimitation of the route, the topography and land negotiation logbooks must be used; as well as the detailed design and engineering plans. During this activity the following aspects must be considered:

- The right of way width (70 meters), the sides of the strip (road shoulders) to be disturbed and the center line will be clearly marked in order to avoid affecting other areas not belonging to the project.
- Locate and marking of all the sensitive areas to be protected, such as the zones with presence of flora, zones of archaeological importance and houses, among others, that might be affected by the project construction. Special care must be taken with the protected flora located in sections I and III, and sites of archaeological interest and hydrogeological sensitivity areas found in section III (specifically between K59 and K66) during the environmental baseline studies.
- Determination of strategies for managing fences, pasture lands, farming lands and irrigation channels.
- Identification and location of preliminary drainage and geotechnical protection works.
- The wooden stakes used for demarcation must be purchased to suppliers with the corresponding license and permits for lumber exploitation.
- All the fences, pasture lands and infrastructure crossed by the location and lay-out activity must be left in the same conditions that they were found at the end of this activity.
- The solid wastes generated will be collected and taken to the temporary storage site in the nearest camp.
- While developing this activity, the project personnel will maintain good relationships with the community and the owners of the properties to be disturbed.

3. Preliminary signposting

At the beginning of the construction phase and during its development, all the work areas, access roads, and sites of environmental or social importance identified for the Project, must be demarcated and signposted with a suitable signposting system that can be easily read and interpreted by both the project personnel and the general public.

The signposting system shall be developed according to following considerations:

- The signposting system will be organized according to the following sign types:

DESCRIPTION OF MEASURES TO BE DEVELOPED
o **Warning:** Warn the work personnel and general public on the existence of a danger and its nature. o **Regulatory:** Indicate limitations, prohibition or restrictions. o **Information:** Guide the user, providing necessary information and directions. o **Other signs:** Temporary signs, such as barricades, guiding cones, oil lamps and cans. • All the areas to be occupied will be duly delimited in order to avoid unnecessary intervention; to that purpose, signs like small flags and stakes painted in vivid colors, safety tapes or other suitable signs. • All the areas considered environmentally and socially sensitive will be demarcated and signalized for protecting sites or activities that might be potentially affected by the construction, including: protected flora sites or individuals, water sources, water holes, irrigation channels, fences and pasture lands, sugar cane-transportation vehicle passages, railroad crossing and secondary access roads crossing, among others. • All the work areas will be properly signalized, especially in those sites with presence of heavy machinery, equipment, chemical products hazardous to human health, fuels, electric systems, open excavations, and other areas of interest for work-site health and safety. • All of the access roads (principal or secondary) to be used by the Project will be properly signalized for informing to the public and Project workers about their use and restrictions during the work duration. • Signposting to the public on the access roads shall be installed so that it warns, at a convenient distant, of the works and activities being conducted on the road. Also, this signalization must remain in place permanently, 24 hours a day during all the time the road is disturbed. Every disruption on main and secondary access roads must be conveyed in a timely manner to local authorities, communities and users, by means of all possible media and according to the strategies indicated in the environmental sheet GS-1 Information and Communication to Community. • In case a temporary traffic suspension is required in the existing roads for enhancing a bypass, all the permits will be obtained from the competent authority and the population will be informed using different media to communicate the dates, hours, etc. In the case of bypasses, the signposting shall inform about alternative routes for vehicle passage.

MEASURE APPLICATION PHASES
Construction Phase

RESPONSIBLE FOR AND INVOLVED IN EXECUTION
• Engineering Group • Production Group • Equipment Group • SSTMA Group

MONITORING PARAMETERS
Refer to Monitoring Program SM-2 “Construction Activity Management”; SM-3 “Waste Management” and SM-4 “Water Quality”.

AC-3 Soil and Material Movement

OBJECTIVE
To establish environmental management measures for activities related to soil movement during the Project construction, such as overburden removal, leveling and cutting and backfill in the right of way; as well as managing the excess material disposal areas. Additionally, environmental management measures will be established for the activities associated with borrow zones and pits and industrial plants enhancement and management.

ENVIRONMENTAL ASSESSMENT	
EFFECTS TO MANAGE	**AFFECTED ELEMENTS**
• Air quality degradation • Noise level increase • Sediment transport to water bodies • Disruption of surface and ground water physical and chemical quality • Soil structure disruption • Susceptibility to erosion • Loss of vegetative cover • Protected species disruption • Temporary transit obstruction • Temporary infrastructure interruption • Job generation • Cultural patrimony disturbance or destruction	• Air • Noise • Water • Soil • Flora and Fauna • Social • Economic • Cultural

DESCRIPTION OF MEASURES TO BE DEVELOPED
1. Overburden Removal, Leveling and Cut and Backfill Execution in the Right of Way
Soil movement for the Autopista del Coral Project construction will include activities such as vegetation removal (clearing), organic horizon removal (overburden removal), cuts, backfills and leveling of the Right of Way (RoW). According to the “Project Description”, the right of way of the projected route goes mainly through agricultural areas, pasture lands and shrub vegetation.

DESCRIPTION OF MEASURES TO BE DEVELOPED
The environmental management measures for the activities associated with soil movement and right of way adjustment are listed below: • Before starting the clearing and overburden removal activities it is necessary to consider the highway location and lay-out, in order to avoid disturbance of additional areas not included within the right of way (70 m). The clearing activity in the road corridor must be limited to the authorized right of way width, with the corresponding restrictions specified by the design. • Before starting any vegetation removal or trimming, a Botany specialist will verify the absence of protected flora species, especially in sections I and III; particular attention will be paid to the possible presence of Rain Palm -*Gaussia attenuate*- and Corozo -*Acrocomia quisqueyana*-. In the event that the presence of these species is detected within the area to be disturbed, a recovery and re-location plan for the specimens with survival viability will be implemented. The vegetation to be directly impacted will be duly marked in order to avoid unnecessary cutting of vegetation not within the authorized right of way. • The vegetative material obtained from the clearing will be used, according to its characteristics, for revegetation or for wooden stakes, preliminary protection works, and other construction uses. Burning of these materials will not be permitted. • The overburden removal will be conducted with equipment that allows for extracting only the organic horizon, without mixing it with the underlying material. The soil or organic material extracted in such a manner will be then utilized in the recovery of disturbed areas. • The organic material will be temporarily stored separately in the areas designed for dumps (excess cut material disposal areas). Transport and storage will take the necessary precautions for avoiding spreading material along the transportation route or its erosion at the storage site. • During the cutting, backfilling and leveling activities, the cut material with the best mechanical properties will be used for backfilling, while the low technical specifications material will be dumped in the excess excavation material disposal sites authorized for the Autopista del Coral project. In the sections where the suitable excess material from excavation might be insufficient, the required volumes will be extracted from borrow pits duly permitted by the environmental authorities. • During the cutting, backfilling and leveling activities in Section III and particularly between K53 and K67 of the route, considering the archaeological evidences found in nearby areas, the presence of an Archaeologist duly authorized by the Museum of the Dominican Man will be ensured. The archaeologist will be following the soil movement activity in this section and, in case any material of archaeological interest is found, he or she will stop the activities in order to conduct the corresponding archaeological rescue and discovery documentation. The material obtained and corresponding documentation will be managed exclusively with

DESCRIPTION OF MEASURES TO BE DEVELOPED

the intervention of the competent authority (Museum of the Dominican Man and the Secretariat of State for Culture).

- Cuttings on fixed rock will be conducted, after an evaluation of geological and hydro geological sensitivity of the intervention areas, with the methodology of embankment cutting with controlled blasting or using hydraulic or pneumatic drills for shaping the slopes according to the mechanical characteristics of the soil to be exposed.
- The cutting areas susceptible to erosion will be quickly stabilized for reducing potential erosion and all surface drainage patterns on the right of way will be kept free from obstruction.
- Ensuring that the equipment and machinery used for these activities are new or in very good operating conditions, and that they are periodically revised for controlling emissions and avoiding possible mechanicals faults during operation leading to oil, lubricants or fuel leaks at the work site.
- During these activities, all the work fronts shall be equipped with systems for prevention, control and cleaning fuel or oil spills due to failure of the equipment or machinery used.
- Refueling, oil changes or maintenance to equipment and machinery in the right of way will be conducted implementing the spill prevention, control and cleaning systems specified by the best environmental management practices for developing this type of activity. For developing these activities, a 500 m minimum distance from any body of water, hole, cavity or cave.
- The temporary storage of equipment, hazardous materials, chemicals, fuels, oils and lubricants will be located at an approximate distance of 1000 meters from any body of water, hole, cavity or cave, protected with a system for erosion and sedimentation control and mechanisms for avoiding soil pollution.

