Environmental and Social Impact Assessment (ESIA) for the Alto Aguan River Valley Irrigation Project in Honduras

PAA Project Finance A/S
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Environmental and Social Impact Assessment (ESIA) for the Alto Aguan River Valley Irrigation

PAA Project Finance A/S

REV.03

For ERM

Approved by: Maria Quintana

Title: Partner

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I. EXECUTIVE SUMMARY

I.1. INTRODUCTION

PAA Project Finance A/S (hereafter referred to as PAA Project Finance), has appointed Environmental Resources Management (ERM) to act as an independent environmental and social consultant to undertake the Environmental and Social Impact Assessment (ESIA) for the Alto Aguan River Valley Irrigation Project in the Olanchito and Arenal municipalities in northern Honduras (hereafter known as "the Project").

The Project is an initiative of the Secretary of Agriculture and Livestock (*Secretaría de Agricultura y Ganadería* or SAG), ascribed to the Government of Honduras, to improve the socioeconomic status of the population in the Alto Aguan River Valley. This objective is sought through the efficient and sustainable use of soil and water resources for the existing livestock and milk production, as well as improving agricultural activities in the valley, by supplying irrigation equipment to selected beneficiaries in the area.

The Government of Honduras is receiving financing from ING Bank, and EKF, Denmark's Export Credit Agency, to transform the Alto Aguan river valley and is expected to conduct the activities in line with the World Bank Group Standards: IFC Performance Standards and IFC/World Bank Environmental, Health and Safety (EHS) General Guidelines.

The Government of Honduras, through the SAG, has awarded PAA Project Finance the contract for delivering311 irrigation sets and accessories, , in addition to training SAG technicians/trainers in their use and maintenance. PAA Project Finance assumes no responsibility for the subsequent operation, use, and decommissioning of the irrigation system.

According to local regulations, the Project does not require the development of an Environmental and Social Impact Assessment (ESIA), because the activities are limited to the delivery and operation of irrigation equipment designed to irrigate up to 10 ha as well as the delivery of trainings and because of the fact that among the conditions that need to be met by potential beneficiaries the land plot to be irrigated cannot be located within the limits of any protected area. Nevertheless, in 2017, PAA Project started developing an ESIA to comply with lender requirements. Currently, PAA Project Finance has commissioned ERM to update and finalize the draft 2017 ESIA, according to the gaps identified by lenders in the draft 2017 ESIA.

The Project is located in the Alto Aguan Valley in Honduras, in the Olanchito and Arenal municipalities. The Project Area covers approximately 60,000 ha, which encompass the 3,110 ha of agricultural land to be irrigated. There are a total of 54 hamlets (aldeas) and 133 settlements (caseríos) within this larger area. Each irrigation system planned to be delivered is designed to irrigate up

to 10 ha of land. It will be provided to approximately 300 milk producers and farmers present in the Project Area, selected based on certain eligibility conditions established by the SAG-PIU and PAA Project Finance.

Figure I.1 ***Project Location***

Source: ERM, 2018

I.2. *LEGISLATION AND POLICY FRAMEWORK*

The legal basis for environmental protection in Honduras is established in General Environmental Law - Decree nº104-93 *(Ley General del Medio Ambiente*), dated 25th July, 1993. The General Environmental Law sets out the framework for the protection, conservation, restoration, and sustainable management of the environmental and natural resources in Honduras. It also establishes the principles for environmental protection, which includes the EIA requirements for the development of certain potentially contaminating and degrading projects.

Other important environmental regulations applicable to this Project are summarised in *Table I.1*.

Table I.1 ***Environmental regulations applicable to the Project***

Area of relevance	Decree name
Environmental Impact Assessment	Ministerial agreement nº08-2015 – Regulation of the Environmental Impact National System Law (SINEIA) modified by Ministerial agreement nº7-2016 and nº11-2016
	Ministerial agreement nº16-2015 – Environmental Categorisation
	Decree nº800-2015 - Public Participation in the Environmental Assessment
Water resources	Decree 181-2009 - General Water Act

Area of relevance	Decree name
	Ministerial agreement nº084-1995 - National Technical Standards for Drinking-Water Quality
	Ministerial agreement nº043-2016
Climate change	Decree nº297-2013 – Climate Change Act
Flora, fauna and protected areas	Decree nº98-2007 – Forestry, Protected areas and Wildlife Law
	Decree nº159-2005 – Protected area of Honduran Emerald Hummingbird
	Decree nº204-2011 - Honduran Emerald Hummingbird Wildlife Refuge
	Decree nº32-2014 - Honduran Emerald Hummingbird Wildlife Refuge
Pesticides and related substances	Regulation on the Registration, Use and Control of Pesticides and Related Substances, Agreement nº 642-98
	Central American Technical Regulation RTCA 65.03.44: 07 - Pesticides for domestic and professional use, of June 13th 2011
	Phytozoosanitary Act, Decree nº 157-94
Solid Waste Management	Regulation of the integral management of solid waste (Executive Agreement nº 1567-2010, dated October 1st, 2010)
Air emissions	Regulation of Emissions of Pollutant Gases and Smoke of Motor Vehicles (January 13th, 2000)
Land property	Property Law, Decree nº82/04
	Resolution of the Property Law nº3/10
Cultural Heritage Protection	Protection of Cultural Heritage Law, Decree nº220-97 (1997)
Risk Management	National Risk Management System Law
	Regulation of the National Risk Management System (SINAGER) Law, Agreement nº032-2010
Labour	Labour Code, Decree nº189-1959
	Agreement nºSTSS-053-04 modifying the General Regulation for the Prevention of Work-related Accidents and Occupational Diseases
	Code of Childhood and Adolescence, Decree nº73-96

Source: ERM 2018

The main government departments, national authorities, or organisations engaged in environmental and social governance in Honduras and that have a specific role or interest in the Project are:

- Ministry of Agriculture and Livestock (*Secretaría de Agricultura y Ganadería* or SAG) and its various directorates (such as SAG – National Service for Agro-food Health and Safety or SENASA, SAG – Directorate of Agricultural Science and Technology or DICTA, SAG – Planning and Evaluation Management Unit or UPEG, etc.);
- Secretary of State in the Office of Energy, Natural Resources, the Environment and Mining (MIAMBIENTE); and
- National Institute of Conservation and Development of Forestry, Protected Areas and Wildlife (ICF) and Research Association for Ecological and Socioeconomic Development (ASIDE).

To conclude, as the development of this Project involves funding from lender entities, WB/IFC Performance Standards have also been considered in order to ensure the Project complies with international good practice. In addition, the Project has to meet the Corporate Social Responsibility (CSR) standards of PAA Project Finance A/S.

I.3. PROJECT DESCRIPTION AND ALTERNATIVES

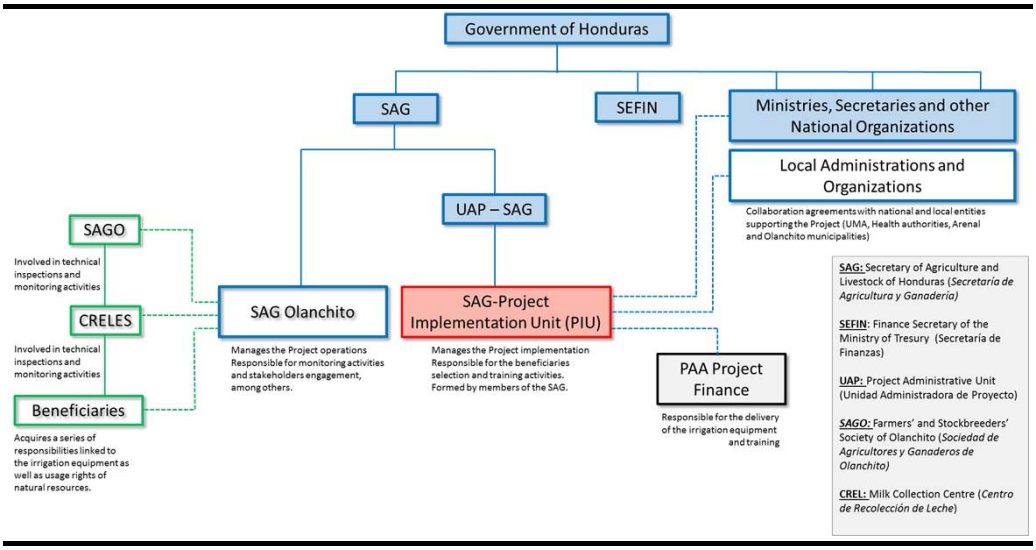
Project Overview, Location, Organization and Management

The Project consists of establishing an irrigation system for a maximum of 3,110 hectares of agricultural land located in the Alto Aguan River Valley in the Olanchito and El Arenal municipalities, in the Yoro department in Honduras. The 3,110 ha to be irrigated are distributed over an area of 60,000 ha which coincides with the Alto Aguan River Valley area, and represents approximately 5% of the total area of the Alto Aguan River Valley.

The specific locations of the plots to be irrigated will be defined only once the beneficiaries have been selected; the overall perimeter of the 60,000 ha that encompasses the maximum total area where the irrigation system may be implementation has been assumed as the Project Area.

Figure I.2 illustrates the parties involved in the implementation and management of the Project.

Figure I.2 Project organization and management



Source: ERM, 2018

Project Beneficiaries

The potential Project beneficiaries are milk producers and farmers who are either independent farmers or members of a locally organized collective, such as a milk collection centre (*Centro de Recolección y Enfriamiento de Leche* or CREL), the Olanchito society of farmers and stockbreeders (*Sociedad de Agricultores y Ganaderos de Olanchito* or SAGO), or the Honduran federation of farmers and stockbreeders (*Federación Nacional de Agricultores y Ganaderos de Honduras* or FENAGH).

The selection criteria that was shared with potential beneficiaries was established by the SAG and PAA Project Finance. The Project eligibility conditions that must be met are:

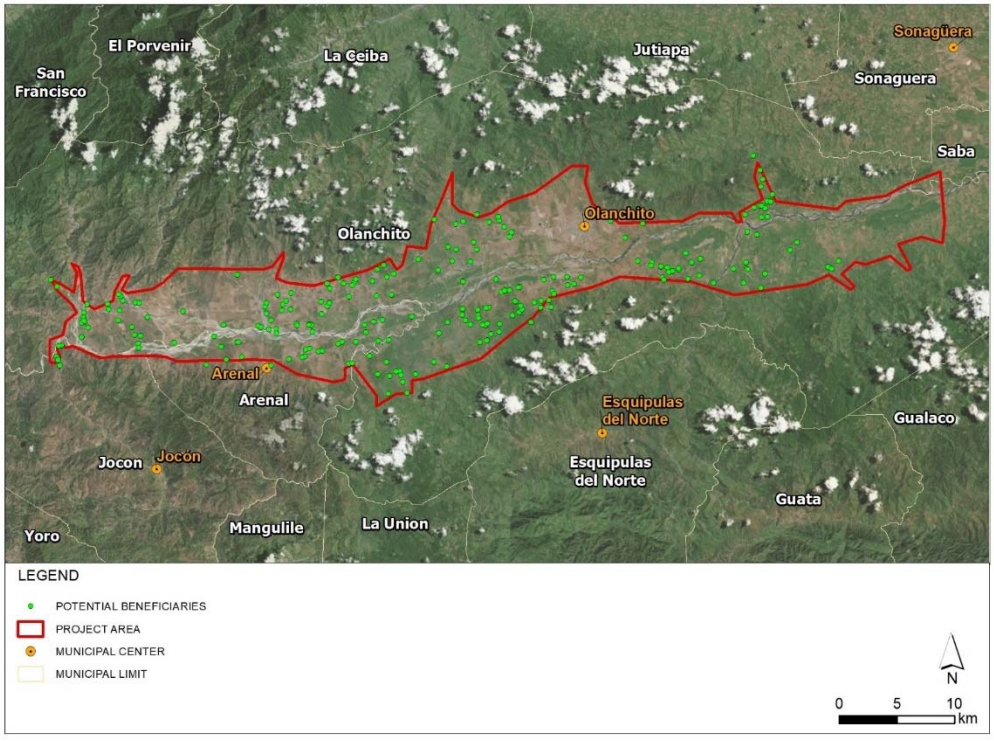
- the beneficiary must be the owner of the land plot to be irrigated;

- the land plot to be irrigated must not be located within the limits of any protected area;
- the land plot must not be situated within natural habitats such as shrubland or forest;
- there must be available water, either surface water or groundwater;
- the land must be flat; and
- the land plot must not be located on indigenous land.

Interested stockbreeders and milk producers and farmers will be reminded of the selection criteria at the start of project activities.

During the assessments undertaken in November 2017, a preliminary survey was launched by CINSA and PAA Project Finance among potentially interested milk producers and farmers in the Project Area in order to better understand their interest and capacities as well as the potential distribution of land plots within the Project Area. A total of 301 milk producers and farmers responded to the survey of which 227 met the preliminary criteria. The location of the potential beneficiary farms identified during the November 2017 assessment is presented in the following figure. The figure shows how irrigated land would be evenly distributed across the Project Area.

Figure I.3 Distribution of potential beneficiaries (as per November 2017 assessment)



Source: ERM, 2018

It is expected that an official application process will be launched by SAG-PIU before start of the Project, planned for the last quarter of 2018 (this will depend on the start date of the Project).

The selected milk producers and farmers will acquire a number of responsibilities which they will need to accept prior to becoming beneficiaries.

These responsibilities include the following aspects: application process, fee, permits and other costs, use and maintenance, sustainability, technical inspections and monitoring, plot transfer or sale, and support to the SAG.

The final list of potential beneficiaries will depend on the ultimate conditions that the beneficiaries will need to meet, their interest in the Project, and whether or not they accept the responsibilities they will acquire with regard to the Project. The selection process will be managed by the SAG-PIU through a transparent process including direct information to all potential interested parties.

Irrigation System and Responsibilities

The irrigation system and responsibilities are summarized in the following figures.

The irrigation system has been assessed as being the most suitable for the current needs of the Project, the objectives of the SAG, best practice applicable to the agricultural activities, and the environmental and social aspects that have been considered throughout the Project design.

Figure I.4 Project irrigation equipment

PAA Project irrigation equipment

PAA Project is responsible for the delivery of an **irrigation set** designed to irrigate up to 10 ha of land.

Each irrigation set consists of the following main components:

- A mobile motor pump or a mobile diesel fuelled generator plus sub-mersible pump
- Two travelling hose irrigators, or micro-sprinklers
- A set of pipelines and accessories.

The **irrigation sets** will be delivered by PAA Project.

The Project equipment will be delivered by PAA Project and stored in the warehouse of the SAGO or other warehouse specified by SAG until the beneficiaries are selected by the SAG-PIU.

The equipment will have a guarantee of 12 months (motors, pumps, hose reels) and of 24 months (irrigation pipelines)

Mobile motor pump

The mobile motor pump of 42 HP will have a capacity of supplying 10 Litres per second at 8 bar pressure. The pump will be connected surface water source (constituting the intake section) and an irrigation network (constituting the output section). It will be diesel fuel-operated. The life expectancy of the motor pump is of 10,000 hours.

Kohler Engines, extracted from the technical sheet of the motor pump model Bomba Capralli, 2018

Mobile diesel generator with submersible pump

The mobile generator will provide electrical power to the submersible electrical pump that will have a capacity of supplying 10 Litres per second at 8 bar pressure to the irrigation pipeline

Travelling hose reel irrigator and sprinkler

Fasterholt – Denmark extracted from technical sheet of hose reel irrigator model OT Plus, or equivalent unit.

Each irrigation kit will include two travelling hose irrigators, each with an integrated sprinkler. These are designed as easily transportable within the land plot allowing for the easy extension of the hose to up to 125 m. This will allow to irrigating the area progressively, in strips of land designed of 150x50 m^2. The hose irrigators will have an irrigation capacity of 12 m^3/h.

The sprinkler will have an irrigation radius of 25 m and it will have water output yield of 11 L/m^2 per irrigation.

The life expectancy of the hose irrigator and sprinkler is of 10 years.