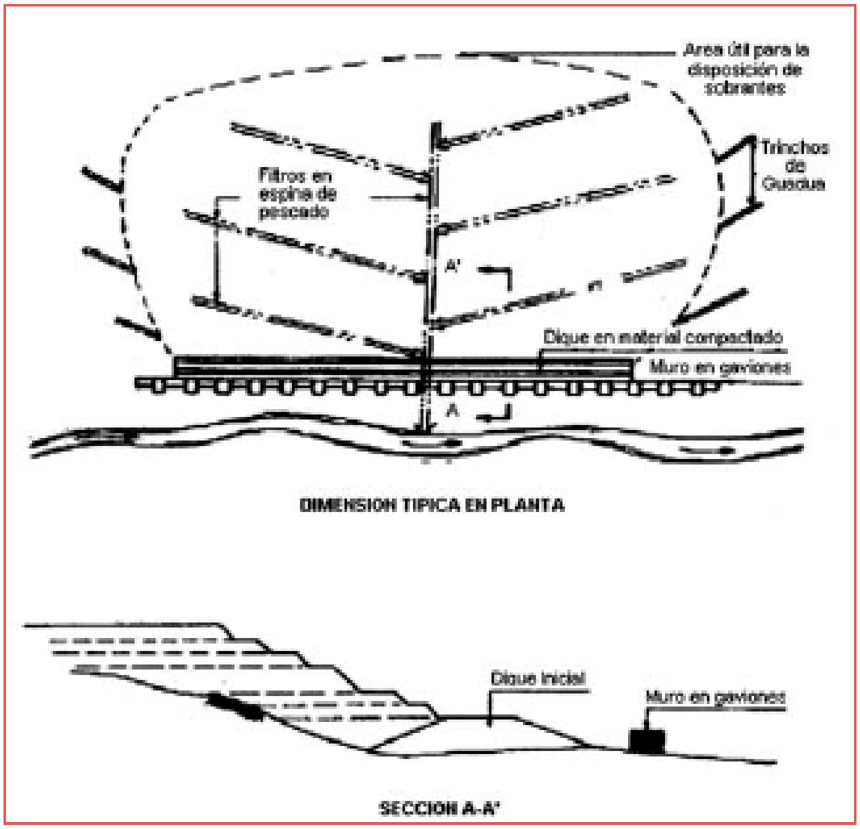
2. Management of excess material disposal areas

According to the “Project Description” the Project will not produce large volumes of excess material because the Project will try to make the maximum use of cuttings as backfill material. However, if some of these soils are considered to have low technical specifications for backfilling, they could be dumped in 47 sites identified as potential areas for that purpose and located near the highway route.

The management of these material disposal areas (dumps) will take into account the following environmental management issues:

DESCRIPTION OF MEASURES TO BE DEVELOPED

Figure AC-3.1. Typical dump scheme



Source: *Taken from Guía Ambiental para el manejo de Actividades de Construcción, Mejoramiento, Rehabilitación y Mantenimiento de la Infraestructura Vial. INVIAS-Ministerio de Transporte, 2003.*

- The disposal area adjustment will consider the same environmental management measures described for clearing, overburden removal, and equipment and machinery.
- Definitive dump design will be conducted during the project's detailed engineering phase. This design will include the particular geometric specifications for material disposal according to topography, internal and external drainage systems and the necessary re-configuration and revegetation plan for the final closure of the area.
- The dump will be temporarily fenced in order to demarcate the filling areas according to the established program, and avoiding the material dispersion at the ground level due to the water or wind action.
- During the filling process, the dumped material will be compressed in order o minimize water accumulation, increase the dump's capacity and providing general stability.
- For controlling infiltration and runoff in the dump, internal and perimeter drainage systems will be installed.

DESCRIPTION OF MEASURES TO BE DEVELOPED

- Once the dump is full, surface restoration, revegetation and an adequate site closure procedure will be conducted. For the restoration, all the material from the right of way clearance and overburden removal will be used. Also, internal and external stability will be ensured by means of all the necessary procedures

3. Management of borrow pits and zones

For the purposes of obtaining construction materials, 21 active (or in different production levels) quarries have been identified in the Project's area of influence. The materials from these pits possess the technical specifications required for use in backfilling, improved subgrade, sub-base, base, concrete aggregates and asphalt.

The Project will not directly open pits for construction material extraction; it will obtain the materials by direct purchase from third parties. Therefore, the Project will establish, in its environmental management system, the necessary tools for verifying and demanding that the environmental management and work-site safety are compatible with the best industry practices.

4. Industrial plant adjustment and management

Industrial plants include the crushing, soil, concrete and asphalt plants, which will be located in the two production camps and in the Yuma quarry. Additionally, the Project will employ two mobile units to be located at the main pits (pits 3, 4, 12 and 13).

The management of these industrial plants shall consider the following environmental management measures:

- The production camps and temporary facilities for the mobile plants will be managed as specified in Sheet AC-2.
- Noise control at the industrial plants will be ruled by *Norma NA-RU-001-03* from the Dominican Republic.
- Air emissions (mainly dust), will be controlled by means of technologies installed on the equipment, such as filters and water spraying on the areas with more dust generation and closer to the plants.
- All the personnel working in the production plants must be equipped with the corresponding personal protection devices, and all the areas with work-site health hazards shall be identified and properly signalized.
- Wastes from the concrete and asphalt plants will be managed as special wastes.
- The areas designated for vehicle and machinery parking shall consider the following:
    - They will be duly signalized and demarcated, in order to allow maneuverability for the vehicle and machinery operators.

DESCRIPTION OF MEASURES TO BE DEVELOPED
o The vehicles will park in reverse position and keeping the assigned sites. o The machinery parking area will possess a rigid zone on compressed soil. o The facility will possess a perimeter drainage ditch for collecting the zone's rain water in a controlled way and conducting it through a grease trap and sand remover before its discharge to the natural environment. • Management of equipment, machinery and vehicles during Project construction will consider the following: o Vehicles, machinery and heavy equipment will be equipped with mufflers. o The contractor will carry out a periodic maintenance of vehicles, machinery and equipment, ensuring good engine synchronization and calibration. o Discharge of grease or fuel wastes in the industrial plants, camps or work sites is forbidden. Any cleaning or maintenance activity will be conducted in a suitable place, designed for these purposes. o Machinery, vehicles and equipment wash, as well as oil changes will be conducted in a previously conditioned area (workshop). o Mobilization of equipment or machinery such as backhoes or caterpillars through principal or secondary roads will be done by means of low bed trucks. o Overloading the trucks during machinery and equipment mobilization will be avoided. When, due to the load shape or dimensions, this is not possible, the corresponding signalization indicating long, heavy or wide load will be placed, also, the pertinent authorization will be requested from the Secretariat of State for Public Works and Communications – SEOPC. • The dump trucks transporting construction materials, excess excavation soil, vegetative material, and solid waste or debris, will be covered with tarpaulins so that the material is kept protected from the origin to the final destination. • 25 Km/h will be established as the maximum speed for vehicle circulation within the plants and camps. • Compliance with the maximum permissible noise limits stipulated by *Norma NA-RU-003-03* of the Dominican Republic will be guaranteed. • Damages or deterioration to the access roads to plants or camps, or to zones adjacent to the right of way due to mobilization and transport of equipment, machinery or materials, will be reported in a timely manner • The areas designated for fuel and lubricants storage will comply with, at least, the following requirements:

DESCRIPTION OF MEASURES TO BE DEVELOPED
o The fuel-storage tank area will possess a containment dyke with the corresponding valves, and a storage capacity of 110% of the volume of the tank(s) it contains. The dyke’s internal area must be lined in concrete. o Limit the zone to be occupied to the minimum required area, considering the operation and safety needs. o The zones occupied by the fuel storage area will be signalized, clearly indicating to the personnel the type of activities that they can conduct in this area, precautions to be taken, maintaining demarcation of the zones for working, consumables storage and machinery and vehicle operation. o The fuel supply and transportation activities will be conducted by a supplier company, which will possess a pumping station and meters for operating with the different types of vehicles, equipment and machinery. o Avoiding any contact with water bodies; to that purpose, it is necessary to close the rain water drains located in vicinity of the storage zone. o A suitable spill containment system shall be designed; periodic revisions must be scheduled in order to identify the repair needs of the containment walls or dykes. o The lubricants storage tanks will be placed on plastic palettes for avoiding tank corrosion. o For avoiding oil and fuel spills, pumps will be used for unloading the volumes to be used from the main storage tank. o An inventory will be kept for controlling the fuel and lubricants, specifying their use or destination in order to facilitate further identification of oily and lubricant waste sources. o The vessels will be kept tightly closed and duly identified and marked in order to avoid leaks, spills or accidents. o The fuel storage area must be equipped with a fire-fighting system. • In the event of a contingency, verify that: o All the fuel and lubricant storage sites are correctly signalized, with the corresponding warning, regulatory or prohibition signs. o To have alternative, clear evacuation ways, with doors opening outwards. o To have absorbent material such as sand, soil, fuller and/or sawdust for spill collection and containment. o To follow the measures proposed in the contingency response plan. o Provide the necessary personal protection elements and demand their use by the personnel, including protection gloves, eyewear or masks, whenever applicable.