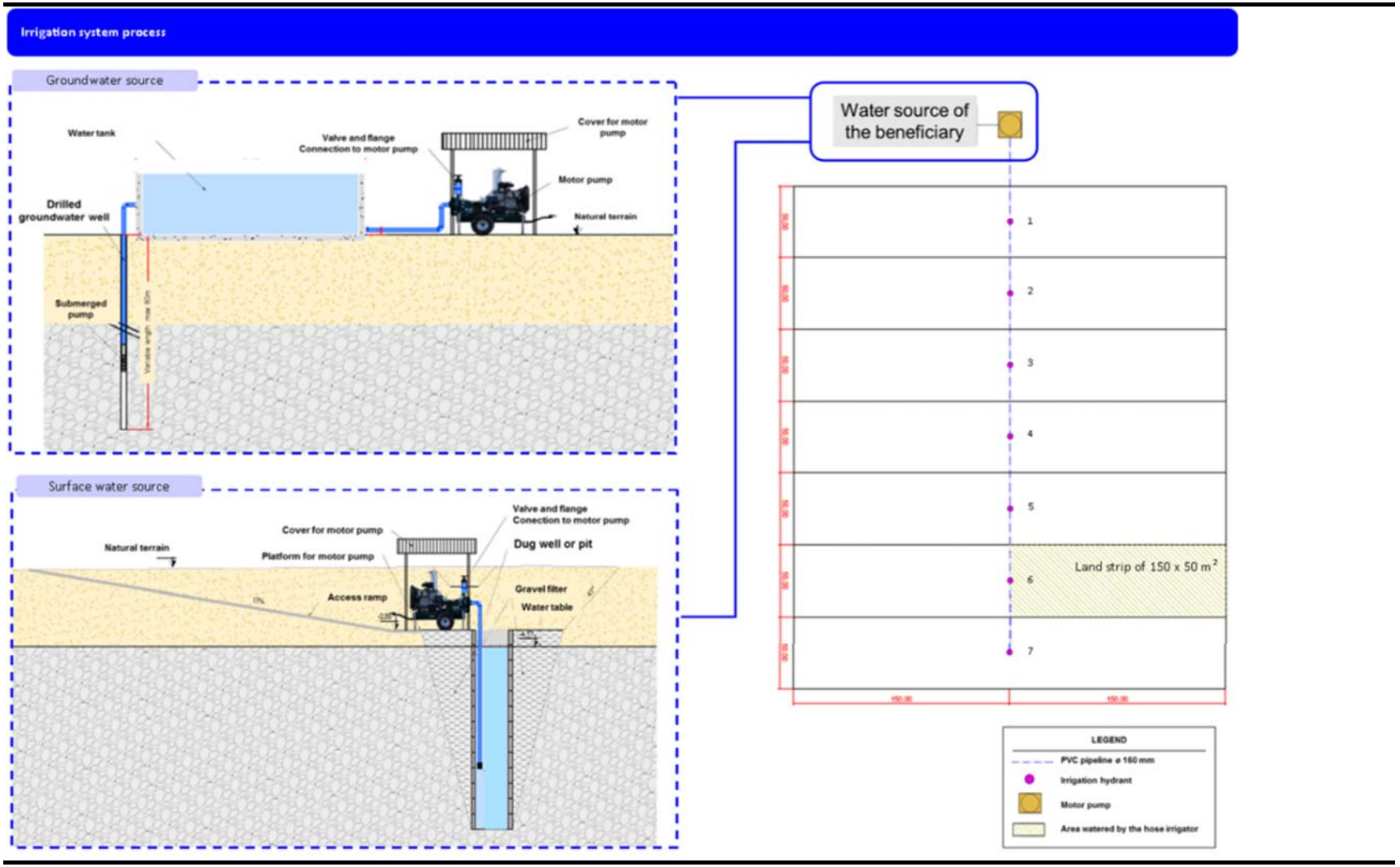
Irrigation network

The pump output will be connected to an irrigation network composed of a set of pipelines and valves, either easy connection aluminium tube segments of 5.8 m length for the travelling hose irrigators, or PVC tubes to connect to the micro- sprinklers

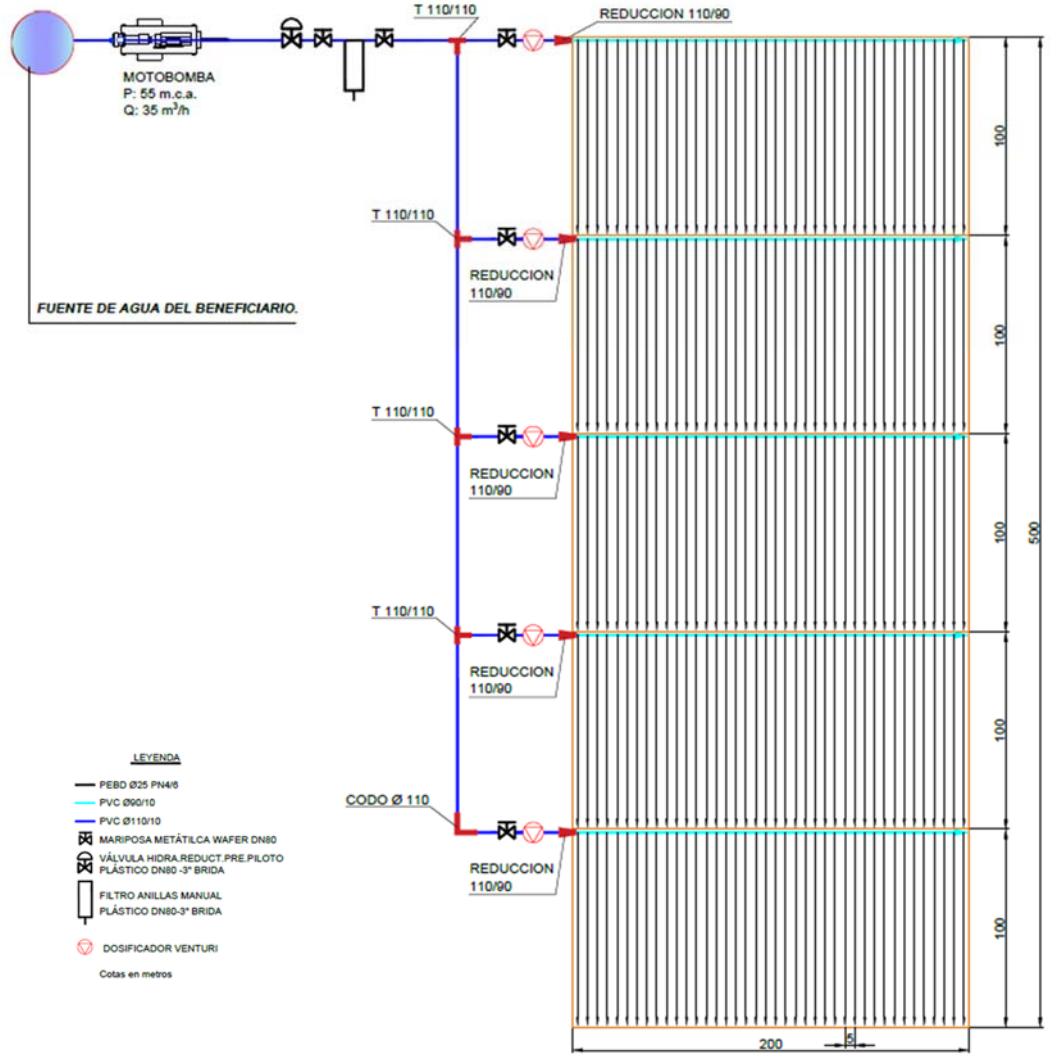
Source: ERM, 2018

Figure I.5 Irrigation process

Hose reel irrigation unit

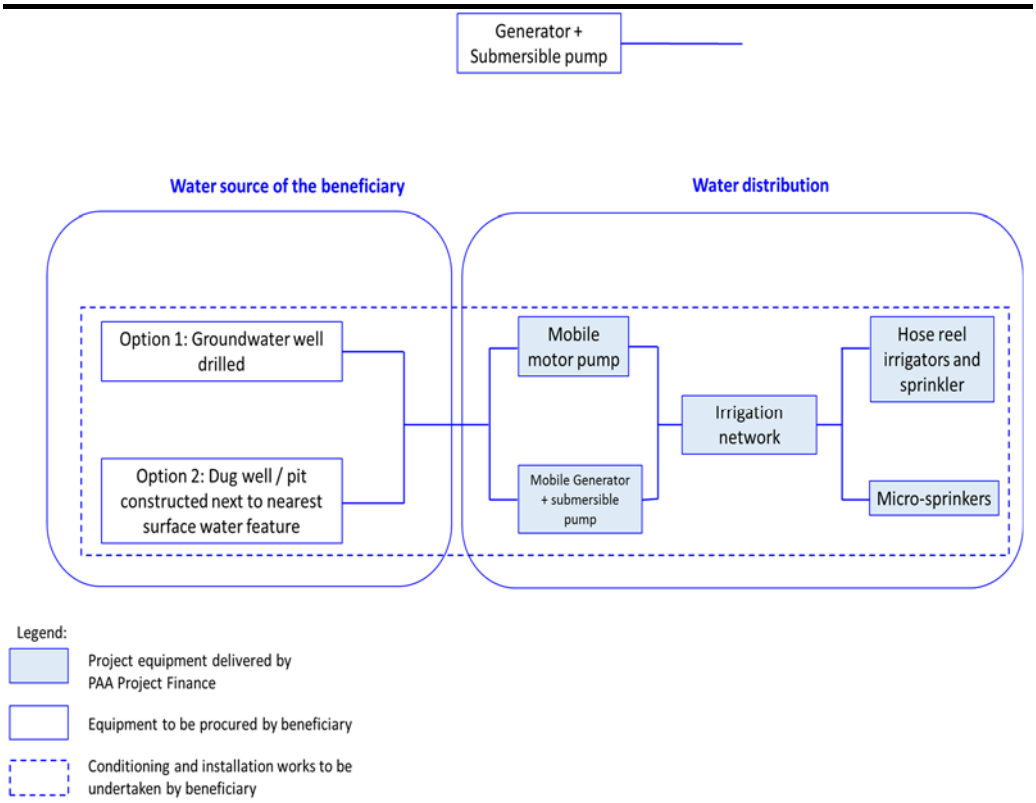


Microsprinkler irrigation unit



Source: ERM, 2018

Figure I.6 Components of the irrigation system and responsibilities



Source: ERM, 2018

Project Phases

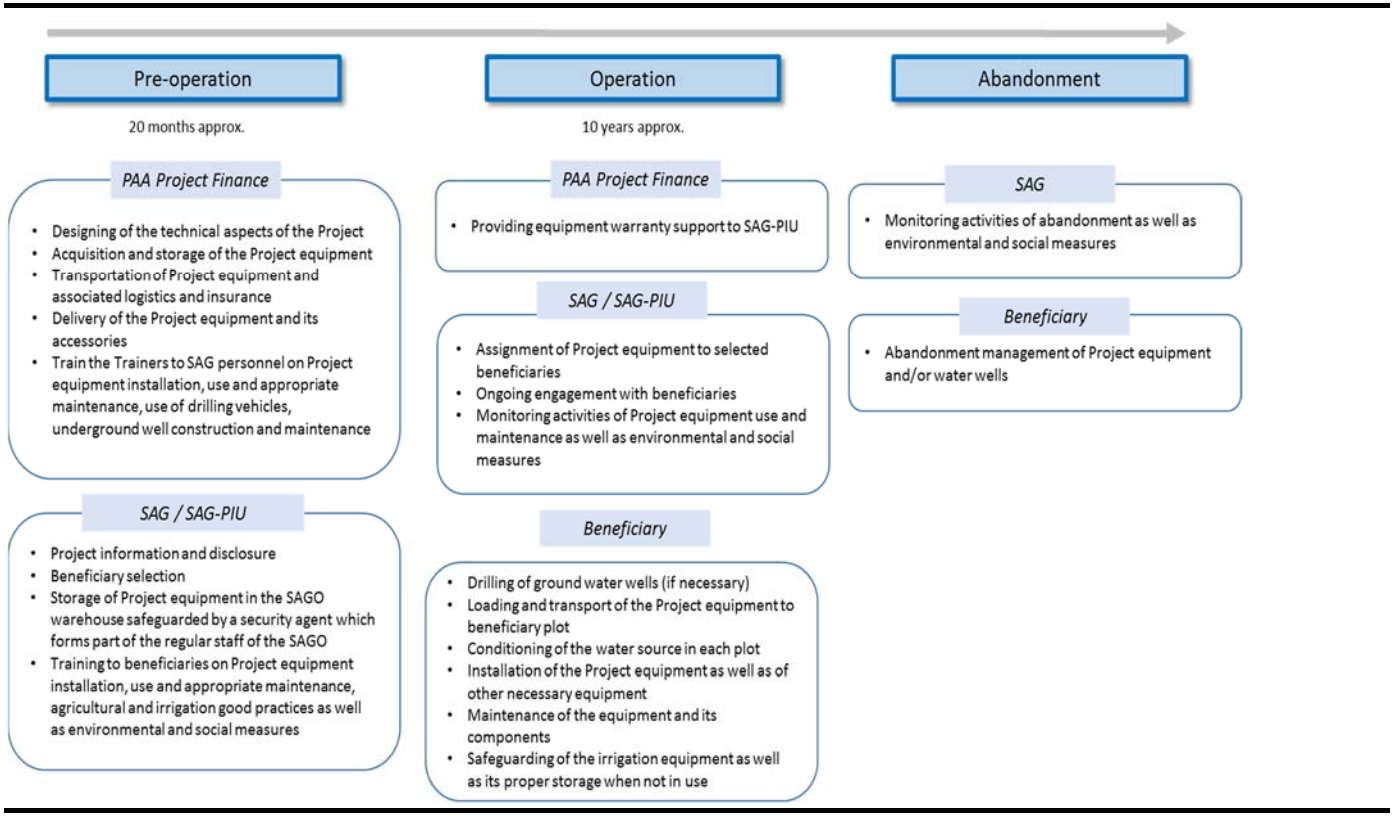
Project activities will take place in three different phases: pre-operation, operation, and abandonment, in which the responsible parties differ from one phase to another.

The Project activities under the direct responsibility of PAA Project Finance, include the delivery of irrigation equipment and its accessories, as well as providing training on in its use, maintenance and other relevant aspects to SAG representatives/trainers. These activities will be implemented exclusively during the pre-operation phase of the Project.

It is important to note that PAA Project Finance assumes no responsibility for assigning irrigation systems to beneficiaries nor the subsequent use and maintenance of these systems (activities that will take place during the operation and abandonment phases). The SAG, through the Project Implementation Unit – PIU (*Unidad Ejecutora de Proyecto* or UEP), will assume responsibility for establishing the Project (pre-operation phase), while the SAG will directly manage and supervise the subsequent phases.

Figure I.7 summarises the main activities of each phase, the responsible parties, and estimated duration.

Figure I.7 Project activities for each Project phase



Source: ERM, 2018

Waste management, use of resources and emissions in each phase is summarized in *Table I.2*.

Table I.2 Waste management, use of resources and emissions due to Project Activities

Phase	Waste management	Use of resources	Emissions
Pre-operation	Irrigation equipment packaging materials (wood, plastic, polymers) Domestic waste and wastewater in the offices where the training activities will take place. Management by the municipality of Olanchito: Olanchito sanitary landfill, sewer network, or corresponding septic tanks.	Fuel consumption required for: (1) transporting the irrigation equipment to the SAGO warehouse; and (2) mobilization of technicians to the Project Area.	Vehicle exhaust emissions related to the described fuel consumption.
Operation	Lubricants. Management by the beneficiary: reuse or recycle. Bentonite-based muds will be used for drilling the wells. Management by the beneficiary	Estimated water consumption for irrigation: 14,93 Hm^3 per year. Estimated diesel consumption by motor pumps: less than 2,500 m^3/year. The drilling of underground water wells will also require fuel.	Exhaust emissions will be generated due to the consumption of fossil fuels by the motor pumps. Noise emissions due to the operation of the pumps. Drilling associated exhaust and noise emissions.
Abandonment	The beneficiaries will be responsible for correctly abandoning the irrigation equipment and water wells. Abandoned Project irrigation equipment can be either managed and recycled by a specialist company or reused by the milk producer or farmer on other machinery, or for other purposes. The SAG will be responsible for monitoring the correct implementation and management of the environmental and social measures relating to abandonment activities.		

Source: ERM 2018

I.4. STAKEHOLDER ENGAGEMENT

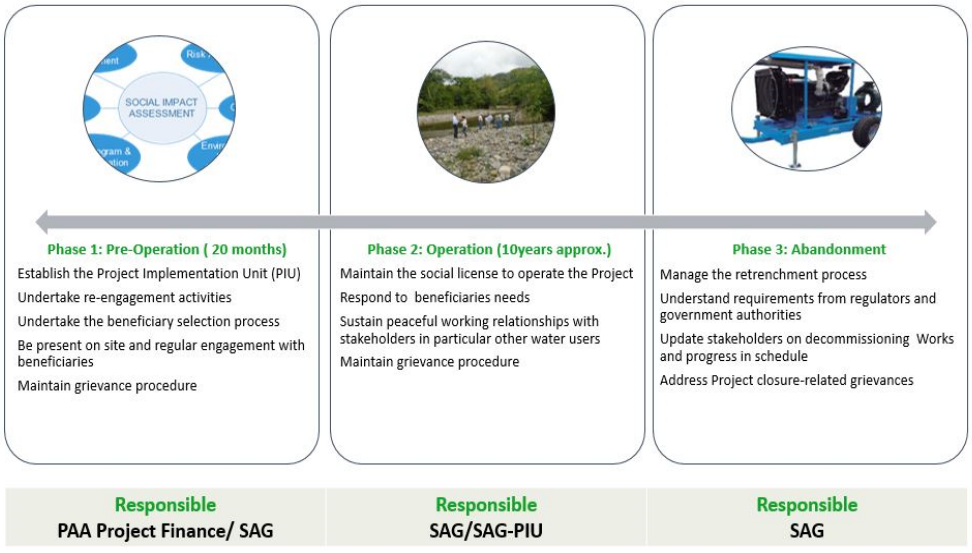
Stakeholder consultations for the Project began during Project planning phase and has been continuous through the feasibility studies, Environmental and Social Impact Assessment (ESIA) update which included new engagement activities with key stakeholders (field survey conducted in June 2018). *Figure I.8* shows a summary of the stakeholder engagement activities during ESIA preparation in 2017 and during the ESIA update preparation in 2018.

Figure I.8 Engagement activities undertaken in 2017 and 2018

Source: ERM, 2018

Stakeholder engagement activities are planned to cover all phases of the Project. However, PAA Project Finance will hand over the Project to the SAG once the irrigation equipment is installed and the training for beneficiaries has been completed. During the operation phase, PAA Project Finance's responsibilities regarding the irrigation project will be limited to supplying spare parts. In this regard, all engagement activities during the operation will be managed and promoted by the SAG. *Figure I.9* outlines the general objectives of the stakeholder engagement for each Project phase.

Figure I.9 Stakeholder engagement objectives for each Project phase



Source: ERM, 2018

To conclude, as part of the stakeholder engagement activities, there will be a grievance mechanism. The Community Grievance Mechanism enables any stakeholder to make a complaint or a suggestion about the way the Project is being implemented. Grievances may take the form of specific complaints for damages/injury, concerns about routine Project activities, or perceived incidents or impacts.

The purpose of the Community Grievance Mechanism Procedure is to implement a formalised process (identification, tracking and redress) to manage complaints/grievances from communities and other local stakeholders in a systematic and transparent manner that could potentially arise from the Irrigation Project.

I.5. BASELINE DESCRIPTION

Table I.3 and *Table I.4* provide a summary of the environmental and social baseline in the Project Area, highlighting those key baseline features considered in the environmental and social impact assessment.