DESCRIPTION OF MEASURES TO BE DEVELOPED
• For spill control, the following procedure will be followed: o Identify the source. o Identify the spilled volume. o Characterize the spill area. o Identify sources of ignition or risk potential increase. o Follow the procedure established in the contingency plan to that purpose. o Control the spill or leak. o Cleaning the area or contaminated elements. o Appropriate waste disposal according to the management sheet for special wastes. o To prepare the respective leak, spill or accident report, identifying the cause and providing corresponding recommendations. o Follow up the affected area and the established recommendations.

MEASURE APPLICATION PHASES
Construction Phase

RESPONSIBLE FOR AND INVOLVED IN EXECUTION
• Production Group • Equipment Group • SSTMA Group

MONITORING PARAMETERS
Refer to Monitoring Program SM-2 “Construction Activity Management”; SM-3 “Waste Management”; SM-4 “Water Quality”; SM-5 “Air Quality” and SM-6 “Noise”.

AC-4 Drainage and Slope Stabilization

OBJECTIVE
To establish environmental management measures for construction of preliminary and definitive slope stabilization and drainage works.

ENVIRONMENTAL ASSESSMENT	
EFFECTS TO MANAGE	**AFFECTED ELEMENTS**
• Sediment transport to water bodies • Soil structure disturbance • Susceptibility to erosion • Temporary transit obstruction • Temporary infrastructure interruption	• Water • Soil • Social

DESCRIPTION OF MEASURES TO BE DEVELOPED

Phenomena such as erosion, soil laminar movements and slope faults in those areas disturbed by road project construction, are typically associated with conduction and management of surface and subsurface waters that flow naturally through the ground. This management requires implementing different types of works along the Project construction period. Consequently, the following issues must be considered:

- The detailed engineering will define, according to the route's geometric configuration and the topographic, climate and hydrological characteristics of the land, the areas and types of preliminary or temporary slope stabilization and drainage works required during the opening and shaping of the right of way activities.
- Also, the detailed engineering will evaluate the drainage and stabilization works proposed by the projects basic engineering; also, the final works to be developed before, after and during road pavement construction.
- During the Right of Way clearing and grading, and immediately after the clearing and overburden removal activities, all the preliminary drainage works will be conducted, with the objective of protecting the banks, avoid erosion and providing continuity to natural drainage transverse flows, streams, channels and ditches that will be intercepted by the project.
- The preliminary drainage and slope stabilization works to be constructed along the road corridor consist basically of: preliminary pipe sewers and interceptors for water handling; wooden trenches and bags full of soil (earth) in the shape of crown, in those sites where retaining cut material is required.

DESCRIPTION OF MEASURES TO BE DEVELOPED
• During the progress of the Right of Way clearing and grading, and particularly during rainy seasons, the conditions of the installed preliminary works for drainage and stabilization will be checked, for detecting possible faults and performing the corresponding corrections. • During rainy seasons, temporary drainage systems (soil interceptors or other) will be built in the areas with high slopes, in order to prevent water flow concentration and soil erosion. • In the sites where surface water erosion is observed, the need for building longitudinal and transverse filters will be evaluated. • In those places where the excavations on grade have slopes higher than 20%, trenches will be installed from the road embankment up to the right of way limit, in order to avoid the excavated soil dragging. The material for trenches will be soil suitable for revegetation. • In the zones where the slope grade must be changed due to the highway geometric design or presence of unstable zones, it will be necessary to evaluate the construction of runoff control works, such as top ditches, ditches, collection channels, and drains with energy dissipators. The discharge of the collected runoff to natural drains will be built with a suitable erosion control. • In cutting slopes and in natural drain banks, where the runoff water may cause erosion or the natural drains may cause scour, the construction of protection works including definitive concrete walls, gabions or trenches that enable revegetation in the form of terraces. • The box cut slopes shall be protected from future erosion and landslides that might be caused by runoff water by means of geo-drains, ditches and revegetation. • Slope stabilization in wet zones or areas susceptible to periodic flooding will consider building protections at the slope base, including stone mattresses (reno structure) and runoff control works. • Revegetation planning shall consider planting specifications, including: species selection (preferably native species of the region), material height, hole digging, fertilization and maintenance care. In slightly graded soils, the feasibility of turf implementation by means of digging and planting seeds in the hole will be evaluated; while in medium and high slope zones, the viability of seed sowing with bio-blanket will be considered. • The turf activity could be conducted using organic material from the overburden or pastures from the region. • According to the basic engineering design described in “Project Description”, the Project proposes pipe and box sewers for the transverse drainage; for the longitudinal drainage triangular ditches and trapezoidal channels were established. All of these works shall be evaluated during the detailed engineering phase, in order to ensure continuity of the land natural drainage at both sides of the road and appropriate water conduction from the road to nearby areas.

MEASURE APPLICATION PHASES
• Detailed Engineering Phase • Construction Phase

RESPONSIBLE FOR AND INVOLVED IN EXECUTION
• Engineering Group • Production Group • SSTMA Group

MONITORING PARAMETERS
Refer to Monitoring Program SM-2 “Construction Activity Management”; SM-4 Water Quality.

AC-5 Paving

OBJECTIVE
To establish environmental management measures to be considered during paving works, including supply, placing and compression of the materials composing the base and sub-base, and final asphalt - concrete wearing surface.

ENVIRONMENTAL ASSESSMENT	
EFFECTS TO MANAGE	**AFFECTED ELEMENTS**
• Air quality degradation • Noise level increase • Sediment transport to water bodies • Disruption of water physical and chemical quality • Soil structure disruption • Susceptibility to erosion • Protected species disturbance • Temporary transit obstruction • Temporary insfrastructure interruption • Job generation	• Air • Noise • Water • Soil • Flora and Fauna • Social • Economic • Cultural

DESCRIPTION OF MEASURES TO BE DEVELOPED

1. Sub-base and base construction

The sub-base construction implies transport and mobilization of machinery and equipment, and construction material, and their handling in the work site. The environmental management guidelines to be considered during these activities are described below.

- The vehicles used for material transportation will be equipped with a container or plate, with sufficient volume for ensuring that the load placed on them remains totally contained and no spill or material loss occur during transportation.
- The transported load will be totally covered in order to avoid spreading, emissions or leaks. The cover will be a resistant material to avoid breaking or tearing.
- During loading and unloading operations, vehicles must be totally stopped.

DESCRIPTION OF MEASURES TO BE DEVELOPED
• The machinery, equipment and vehicles used in this activity will be periodically checked and duly synchronized in order to control air emissions and avoid mechanical faults. • The sites for stony material temporary storage must be located at an appropriate distance from existing water bodies and courses, and they will be covered in order to avoid dispersion due to the wind. • The stony aggregates shall be (totally) protected with tarpaulins or plastic while they are stored to avoid particulate material emissions. • Material storage will not be permitted in waterbody zones (streams, rivers, lagoons, spring heads, etc.). • Material storage will not be allowed in green areas next to the Project building works. If necessary, the corresponding authorization must be obtained and at the end of the activity all the wastes will be removed, as well as the materials used for signalizing and demarcating the area. This zone shall be returned to the land owner's complete satisfaction. • The granulated material storage areas and temporary stockpiling sites will be demarcated and isolated with signalization tapes and supports. • Conduct periodic irrigation with water for keeping wet the surfaces and controlling dust emission. • Cement addition, when required, shall be careful and avoiding its placing outside the highway area; in any case natural drains or water bodies will be affected. • No waste will be left at the road sides; it will be collected by a maintenance team every day at the end of work. • All the disciplines shall use the appropriate personal protection devices. **2. Asphalt – Concrete wearing surface construction** • Whenever required, asphalt concrete mixing at the work site shall be conducted on a metal platform or on geo-textile with the appropriate caliber for ensuring its isolation from the soil so that the area is kept in good conditions. Mixing directly on the soil will not be permitted. • In case of concrete mixture or asphalt spill, it will be collected and taken to the site designated for debris disposal. The zone of the spill will be cleaned, so that no evidence of the spill remains. • No wooden framework will be used for pouring asphalt concrete works; unless, special forms are required, and provided the Supervisor's approval is obtained. • When pavement joint seals and asphalt primer are prepared, the heating asphalt emulsion will be heated in a portable large pan. The fuel used must comply with the environmental and industrial safety norms, and its direct contact with the soil will be avoided. Before starting this activity, the contractor must inform the supervisor about the fuel to be used and deliver the procedure for its use.