Table I.3 Summary of Environmental Baseline

Physical environmental baseline	
Climate	The climate in Honduras is tropical and temperate, according to the Köppen climate classification. In the case of the climate conditions in the Project Area, located between the lowlands along the Caribbean and the highlands within the country, the presence of the mountain range *Sierra Nombre de Dios* is particularly significant. This mountain range acts as a barrier that prevents the humidity of the Atlantic Ocean reaching the area, making the climate warm and dry. The average temperatures range between 26-27ºC in the Project Area. The climate in Honduras is characterized by two differentiated seasons: rainy and dry, with a very variable rainfall distribution throughout the year. The dry season in the Project Area occurs from January to April and during the rest of the year, the monthly rainfall ranges from 80 mm/month to 160 mm/month where June and September are the months with the highest rainfall. Hurricanes and tropical storms occur most often between June and October. However, this varies substantially from year to year.
Air Quality	Information on air quality in Honduras and specifically in the Project Area is very scarce. Honduras is reported to have only one air quality station, located in Tegucigalpa. Poor air quality conditions are reported in urban areas in Honduras due to emissions from urban transport, re-suspension of dust in the streets, unpaved street emissions and eroded areas, and lime and brick kiln plants operating in urban surroundings. Rural areas also face problems of air quality because of forest fires and agricultural burning, which produce emissions of suspended particles. The Project Area does not present any particular sources of air emissions such as industries, mining activities and power plant apart from traffic-related emissions. Livestock production activities are the dominant economic activity in the Project Area, however industrial milk-processing centres, which are potentially air emission sources, are located outside the Project Area.
Acoustic environment	Information on the acoustic environment in Honduras, and specifically the Project Area, is very scarce. It is expected that noise levels in urban areas (e.g., Tegucigalpa) are high, taking into account the typically dense traffic. In very remote areas, far from any human activities, the sound level is determined by natural sources such as water (rain, rivers and waterfalls), and the wind making waves and blowing through the vegetation. The Project Area is located in a rural area, characterized by relatively low ambient noise levels, particularly at night. However, some noise sources (e.g., traffic) are present, but these are more limited than in the urban areas.
Topography	The Project Area is surrounded by hills and mountains on both sides of the valley: those in the north correspond to the mountain range *Sierra Nombre de Dios* and those in the south correspond to the mountain range *Sierra La Esperanza*. Most of the Project Area is relatively flat, corresponding to the bottom of the Aguan River Valley.
Geology	The Project Area presents the following geological units: Palaeozoic materials of the Chortis Block (Palaeozoic basement), in the western section of the Project Area, in the hills around the valley, Angels Valley Group deposited during the Cretaceous, in the eastern section of the Project Area, Undifferentiated plutonic rocks, in the central section of the Project Area, in the hills around the valley, and finally alluvial deposits associated to the Aguan River and its tributaries. The alluvial deposits represent the predominant geological unit in the Project Area.
Soils	The main types of soils found in the Project Area are alluvial soils and two types of lithosols (Jacaleapa and Yaruca). Soil quality conditions in the Project Area are expected to be good. Based on the information gathered during the field survey in 2018 through interviews with the local population, no erroneous uses of chemical products were observed. Chemical products (herbicides, pesticides, and fertilizers) are commonly employed on the farms in the Project Area, however only small quantities are used.

Hydrology	The Project Area is located in the macro-basin of the Aguan River which is characterized to be very dynamic with changes along its course and bars being formed from the sedimentary materials transported downstream. The water flow of the Aguan River fluctuates between the dry season (January – April) and the rainy season (rest of the year). The Aguan River has many tributaries in the Project Area (34 in total). The water flow in the Aguan River comes from two main sources: tributaries flowing towards this river; and groundwater flow towards the river from the alluvial aquifer located in the bottom of the valley. Surface water features in the Project Area are used for irrigating agricultural fields and providing water for the cattle. Tributaries of the Aguan River also used as a water supply for the communities (human consumption). There is a lack of data on surface water quality analyses. The observations during the field survey in 2018 suggest a generally good condition based on biological indicators of good quality fresh water, such as fish. However, there is a potential risk of loss of quality by organic contamination as a result of the wastewater management procedures in the communities.
Hydrogeology	The Project Area presents four categories of aquifers: a highly productive and extensive aquifer which corresponds to the alluvial deposits of the Aguan River, moderately to highly productive local aquifers which correspond to a fissured aquifer associated to the Angels Valley Group materials, poor to moderately productive local and extensive aquifers which correspond to undifferentiated volcanic rocks located in two areas around the municipality of Olanchito, rocks with limited and local groundwater resources which correspond to the Cacaguapa Schist formation. Most of the Project Area is located on the Alluvial Aquifer of the Aguan River. It presents a confined/semiconfined condition where water flow ranges between 4 and 30 L/s as well as an unconfined condition where water flow of 67 L/s have been reported. The Project Area is characterized by groundwater levels at depths of < 10 m to 40 m. There are two main categories of groundwater wells in the Project Area based on their construction characteristics: dug wells, shallow and built using hand tools; and drilled wells, deeper and built using drilling equipment. There is no official register of groundwater wells as so accurate information on the exact number of groundwater wells in the Project Area is not available. The use of groundwater is minor in comparison with the use of surface water. Groundwater wells are mostly utilized for farming activities (cleaning and water for cattle), but in a few cases they are also used as a water supply for the communities (human consumption). The available chemical analyses of groundwater resources show that these are adequate for irrigation purposes.
Habitats	The main habitats in the Project Area are agricultural fields and pastures, grassland, aquatic systems, inhabited urban and rural areas, and shrubland and forest. In the eastern section of the Project Area, the agricultural areas are mostly irrigated banana and African palm plantations, while the agricultural areas in the central and western sections of the Project Area are mostly pasture and non-irrigated crops used for livestock feeding. Agricultural fields and pastures habitats represents about 50.5% of the total surface area of the Project Area. Grassland in the Project Area is generally found in abandoned areas that were previously used for livestock. The aquatic systems in the Project Area are the Aguan River and its tributaries, together with small lakes, ponds, and artificial lagoons. The shrubland and forest habitat is composed of different vegetation units which can be grouped as two different types of forest: very dry tropical forest and dry tropical forest, representing about 23% of the total Project Area. The very dry tropical forest is a habitat of high biodiversity value, since it only occurs in two locations in Central America and has a high level of endemism in flora and fauna and it is also considered Critical Habitat with respect to IFC PS6. The project will not result in any loss of this habitat, neither directly through land use change or other kind of direct or indirect alteration, nor to any flora or fauna species. On the contrary it is expected that an indirect effect of the project will result in a lowered grazing pressure in this habitat by cattle during the dry months, and as a consequence on a net improvement of the habitat quality.
Flora	There are 306 flora species identified in the Project Area: 10 endemic species; six species classified as VU by IUCN; two species classified as EN by IUCN; three species classified as CR by IUCN; 26 species included in the Appendices of CITES; and one species classified as a Species of Special Concern in Honduras: *Nyctocereus guatemalensis*.

	The local population in the Project Area use certain species of plants for grazing livestock (both forage plants and natural shrub vegetation), medicinal purposes such as guayacan plant (*Guaiacum sanctum*), provision of wood (for firewood, and as a construction material).
Fauna	The fauna species potentially present in the Project Area include (per group): 33 species of fishes (none endemic; one species classified as VU by IUCN; and two species classified as Species of Special Concern in Honduras *Agonostomus monticola* and *Joturus pichardi)*, 15 species of amphibians (no endemic species), 40 species of reptiles (two endemic species; one species classified as CR by IUCN; and two species included in the Appendices of CITES), 189 species of birds (one endemic species; one species classified as EN by IUCN; 34 species included in the Appendices of CITES and seven species included in the Appendix II of the CMS) and 40 species of mammals (no endemic species; one species classified as VU by IUCN; and five species included in the Appendices of CITES). The black-chested spiny-tailed iguana (*Ctenosaura melanosterna*) and the Honduran Emerald Hummingbird (*Amazilia luciae*) have been described both within the protected area Honduran Emerald Hummingbird Wildlife Refuge (RVSCEH) and beyond. The *Ctenosaura melanosterna* is endemic and classified as CR by IUCN. The *Amazilia luciae* is endemic as well and classified as EN by the IUCN. Although *Amazilia luciae* can be observed in various habitats, especially when searching for food, *Ctenosaura melanosterna* is a more specialized species which is mostly found within the very dry tropical forest.
Protected areas	There is one protected area within the Project Area: Honduran Emerald Hummingbird Wildlife Refuge (RVSCEH – *Refugio de Vida Silvestre Colibrí Esmeralda Hondureño*). The RVSCEH was declared a protected area in 2005 (Legislative Decree 159-2005) and in 2011, new areas were also declared protected making the total surface area of the RVSCEH of 1,992.7 ha. The main ecological features of the RVSCEH are: (1) fauna – Honduran emerald hummingbird and black-chested spiny-tailed iguana, (2) up to 10 species of endemic flora: *Bakeridesia molinae, Caesalpinia yucatanensis (subsp. hondurensis), Capparicordis yunckeri, Dioon mejiae, Eugenia lempana, Eugenia coyolensis, Leucaena lempirana, Lonchocarpus trifolius, Opuntia hondurensis and Zamia standleyi*; (3) very dry tropical forest habitat.

Source: ERM, 2018

Table I.4 Summary of Social Baseline

Socioeconomic, infrastructure, archaeological and cultural heritage Environment	
Overview of potential Project beneficiaries	The beneficiaries of the Aguan Irrigation Project will be chosen among all the livestock breeders, farmers and milk producers present in the area. Currently, there are approximately 350 and 400 milk producers members of the SAGO; most of whom are also members of the 16 CRELES present in the Project Area. Based on CINSA & PAA's preliminary assessment, 75% of potential beneficiaries are expected to meet the selection criteria. The Project is therefore expected to benefit between 260 and 300 producers. These Producers occupy approximately 16,000 ha of land which correspond to 70% of the total cultivated and pasture land in the Area. The majority (48%) of potential beneficiaries are small producers with less than 40 ha of land while 14% have less than 10 ha. In addition, Preliminary findings show that 70% of potential beneficiaries do not have access to a source of surface water for irrigation and would therefore require underground wells as part of the irrigation equipment installation.
Socioeconomic environment	The Project Area is located in the Department of Yoro with most of the area included in the municipality of Olanchito and a smaller portion in El Arenal. The population in the Project Area is mostly rural with 89,166 inhabitants as of 2013 which corresponds to 86% of the population in Olanchito and Arenal municipalities. In the Project Area the population is quite young with approximately 53% of working age. The presence of indigenous groups in the Project Area is limited, with indigenous communities mainly located in the mountainous areas north of Olanchito and outside the Project Area. Field survey findings show that a small population of Tolupan individuals reside and work in the Valley and in the Project Area, as part of non-indigenous communities and are reportedly well integrated into the labour market in the Study Area. In the Study Area, livestock and milk production is the main livelihood activity, followed by employment in large scale production companies, and agriculture. In the Study Area, between a quarter and one third of the population is employed in the agriculture and livestock sector as low-skilled farm workers. The Area, as the rest of Honduras, is also characterized by a high underemployment rate which translates into one third of the occupied population in Honduras being underemployed with higher numbers in rural areas. Agricultural land is the predominant land use (50.5%) of land coverage in the Project Area, followed by shrubland and forested areas (43% while residential areas represent less than 5% of the total area. In the Project Area, most agricultural producers are livestock breeders whose agricultural output focuses on forage crops for livestock feed. Some producers sometimes diversity their production with the cultivation of basic grains, vegetables, African palm, sugar cane, citrus fruits, for both self-consumption and additional income generation. The average income of small producers is currently estimated between 20,000 and 40,000 lempiras (834 – 1,665 USD) in the rainy season compared to 10,000 and 20,000 (416 – 834 USD) in the dry season with an overall average of 30,000 lempiras (1,249 USD) per month. Potential beneficiary farms employ on average 6 permanent employees and 12 in the rainy season.
Labour rights	Formal employment in Honduras is overseen by the Secretariat of Labour and Social Security (*Secretaría de Trabajo y Seguridad Social*) and is primarily regulated by the National Labour Code and National Program of Employment per Hour along with the dispositions of social security and minimum wage. Although National Labour Laws exist in Honduras, practice in terms of hiring and employment practices may fall short of international standards. The National Labour Code does not require written contracts for labour employed in agricultural and livestock farms that are not industrial or commercial, nor for temporary labour of up to 60 days and punctual tasks. In line with the national law, field survey findings show that that farm workers do not have formal contracts. Their average salary is below the minimum wage of 6,000 lempiras (ie. 249 USD) per month established for enterprises employing up to 10 workers in the agricultural and livestock sector. National minimum working age is 14 for children who continue to attend school and otherwise 16, whereas ILO standards set the general minimum working age at 15 and 18 for hazardous work (16 under strict conditions). In practice, child labour in Honduras is prevalent with 14.7% of children between 5 and 14 who work, of which

	57.5% are employed in the agriculture sector (sugarcane, coffee, etc.). It has been reported during the field survey that children under 14 help out at the farm on their free time outside of school, including children of the farm owner.
Health and access to healthcare	The most common types of diseases reported in Olanchito and in Arenal municipalities are: intestinal, respiratory, and hypertension. Water-borne infections are the most common causes of intestinal infections and diarrheas. In addition, vector-borne diseases such as malaria and dengue are present in the Project Area, however reportedly malaria and dengue breakouts have been successfully controlled in the Alto Aguan Valley and there is very limited occurrence of malaria and dengue fever in the Municipality of Olanchito. Children under 14 are most vulnerable to vector-borne and water-borne diseases. In fact, water-borne infections are the most common causes intestinal infections and diarrheas, for which 18% of all reported cases in Olanchito occurred among children under 5 years of age and 20% among children between 5 an 14. The most important health centre is the area's public hospital located in Olanchito's urban centre, which provides health services to other municipalities in the departmer of Yoro, including Arenal. Olanchito and Arenal municipalities also count with additional health centres of the following categories: Dental Medical Centre, Rural Health Centre, Health centres with a permanent doctor, Health centres only staffed with medical assistants. Private clinics are also present in Olanchito and provide general healthcare services. The doctor per capita ratio is very low with 0.083 doctors out of 1,000 inhabitants. In rural areas, access to healthcare is limited considering that there are about 12 rural health centres in Olanchito municipality, which are only present in hamlets of 2,000 inhabitants or more, and there are 2 in Arenal municipality.
Infrastructure and public services	The water supply coverage in Olanchito and Arenal municipalities is reportedly of 88% and 65% respectively. This percentage of the population has access through the municipal distribution network. The remaining population rely on small springs, private wells, rivers, streams, etc. for water consumption. There is also a limited sanitation coverage and poor waste wastewater management in rural settlements. Access to electricity at the national level is predominant in urban areas (99% in 2013) although electricity cuts are frequent. In rural areas electricity coverage is of 75% combined with 16% of alternative energy sources including candles, gas lamps, and fuel wood. Waste collection and disposal services are present in both municipalities of Olanchito and Arenal and cover domestic users and non-domestic users including commercia and industrial. However, this service mostly covers the urban area of Olanchito with limited coverage in rural areas Waste collected is taken to the municipal landfill where it is burned. In the absence of a dedicated landfill or waste disposal location, residents either berry or burn their waste themselves. The industries that generate hazardous wastes are responsible for establishing their own system of hazardous waste disposal with approval from the municipality (hospitals, chemical plants, or similar). The road infrastructure in the Project Area and leading to the Project Area from the port of San Pedro Sula (where the kits will be delivered) includes both paved and unpaved roads, some of them well maintained while others tend to lack proper maintenance and appropriate paving and present deficiencies in terms of signage, landslides, and potholes.
Archaeological and cultural heritage	Some of the earliest evidence of human occupation in Honduras comes from the Aguan Valley, such as the Cuyamel Caves, located outside the Project Area towards the eastern end of the Aguan Valley. The Project Area contains a number of known archaeological sites, such as Puerto Escondido, located south of Olanchito town. It was occupied from 900BC to 1000AD. Many early sites are under or beside existing settlements, such as at Olanchito.

Source: ERM, 2018

I.6. IMPACT ASSESSMENT METHODOLOGY

The methodology employed in the environmental, social and health impact assessment was prepared in accordance with the ERM Impact Assessment Standard v1.1 (2012). *Box I.1* presents the ERM Impact Assessment Approach which is aligned with international best practices.

Box I.1 ERM Impact Assessment Approach

A project can have potential significant impacts on a wide range of environmental, social and health receptors. The importance or significance of these impacts depends upon a number of factors, principally the level of magnitude of the impact and secondly the sensitivity of a receptor to be affected by the impact. It is therefore important to:

- Identify those processes or actions which will lead to an impact (i.e., a change in the environment) and evaluate the magnitude of this change; and,
- Identify any environmental receptors upon which the impacts may act and evaluate their sensitivity.

The significance of the impact is determined by comparing, wherever possible, against accepted company, national or international standards. If no standards are available then it is necessary to develop project-specific limits, based on guidance or experience, as necessary. Such standards or limits are referred to as the significance threshold. Wherever possible the significance thresholds are based on a measurable value and compared with a legal, policy or guideline value.

If the size and type of the impact is greater than the significance threshold, this is then termed a significant impact, which is further defined as high, moderate or low. A significant impact may be broadly defined as one which should be brought to the attention of those involved in the decision-making process and therefore any significant impacts identified must be reported in the ESIA Report and, wherever possible, avoided or mitigated to reduce them to an acceptable level.

Recommended mitigation measures have been identified and follow a mitigation hierarchy as shown in *Figure I.10*. Mitigation is clearly described for all significant environmental and social impacts to a level appropriate for the stage of project development.

Figure I.10 *Mitigation Hierarchy*

- **Avoid at Source; Reduce at Source:** avoiding or reducing at source through the design of the Project (e.g., avoiding by siting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity).
- **Abate on Site:** add something to the design to abate the impact (e.g., pollution control equipment, traffic controls, perimeter screening and landscaping).
- **Abate at Receptor:** if an impact cannot be abated on-site then control measures can be implemented off-site (e.g., noise barriers to reduce noise impact at a nearby residence or fencing to prevent animals straying onto the site).
- **Repair or Remedy**: some impacts involve unavoidable damage to a resource (e.g. agricultural land and forestry due to creating access, work camps or materials storage areas) and these impacts can be addressed through repair, restoration or reinstatement measures.
- **Compensate in Kind; Compensate Through Other Means:** where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g., planting to replace damaged vegetation, financial compensation for damaged crops or providing community facilities for loss of fisheries access, recreation and amenity space).

Source: ERM, 2012

I.7. ASSESSMENT OF ENVIRONMENTAL AND SOCIAL IMPACTS

Table I.5 to *Table I.8* provide a summary of the residual impacts, taking into account the mitigation measures planned to be adopted during the implementation of the Project.

Table I.5 *Summary of Impact Assessment: Pre-operation phase*

Impact Code	Impact Name	Residual Impact
EE1	Long-term benefits of capacity enhancement for SAG technicians and Project beneficiaries	Positive - moderate
OHS1	Health and safety and labour rights related to road transport of irrigation kits to the SAGO warehouse	Negligible

Source: ERM, 2018

Table I.6 *Summary of Impact Assessment: Operation phase*

Impact Code	Impact Name	Residual Impact
CA1	Emissions of air pollutants and GHGs potentially affecting air quality and climate change	Negligible
N1	Potential disturbance to workers and/or fauna due to noise levels	Negligible
S1	Potential loss of soil properties due to excessive irrigation and soil disturbance	Minor
W1	Loss of surface water quality	Minor
W1	Loss of groundwater quality	Negligible
W2	Eutrophication of surface water	Minor

Impact Code	Impact Name	Residual Impact
W3	Effect on river flow	Minor
W4	Increase of organic matter in the groundwater	Negligible
W5	Effect on groundwater level	Negligible
B1	Disturbance to fauna	Negligible
B2	Disturbance to flora	Negligible
B3	Loss of natural habitats and subsequent loss of flora and fauna due to change of habitat	Negligible
B3	Loss of natural habitats and subsequent loss of flora and fauna due to the transformation of natural land to increase agriculture and livestock activity	Positive - medium
PA1	Effect on habitats, flora, and fauna in the protected area	Negligible
PA1	Effect on habitats, flora, and fauna in the Protected Area due to the transformation of natural land to increase agriculture and livestock activity	Positive - medium
EE2	Temporary economic impacts from beneficiary fee payment to the SAG and procurement	Positive - moderate
EE3	Temporary direct employment of labour for installation of irrigation equipment	Positive Negligible to Minor
EE4	Long-term economic growth from production increase d improvements in the milk production and agriculture sectors and related sectors	Positive Moderate to Major
EE5	Long-term direct and indirect employment in the livestock breeding and milk production and agriculture sectors and related sectors	Positive Moderate to Major
LL1	Improved livelihoods and food security for Project beneficiaries and farm labour	Positive – major
LL2	Risk of livelihood losses for beneficiaries due to increased financial pressure on beneficiaries	Minor
LL3	Risk of livelihood losses for beneficiaries and other land users due to loss of soil fertility	Minor
LL4	Risk of livelihood and losses for non-project beneficiaries due to decreased availability of water	Minor
OHS2	Occupational health and safety and labour rights related to installation and well drilling	Negligible to Minor
OHS3	Occupational health and safety of farm labour	Minor
OHS4	Labour rights for farm labour including the risk of child labour and forced overtime	Negligible to Minor
CHS1	Increased risk of water-borne disease due to poor drinking water quality	Minor
CHS2	Increased transmission of vector-borne diseases	Minor
CHS3	Increased pressure on health infrastructure care and access to health care	Minor
CC1	Increased tensions between communities, producers, and beneficiaries over land ownership and water availability in the dry season	Minor
CH1	Potential damage to archaeological or cultural heritage elements in the Project Area	Minor

Source: ERM, 2018

Table I.7 Summary of Impact Assessment: Non-routine events

Impact Code	Impact Name	Residual Impact
Acc1	Affection to the soil quality and water resource quality due to accidental spills of fuel (diesel) and/or wastes (lubricants, bentonite-based muds)	Low

Source: ERM, 2018

Table I.8 Summary of Impact Assessment: Cumulative impacts

Other projects considered	Residual Impact
Impacts which are the result of the combination of activities associated with the Alto Aguan Project (i.e. irrigation activities and water use) together with other similar ongoing or foreseen activities	Not Significant

Source: ERM, 2018

I.8. EMBEDDED AND MITIGATION MEASURES

For those significant impacts identified, a series of mitigation measures additional to the already considered in the design of the project (e.g. embedded measures) have been proposed.

The implementation of mitigation measures aims to prevent and reduce the possible negative effects of the project activities to a tolerable level.

In addition to the positive impacts identified in the socio-economic environment, a series of enhancement measures have been identified.

I.9. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The main objective of the Environmental and Social Management Plan (ESMP) is to provide a framework for the implementation of the measures identified in the impact assessment to avoid, mitigate or offset adverse impacts and to minimise and manage risks on the physical, biological and social environments from Project activities.

The broad purpose of the ESMP is to:

- Ensure that good industry practice with regards to environmental and socioeconomic management is adopted during all phases of the Project (pre-operation, operation and abandonment);
- Define strategies and methods and control approaches to ensure implementation of measures to effectively mitigate potentially adverse environmental or socioeconomic impacts;
- Provide a framework for compliance monitoring (auditing and inspection) by which the identified responsible parties will assure that the environmental and socioeconomic performance commitments of the Project are being met.

The proposed mitigation measures as well as the embedded measures of the Project design make reference to a number of specific management plans that will need to be developed to address in detail key areas of potential environmental and socioeconomic impacts and risks. The following plans and programs are foreseen for the Project in the context of the mitigation and embedded measures proposed based on the outcomes of the impact assessment as well as the Project design.

- Permitting Action Plan.
- Water Management Plan.
- Biodiversity Management Plan.
- Good Practice Irrigation Guideline.
- Pesticides, Herbicides and Fertilizer Management Plan.
- Waste Management Plan
- Cultural Heritage Management and Monitoring Plan
- Occupational Health and Safety Guidance.
- Community Health Management Plan.
- Training Management Plan.
- Monitoring Plan.

Additional management plans may be introduced as the Project progresses to aid in the management of any newly identified impacts or sensitive receptors or changes that may occur in the course of Project implementation.

These plans are regarded as 'live' documents and will need to be updated periodically as the implementation of the Project evolves.

Environmental and Social Impact Assessment (ESIA) for the Alto Aguan River Valley Irrigation Project in Honduras

PAA Project Finance A/S

Rev.03

January 2019

The business of sustainability

ERM

Environmental and Social Impact Assessment (ESIA) for the Alto Aguan River Valley Irrigation

PAA Project Finance A/S

Rev.03

For ERM

Approved by: Maria Quintana

Title: Partner

Date: 25 January 2019

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LIST OF ANNEXES

LIST OF ACRONYMS

ABC	American Bird Conservation
AHJASA	Honduran Society of Administrative Boards of Water Systems *(Asociación Hondureña de Juntas Administradoras de Sistemas de Agua).*
AJAASPIB	*Asociación de Juntas Administradoras de Agua del Sector Sur del Parque Nacional Pico Bonito).*
ALARP	As low as reasonable practical
AMHE	Habitat Comanagement Agreement By Species of the Honduran Emerald Hummingbird (Convenio de comanejo del Hábitat Por Especie del Colibrí Esmeralda Hondureño)
ASCDE	Association of Research for the Ecological and Socioeconomic Honduran Development (Asociación de Investigación para el desarrollo hondureño ecológico y socioeconómico)
ASIDE	Research Association for Ecological and Socioeconomic Development (*Asociación de Investigación para el Desarrollo Ecológico y Socioeconómico*)
ASL	Above sea level
BAP	Biodiversity Action Plan
CBO	Community-Based Organisations
CCAFS	Climate Change, Agriculture and Food Security
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security.
CEDEX	Center of Studies and Experimentation of Public Works *(Centro de Estudios y Experimentación de Obras Públicas).*
CESCCO	Pollutant Control and Study Center *(Centro de Estudios y Control de Contaminantes).*
CGIAR	Consultative Group on International Agricultural Research
CGIAR	Consultative Group for International Agricultural Research
CH4	Methane
CICC	Inter-institutional Climate Change Committee (Comité Interinstitucional de Cambio Climático)
CINSA	Consultores en Ingenieria
CITES	The Convention on International Trade in Endangered Species of Wild Fauna and Flora
CITES	The Convention on International Trade in Endangered Species of Wild Fauna and Flora.
CMS	Content Management System
CO	Carbon oxide
CO2	Carbon dioxide
COMAS	Municipal Water and Sanitation Commission *(Comisión Municipal de Agua Potable y Saneamiento).*
CONASA	National Council on Drinking Water and Sanitation (Consejo Nacional de Agua Potable y Saneamiento)
CONASA	National Council on Drinking Water and Sanitation *(Consejo Nacional de Agua Potable y Saneamiento).*
COPECO	Permanent Commission of Contingencies (*Comisión Permanente de Contingencias*).
CR	Critically endangered
CREA	(Environmental Training Regional Center - *Centro Regional de Educación Ambiental*)
CRELES	Milk Collection Centers
CRES	*(Centro de Recolección y Enfriamiento de Leche).*
CURLA	Regional University Center of Aguan Valley (*Centro Universitario Regional del Valle Aguan*
dBA	Decibel
DD	Data Deficient

DECA	Direction of environmental assessment and control *(Dirección de Evaluación y Control Ambiental).*
DICTA	Dictatorate of Agriculture Science and Technology
DNCC	National Directorate for Climate Change (Dirección Nacional de Cambio Climático)
DOLE	American agricultural multinational corporation
EBRD	The European Bank for Reconstruction and Development
ECA	Environmental Compliance Aproval
EE	Economy and employment
EER	Coefficient of energy efficiency
EHS	Environmental Health and Safety
EKF	Denmark's Export Credit Agency
EN	Endangered
ENCC	National Climate Change Strategy (Estrategia Nacional de Cambio Climático)
ENCC	National climate change strategy *(Estrategia Nacional de Cambio Climático).*
ENEE	*(Empresa Natural de Energia Electrica).*
EPA	Environmental Portection Agency
ERM	Environmental Resource Management
ESIA	Environmental social impact assessment
ESMP	Environmental and Social Management Plan
EU	European Union
FAO	Food and Agriculture Organization
FENAGH	National Farmers Stockbreeders Federation of Honduras
FETRIXY	Federation of Xicaque Tribes of Yoro
GDP	Gross Domestic Product
GEO	Global Environmental Outlook
GHG	Greenhouse gases
GHG	Greenhouse Gases
GM	Grievance mechanism
GPS	Global Positioning System
GW	Ground Water
GWh	Gigawatts hour
H2O	Water
HC	Hydrocarbon
ICEP	Institute for Cooperation in Development Projects (Instituto para la Cooperación en Proyectos de Desarrollo).
ICF	National Institute of Forest Conservation and Development, Protected Areas and Wildlife (Instituto Nacional de Conservación y Desarrollo Forestal, Áreas Protegidas y Vida Silvestre)
ICF	Institute of Conservation and Development *(Instituto de Conservación y Desarrollo).*
IFC	International Finance Corporation
IHT	Honduran Tourism Institute
INA	National Agrarian Institute *(Instituto Nacional Agrario).*
INAH	Honduran Institute of Anthropology and History *(Instituto Hondureño de Antropología e Historia).*
INFOP	National Institute for Professional Training *(Instituto Nacional de Formación Profesional).*
IPC	Integrated Pest Control
ITCZ	Intertropical Convergence Zone (Zona Intertropical de convergencia)
ITCZ	Intertropical Convergence Zone
IUCN	International Union for Conservation of Nature and Natural Resources
Kti	Cretacic plutonic intrusions
Kva	Angels Valley Group
LC	Least Concern
LEYDE	Leche y Derivados S.A.
LULUCF	Land use, land-use change, and forestry

MP	Management Plan
MW	Megawatts
N2O	Nitrous oxide
NGO	Non-governmental organization
NOx	Nitrogen oxides
NT	Near threatened
OOPEC	Office for Official Publications of the European Communities
PAT	Lands Management Program (*Programa de Administración de Tierras*)
PIUY	Project Implementation Unit
PM	Particulate Matter
PM10	Particulate matter
PNUD	United Nations Development Program (Programa de las Naciones Unidas para el Desarrollo)
PNUD	UNDP United Nations Environment Programme
PS	Performance Statement
PVC	Polyvinylchloride
RTN	National Tax Registry
RVSCEH	Wildlife Refuge for Hummingbird Emerald (Refugio de vida Silvestre Para Colibrí Esmeralda)
SAG	Secretariat of Agriculture and Livestock (*Secretaría de Agricultura y Ganadería*)
SAGO	Farmers and stockbreeders society of Olanchito
SEDINAFROH	Secretary of State for Indigenous and Afro-Honduran Peoples *(Secretaria de Estado de Pueblos Indígenas y Afrohondureños).*
SEFIN	Ministry of Finance of Honduras (*Secretaría de Finanzas de Honduras*)
SEIP	Social Environmental Investment Plan
SENASA	National Agricultural Health Service (*Servicio Nacional de Sanidad Agropecuaria*)
SEP	Stakeholder Engagement Plan
SERNA	Secretariat of Natural Resources and Environment (Secretaría de Recursos Naturales y Ambiente)
SINIT	National System of Territorial Information (Sistema Nacional de Información Territorial)
SINIT	Sistema Nacional de Información Territorial
SINIT	National System of Territorial Information *(Sistema Nacional de Infromación Territorial).*
SPR	Source Pathaway Receptor
SW	Surface water
TNC	The Natural Conservatory
TSP	Total suspended particles
UAP	Project Management Unit (*Unidad Administradora de Proyectos*)
UEP	Unidad Ejecutora de Proyecto
UICN	Unión Internacional paca la Conservación de la Naturaleza
UMA	Municipal Unit of the Environment (*Unidad Municipal del Ambiente*)
UN	United Nations
UNAH	National Autonomous University of Honduras (*Universidad National Autonoma de Honduras*)
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNESCO	United Nations Educational, Scientific and Cultural Organization
USAID	United States Agency for International Development
VOCs	Volatile Ogranic Compunds
VU	Vulnerable
WHO	World Health Organization
WHS	Worker Health Safety
WMP	Waste Management Plan

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LIST OF FIGURES

1 INTRODUCTION

1.1 OVERVIEW

PAA Project Finance A/S (hereafter referred to as PAA Project Finance), has appointed Environmental Resources Management (ERM) to act as an independent environmental and social consultant to undertake the Environmental and Social Impact Assessment (ESIA) for the Alto Aguan River Valley Irrigation Project in the Olanchito and Arenal municipalities in northern Honduras (hereafter known as "the Project").

The Project is an initiative of the Secretary of Agriculture and Livestock (*Secretaría de Agricultura y Ganadería* or SAG), ascribed to the Government of Honduras, to improve the socioeconomic status of the population in the Alto Aguan River Valley. This objective is sought through the efficient and sustainable use of soil and water resources for the existing livestock and milk production, as well as improving agricultural activities in the valley, by supplying irrigation equipment to selected beneficiaries in the area.

The Government of Honduras is receiving financing from ING Bank, and EKF, Denmark's Export Credit Agency, to transform the Alto Aguan river valley and is expected to conduct the activities in line with the World Bank Group Standards: IFC Performance Standards and IFC/World Bank Environmental, Health and Safety (EHS) General Guidelines.

The Government of Honduras, through the SAG, has awarded PAA Project Finance the contract for delivering irrigation sets and accessories, and two drilling vehicles, in addition to training SAG technicians/trainers in their use and maintenance. PAA Project Finance assumes no responsibility for the subsequent operation, use, and decommissioning of the irrigation system.

According to local regulations, the Project does not require the development of an Environmental and Social Impact Assessment (ESIA), as the activities that will be carried out, namely the supply of equipment such as portable pumps and irrigation units, and water-well drilling, are not subject to a specific environmental licence. However, in 2017, PAA Project started developing an Environmental and Social Impact Assessment (ESIA) to comply with lender requirements. Currently, PAA Project Finance has commissioned ERM to update and finalize the draft 2017 ESIA, according to the gaps in this ESIA identified by lenders. Additionally, ERM, on behalf of PAA Project Finance and the SAG, will develop all the required management plans over a four and a half months period, once the ESIA is approved.

The Project is located in the Alto Aguan Valley in Honduras, in the Olanchito and Arenal municipalities, in the Yoro department. A small portion of the Project Area also touches the municipalities of Jocón and Sabá. The Project Area covers approximately 60,000 ha, which encompass the 3,110 ha of

agricultural land to be irrigated. There are a total of 54 hamlets (*aldeas*) and 133 settlements (*caseríos*) within this larger area.

Figure 1.1 Project Location

Source: ERM, 2018

1.2 PURPOSE OF THE REPORT

This report presents the results of the Environmental and Social Impact Assessment (ESIA) undertaken for the Alto Aguan River Valley Irrigation Project in the Olanchito and Arenal municipalities in northern Honduras, hereafter known as "the Project".

The information contained in this report, along with the comments and inputs received from stakeholders and commenting authorities, will assist the SAG, owner of the Project, to manage environmental and social activities and impacts throughout the lifespan of the Project. It is noted that the involvement of PAA Project Finance will be limited to the initial phase of the Project when the equipment will be delivered and the training provided.

The environmental and social impact assessment process involves the identification, prediction, and evaluation of actual and potential environmental and social impacts of a Project, and outlines proposed mitigation measures for negative impacts, as well as enhancement measures for positive impacts resulting from the Project.

The objectives of this document are to:

- communicate the results of the ESIA process for the proposed Project and alternatives considered;

- ensure that the impacts identified during the ESIA process are assessed;
- present the mitigation and enhancement measures which will be implemented by the Project to manage any impacts identified;
- provide a record of comments and responses received from Interested and Affected Parties (I&APs) during the ESIA process; and
- facilitate an informed decision-making process by the SAG-PIU and other relevant institutions.

1.3 PROJECT OBJECTIVES

The Alto Aguan River Valley is a geographical area with rainy and very dry seasons, where livestock production activities (the dominant economic activity in the region) are affected during the dry season due to a lack of grass (*pasto*) for pasturing the cattle. Over an average of four months, from January to April, the lack of rain limits the availability of water for agricultural activities. There is a risk that climate change effects could prolong the dry seasons, affecting the agricultural productivity of the valley to an even greater extent.

The activity in the valley is based around small and medium-sized livestock producers. Although the water resources in the Alto Aguan River Valley are abundant, the climatic limitations have restricted any agricultural intensification and diversification, which in turn make producers very vulnerable to market variations.

For this reason, the purpose of the Project is to take advantage of the water resources available in the area around the year in order to effectively use them for crop irrigation. By implementing individual irrigation systems across the Olanchito and Arenal municipalities, producers will be able to maintain their agricultural production throughout the year, even increasing the quality of yields, and potentially increasing the profitability of the farms, the number of jobs, and ultimately contributing to the settlement of the population. Yearlong use of water resources will help solve current problems related to the agriculture as well as feeding livestock during the dry season, which worsen livestock conditions and reduce milk production.

The commitment of the Project is to ultimately improve the economy of the area, through job creation, higher productivity of its fields, and greater competitiveness of the current local livestock and milk production, as well as improving the agricultural sector.

The Project aims to contribute to the rural development of the valley and pursue, through the sustainable management and exploitation of the irrigation system, the following results:

- increased and improved livestock conditions and milk production during the dry season thanks to irrigation systems installed in cattle pastures, by optimising irrigation according to the needs of the plant.