DESCRIPTION OF MEASURES TO BE DEVELOPED
• Concrete mixer washing at the work site or at nearby water bodies will be prohibited. Washing will be conducted at the industrial plant, equipped with the necessary structures and treatment systems for this activity (perimeter ditches and settling pools). • The aggregate material and asphalt wastes will be managed as special wastes and according to the procedure established for solid waste management. Disposal of these wastes within the right of way or near water bodies will be forbidden. • Due to the high temperatures for the asphalt-concrete wearing surface application, the workers will be equipped with the appropriate personal safety and protection devices; also, the access to these building works will be signalized and restricted to authorized personnel.

MEASURE APPLICATION PHASES
Construction Phase

RESPONSIBLE FOR AND INVOLVED IN EXECUTION
• Production Group • Equipment Group • SSTMA Group

MONITORING PARAMETERS
Refer to Monitoring Program SM-2 “Construction Activity Management”; SM-3 “Waste Management”

AC-6 Structure Construction

OBJECTIVE
To establish the environmental management measures to be considered during construction of complementary structures and engineering works, such as: junction works, vehicular traffic distributors, operational returns, bridges, toll gates and administrative offices for the motorway operation.

ENVIRONMENTAL ASSESSMENT	
EFFECTS TO MANAGE	**AFFECTED ELEMENTS**
• Air quality degradation • Noise level increase • Sediment transport to water bodies • Disruption of surface and groundwater physical and chemical quality • Soil structure disruption • Susceptibility to erosion • Protected species disturbance • Loss of vegetative cover • Temporary transit obstruction • Temporary infrastructure interruption • Job generation • Cultural patrimony disturbance or destruction	• Air • Noise • Water • Soil • Flora and Fauna • Social • Economic • Cultural

DESCRIPTION OF MEASURES TO BE DEVELOPED
The construction of engineering works and complementary structures for the Autopista del Coral such as: bridges over water bodies and railroad, vehicular passages, cattle and sugar cane vehicles, traffic distributors, operational returns, toll gates and administrative offices, will be conducted under the following environmental considerations: • The definitive planning of complementary structures and engineering works construction will be carried out during the detailed engineering; such planning will take into account the vehicular traffic volumes circulating through the current highway, La Romana – Higüey –

DESCRIPTION OF MEASURES TO BE DEVELOPED
Verón. The internal traffic in the Romana Sugar Mill areas, which include trains and trucks transporting sugar cane, the crop seasons and vehicle and personnel mobilization will be considered; additionally, the cattle and vehicle passage in secondary roads intercepted by the right of way will be taken into account. • Building works planning will include adequate and timely information about the activities to be conducted in order to avoid accidents and trouble to ordinary users. The communication systems shall be combined with adequate signposting systems before the work sites and in projected detours. • Additional to communication, building works planning will establish the corresponding and appropriate bypasses, for ensuring the service continuity and temporary interruptions in the current highway and secondary access roads. • The detours or bypasses will be coordinated with the corresponding authorities and particular users. • During temporary or permanent intervention of water bodies for bridge construction, special attention will be paid to the following issues: o The water course occupation for bridge construction will be planned according to the hydraulic designs and the historic behavior of the course. The course channeling works will be conducted in the most favorable way for the project and respecting the river's hydraulic behavior. o The water course intervention shall be planned for dry seasons or low river flows, in order to avoid disturbance to the water flow, transportation of excavation material to the course and scour phenomena. Before starting the course intervention, an initial photographic record of the work site will be taken. o The channels will be built according to the topographic and bathymetric surveys resulting from the detailed engineering studies, permitting, as far as possible, foundations with adjacent pile groups. o The dykes for shaping channels will be built with bed material, piled with a machine and partially compressed so that the maximum elevations channel the flow to those sectors favorable for the work. The final location of these dykes will be determined locally, depending on the river's hydraulic conditions observed immediately before their construction. o As an additional protection, longitudinal defenses will be built along the uncovered sides of the embankment protection.

DESCRIPTION OF MEASURES TO BE DEVELOPED
o The soil from excavations and residues from construction materials and consumables will be piled at a distance greater than 20 meters from river banks and, as much as possible; they will be transported in the same day to the final disposal sites. o After finishing the foundation of every pile or pier stage, the dykes will be demolished and the river bed will be shaped to resemble, as far as possible, its conditions prior to channeling. For restoring the river course at the end of this activity, the initial photographic record will be consulted. o All the equipment and machinery must be new or in the best operating conditions and they will be periodically revised for avoiding oil, lubricant or fuel leaks at the work site. o While conducting building works in minor water courses, diversions will be done by means of a channel or pipe that allows the whole flow passage; in this case, dry work will be carried out. The engineering team shall conduct the hydraulic calculation for estimating the channel or diversion work's dimensions. o In general, measures shall be taken for protecting water bodies and their surroundings, including isolating the water body from the building work in order to protect the area and avoiding sediment transport; to that purpose, synthetic mesh or barriers may be installed for preventing material discharge to the water bodies. o Solid waste disposal to surface waters will be forbidden. o Dumping any kind of industrial waste, such as solvents, used oils, paints or other material to surface waters will be prohibited. o In case of a contingency or accident due to a hydrocarbon or other substance spill, immediate cleaning activities will be conducted to control and remediate the problem. <u>Toll gates, administrative offices and operational returns</u> • For toll gate location, a socio-economic study will be conducted to determine the possible implications of its location, particularly the toll located in the Higüey sector, given the dissatisfaction expressed by the community during the public consultation. • In general, the construction of toll gates, administrative offices and operational returns will follow the recommendations associated with construction material management, waste management and work-site safety.

MEASURE APPLICATION PHASES
Construction Phases

RESPONSIBLE FOR AND INVOLVED IN EXECUTION
• Engineering Group • Production Group • Equipment Group • SSTMA Group

MONITORING PARAMETERS
Refer to Monitoring Program SM-2 “Construction Activity Management”; SM-3 “Waste Management”; SM-4 “Water Quality” and SM-1 “Social Management”.

AC-7 Demobilization

OBJECTIVE
To establish the environmental management measures for the construction phase demobilization, including activities such as: final cleaning, restoration and revegetation, and final signposting.

ENVIRONMENTAL ASSESSMENT	
EFFECTS TO MANAGE	**AFFECTED ELEMENTS**
• Noise level increase • Disturbance of surface and ground water physical and chemical quality • Loss of vegetative • Temporary transit obstruction • Job generation	• Noise • Water • Flora and Fauna • Social • Economic

DESCRIPTION OF MEASURES TO BE DEVELOPED
Demobilization activities will start when all the building works related to the construction phase are completed. Following are the considerations to be observed for final cleaning, restoration and revegetation of the zones temporarily disturbed during construction and final signposting before starting the operations of the motorway. • During dismantling of the main camp, production camps and temporary facilities like industrial plants, machinery and equipment storage areas, etc., all the temporary structures will be removed, in order to restore the area to conditions similar to the original one. To this purpose, the seedbank soil and organic soil stored during the camp and temporary structure installation will be used. • The camp and temporary facility dismantling will comply with all work-site safety standards, in order to minimize accidents. All the personal involved in dismantling activities will be equipped with the appropriate personal protection equipment. • The appropriate transportation means will be provided for transporting the structures, equipment, machinery, etc. Transportation of wastes, fuels, and others, will be conducted with corresponding precautions and safety measures for avoiding accidents and environmental pollution. • All of the temporary concrete structures will be demolished and debris will be removed and

DESCRIPTION OF MEASURES TO BE DEVELOPED

properly disposed of in the authorized places.

- In the zones with potential soil contamination, removal of hard zones and lined systems will be carried out, verifying that no soil pollution is present.
- In the event of soil contamination with fuel or other products, the contaminated soil will be removed and replaced by clean soil. The contaminated soil will be adequately dumped, after its treatment to acceptable conditions.
- The residues of channels or covered ditches and hard zones will be removed and disposed of. These structures will be also demolished and debris will be disposed according to the management established for this type of waste.
- All the liquid and solid wastes (including grease traps and sand removers) will be collected and treated for reaching acceptable conditions, and will be disposed of according to the management established for this type of waste.
- All of the treatment systems will be closed and removed from the site.
- Once dismantling and cleaning of temporary facilities is over, a detailed inspection will be conducted for evaluating the scope and needs of the environmental restoration to be developed in each site for its definitive closure.
- All the road and service structures that damaged during the construction activities will be reconstructed until conditions are acceptable to their users or owners. Evidence of Records of Acceptance of this work will be part of the folders and project commissioning.
- A general cleaning of the constructed highway and right of way will be conducted, removing debris and other wastes that might contribute to contamination of soils or nearby water bodies, or reducing the effectiveness of restoration and revegetation in vicinity of the highway. Final disposal of the debris and wastes from this cleaning will be conducted according to their characteristics.

Restoration and revegetation

Revegetation of lands wills begin as soon as their intervention is over or when the necessary engineering works are finished. The coverage can be done with hedges and/or live barriers. Hedges or live barriers provide isolation from noise, air pollution, protect the soil by reducing water speed and retaining sediments, and finally, they contribute with organic matter to the soil.

Soil reconditioning.

The main objective of the surface adjustment for revegetation is to ensure optimum recovery of the vegetative cover. To that end, diverse works and activities will be conducted, in order to promote and improve the substrate characteristics; thus facilitating quick and effective coverage of the affected surface by providing favorable conditions for rooting and development of the

DESCRIPTION OF MEASURES TO BE DEVELOPED

vegetation planted. The following stages will be followed:

- Physical and chemical characterization of surface substrate. A general physical and chemical soil analysis is recommended in order to perform the necessary corrections, according to the laboratory results. Sampling will permit setting the chemical modifications to be implemented for the substrate reconditioning.
- If no substrate is available, a 15cm –minimum- organic soil layer will be incorporated; this is the case for pits and temporary facilities hard zones.
- Manure and Fertilizer Application. Based on the laboratory results, the technician in charge of the program will set the corrective proportion to be implemented, considering also the application of compost, poultry manure or any other organic compound that ensures an adequate substrate final composition. The soil nutritional management must be conducted according to the types of vegetation to be used in the program, as indicated below:
    - Gramineous, Leguminous and Herbaceous. 45 days after sowing or planting, it is convenient to apply manure again to ensure optimum rooting.
    - Shrub Species. Apply organic manure into the opened hole a week before planting, mixing the bottom earth with the fertilizer. Apply the fertilizer with a mix of major and minor elements into the top. 75 days after planting, apply a fertilizer reinforcement, to strengthen rooting.

Adaptation of Surfaces to be Revegetated

The first activity, after surface conditioning, is to extend the vegetative cover. In the slopes, an anchoring system will be considered, which might consist of geomembranes.

Revegetation.

The revegetation process itself may include two principal groups: turf and reforestation.

The revegetation process will be implemented after completing the geotechnical works planned and designed for the zone rehabilitation (pits, cut slopes). It is necessary to consider availability, size and quantity of propagated material in the nursery for the sites determined during the periods planned for sowing and planting. Planting and sowing is limited to the activities of turf and native species planting, either by direct seed sowing, stolons, naked root plants, in stakes, pseudo-stakes and/or seedling in bags with manioc.

Turf This activity will consist of installing turf grass in the disturbed lands, after their geomorphologic restoration. The grasses installed must be used and/or native from this region.

Organic soil laying. Over the restored substrate, an organic manure layer will be placed (poultry manure) on the areas to be sodded. The organic soil used for sodding shall be approved by the supervisor (preferably the material stored during overburden removal).

DESCRIPTION OF MEASURES TO BE DEVELOPED
Application of agricultural amendments and fertilizers: fertilizers will be added as well as the agricultural amendments or the organic material previously stored, if required, to ensure suitable rooting of the vegetative material. For instance, it might be necessary to add agricultural lime (calcium carbonate) or calfos, if acidity correction is required. In the mixing process, any large lumps of organic soil will be pulverized, removing the rocks, trunks, and other undesirable material. Mixing of the organic soil and the amendment will be conducted under dry conditions to prevent the mixture from sticking to the equipment and to ensure that a satisfactory consistency is obtained. Substrate compression. The organic soil will be compressed with equipment to avoid affecting the substrate. Seed sowing**.** Grass seeds will be sowed in the soil layer thus prepared,. The species will be of common use in the region and must be of good quality, certified by the seller. If the sprout is not dense after irrigation, a new seed application will be required. Stolon planting. Seed planting with stolons may also applied, using stolons of a pasture grass species suitable for the region and climate of short height and thick foliage, fertile, fresh and with a well shaped reticular system. The stolons will be planted by hand, when the soil is not too wet or too dry, in furrows at a distance not greater than 40cm. Part of the overburden material removed from Project area can be used for this activity. Sodding by seed or stolon will be conducted at the appropriate time, before the rainy season, applying irrigation when necessary. Based on the selected species, the reproduction form will be determined, considering beforehand the soil requirements and the hydric availability in the sector. During the sodding process, diverse alternatives are possible, depending on the characteristics of the area. Planting season: According to the magnitude and difficulty for providing adequate irrigation to the seedlings , they could be planted during the first rainfall of every rainy season. Otherwise, an irrigation system will be required, for ensuring the rooting and survival of the seedling . **Final signposting** • Before the motorway operation, the vertical and horizontal signs will be installed, according to the Manual of Signposting from the SEOPC. The design, distribution and content of this signalization will provide adequate regulatory and safety information to the motorway users. • Additional to the appropriate installation and adjustment of the transit signs and to ensure safety to motorway users, inhabitants and non-residents in areas neighboring the road corridor, steel handrails and concrete barriers will be installed in those sections in which the route alignment or the characteristics of the area require its installation.

MEASURE APPLICATION PHASES
Construction Phase

RESPONSIBLE FOR AND INVOLVED IN EXECUTION
• Production Group • Equipment Group • SSTMA Group

MONITORING PARAMETERS
Refer to Monitoring Program SM-2 “Construction Activity Management”

MAINTENANCE ACTIVITY

MANAGEMENT PROGRAM

Maintenance Activity Management Program

OBJECTIVE
To establish the general environmental measures to be considered during the activities for conserving the infrastructure and the operating and safety conditions of the Autopista del Coral.

ENVIRONMENTAL ASSESSMENT	
EFFECTS TO MANAGE	**AFFECTED ELEMENTS**
• Air quality degradation • Noise level increase • Disruption of surface and ground water physical and chemical quality • Susceptibility to erosion • Protected species disturbance • Loss of vegetative • Temporary transit obstruction • Temporary insfrastructure interruption • Job generation	• Air • Noise • Water • Soil • Flora and Fauna • Social • Economic

DESCRIPTION OF MEASURES TO BE DEVELOPED

The maintenance activities for conserving the infrastructure and the operating and safety conditions of the Autopista del Coral will be established by the operation and maintenance team. Following are the key maintenance activities and some environmental management considerations that shall be incorporated to their development.

AM-1 PAVEMENT EVALUATION AND MAINTENANCE

During planning and development of pavement evaluation and maintenance the following management measures will be kept in mind:

- Before conducting the pavement maintenance works, the signposting must be placed warning the users about the projected activities and diversions, and the previewed timetables. The maintenance area shall possess permanent and adequate signalization for ensuring the workers and road users safety.

DESCRIPTION OF MEASURES TO BE DEVELOPED

- Reducing paving material spills during repairs.
- Covering rainwater drainage and sewers before repaving.
- Preventing runoff from the areas being maintained, using measures for erosion and sedimentation control in the work area perimeter.
- Reducing the water volume for dust control by employing sweeping practices before washing. Swept material may be recycled as an aggregate or managed as a special waste, if the first alternative is not feasible.
- Cleaning the asphalt equipment with vegetable oil and brushing; collecting the cleaning wastes and proper disposal of other wastes.
- Maximize repaving material recycling into aggregates or base, and evaluate possibility of incorporating recyclable materials for reducing the cost of new asphalt and concrete mixtures.

AM-2 EVALUATION AND MAINTENANCE OF DRAINAGE WORKS

While planning and developing the evaluation and maintenance of drainage works, the following management measures will be considered:

- The drainage works maintenance shall be conducted, preferably during dry season.
- The operation of sewers and ditches will be ensured by means of their periodic cleaning. Cleaning will be conducted with hand tool.
- Conducting regular inspection in areas with permanent erosion and runoff troubles.
- Evaluating the characteristics of sludges accumulated in drainage systems and managing them according to their hazardous or no-hazardous nature.

AM-3 EVALUATION, MONITORING AND MAINTENANCE OF SLOPE AND HILLSIDE STABILIZATION WORKS

During the evaluation, monitoring and maintenance of slope and hillside stabilization works, the following management measures will be observed:

- Conducting maintenance of sodded surfaces as follows: towards the end of the two first months, a reseeding will be conducted. After six months, weeds will be removed and fertilizer applied; this activity will be repeated every six months during the first two years and then it will be repeated after five years.
- To establish areas susceptible to stability faults due to natural phenomena or caused by failures of the construction system used, and implementing dynamic monitoring systems that permit a diagnostic and formulating effective solutions.