This increase could reportedly be as much as 40%, depending on the crops, as the farmers will be able to irrigate in the most optimised way possible according to the needs of the plants in each vegetative cycle;

- high reliability and flexibility of supply, and increased value of agricultural production;
- collective management of irrigation;
- increased technical efficiency of irrigation and efficient use of water resources through training on efficient irrigation, water-use optimisation, and good agricultural practices. This increase aims to:
    - reduce water use by up to 40%, contributing to sustainable environmental development;
    - avoid soil and aquifer pollution as a result of an adequate irrigation; and
    - mitigate drainage problems, erosion, water pollution, and overexploitation of aquifers.
- improved environmental quality;
- economic diversification through the possibility of growing a higher number of crops, allowing farmers to adjust more easily to any market variations;
- increased labour demand, increased employment, and improved working and living conditions for farmers, having a consequently positive effect on potential population settlement in rural environments;
- poverty alleviation, through the creation of wealth and employment, potentially boosting the economic and social development of the municipalities;
- potential gender equality through increased job opportunities and improved economic conditions for the population; and
- positive influence on the creation or establishment of agro-food industries related to the crops grown thanks to the irrigation system, consequently also increasing job opportunities.

The alternative to not implementing this Project (alternative no-project) is presented in *Section 3.7*.

1.4 PROJECT PROPONENT

PAA Project Finance is a project management and project finance firm that is part of the Aarsleff Group. PAA Project Finance provides project trade finance services for infrastructure projects in developing countries.

The firm holds a proven track record of successfully completed projects within secondary healthcare, the rehabilitation and construction of potable water and wastewater treatment plants, irrigation projects, as well as light rail and airport projects.

Their core values, policies and corporate social responsibility comply with those of the Aarsleff Group, and use the standards OHSAS 18001 – Occupational health and safety management, DS/ISO 9001 – Quality management and DS/ISO 14001 – Environmental management as a reference whenever this is relevant to their services and customers. Further information on PAA Project Finance standards are presented in *Chapter 2- Legislation and Policy Framework*.

PAA Project Finance handles the entire process from project identification, financing, sourcing and purchasing, to logistics and progress reporting.

Focus is set on providing continuous, professional and efficient project management services to its clients. Through strong international relationships with key stakeholders, contractors and reputable financial institutions, PAA Project Finance assists their clients in ensuring a reliable and efficient management of their projects.

1.5 PROJECT CONSULTANTS

1.5.1 ERM

ERM Iberia S.A. (which is part of the ERM group; hereinafter ERM) was appointed by PAA Project Finance to undertake the ESIA for the proposed Project. ERM have no financial ties to, nor are they a subsidiary, legally or financially, of PAA Project Finance.

ERM is the world's leading provider of sustainability services covering the full spectrum of environmental, health and safety, risk, and social consulting issues. ERM has more than 160 offices in over 40 countries and employs over 5,000 specialists representing more than 30 disciplines, including engineering, natural and earth sciences, social sciences, economics, planning, and business management. ERM combines local focus with a global scale, providing a unique platform from which to understand local context and regulatory needs, as well as the unparalleled ability to leverage the best technical expertise around the world.

ERM is committed to operating in a socially, ethically, and environmentally responsible way. ERM's business is underpinned by a number of principles concerning the environment, business, and people. These include conducting business with integrity, and applying ethical principles to ERM's relationships with clients, employees, suppliers and other stakeholders.

1.5.2 CINSA

Consultores en Ingeniería, S.A. (CINSA) is a Honduran consulting company that began operation on January 22nd, 1968.

CINSA is a certified company by the Honduran Secretary of State in the Office of Energy, Natural Resources, the Environment and Mining (*Secretaría de Energía, Recursos Naturales, Ambiente y Minas* or MIAMBIENTE), under Environmental Service Lender certification number. RE-00009-2002. CINSA holds ISO 9001:2008, among other certifications.

The company was involved in the development of the environmental impact assessment for the draft 2017 ESIA that was performed as a result of the 2016 and 2017 field surveys undertaken on site, in addition to a preliminary assessment of potentially interested beneficiaries. CINSA was also present during the field survey undertaken in June 2018.

1.5.3 Integra Ingeniería

Integra Ingeniería, S.L. is a Spanish consulting engineering company founded in 1997. The company developed the 2017 technical engineering aspects of the Project. The company has been involved in on-site field work in 2017 and 2018 and has undertaken an identification of Project needs, geological and hydrological analysis, and the design and selection of the irrigation technology solution.

1.6 REPORT STRUCTURE

The report is organised with the following structure:

- *Executive Summary:* presents a non-technical summary of the main findings of the environmental and social impact assessment as well as the environmental and social management plan.
- *Acronyms:* presents the list of acronyms used in this study.
- *Chapter 1 Introduction:* presents the objectives of the report, the Project background information and objectives, its location, and finally the report organisation.
- *Chapter 2 Legislation and policy:* presents the key applicable national legislation and policy framework, the applicable international standards, and the relevant internal policies and standards of the Company.
- *Chapter 3 Project description and alternatives:* presents the Project features and planned activities as well as their associated waste generation and resource use and emissions. It also presents the different parties responsible for each of the Project phases, and their roles. Finally, the different alternatives considered for the Project have been summarised.
- *Chapter 4 Stakeholder engagement:* presents a description of the different stakeholders involved in the Project activities and the consultation activities undertaken.
- *Chapter 5 Baseline:* provides a summary of the environmental and social baseline conditions in the Project Area. This section is based on publicly available data as well as information collected during the 2016, 2017, and 2018 field surveys.

- *Chapter 6 Impact assessment method:* describes the method and criteria applied for identifying and evaluating impacts, as well as a definition of mitigation and recommended measures. It also presents the impact matrix identifying the potential impacts assessed in *Chapters 7* and *8*.
- *Chapter 7 Assessment of environmental and social impacts****¡Error! No se encuentra el origen de la referencia.****:* presents the results of the assessment of the environmental and social potential impacts associated to the Project activities, including the mitigation measures proposed to reduce or enhance any potential negative or positive effects, respectively.
- *Chapter 8 Environmental and social management plan:* presents a summary of the mitigation measures proposed in the previous Chapter and the project commitments made throughout the ESIA, as well as the roles and responsibilities for implementing such commitments.
- *Chapter 9 References:* presents the list of references used in the development of this report.

The following annexes containing supporting information relevant to the ESIA are included:

Annex 1: Stakeholder Engagement Plan (SEP)
Annex 2: Assessment of potential beneficiaries (2017)
Annex 3: May 2018 field survey photo log
Annex 4: May 2018 field survey maps
Annex 5: Soil and water well profiles
Annex 6: Significant flora and fauna
Annex 7: List of settlements (aldeas and *caseríos)*
Annex 8: Summary of water balance
Annex 9: Critical habitat assessment

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2 LEGISLATION AND POLICY FRAMEWORK

This chapter provides a summary of the national environmental and social regulatory framework applicable to planned Project activities, mainly focused on the use of water resources and irrigation activities.

As the development of this Project involves funding from lender entities, WB/IFC Performance Standards have also been considered in order to ensure the Project complies with international good practice. In addition, the Project has to meet the Corporate Social Responsibility (CSR) standards of PAA Project Finance A/S. All these standards have been summarised in this chapter.

This chapter is therefore structured as follows:

- *Section 2.1 Honduran environmental and social legal framework:* presents the key Honduran environmental and social legislation relevant for the Project activities as well as the institutional framework with an interest or role in the Project.
- *Section 2.2 International and reference standards for the Project:* summarises the international conventions of interest for the Project ratified or signed by Honduras as well the WB/IFC Performance standards.
- *Section2.3 PAA Project Finance CSR standards:* provides an overview of PAA Project Finance A/S internal CSR standards of relevance for the Project.

2.1 HONDURAN ENVIRONMENTAL AND SOCIAL LEGAL FRAMEWORK

2.1.1 Overview

This section presents the legal basis in Honduras of the key environmental and social aspects relevant to the Project activities: environmental licensing requirements, water resources, climate change, flora and fauna, protected areas, as well as other legal instruments relating to the topics addressed throughout the study.

It also presents the government departments or national governing bodies and authorities with a role or interest in the Project.

2.1.2 Environmental and social regulatory framework

The legal basis for environmental protection in Honduras is established in General Environmental Law - Decree nº104-93 (*Ley General del Medio Ambiente*), dated 25th July, 1993. The General Environmental Law sets out the framework for the protection, conservation, restoration, and sustainable management of the environmental and natural resources in Honduras. It

also establishes the principles for environmental protection, which includes the EIA requirements for the development of certain potentially contaminating and degrading projects.

The most important environmental regulations applicable to this Project are summarised in *Table 2.1* along with references to the sub-sections of this Chapter where each decree is further explained.

Table 2.1 Environmental regulations applicable to the Project

Decree name	Area of relevance	Reference section
Environmental Impact Assessment		
Ministerial agreement nº08-2015 – Regulation of the Environmental Impact National System Law (SINEIA) modified by Ministerial agreement nº7-2016 and nº11-2016	Establishes the procedures and mechanisms of the Regulation of the Environmental Impact National System Law (Sistema Nacional de Evaluación de Impacto Ambiental; SINEIA).	Section 2.1.3
Ministerial agreement nº16-2015 – Environmental Categorisation Table	Establishes the sectors and activities that need to apply for environmental licences as well as the procedures to follow.	
Water resources		
Decree 181-2009 - General Water Act	Establishes the principles and regulations applicable to the proper handling of water resources for its protection, conservation, enhancement, and use.	Section 2.1.4 Water resources
Ministerial agreement nº084-1995 - National Technical Standards for Drinking-Water Quality	Establishes the adequate or maximum standard quality level for drinking water.	
Ministerial agreement nº043-2016	Authorises the Secretary of State in the Office of Energy, Natural Resources, the Environment and Mining, through the General Directorate of Water Resources, to be responsible for implementing the policies of the water sector.	
Climate change		
Decree nº297-2013 – Climate Change Act	Establishes the principles and regulations necessary to plan, prevent, and respond appropriately, in a coordinated and sustainable way, to impacts generated by climate change in Honduras.	Section 2.1.5
Flora, fauna and protected areas		
Decree nº98-2007 – Forestry, Protected areas and Wildlife Law	Establishes the principles for the management of forest resources, protected areas and wildlife, including protection, restoration, use, conservation, and development.	Section **¡Error! No se encuentra el origen de la**

Decree nº159-2005 – Protected area of Honduran Emerald Hummingbird	Declares the Honduran Emerald Hummingbird Protected area, under the category of Habitat Management Area.	**referencia.** and 2.1.7
Decree nº204-2011 - Honduran Emerald Hummingbird Wildlife Refuge	Declares the Honduran Emerald Hummingbird Wildlife Refuge.	
Decree nº32-2014 - Honduran Emerald Hummingbird Wildlife Refuge	Redefines the limits of the Honduran Emerald Hummingbird Wildlife Refuge.	

Source: ERM 2018

2.1.3 Environmental Impact Assessment (EIA)

Ministerial Agreement 016-2015, published on 6th October, 2015, contains an Environmental Categorisation used by the governing body establishing the sectors and activities that need to apply for an environmental licence. The procedures to follow are specified in Ministerial Agreement 08-2015, published on 14th September, 2015, which details the Regulation of the Environmental Impact National System (*Sistema Nacional de Evaluación de Impacto Ambiental* or SINEIA) coordinated by the Secretariat of State in the Office of Energy, Natural Resources, the Environment and Mining (*Secretaría de Energía, Recursos Naturales, Ambiente y Minas* or MIAMBIENTE).

The Project falls under the following environmental categorisations: Sector 01 – Farming; and Sector 10 - Infrastructure, Construction, and Housing. However, Sector 01 refers to specific types of crops that, in the case of the Project, depend on each individual producer. Moreover, in Sector 10 there are no activities listed similar to those that concern the Project with regard to water intake, transport, supply, provision, and utilisation through sprinkler irrigation.

As the **Project** is limited to the delivery and operation of irrigation equipment designed to irrigate up to 10 ha, as well as the delivery of trainings and because of the fact that among the conditions that need to be met by potential beneficiaries, the land plot to be irrigated cannot be located within the limits of any protected area, it **does not require environmental licensing**. With the aim of assuring the regulation compliance of the Project, an official letter request was sent to MIAMBIENTE, which confirmed the absence of environmental licensing requirements for the Project (see response from MIAMBIENTE presented in *Figure 2.1*).

Figure 2.1 Confirmation received from MIAMBIENTE on environmental licensing requirements

GOVERNMENT OF THE
REPUBLIC OF HONDURAS

MINISTRY OF ENERGY,
NATURAL RESOURCES,
THE ENVIRONMENT AND MINING

Tegucigalpa, M.D.C., 14 December 2017 OFFICIAL LETTER NO. DMA-1132-2017

Engineer
JACOBO PAZ BODDEN
Minister
Ministry of Agriculture and Livestock (SAG)
His Office

Dear Minister:

Further to the OFFICIAL LETTER NO. SAG-939-2017, in which this Secretarist of State is requested to inform of the technical documentation required for the category 1 projects, which must be submitted by the corresponding beneficiaries, regarding the activity of portable sprinkler irrigation systems that use surface sources and groundwater.

In response to the foregoing we hereby state to you that the activity of portable sprinkler irrigation systems is not contemplated in the Environmental Categorisation Table of Ministerial Agreement No. 016-2015. It should be mentioned that crop-growing activities are contemplated by number of hectares, and are located in the Environmental Categorisation Table from 3 hectares onwards. Consequently, the activity of irrigation as such is not classified in the Environmental Categorisation Table. However, in accordance with Article 30 of the Regulations of the SINEIA Executive Agreement No. 008-2015:

"All projects, works or activities that are under those of Category 1, are classified as of very low environmental impact or of very low environmental risk. As such they shall not be subject to fulfilling Environmental Licensing procedures. However, at the request of the interested party, they shall issue a corresponding Record of Not Requiring an Environmental Licence. If the projects are in an environmentally fragile area, an automatic ascent to the next category above applies, whilst therefore needing to apply the environmental assessment procedures that the existing regulations indicate".

With nothing further at present, we send you our greetings of the highest consideration.

[Stamp: MINISTRY OF ENERGY, NATURAL RESOURCES, THE ENVIRONMENT AND MINING – MIAMBIENTE – SECRETARY OF STATE – HONDURAS]

[Signature]
ENG. JOSÉ ANTONIO GALDAMES
SECRETARY OF STATE

G.A.
Archive

EDIF PRINCIPAL DESPACHO DE ENERGIA, RECURSOS NATURALES, AMBIENTE Y MINAS (MIAMBIENTE); 100 METROS AL SUR DEL ESTADIO NACIONAL
TEL. (504) 2232-9200 / 2232-1366/2239-3690; APARTADO POSTAL 1389,47102; www.miambiente.gob.hn
TEGUCIGALPA, HONDURAS, CENTROAMERICA

Source: MIAMBIENTE, 2017

During the environmental evaluation, there are two main regulations relevant to the Project that require stakeholder engagement:

Public Participation in the Environmental Assessment (Decree nº800-2015)

Public participation in the environmental evaluation is regulated by Executive Decree nº008-2015, in force since September 14th, 2015 (Chapter VII: Elements of the Environmental Assessment and Control Process) which declares the following:

- Art. 58: MIAMBIENTE will promote the participation of the general public during the environmental evaluation process, in all its phases, for any projects, work, or activities considered significant from the environmental point of view, according to the Principles of Proportionality and Gradualness.
- Art. 59: The proponent of the project, work, or activity subject to environmental assessment, in accordance with the terms of reference established by MIAMBIENTE, must involve the neighbouring population of the project area at the earliest possible stage of the ESIA preparation process.

However, as the Project requires no environmental licensing, no public participation is required.

General Water Act (Decree nº181-2009)

The General Water Act states that:

- Art.3: Citizen participation will be effective in the planning of water management, use, protection, and conservation.

This Act is described in detail in the following subsection.

2.1.4 Water resources

Article 3 of the *General Water Act, Decree nº181-2009*, in force since December 14th, 2009, declares the principles and foundations of water management. These include the following:

- Water is an essential resource for life, as well as social and economic development. Its protection and conservation constitute a priority action of the State.
- Human consumption has a preferential and privileged relationship over other uses.
- Water is a social resource, and its access will be equitable.
- Citizen participation will be effective in the planning of its management, use, protection, and conservation.
- The comprehensive management of the resource, linked to the water cycle and the natural environment, will take place with the involvement and responsibility of all Government bodies, their organizations.
- Remuneration for services will be linked to the use, protection, and conservation of water.

Art. 10 of the *General Environmental Health Regulations* classify water according to its use:

- for human consumption;
- for domestic use;
- for the preservation of flora and fauna;
- for agricultural and livestock use;

- for industrial use.

Article 7 of the General Water Act designates MIAMBIENTE as being responsible for the sectoral handling and management of the water resources. According to the same article, the framework for the management of water resources is organised as follows in hierarchal order:

1. The National Council of Water Resources
2. The Water Authority
   a. The National Institute of Water Resources
   b. Regional Agencies
3. Basin bodies, user bodies, and advisory councils.

However, this management structure is not yet in place due to the lack of regulation. The issue of new regulations is planned for the near future.

In the meantime, according to *Decree nºPCM-043-2016*, of 5th September, 2016, MIAMBIENTE is authorised, through its General Directorate of Water Resources, to implement the Water Sector Policies, including responsibility for registering water wells, as well as managing and authorising water contracts.

Articles 66, 69 and 70 of the General Water Act specify the permits, licences, and concessions necessary for water use and the procedure for requesting these, under the conditions that the water balance is not affected and drinking water availability is not limited. The use of water resources is regulated by the principles of (Art. 61):

- optimal human, social, and economic benefit
- durability and protection of the resource
- generation of minimum environmental impacts

Depending on the case, either the municipalities or the Water Authority will deliver this water use authorisation:

- Municipalities will grant water use rights through permits and licences in the case (among others) of irrigation systems not exceeding a total of ten (10) hectares, and in the case of agricultural use in farms whose consumption in isolation does not exceed 0.06 litres per second.
- The Water Authority (currently MIAMBIENTE through its General Directorate of Water Resources as mentioned previously) will grant rights of use through concession agreements for (among other things) irrigation systems which use infrastructure and irrigation systems of more than ten (10) hectares.

Associated to the use of water, Art. 49 states the existence of "environmental services costs, which are part of the costs that water users must assume and whose sole destination will be for conservation and protection of the water resource in the basin that generates them."

According to Art. 52, "any State institution, natural or legal person providing a public water supply service for human or industrial consumption, hydroelectricity, irrigation, tourism or aquaculture, recreational or scenic use, among others, with the aim of compensating for the environmental service of protecting the water resource in the producer basin, sub-basin, or micro-basin, shall incorporate a compensation cost into the established fee structure, so that it is charged to the end user of the environmental service; it is to be provided through the Water Authority, and it shall relate to the estimated value of the water resource according to the quality, quantity, and use variables."

2.1.5 Climate change

The *Climate Change Act, Decree nº297-2013*, has been in effect since 2013. It establishes the Inter-institutional Climate Change Committee (*Comité Interinstitucional de Cambio Climático* or CICC) as a permanent, consultative, deliberative, and advisory body responsible for formulating policies, monitoring, and social control to manage the reduction and prevention of the negative impacts of climate change and mitigate its adverse effects.

In the presidency of the Republic, the Presidential Delegation for Climate Change was set up with the aim of formulating and concluding the Water, Forest, and Soil Master Plan at the national level.

Within MIAMBIENTE, the National Directorate for Climate Change (*Dirección Nacional de Cambio Climático* or DNCC), established in Art. 14 of the aforementioned Climate Change Act, acts as the technical entity specialised in adapting and mitigating climate change, through which municipalities and different stakeholders have been trained in recent years.

2.1.6 Protected areas

The legislative framework for protected areas is set out in *Decree nº98-2007 – Forestry, Protected areas and Wildlife Law*, of 28th February, 2008. This establishes the requirement for preparing and updating management and operating plans for protected areas, as well as undertaking monitoring activities to verify their correct implementation. There are a total of 16 different categories of protected areas management in Honduras that correspond to the IUCN (International Union for Conservation of Nature and Natural Resources) standards.

The Institute of Conservation of Forestry, Protected Areas, and Wildlife (*Instituto de Conservación Forestal, Áreas Protegidas y Vida Silvestre* or ICF) is the entity in charge of managing protected areas.

Through the National System of Protected Areas (*Sistema Nacional de Areas Protegidas* or SPINAPH), created in 1992 under the General Environmental Law - Decree 104-93, and regulated by the Forestry, Protected areas and

Wildlife Law and Agreement nº921-97, protected areas must be declared and registered. There are a total of 91 protected areas registered in Honduras.

There is one protected area within the Project Area: the Honduran Emerald Hummingbird Wildlife Refuge (*Refugio de Vida Silvestre Colibrí Esmeralda Hondureño* or RVSCEH) (declared as such in Decree nº204-2011 of May 2011, and amended by Decree nº32-2014, which defines the revised limits of the area). This refuge consists of a series of isolated plots of different sizes, on which a dry tropical forest grows. This habitat in Honduras first received the designation of protected area through Decree nº159-2005.

2.1.7 Flora and fauna

The legislative framework for wild flora and fauna in protected areas is set out in *Decree nº98-2007 – Forestry, Protected areas, and Wildlife Law*. The ICF is the entity in charge of the protection, management, and administration of wildlife in the country.

Decree nº98-2007 establishes that any endangered flora species will be managed as per ICF policies and strategies aligned with the international conventions the country has ratified (i.e., IUCN and CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora).

According to the lists of species of flora and fauna of special concern in Honduras, developed by Honduran national institutions (SERNA, now MIAMBIENTE, and the General Directorate of Biodiversity), there are a total of 253 plant and 387 animal species of special concern. These include endemic fauna and flora, of national concern due to the ecological/economical value the species represent, as well as those included in IUCN and in CITES.

2.1.8 Other legal instruments

Below is a summary of other regulations in Honduras that are relevant to the project and which complement the aforementioned regulations.

Pesticides and related substances

The legal framework for pesticides and related substances in Honduras is essentially expressed in the following instruments:

- *Regulation on the Registration, Use and Control of Pesticides and Related Substances*, Agreement nº 642-98: this standard is the basis for regulating pesticides in the country. It establishes the general principles and procedures regulating the registration, use, and control of formulated synthetic pesticides, technical-grade active ingredients, processing aids, and related substances for agricultural use. After sufficient scientific data has been evaluated to demonstrate that a product is effective for the purpose intended and does not represent an unacceptable risk to health and the environment, when

used in accordance with recommendations for use, the sale and use of the evaluated substance can be approved.

- *Central American Technical Regulation RTCA 65.03.44: 07 - Pesticides for domestic and professional use,* of June 13th 2011: establishes the requirements for registering pesticides for domestic and professional use.
- *Phytozoosanitary Act, Decree nº 157-94*: revokes the Plant Health Law, Decree nº23 (17612), of February 24th, 1962. It aims to ensure the protection and health of plants and animals, and the conservation of their products and by-products, against the harmful action of pests and diseases of economic, quarantine, and human importance.

The National Service for Agro-food Health and Safety (*Servicio Nacional de Sanidad e Inocuidad Agroalimentaria* o SENASA) is, through the Pesticide Control and Use Department (DCUP), in charge of regulating and controlling the registration, manufacture, formulation, import, export, reshipment, distribution, sale, application, storage, management, and proper use of pesticides, fertilizers, and related substances.

Solid Waste Management

- *Regulation of the integral management of solid waste (Executive Agreement nº 1567-2010, dated October 1st, 2010):* regulates the integral management of solid wastes, including the prevention, reduction, storage and conditioning, transportation, treatment, and final disposal of waste, encouraging the use of these operations in order to avoid risks to health and the environment.

Air emissions

- *Regulation of Emissions of Pollutant Gases and Smoke of Motor Vehicles (January 13th, 2000):* states the maximum permissible levels for emissions of polluting gases and smoke and preventive measures, infractions, and sanctions.

Land property

- *Property Law, Decree nº82/04*: strengthens and grants legal security to owners of property, developing and executing a national policy that allows foreign national investment and access to property by all sectors of society.
- *Resolution of the Property Law nº3/10*: develops the principles, objectives, and provisions of the aforementioned Property Law in order to facilitate its application and achieve compliance.

Cultural Heritage Protection

- *Protection of Cultural Heritage Law, Decree nº220-97 (1997)*: aimed at defending, conserving, protecting, rescuing, and transmitting to

future generations the goods that constitute the Cultural Heritage of the Nation throughout the national territory and in jurisdictional waters.

Risk Management

- *National Risk Management System Law:* creates the National Risk Management System (SINAGER), establishing the Honduran legal framework that will help the country develop the capacity to prevent and reduce the risks of potential disasters, as well as prepare, respond, and recover from real damage caused by natural phenomena or by those generated by human activities.
- *Regulation of the National Risk Management System (SINAGER) Law, Agreement nº032-2010:* establishes the framework needed to assure the effectiveness and application of the above-mentioned *National Risk Management System Law.*

Labour

The labour legal framework in Honduras is essentially expressed in through following instruments:

- *Labour Code, Decree nº189-1959*: regulates the relationship between capital and labour, according to a base of social justice that guarantees workers the conditions necessary to carry out a normal life, in addition to equitable compensation for the investment.
- *Agreement nºSTSS-053-04 modifying the General Regulation for the Prevention of Work-related Accidents and Occupational Diseases*: reforms numerous articles of the aforementioned regulation regarding employer and worker obligations, training, composition, operation and functions of the Joint Health and Safety Commissions, the functions of the Occupational Safety Delegate, occupational health and safety programmes for preventing occupational hazards that should be provided by public and private employers, contractors and subcontractors, among other subjects.
- *Code of Childhood and Adolescence, Decree nº73-96:* enshrines the fundamental rights and freedoms of children; establishes and regulates the prevention and protection regime that the State guarantees to ensure their integral development, as well as creating the necessary bodies and procedures for offering them the necessary protection; facilitates and guarantees their access to justice; and defines the principles that should guide national policies relating to children.

2.1.9 Institutional Framework

The main government departments, national authorities, or organisations engaged in environmental and social governance in Honduras and that have a specific role or interest in the Project are described below:

Ministry of Agriculture and Livestock (SAG)

The Ministry of Agriculture and Livestock (*Secretaría de Agricultura y Ganadería* or SAG) was created by Decree n° 218-96, in accordance with the sectoral framework established by the Law for the Modernization and Development of the Agricultural Sector and the 2002-2006 Government Plan. It is responsible for coordinating the planning and execution of public sector agriculture policies.

The ministry integrates various directorates, including:

- SAG – SENASA: National Service for Agro-food Health and Safety (*Servicio Nacional de Sanidad e Inocuidad Agroalimentaria*)
- SAG – DICTA: Directorate of Agricultural Science and Technology (*Dirección de Ciencia y Tecnología Agropecuaria*)
- SAG – DIGEPESCA: Directorate of Fisheries and Aquaculture (*Dirección General de Pesca y Acuicultura*)
- SAG- DGRD: Directorate of Irrigation and Drainage (*Dirección General de Riego y Drenaje*)
- SAG – PRONADER: National Programme of Sustainable Rural Development (*Programa Nacional de Desarrollo Rural Sostenible*)
- SAG – UPEG: Planning and Evaluation Management Unit (*Unidad de Planeamiento y Evaluación de la Gestión*)

The Aguan Irrigation Project is a SAG initiative. The SAG-PIU will be in charge of implementing the Project through a Project Implementation Unit – PIU (*Unidad Ejecutora del Proyecto* or UEP). The SAG-PIU will comprise members of the SAG.

Secretary of State in the Office of Energy, Natural Resources, the Environment and Mining (MIAMBIENTE)

In 1993, with the promulgation of the General Environmental Law - Decree n°104-93, the Secretary of State in the Environment Office (*Secretaría de Estado en el Despacho del Ambiente - SEDA*) was created. In 1996, through Legislative Decree n°218-96, SEDA was replaced by the Secretary of Natural Resources and Environment (SERNA). In 2014, through Executive Decree PCM 042-2014, the National Institute of Forest Conservation and Development, Protected Areas and Wildlife (IFC) and the Honduran Institute of Geology and Mines (INHGEOMIN) were attached to the Secretary of State for Energy, Natural Resources, Environment and Mines (*Secretaría de Estado de Energía, Recursos Naturales, Ambiente y Minas*), renamed MIAMBIENTE.

MIAMBIENTE is in charge of the public and private coordination of environmental matters including water resources, renewable energy, climate change, hydrocarbons, environmental management, fauna and flora, and protected areas.

It is also responsible for the Environmental Impact Assessment process in Honduras through the Regulation of the Environmental Impact National

System (SINEIA). It issues the Environmental Licenses required for certain Project categories.

In addition, since 2016, MI AMBIENTE, through its General Directorate of Water Resources, has been the competent entity, according to Decree nº PCM-043-2016, for executing water sector policies, including registering water wells, receiving requests for water usage rights, and authorising these rights.

As such, for this Project MIAMBIENTE was first consulted regarding the overall Project compliance requirements, and will subsequently be consulted on water use permitting and environmental licensing issues, as part of the beneficiaries' responsibilities will be to obtain the necessary permits:

- the environmental licence for the type of crop they wish to farm;
- a request for water usage rights; and
- a permit for exploring and exploiting groundwater.

National Institute of Conservation and Development of Forestry, Protected Areas and Wildlife (ICF)

The National Institute of Conservation and Development of Forestry, Protected Areas and Wildlife (*Instituto Nacional de Conservaci6n y Desarrollo Forestal, de Áreas Protegidas y Vida Silvestre* or ICF) is integrated within MIAMBIENTE according to Decree nº PCM 042-2014. The ICF is in charge of managing the protected areas in Honduras under the National System of Protected Areas of Honduras (*Sistema Nacional de Áreas Protegidas de Honduras* or SINAPH).

In this Project, IFC as well as the Research Association for Ecological and Socioeconomic Development (*Asociación de Investigación para el Desarrollo Ecológico y Socioeconómico* or ASIDE) have been consulted regarding the management of protected areas, and specifically the Honduran Emerald Hummingbird Wildlife Refuge.

2.2 INTERNATIONAL AND REFERENCE STANDARDS FOR THE PROJECT

2.2.1 International conventions and multilateral agreements

With respect to environmental and social protection relevant to the Project, Honduras has ratified a number of international agreements. Those relevant to climate change, local content, and indigenous peoples are listed below.

With respect to climate change and biodiversity, which constitutes a relevant part of the Project rational, Honduras has ratified the following agreements:

- The RAMSAR wetlands Convention of 1971, ratified on 23rd October, 1993;
- The Convention on biological diversity, ratified by Honduras on 21st February, 1995;
- The Convention to combat desertification, ratified on 23rd June, 1997
- The Central American Convention for the protection of the environment, ratified on April 3rd, 1990.
- The Paris agreement on Climate Change, ratified on 21st September, 2016.
- The Kyoto Protocol (Kyoto, 1998); ratified on 19th July, 2000. In 2014, Honduras accepted the Doha amendment to the Kyoto Protocol.
- United Nations Framework Convention on Climate Change (New York, 1992); ratified on 19th October, 1995.
- Vienna Convention on the Protection of the Ozone Layer (Vienna, 1985); ratified on 20th September, 1979.
- Montreal Protocol on Substances that Deplete the Ozone Layer (Montréal, 1989); ratified on 14th October, 1993; and, in 2002, the Copenhagen Amendments.
- The United Nations Conference on Environment and Development (UNCED), ratified in June 1992.
- CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora), ratified in September 1979.
- Convention on the Conservation of Migratory Species of wild animals (CMS), of which Honduras has been a member since 2007.

In addition, with respect to local content regulations, in 2005 Honduras joined the International Convention of the United Nations on the Protection of the Rights of All Migrant Workers and their Families, in addition to being a member of the International Labour Organisation (ILO), and ratified 26 conventions of the ILO including:

- ILO Convention No. 87 on Freedom of Association and Protection of the Right to Organize,
- ILO Convention No. 98 on the Right to Organize and Collective Bargaining,
- ILO Convention No. 29 on Forced Labour,
- ILO Convention No. 105 on the Abolition of Forced Labour,
- ILO Convention No. 138 on the Minimum Age (of Employment),
- ILO Convention No. 182 on the Worst Forms of Child Labour,
- ILO Convention No. 100 on Equal Pay,
- ILO Convention No. 111 on Discrimination (Employment and Occupation)

With respect to the protection of indigenous peoples, Honduras has ratified the ILO Convention No. 169 on Indigenous and Tribal Peoples in Independent Countries (1989) and voted in favour of the 2007 Declaration of the United Nations on the Rights of Indigenous Peoples.

It is worth mentioning that the IUCN Red List of Threatened Species™ provides taxonomic, conservation status and distribution information on plants, fungi, and animals that have been globally evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those plants and animals that are facing a higher risk of global extinction, i.e., listed as Critically Endangered (CR), Endangered (EN), or Vulnerable (VU). Species in these three categories are regarded as 'threatened' and are therefore subject to special conservation attention.

In addition, CITES has created an international legal framework for the prevention of trade, which includes the following annexes:

- Annex I: lists species threatened with extinction and for which the trade in wild-caught specimens is illegal.
- Annex II: lists species for which trade must be controlled to avoid endangering the species.
- Annex III: list species for which one country has asked other CITES parties for assistance in controlling the trade. Species locally at risk. Trade only permitted with export permit and certificate of origin.

As an environmental treaty under the aegis of the United Nations Environment Programme, the CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. The CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.

These appendices list migratory species to which the Convention applies. The text of the Convention defines the basic obligations of the Contracting Parties towards species listed in Appendix I and Appendix II. These obligations are quite distinct for the two Appendices, and a migratory species can be listed in both Appendices at the same time, if the circumstances so warrant.

- Appendix I – Endangered migratory species
  Appendix I comprises migratory species that have been assessed as being in danger of extinction throughout all or a significant portion of their range.
- Appendix II - Migratory species conserved through Agreements
  Appendix II covers migratory species that have an unfavourable conservation status and that require international agreements for their conservation and management, as well as those that have a conservation status which would significantly benefit from the international cooperation that could be achieved by an international agreement.

2.2.2 *WB/IFC Performance standards*

The IFC, a division of the World Bank Group that lends to private investors, has released a Sustainability Policy and set of Performance Standards on Social and Environmental Sustainability (January 2012). These standards can be used either to evaluate a project seeking funding through the IFC, or as a benchmark of international good practice for projects that do not expect to seek financing from the IFC. For this Project, financing is sought from international financial institutions (IFI), in this case Denmark's Export Credit Agency, EKF. Many IFIs require the project to meet international standards of management and environmental and social performance. The international standards most widely used by the IFIs are the WB/IFC environmental and social performance standards.

Performance Standards provide guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities.

The WB/IFC Performance Standards are outlined in *Performance Standards*: Box 2.1.

- PS 1: Assessment and Management of Environmental and Social Risks and Impacts

Performance Standards:

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

Box 2.1 WB/IFC Performance standards

In the case of direct IFC investments (including project and corporate finance provided through financial intermediaries), the IFC requires its clients to apply the Performance Standards to manage environmental and social risks and impacts in order to enhance development opportunities (IFC, 2012).

The IFC Performance Standards are outlined in *Table 2.2*. Of the eight Performance standards, neither PS5 nor PS7 are applicable in this case as no land acquisition activities will be undertaken as a result of Project activities, and there are no indigenous communities or lands affected by the Project.

Table 2.2 References to WB/IFC standards in following section of the study

PS	Performance Standard	
1	Assessment and Management of Environmental and Social Risks and Impacts.	Underscores the importance of managing environmental and social performance throughout the life of a project (any business activity that is subject to assessment and management).
2	Labour and Working Conditions	Recognises that the pursuit of economic growth through employment creation and income generation should be accompanied by the protection of the fundamental rights of workers.
3	Resources Efficiency and Pollution Prevention	Recognises that increased economic activity and urbanisation often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels.
4	Community, Health, Safety and Security	Recognises that project activities, equipment, and infrastructure can increase community exposure to risks and impacts.
5	Land acquisition and involuntary resettlement	Recognises that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. **Not applicable** to the Project as no land acquisition activities will be undertaken as a result of Project activities.
6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	Recognises that protecting and conserving biodiversity, maintaining ecosystems services, and sustainably managing living and natural resources are fundamental to sustainable development
7	Indigenous peoples	Recognises that indigenous peoples (IPs) may be particularly vulnerable to the adverse impacts associated with project development, including risk of impoverishment and loss of identity, culture, and natural resource-based livelihoods. **Not applicable** as there are no indigenous people or lands affected by the Project.
8	Cultural Heritage	Recognises the importance of cultural heritage for current and future generations

2.3 *PAA PROJECT FINANCE CSR STANDARDS*

In 2007, The Aarsleff Group acquired PAA Project Finance (formerly called EAC Trading) as a fully owned subsidiary. PAA Project Finance services are rendered internally within the Aarsleff Group as well as to customers and partners in a global environment.

For this reason, PAA Project Finance policies and corporate social responsibility standards comply with those of the Aarsleff Group.

In addition, PAA Project Finance applies OHSAS 18001 – Occupational health and safety management standards, DS/ISO 9001 – Quality management standards, and DS/ISO 14001 – Environmental management standards whenever these are relevant to their services and customers.