DESCRIPTION OF MEASURES TO BE DEVELOPED

AM-4 MAINTENANCE OF COMPLEMENTARY INFRASTRUCTURE

During planning and development of the complementary infrastructure maintenance activities, the following management measures will be considered:

- After the maintenance of bridges and engineering works along the highway is completed, the warning signposting will start for informing the users about the projected works and bypasses, and the corresponding timetables. The maintenance area will possess permanent and adequate signalization for ensuring safety to workers and road users.
- The structure maintenance in water courses with base water level will be conducted with equipment installed on floating systems and duly protected for containment of spills and wastes generated by this activity; avoiding heavy vehicles and equipment work within the water course.
- Management of lead-based paint wastes and debris will be conducted according to the nature of the wastes.
- Whenever surface cleaning with sandblasting is required, all the procedures associated to this activity will be adopted, including the appropriate industrial safety and environmental waste management measures.

AM-5 SIGNPOSTING MAINTENANCE

During planning and development of the signalization maintenance activities, the following environmental management measures will be considered:

- During signposting maintenance, the work area and workers in charge of this activity shall possess a permanent and adequate signalization, in order to ensure the workers safety.
- Management of lead-based paint wastes, welding and metal residues wastes, will be conducted according to their respective nature.
- Implementing the safety signalization required in areas of poor visibility (luminous, reflective and markers) and for speed control.

AM-6 EVALUATION, MONITORING AND MAINTENANCE OF ROAD SAFETY

During the activities for evaluation, monitoring and maintenance of road safety, the following management measures will be considered:

- Keep accident statistics, specifying types of factors involved.
- Evaluating, according to statistics, the sections with higher accident rate for pedestrians and vehicles.
- Evaluating need for installing speed reducers, signs and markers in those sites identified as high accident risk sections.

DESCRIPTION OF MEASURES TO BE DEVELOPED
• To establish an emergency readiness and response plan, with the support of local communities and entities, for vehicular accidents and spill response, and conducting periodic drills and trainings for ensuring the effectiveness of the plan. • To establish procedures for transportation and management of hazardous materials through the motorway. • Evaluating the need for building strategic rest areas for reducing driver fatigue.

MEASURE APPLICATION PHASES
Operation Phase

RESPONSIBLE FOR AND INVOLVED IN EXECUTION
Operation and Maintenance Team of the Moya – Odebrecht Consortium

MONITORING PARAMETERS
The monitoring parameters will be obtained from the following records to be kept by the operator: • Maintenance Record • Monitoring Record • Accident Record • Road Usage Record

MONITORING PROGRAM

Monitoring Program

OBJECTIVES
General Objective: To conduct a periodic evaluation of the effectiveness of execution of the measures in the Environmental Management and Adaptation Program proposed for the project. **Specific Objectives:** • To establish monitoring parameters for evaluating performance and compliance with the Environmental Management and Adaptation Program (EMAP). • To inform to the Sub-secretariat for Environmental Management (Directorate of Environmental Quality) from SEMARN, on the performance and compliance with the EMAP and development of the Monitoring Program proposed for the project. • To define criteria for evaluating the environmental performance of the Autopista El Coral construction project. • To verify and ensure effectiveness of the management measures proposed for avoiding potential impacts on those water bodies to be crossed by the project. • To verify and ensure effectiveness of the management measures proposed for avoiding potential impacts on air quality and workers' health resulting from project activities. • To verify and ensure effectiveness of the management measures proposed for waste management.

ENVIRONMENTAL ASSESSMENT	
EFFECT TO MANAGE	AFFECTED ELEMENTS
• Social Management • Construction Activity Management • Waste Management • Water quality • Air Quality • Noise Levels	• Communities and Institutions • Physical, Natural and Social Components

DESCRIPTION OF MEASURES TO BE DEVELOPED

The monitoring program for the Autopista del Coral Project will be implemented by following management parameters and environmental quality parameters, as described below, which will be periodically verified during implementation of the project's Environmental Management and Adaptation Program in the detailed engineering and construction phases.

Data from this monitoring program and, in general, from the project's environmental performance during the above mentioned phases, will be presented in the "Environmental Compliance Report" – ICA, in Spanish- which will be submitted twice yearly to the Sub-secretariat for Environmental Management (Directorate of Environmental Quality) of SEMARN.

SM-1. SOCIAL MANAGEMENT

Monitoring of the activities related to social management will consist of verifying the following:

Information and Communication to Community

The parameters to be followed are the following:

- Number of meetings held with the community
- Number of meetings held with institutions
- Number of claims/complaints received
- Number of claims/complaints resolved
- Number of requests received
- Control of disclosure pieces and information fliers delivered

Monthly revision of the following records will be conducted:

- Content, List of Attendees and Minutes of the start, progress and finish Meetings with the communities of the Project's direct area of influence.
- Schedule of meetings.
- Control of delivery and reception of written disclosure pieces.
- Record of claims/complaints received and resolved at the Community Attention Points – PAC.

The corresponding management indicators will be established for each monitoring parameters proposed.

Job Generation

The monitoring parameters will be the following:

- Number of meetings held for labor selection and hiring.

DESCRIPTION OF MEASURES TO BE DEVELOPED

- Number of job offer calls conducted
- Schedule, minutes and list of attendees to information meetings.
- Quantity and type of jobs and contracts signed within the project's area of influence.

Monthly checking of the following records:

- Published announcements requiring qualified and non-qualified labor.
- Register of applicants who attended the labor announcements and qualification criteria used for selection; as well as record of applicants hired.
- Record of qualified and non-qualified labor hired, belonging to communities from the project's direct area.

Based on the above data, the corresponding management indicators will be calculated.

Acquisition of local goods and services

The parameters to be monitored are the following:

- Type, Quantity and Cost of Goods and Services purchased in each town of the project's area of influence.
- Type, Quantity and Cost of Goods and Services purchased in other towns outside the project's area of influence.

Following will be conducted to the monthly records of the abovementioned parameters.

Based on the above data, the corresponding management indicators will be calculated.

Education and Training on Environment and Safety to the Project Personnel

The parameters to be monitored are the following:

- Type and quantity of courses offered
- Number of Participants in each of the courses offered
- Quantity of training hours by topic

Following will be conducted to the monthly records of the abovementioned parameters.

Based on the above data, the corresponding management indicators will be calculated.

SM-2. CONSTRUCTION ACTIVITY MANAGEMENT

Following to the Construction Activity Management program will consist of verifying, with a monthly frequency, the implementation of the environmental management measures and the construction general performance on the following issues:

DESCRIPTION OF MEASURES TO BE DEVELOPED

Work Fronts

- Work-site signalization and demarcation.
- Cleanliness and order in the working areas.
- Collection and management of generated wastes.
- Use and maintenance of portable bathrooms.
- Dust control.
- Temporary construction material storage.
- Use of the personal protection devices, according to the type of activity.
- Conditions and maintenance of the equipment, machinery and vehicles used.
- Hydrocarbons spill prevention, control and management systems.
- Environmental protection systems used.

Camps and Industrial Plants

- Cleanliness and order in the areas.
- Conditions and operation of the perimeter rainwater drainage system.
- Status and operation of the waste water treatment systems.
- Collection and management of generated wastes.
- Dust and noise control.
- Signalization and demarcation of areas according to their use.
- Use of the personal protection devices according to the type of activity.
- Conditions and maintenance of equipment and machinery used.
- Hydrocarbons spill prevention, control and management systems.
- Fuel storage and management.

Pits

The project will obtain material from quarries in different levels of operation or active, operated by third parties. Nevertheless, the environmental management and work-site safety activities will be conducted according to the best practices of the industry.

DESCRIPTION OF MEASURES TO BE DEVELOPED

<u>Dumps</u>

- Area signalization and material containment.
- Installation and functioning of drainage systems.
- Daily control and record of the material volume dumped on each area.
- Material disposal according to each site's final design.
- Slope conditions and shaping.
- Site restoration and revegetation.
- Use of personal protection devices according to the type of activity.
- Status and maintenance of equipment, machinery and vehicles used.
- Hydrocarbon spill prevention, control and management systems.
- Dust control.

SM-3. WASTE MANAGEMENT

Monitoring of waste management will verify the following:

<u>Ordinary and Special Wastes</u>

- Monitoring the quantity of generated wastes, classified by waste type.
- In each work front, camp, industrial plant or operating area, the location and conditions (cleanliness and signalization) of the temporary waste storage sites will be verified.
- The appropriate t waste disposal will be certified with a reception record of the generated wastes by the competent municipal authority; the ordinary waste final disposal will be conducted through a contract with the municipal authorities. For the special wastes, the appropriate management will be certified by the operator authorized by SEMARN with which the corresponding arrangements will be made.