The Aarsleff Group currently works on identifying the CSR matters that are most important to the Group and its stakeholders. The Group takes responsibility for its business activities and wants to ensure positive and clear coherence between the activities of the Group and a sustainable society.

The four main strategic areas of the Group are:

2.3.1 Environment and climate

The Aarsleff Group has incorporated a number of policies, principles and working methods to protect the environment on a short- and long-term basis. One of the relevant policies is the environmental policy, which describes the Group's awareness of their influence on the environment and how it works to protect it and prevent pollution.

The Aarsleff Group is committed to minimising their environmental impact through planning, design, and choice of method. The Group measures significant environmental parameters and seeks to minimise waste and excessive consumption of materials.

The environmental policy covers issues such as fuel efficiency, energy-saving measures, and purchasing products from environmentally friendly companies.

Furthermore, the Aarsleff Group's quality, environment and occupational health and safety management system (QE&OHS) provides guidelines for environmentally responsible actions and operating procedures.

2.3.2 Employees

The Aarsleff Group has been certified in occupational health and safety since 2009. To achieve its goals, it has developed a number of policies, principles and working methods all incorporated into everyday work routines.

The Group's occupational health and safety policy shows that it wants to offer attractive workplaces with a focus on occupational health and safety, job satisfaction, and lifelong development.

The Aarsleff Group has already incorporated OHS aspects in the design phase and method selection; prioritising order, tidiness, and a systematic

fitting out of the workplaces; and the Group continuously improves its occupational health and safety measures.

Aarsleff's One Company approach and Code of Conduct are the cornerstones for its code of good management. The OHS policy states that the Group wants a sound and stimulating working environment that enhances job satisfaction.

2.3.3 Society

The Aarsleff Group wishes to contribute to a sound, democratic, and competitive development of society. The Group aspires to comply with applicable competition legislation and oppose all types of corruption, including blackmail and bribery.

It has developed a guideline for compliance with competition legislation providing information on the prohibition of agreements or the exchange of information that coordinates tenders or splits up markets or customers.

As stated in its policy on respect for human rights, the Aarsleff Group wishes to avoid negative impacts on human rights, and it actively manages any negative impacts it may have caused or contributed to. The Group's approach is based on the UN Guiding Principles for Business and Human Rights.

Actively entering into applicable collective agreements is a fundamental principle of the Aarsleff Group, and it does everything possible to counteract social dumping.

2.3.4 External business partners

As stated in the Aarsleff Group quality policy, it complies with legislation, rules and agreements entered into, and customer satisfaction is an important quality parameter. It is committed to engaging in professional collaboration, making customer satisfaction a high priority.

Planning and preparation are essential to the Group, and it continuously seeks to improve through systematic control. In addition it deliberately seeks to cultivate a culture of improvement that allows experience and creativity to be communicated and applied.

The Aarsleff Group has defined a set of principles applying to "Activities with customers and business partners" that provides specific rules concerning gifts, lunches, dinners, study trips, and training courses.

Actively creating collaborations and good stakeholder relations on projects is a fundamental principle of the Aarsleff Group, as this benefits project implementation and increases stakeholder satisfaction.

2.3.5 Equality

Aarsleff Group believes that equality helps generate better results, wiser decisions, increased innovation ability, an improved internal working environment, and make the Group an attractive employer.

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3 PROJECT DESCRIPTION AND ALTERNATIVES

3.1 INTRODUCTION

The Project consists of establishing an irrigation system for 3,110 hectares of agricultural land located in the Alto Aguan River Valley in the Olanchito and El Arenal municipalities, in the Yoro department in Honduras.

By establishing individual irrigation systems, the Project, designed by the engineering company Integra Ingeniería and managed by PAA Project Finance, aims to support the Secretary of Agriculture and Livestock of Honduras (*Secretaría de Agricultura y Ganadería* or SAG), owner of the Project, to improve the socioeconomic status of the population in the Alto Aguan River Valley.

The Project activities under the direct responsibility of PAA Project Finance, include the delivery of irrigation equipment and its accessories, as well as providing training on in its use, maintenance and other relevant aspects to SAG representatives/trainers. These activities will be implemented exclusively during the pre-operation phase of the Project.

It is important to note that PAA Project Finance assumes no responsibility for assigning irrigation systems to beneficiaries nor the subsequent use and maintenance of these systems (activities that will take place during the Operation and Abandonment phases). The SAG, through the Project Implementation Unit – PIU (*Unidad Ejecutora de Proyecto* or UEP), will assume responsibility for establishing the Project (Pre-operation phase), while the SAG will directly manage and supervise the subsequent phases. A detailed account of the roles and responsibilities in the Project is presented in *Section 3.3* below.

This chapter presents the Project organisation and features, and outlines the various Project phases (pre-operation, operation, and abandonment) to be undertaken, including the roles and responsibilities involved in Project implementation and management. A summary of the different Project alternatives assessed is also presented.

3.2 PROJECT LOCATION

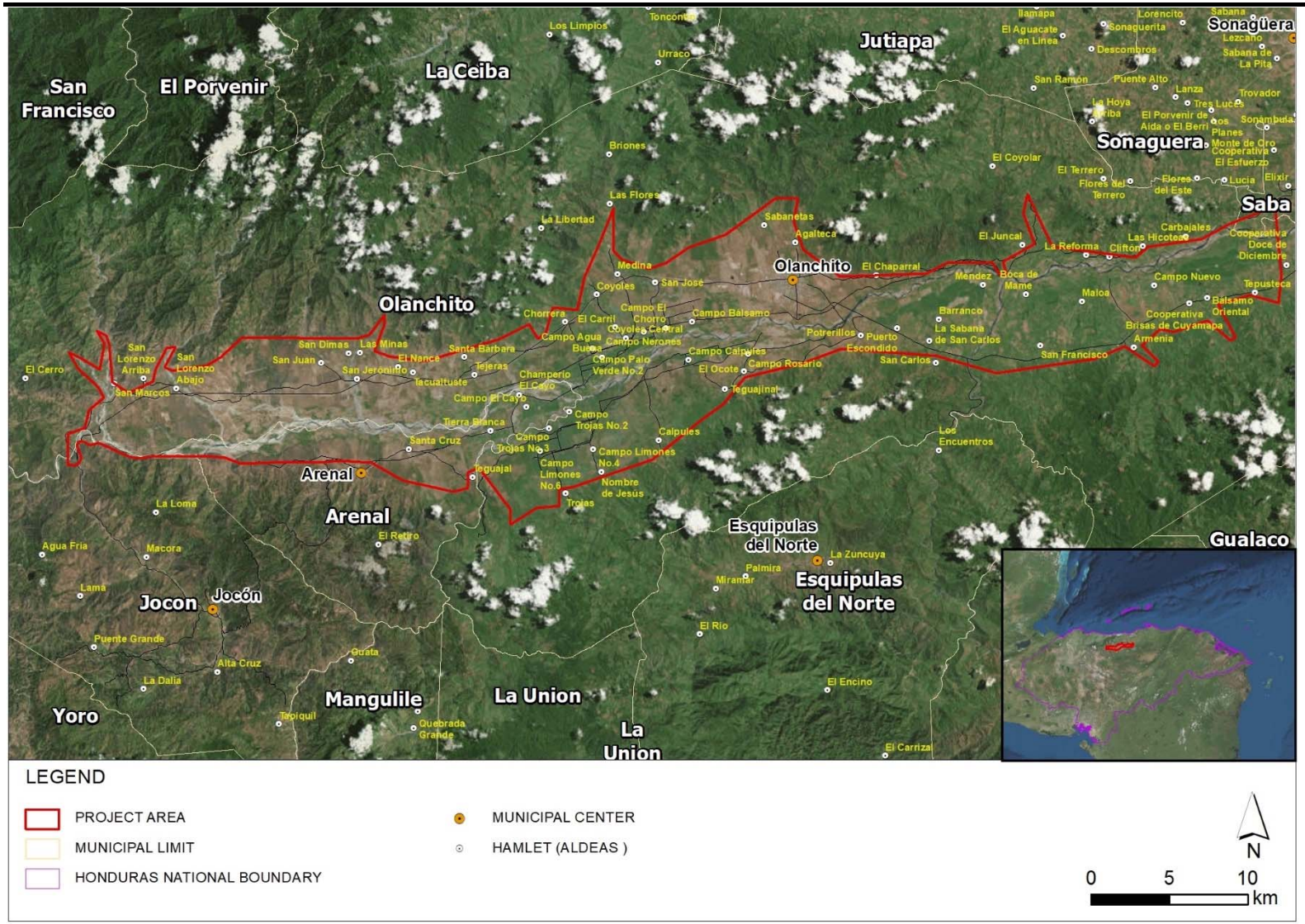
The Project is located within the Yoro department, within the Olanchito and El Arenal municipalities. A small portion of the potential areas to be irrigated touch the Jocón and Sabá municipalities.

The 3,110 ha to be irrigated are distributed over an area of 60,000 ha which coincides with the Alto Aguan River Valley area, and represents approximately 5.2 % of the total area of the Alto Aguan River Valley. The

specific locations of the plots to be irrigated will be defined only once the beneficiaries have been selected; the overall perimeter of the 60,000 ha that encompasses the maximum total area where the irrigation system may be implementation has been assumed as the Project Area (see *Section 3.4* for details on the beneficiary selection process).

Figure 3.1 shows the location of the Project Area.

Figure 3.1 Location of the Project Area



Source: ERM, 2018

3.3 PROJECT ORGANISATION AND MANAGEMENT

The Project is an initiative of the Secretary of Agriculture and Livestock of Honduras (*Secretaría de Agricultura y Ganadería* or SAG) ascribed to the Honduran Government. As such, the SAG is the owner of the Project. In order to deploy the Alto Agua Irrigation Project (the Project), the SAG plans to designate a Project Implementation Unit – PIU (*Unidad Ejecutora del Proyecto* or UEP), which will be in charge of implementing the Project during the pre-operation phase. After the establishing the Project, the SAG will supervise the irrigation operations throughout the Project lifetime. The PIU will be formed exclusively by members of the SAG.

The Government of Honduras, through the SAG, has awarded PAA Project Finance the contract for providing individual irrigation equipment for irrigating independent plots in the Alto Aguan River Valley. The engineering company Integra Ingeniería, managed by PAA Project Finance, has designed the irrigation system in close collaboration with SAG technicians and representatives of the local milk producers and farmers. The irrigation sets to be delivered to individual farmers consist of a combination of equipment pieces, diesel motor pump or a diesel fuelled generator together with a submersible pump, and each with two easy-to-handle travelling hose irrigators or micro-sprinkles, a set of pipelines, and associated accessories. Each irrigation system is designed to irrigate up to 10 ha of land. It is planned that a total of 311 irrigation sets will be supplied for the Project. which will be divided per set combination as follows:

- 95 units of surface diesel motor pump and two hose reel irrigators and metal pipelines
- 155 units with diesel fuelled generator + submersible pump and two travelling hose irrigators and metal pipelines
- 26 units of surface diesel motor pump, micro-sprinklers and PVC pipelines
- 35 units with diesel fuelled generator + submersible pump, micro-sprinklers and PVC pipelines

The irrigation systems will go to selected livestock and milk producers as well as farmers in the Alto Aguan River Valley. These will be chosen from among the approximately 400 milk producers and farmers present in the Project Area. They will be able to apply to become beneficiaries of the Project provided they meet the criteria set by the SAG and PAA Project Finance (details on the potential beneficiaries and the preliminary selection criteria they must meet are provided in *Section 3.4*).

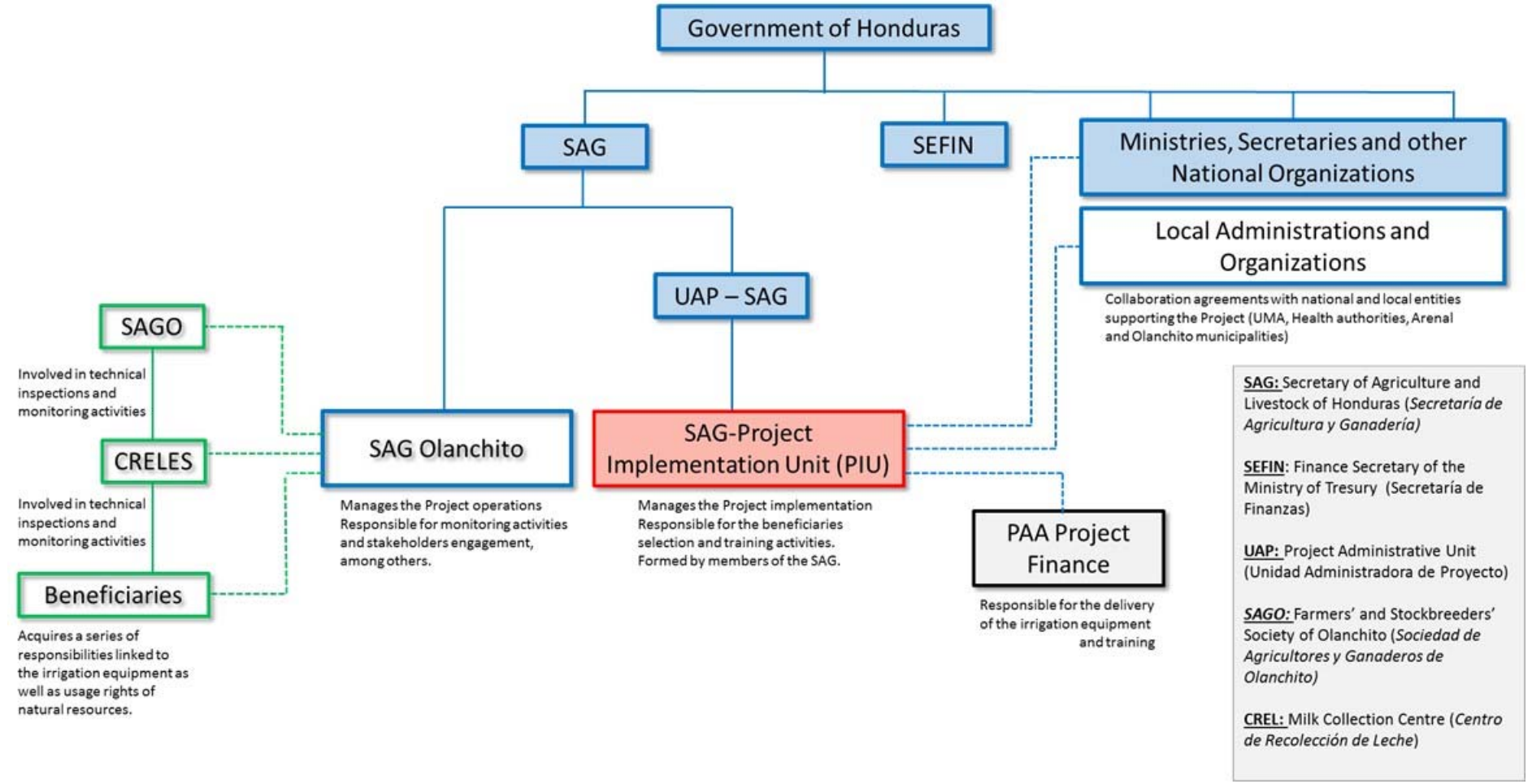
This selection process will be undertaken by the PIU of the SAG. It is envisaged that the Project could benefit between 250 and 300 beneficiaries in the area. Farmers will be able to apply for more than one irrigation set depending on land availability and resources. In addition to complying with the strict selection criteria set, beneficiaries will have to pay a fee (*canon*) to receive the irrigation equipment and accept the responsibilities acquired when

becoming a beneficiary of the Agua Irrigation Project (more details on beneficiary responsibilities are presented in detail in *Section 3.4)*.

The fee or *canon* will be established by the SAG based on socioeconomic criteria and a series of to-be-defined Project variables. To date (September 2018), these have not yet been established by the SAG. Their purpose is to ensure the long-term viability of the Project and the correct use of the equipment received. The fees collected will be used for the Project (e.g., for training purposes and supervision activities).

Figure 3.2, below, illustrates the parties involved in the implementation and management of the Project. The complete list of identified stakeholders involved in the Project and their role in the Project organisation is provided in *Chapter* ***¡Error! No se encuentra el origen de la referencia. ¡Error! No se encuentra el origen de la referencia.*** and *Annex A Stakeholder Engagement Plan (SEP)*.

Figure 3.2 Project organization and management



Source: ERM, 2018

3.4 *PROJECT BENEFICIARIES*

The potential Project beneficiaries are milk producers and farmers who are either independent farmers or members of a locally organized collective, such as a milk collection centre (*Centro de Recolección y Enfriamiento de Leche* or CREL), the Olanchito society of farmers and stockbreeders (*Sociedad de Agricultores y Ganaderos de Olanchito* or SAGO), or the Honduran federation of farmers and stockbreeders (*Federación Nacional de Agricultores y Ganaderos de Honduras* or FENAGH).

The majority[1] of the producers in the Project Area are members of a CREL, a common interest association. There are currently 16 CRELs in the Project Area. It was, however, reported during the June 2018 field survey that two new CRELs are being established. Each CREL has on average 30-50 members (see *Section 5.5.9* in *Chapter 5*).

It is estimated that the number of milk producers and farmers in the Project Area, and thus potential beneficiaries, is between 350 and 400. Of these approximately 48% are considered small producers (less than 40 ha of land) while 33% are categorized as medium size (40-80 ha of land). Only a small portion of the total potential beneficiaries have a landholding of more than 80 ha (see *Section 5.5.9* in *Chapter 5* for more details on potential beneficiaries).

3.4.1 *Selection criteria of beneficiaries*

During the project promotion stage where the first stakeholder engagement activities were undertaken in 2017, a conference was held at the SAGO offices to explain to members of the CRELs and SAGO the Project benefits and the beneficiary selection criteria (*see Chapter 4* for detailed account of engagement to date).

The selection criteria that was shared with potential beneficiaries was established by the SAG and PAA Project. The Project eligibility conditions that must be met are:

- the beneficiary must be the owner of the land plot to be irrigated;
- the land plot to be irrigated must not be located within the limits of any protected area;
- the land plot must not be situated within natural habitats such as shrubland or forest;
- there must be available water, either surface water or groundwater;
- the land must be flat; and
- the land plot must not be located on indigenous land.[2]

[1] Based on the field survey activities undertaken in 2017 and in 2018, it has been estimated that between 85% and 90% of the milk producers and farmers in the Project Area are members of a CREL.