<u>Excess Material or Debris</u>

- At the work fronts, a record will be kept of debris generated and a debris control form will be filled out.
- At the end of every month, the debris control form will be filled out, in order to facilitate tracking the debris quantity generated and its disposal site.
- Following the appropriate debris transportation procedure - material covering and other conditions exposed in the corresponding management sheet.

DESCRIPTION OF MEASURES TO BE DEVELOPED

- The waste management records could be kept using the attached forms (Special Wastes, Debris Control and Debris Disposal) or other forms could be adapted to include the pertinent data.

SM-4. WATER QUALITY MONITORING

Water quality will be used as a general indicator of the correct management for different activities, including: camp operation, excess material disposal zones (dumps), wearing course shaping, drainage works construction, and compliance with management measures proposed for equipment and machinery operation.

Water quality monitoring will be conducted for effluents and for the water bodies receiving the effluents, or to those water bodies that might potentially be affected by any of the project activities.

Effluent monitoring

- **Domestic waste waters**
  - In the camps, the quality of the effluent waters from the treatment system and treatment system efficiency will be evaluated quarterly. To that purpose, a sample will be taken at the inlet of the treatment system and another one at the outlet.
  - For each sample, the following parameters will be analyzed: dissolved oxygen, pH, nitrites, nitrates, orthophosphates, BOD5, COD, Suspended Solids and Total Coliforms and Fecal Coliforms. The analytical results will be compared to the standing norms in order to verify compliance with the same.
- **Industrial Wastewater:** Refers to waste waters generated in operation areas (workshops, industrial plants), such as equipment and machinery wash waters, which will be managed separately. The following monitoring will be conducted:
  - Quarterly evaluations of the quality of effluents from the grease interceptors and sediment trap, thus evaluating the treatment system efficiency. To that purpose, a sample will be taken at the inlet and another one at the outlet.
  - For each sample, the following parameters will be analyzed: dissolved oxygen, pH, nitrites, nitrates, orthophosphates, BOD, COD, Suspended Solids, Dissolved Solids, Oil and Grease. The analyses results will be compared to the standing norms in order to verify compliance with the same.

Waterbody monitoring

- **Waterbodies close to camps, industrial plants and dumps**
  - A twice yearly characterization of the waterbody closest to any camp, industrial plant or operating dump will be conducted.

DESCRIPTION OF MEASURES TO BE DEVELOPED

- In each waterbody to be characterized, a water sample will be collected upstream of the potentially affected site and another sample 100 m downstream.
- For each sample, the following parameters will be analyzed: dissolved oxygen, pH, BOD, COD, Turbidity, Suspended Solids, Dissolved Solids, Oil and Grease. The analyses results will be compared to the standing water quality norms, in order to determine possible disturbance or change in the water body quality, in the evaluated zone.

- **Waterbodies where drainage works will be built implying course disruption**
  - In those waterbodies where temporary course changes will occur due to drainage works construction, monitoring will be conducted at two sampling sites; one upstream and one downstream the work site (100m minimum, depending on the water body’s mixing conditions).
  - At each sampling point, at least, the following parameters will be analyzed: suspended solids, total solids, temperature, BOD and COD, color, turbidity, and oil and grease.
  - Monitoring will be conducted at three phases of the project: before the intervention (as the baseline), during construction of the works, and after the project construction, prior to start of operation.
  - Based on this monitoring results, disturbance of the water body will be assessed and compared to the standing norms on water quality.

SM-5. AIR QUALITY MONITORING

The air quality will be affected by point sources and mobile sources; therefore, air quality monitoring will focus basically on these aspects, keeping in mind that the main sources will be the pits or material extraction sites and the industrial plants.

- In the material extraction sites and industrial plants, a twice yearly monitoring will be conducted.
- Taking into account the wind rose at area of influence of the quarries and industrial plants, the most representative sites will be selected for location of 2 points in each site, where the monitoring stations will be installed.
- The parameters to be evaluated in each of the representative points are particulate matter (PM 10) and gas emissions (NO_x and SO_x) over 24 hours.
- The analytical results will be compared to the standing air quality norm.

SM-6. NOISE MONITORING

Noise will be evaluated in those sites where the noise levels could increase depending on the activities being conducted; noise monitoring must consider the following:

DESCRIPTION OF MEASURES TO BE DEVELOPED
• Conducting environmental noise monitoring in the work sites, in the pits and industrial plants. According to the special criteria and considering the methodology established in the standing norm for noise control, the sampling points will be selected and the corresponding metering conducted. • Noise monitoring will be conducted bi-monthly during the Project construction.

MEASURE APPLICATION PHASES
Construction Phase

RESPONSIBLE FOR AND INVOLVED IN EXECUTION
SSTMA Group

Hoja 1 de 1
Fecha

PLANILLA DE RESIDUOS ESPECIALES

PROYECTO:

CONSTRUCCIÓN AUTOPISTA DEL CORAL

CONTRATISTA

PERIODO:

FECHA	TIPO DE RESIDUO	VOLUMEN GENERADO M^3	VOLUMEN TRATADO M3	GESTOR APROBADO POR LA SECRETARÍA DE AMBIENTE

(Elaborò) (Aprobo)

(Nombre) (Nombre)

Supervisor

Hoja 1 de 1		
Fecha		
DD	MM	AA

PLANILLA DE DISPOSICIÓN DE ESCOMBROS

TRAMO DEL PROYECTO: ______________________

CONTRATISTA ______________________

PERIODO: ______________________

SITIO DISPOSICIÓN: ______________________

FECHA	PLACA VOLQUETA	VOLUMEN TRANSPORTADO M^3	NOMBRE DEL TRANSPORTADOR	FIRMA RESPONSABLE DE LA OBRA

(Elaborò) ______________________
(Nombre)
Contratista

(Aprobo) ______________________
(Nombre)
Supervisor

Hoja de		
Fecha		
DD	MM	AA

FORMATO CONTROL DE ESCOMBROS

CUADRO CONTROL DE ESCOMBROS DE ACUERDO A LOS ITEMS CONTRACTUALES QUE GENERAN ESCOMBROS										
Codigo	Items			Unidad	Calcule cantidad en m3		Factor de expansión	Escombros generados		Sitio en los que fueron dispuestos
		Periodo	Acumulado		Periodo	Acumulado		Periodo	Acumulado	

CONSOLIDADO FINAL DE CARÁCTER AMBIENTAL													
Sitios de disposición final	Material organico		Material de excavación		Material demolición concreto		Material demolición asfalto		Materal demolición edificaciones		Total	Cantidad Certificada
	Periodo	Acumulado	Periodo	Acumulado	Periodo	Acumulado	Periodo	Acumulado	Periodo	Acumulado		

Elaboró ____________________ Nombre director ____________________

Firma ____________________ Firma director ____________________

ACLARACIONES

1. Calcule la cantidad del item en metros cubicos, en caso de que la unidad del item sea m o m2

2. Escriba el factor de expansion de acuerdo a los siguientes: Items de excavación y descapotes 1.25, items de demolición 1.3.

3. Multiplique las respectivas cantidades de los items en m3 por el factor de expansión respectivo. (5 * 6)

4. Liste para cada uno de los items los sitios en los cuales fueron dispuestos dichos materiales, incluya aquí tambien si estos fueron reutilizados .

5. Este consolidado se realizará con las cantidades de la columna **"escombros generados"** del cuadro control de escombros.

6. Consolide y liste los sitios de disposición final de escombros relacionados en el cuadro de control.

7. Totalice la cantidades de eescombros dispuestas en el respetivo sitio de disposición.

(Firma) ____________________ (Firma) ____________________
(Nombre) (Nombre)
Contratista Supervisor

SPECIAL AREA MANAGEMENT PROGRAM

PAE-1 Special Management Area “Hoyo Claro Natural Monument”

OBJECTIVE
To set environmental management measures for the Autopista del Coral construction, in the section between K61+820 and K66+500, that overlaps with the northern side of the border of the Hoyo Claro Natural Monument.

ENVIRONMENTAL ASSESSMENT	
EFFECTS TO MANAGE	**AFFECTED ELEMENTS**
• Air quality degradation • Noise level increase • Transport of sediment to water bodies • Disturbance of physical and chemical surface and ground water quality • Soil structure disruption • Loss of vegetative cover • Job generation	• Air • Noise • Water • Soil • Flora and Fauna • Economic

DESCRIPTION OF MEASURES TO BE DEVELOPED
The section between K61+820 and K66+500 of the Autopista del Coral Project is regarded as a special management area, due to this section’s overlapping with the northern border of the Hoyo Claro Natural Monument (See Figure PAE-1.1). The “Monumento Natural Hoyo Claro” belongs to the System of Protected Areas of the Dominican Republic and it’s classified as management category III. The monument includes geological attractions such as water springs, typical of karstic formations in the zone. The environmental measures proposed for the project construction in this special management area are listed below: • During the Detailed Engineering and before establishing the final schedule and the equipment to be used in the construction of the section between K61+820 and K66+500, the required geophysical research will be conducted to identify the presence of caverns under the surface, and to evaluate potential collapse risks during the highway construction in this sector. • Based on the results of the geophysical research, the Detailed Engineering phase will evaluate the use of a “grinder” in all the cut areas planned for this section. Also, the Project design will evaluate the use of explosives with controlled blasting and its possible effects on secondary fractures and disruption to the drainage patterns of the aquifers in this sector.

DESCRIPTION OF MEASURES TO BE DEVELOPED
• In this section, the detailed engineering will evaluate the possibility of avoiding large cutting and the preferred use of backfill along the overlapped section. • The section from K61+820 to K66+500 will only be intervened in a 70m width along its entire and no widening will be allowed. • To establish a 1000m (approximately) buffer area around any cave or hole discovered during the “RoW Location and Lay-out” activity or during any other activity related to project construction. The caves and holes identified will be reported to the Engineering Team and to the building works Supervisor, in order for them to conduct a more detailed evaluation and establish the sensitivity of these features during the project construction. • If new holes or caves appear to surface during the construction, no backfill material will be placed in these sites until the authorized personnel conduct the corresponding research. The record of the research done in these sites and the procedure will be duly documented and included in the project environmental management record, for future submittal to the environmental authorities. • During construction, a sedimentation and erosion control plan will be implemented using the best construction practices, such as: a) installation of sediment barriers and straw bales for catching sediments, and b) deposition of the excavated material in the excess material dumps approved for the Project, which will be located at least 100m away from waterbodies and carstic features, such as caves or cavities, so that the waterbodies do not enter these areas. • Monitoring the sedimentation and erosion control measures periodically during the construction. Cleaning, repairing and replacing the structures as necessary. • All the personnel involved in construction, and particularly in those sections located in carstic zones, will receive periodic chats on safety procedures to be followed in the event of cave discoveries and sudden surface collapses. • During construction in the section located between K61+820 and K66+500, the equipment and machinery to be used will be new or in optimum working condition, and will be periodically reviewed to avoid oil, lubricant or fuel leaks in the work site. • Cutting areas susceptible to erosion will be quickly stabilized to reduce their potential erosion. • All the surface drainage patterns shall be kept free from any obstruction. • Areas for camps, storage of equipment, hazardous materials, chemicals, fuels, oils and lubricant, will not be located in the section between K61+820 and K66+500. Such areas will be situated in other sections, at an approximate distance of 1000 meters from any waterbody, hole, cavity or cave, and they will be protected with erosion and sedimentation systems and mechanisms for avoiding soil pollution.

DESCRIPTION OF MEASURES TO BE DEVELOPED
• Storage of organic or inorganic waste material, stony or backfill material will be forbidden in vicinity of any karstic element present in the construction sites or neighboring areas. • Refueling, oil change or maintenance of equipment and machinery in the section between K61+820 and K66+500, will be conducted implementing the spill prevention, control and cleaning systems specified by the best practices for environmental management in this type of activity. These activities will be developed a minimum distance of 500 m from any waterbody, hole, cavity or cave. • During construction of this section, fuel and oil spill prevention, control and cleaning systems will be available, in the event of failure of the equipment and machinery. • Revegetation of all areas as soon as possible, using native plants to reduce soil erosion. Employing annual species (gramineous), combined with native species in those areas subject to immediate soil loss, such as strong slopes, to provide quick erosion control. Final revegetalization will only use native species. • Removing and disposing of any waste and excess material after completing the construction activity in the section of interest. • By means of geophysical research, the detailed engineering shall evaluate the need for designing closed drainage systems for the road operation, so that the runoff is collected and carried to a retention and filtration system before discharge to the natural land to avoid direct transportation of contaminants to the ground and surface aquifer system. The project's Detailed Engineering Team will establish these designs. • During the road operation, periodic maintenance will be conducted to the retention and filtration systems to ensure their adequate functioning.

MEASURE APPLICATION PHASES
Detailed Engineering Phase Construction Phase

RESPONSIBLE FOR AND INVOLVED IN EXECUTION
• Engineering Group • Production Group • Equipment Group • SSTMA Group

MONITORING PARAMETERS
Refer to Monitoring Program SM-2 "Construction Activity Management" and SM-3 "Waste Management".

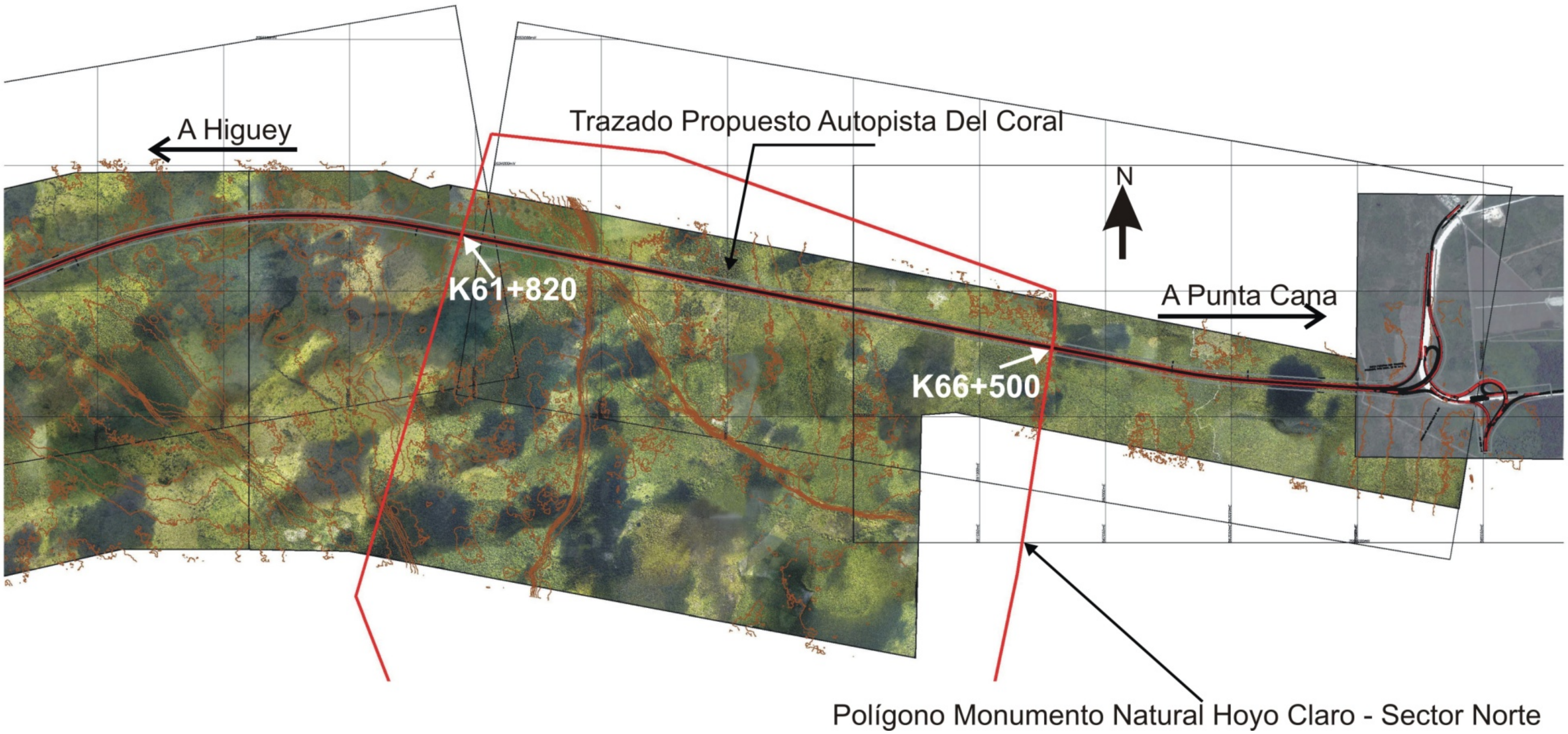


Figure PAE-1.1 Location of the Route Overlapping with the "Monumento Natural Hoyo Claro"

Source: Golder, 2007.