[2] It has been confirmed by the Project that there is no indigenous land within the Project Area. However it was felt necessary to reinforce to potential beneficiaries the message that respecting indigenous rights was important to the Project.

Interested stockbreeders and milk producers and farmers will be reminded of the selection criteria early in the pre-operation phase (see *Chapter 4* for detailed account of future engagement).

During the assessments undertaken in November 2017, a preliminary survey was launched by CINSA and PAA Project Finance among potentially interested milk producers and farmers in the Project Area in order to better understand their interest and capacities as well as the potential distribution of land plots within the Project Area (details provided in *Annex 2*). A total of 301 milk producers and farmers responded to the survey of which 227 met the preliminary criteria. The location of the potential beneficiary farms identified during the November 2017 assessment is presented in the following figure:

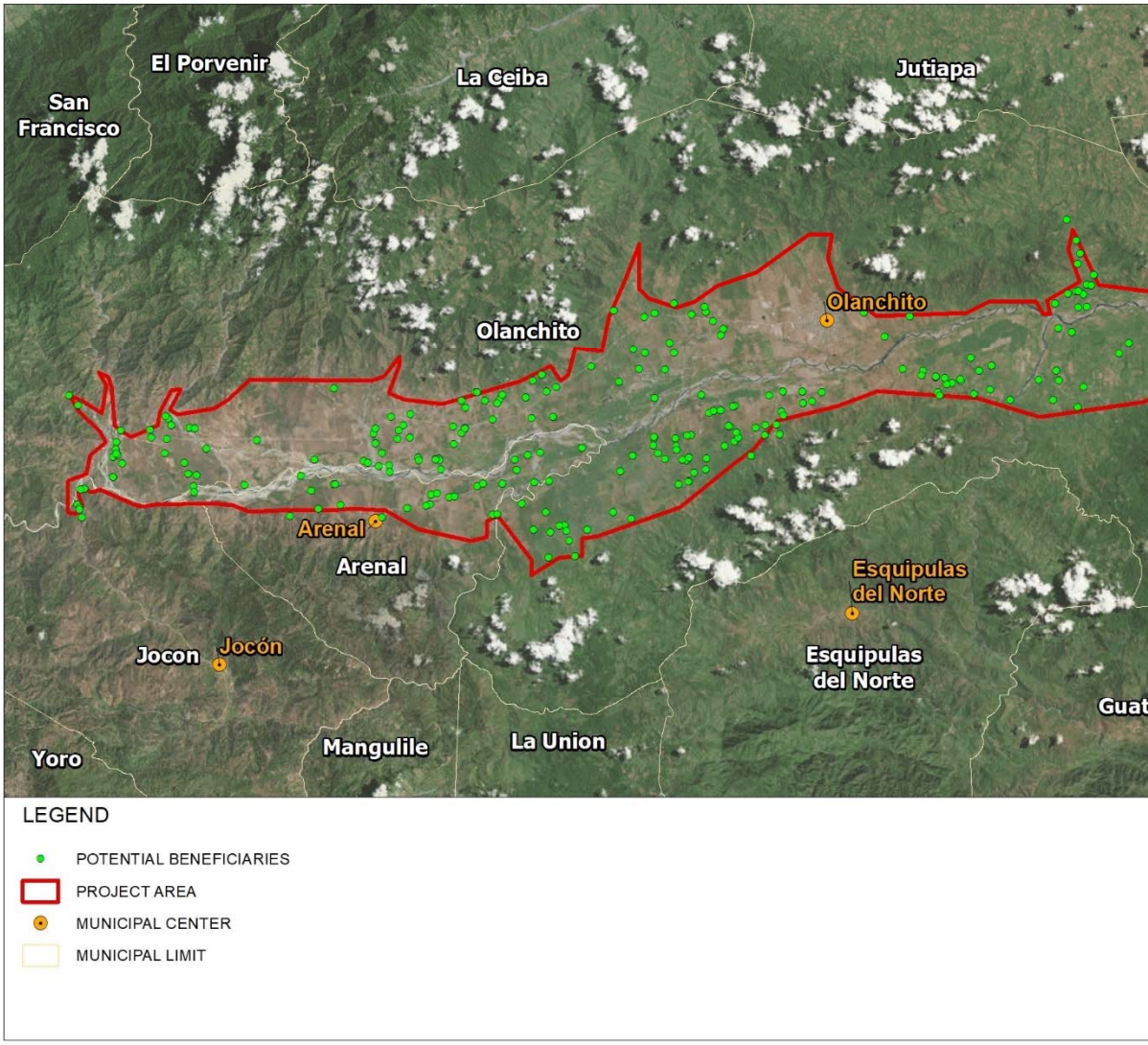


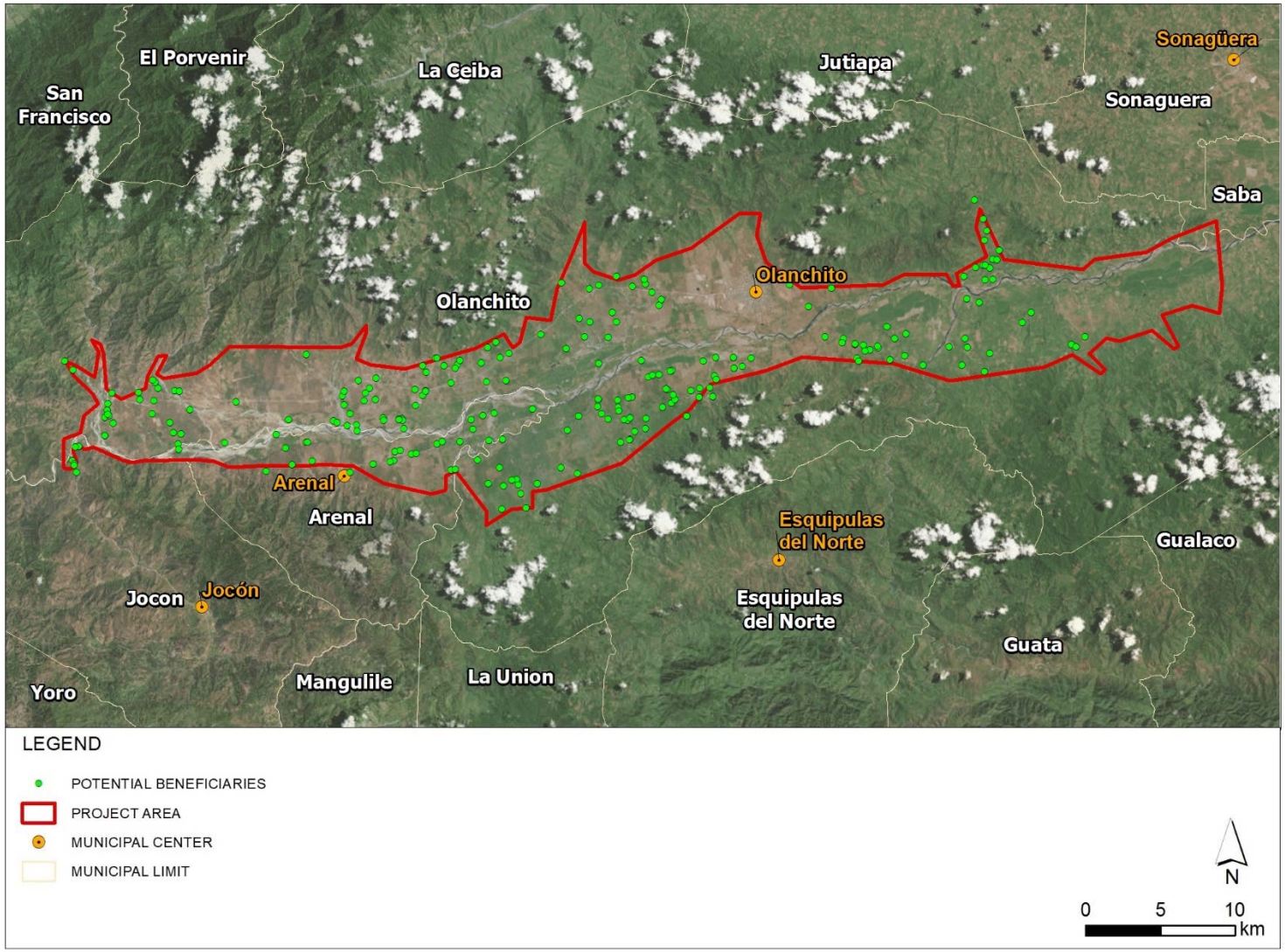
Figure 3.3 Distribution of potential beneficiaries (as per November 2017 assessment)

The figure shows how irrigated land would be evenly distributed across the Project Area.

It is expected that an official application process will be launched by SAG-PIU before start of the Project, planned for the first quarter of 2019.

The final list of potential beneficiaries will depend on the ultimate conditions that the beneficiaries will need to meet, their interest in the Project, and whether or not they accept the responsibilities they will acquire with regard to the Project, as presented below. The selection process will be managed by the SAG-PIU through a transparent process including direct information to all potential interested parties (see *Annex 1 SEP*).

Figure 3.3 Distribution of potential beneficiaries (as per November 2017 assessment)



Source: ERM, 2018 based on the November 2017 assessment undertaken by CINSA and PAA Project Finance

3.4.2 Responsibilities of selected beneficiaries

The responsibilities that the selected milk producers and farmers will acquire and therefore that they will need to accept prior to becoming beneficiaries, are presented below.

Table 3.1 Responsibilities of the selected beneficiaries

Aspect	Responsibility
Application	• Attesting to the veracity of all documents to be included in the file for the irrigation equipment application. • Attesting that the title deed submitted for the land where the irrigation system will be installed is free of all encumbrances, mortgages, and that they are the absolute owner of the property, as well as any other aspects of a legal nature that may affect their possession for a period of at least 10 years. • Complying with and attesting to all the requirements demanded in the operating regulations of the agreement between the SAG and the beneficiary, which are mainly indicated below: o Application signed by the applicant producer. o Photocopy of public deed or any other title that is registered in the Property Institute of the Department to which the property to be cultivated and the irrigation equipment to be installed are ascribed. o Photocopy of the applicant's identity document. o Photocopy of the applicant's National Tax Registry (numerical RTN). o Proof of neighbourhood of the applicant issued by the Municipal Mayor, or their representative, for the place where the property in the application is located. o Investment plan or crop feasibility study that is being, or will be, carried out.
Fee	• Once the application has been approved by the Ministry of Agriculture and Livestock, the benefit fee amount must be settled.
Permits	• The beneficiary takes the responsibility for processing all permits related to their productive and commercial activity, if any. • The beneficiary of the equipment must acquire all the usage rights for natural resources and any respective environmental permits necessary for their activity, which could include: o The environmental licence for the type of crop they wish to farm. o The water contract. o The permit for connecting any additional necessary equipment to the national electric power grid. o The permit for exploring and exploiting groundwater.
Other costs	• The beneficiary shall be liable for the costs of the environmental services regarding the use of water or the corresponding environmental compensation. • Covering all expenses for the loading, transport, and operability of the irrigation equipment from the city of delivery to its final destination (farm).

	• If necessary, covering expenses for the conditioning of their water source, such as the drilling of underground water wells or the construction of a dug well near a surface water supply, in addition to all the associated accessories, materials, and other work required for the proper installation and functioning of the equipment. • Acquiring, on their own, all the accessories or materials that are needed to install the irrigation equipment from the site of the water supply to their property, as well as that necessary for the proper functioning of the equipment. • Providing, on their own, all fluids such as lubricants, fuel, battery acids, and anything else necessary for the installation and start-up of the irrigation equipment received, as well as electric power if necessary. • Paying the compensation, where applicable, corresponding to third parties for the use of the irrigation equipment. • If the beneficiary producer sells or loses the equipment, they must reimburse its value to the General Treasury of the Republic, and should they fail to do so, a case must be submitted to the corresponding judicial authorities.
Use and maintenance	• Complying with the objectives and commitments established in the Conditional Donation Agreement, as well as with the technical assistance and manuals recommended for the irrigation equipment. • Correctly using and maintaining the irrigation equipment acquired through this Conditional Donation Agreement. • Carrying out, on their own, all the equipment and hydrant pipe installation work on the plot where the received irrigation equipment is going to operate. • Maintaining the equipment and its components, accessories, as recommended by the manufacturer or supplier. • Taking responsibility for any damage to the equipment due to mishandling, theft, or loss, and repairing or replacing the parts within a period of no more than 30 days after the event has been detected. • Additionally, they authorise the Ministry of Security or another related institution to designate the SAG to take the equipment away from them if they are not using it or are misusing it. The beneficiary will be responsible for transporting the equipment to SAGO's warehouse. • The irrigation equipment acquired through the agreement between the SAG and the beneficiary cannot be unused as this would imply the immediate termination of the equipment agreement, nor can it be sold or used as collateral for a loan with a natural person or financial entity, nor removed from the property to which it is assigned or belongs, unless this is with the approval of the SAG. • The irrigation equipment received by the beneficiary can only be handled or operated by the beneficiary and cannot be loaned, rented or temporarily used by any persons other than the beneficiary themselves.
Sustainability	• The responsibility for the management of water and soil resources lies with the beneficiary. The project only intervenes in raising awareness and contributes to the improvement of the educational offering for the beneficiary to acquire the knowledge and the will to implement preventive measures aimed at preserving the sustainability of the water and soil resources.
Technical inspections and monitoring	• Allowing the monitoring of the irrigation equipment for a period of no less than 10 years, by the SAG, SAGO, FENAGH, or the Environment Unit (*Unidad de Medioambiente* or UMA) of Olanchito, in order to verify its condition and correct operation. At the same time, providing information about the crops they are managing through its operation.

	• The beneficiary must authorise technical inspections by the SAG, as well as provide the information requested by the SAG on the use of the equipment and crop yields. • The SAG may authorise the transfer of the equipment or its damaged parts for repair, outside the property of the beneficiary.
Plot transfer or sale	• In the event of sale of the plot or transfer of ownership of the land exploited by the irrigation equipment, its beneficiary must deliver all of the Irrigation Equipment in good working condition to the SAG, whilst being responsible for all logistics expenses, as well as any other costs generated by this. The SAG will proceed to make a decision on the equipment. If the equipment is damaged, the beneficiary is obliged to replace it for the SAG so that it can be delivered to another producer in good condition. • In the event that the equipment is transferred to another property owned by the same beneficiary, this party must inform the SAG in order to determine the technical feasibility, attaching the relevant data on the new property that is to be exploited, whilst entering into a new agreement according to the data on that property and the adjoining areas.
Other	• Supporting the SAG in priority actions that are decreed in support of national food security or sovereignty.

Source: ERM 2018, based on information by SAG and PAA Project Finance, 2017

3.5 IRRIGATION SYSTEM IMPLEMENTATION

The Project consists of establishing and implementing an irrigation system. This irrigation system is made up of a set of Project irrigation equipment that is to be delivered by PAA Project Finance to the SAG as part of its main responsibilities in the Project.

Each of the elements of the irrigation system for which PAA Project Finance is responsible are presented in *Section 3.5.1*.

Section 3.5.2 provides a description of the irrigation system design and overall process: from each beneficiary's water input which can be either a groundwater or surface source, depending on each beneficiary and the location of their plot, to the area of land to be irrigated.

In addition to the procurement of additional equipment, beneficiaries will also be responsible for installing all the equipment, as well as any work necessary for conditioning their water source. The responsibilities regarding the implementation of the irrigation system are illustrated in *Section 0*.

3.5.1 *Project irrigation equipment*

PAA Project Finance is responsible for delivering a total of 311 sets of up to 10 ha irrigation equipment to the SAG for onward distribution to selected milk producers and farmers. An irrigation set comprises a combination of equipment pieces, diesel motor pump or a diesel fuelled generator with a submersible pump, and each with two easy-to-handle travelling hose irrigators or micro-sprinkles, and the irrigation pipeline with valves.
The distribution of equipment combination within the 311 irrigation sets will be divided per set combination as follows:

- 95 units of surface diesel motor pump and two hose reel irrigators and metal pipelines
- 155 units with diesel fuelled generator + submersible pump and two travelling hose irrigators and metal pipelines
- 26 units of surface diesel motor pump, micro-sprinklers and PVC pipelines
- 35 units with diesel fueled generator + submersible pump, micro-sprinklers and PVC pipelines

The Project irrigation technology to be supplied by PAA Project Finance has been designed to irrigate up to 10 ha of land per set of equipment. It has been assessed as being the most suitable for the current needs of the Project as it allows the highest number of beneficiaries to receive equipment, irrigation across a wide area, and it is more environmentally friendly than other potential alternatives (see assessment of Project alternatives in *Section 3.7*).

The irrigation equipment set to be provided by PAA Project Finance is presented in *Figure 3.4*, below.

Figure 3.4 Project irrigation equipment

PAA Project irrigation equipment

PAA Project is responsible for the delivery of an **irrigation set** designed to irrigate up to 10 ha of land.

Each irrigation set consists of the following main components:

- A mobile motor pump or a mobile diesel fuelled generator plus sub-mersible pump
- Two travelling hose irrigators, or micro-sprinklers
- A set of pipelines and accessories.

The **irrigation sets** will be delivered by PAA Project.

The Project equipment will be delivered by PAA Project and stored in the warehouse of the SAGO or other warehouse specified by SAG until the beneficiaries are selected by the SAG-PIU.

The equipment will have a guarantee of 12 months (motors, pumps, hose reels) and of 24 months (irrigation pipelines)

Mobile motor pump

The mobile motor pump of 42 HP will have a capacity of supplying 10 Litres per second at 8 bar pressure. The pump will be connected surface water source (constituting the intake section) and an irrigation network (constituting the output section). It will be diesel fuel-operated. The life expectancy of the motor pump is of 10,000 hours.

Kohler Engines, extracted from the technical sheet of the motor pump model Bomba Caprolli, 2018

Mobile diesel generator with submersible pump

The mobile generator will provide electrical power to the submersible electrical pump that will have a capacity of supplying 10 Litres per second at 8 bar pressure to the irrigation pipeline

Travelling hose reel irrigator and sprinkler

Fasterholt – Denmark extracted from technical sheet of hose reel irrigator model OT Plus, or equivalent unit.

Each irrigation kit will include two travelling hose irrigators, each with an integrated sprinkler. These are designed as easily transportable within the land plot allowing for the easy extension of the hose to up to 125 m. This will allow to irrigating the area progressively, in strips of land designed of 150x50 m^2. The hose irrigators will have a irrigation capacity of 12 m^3/h.

The sprinkler will have an irrigation radius of 25 m and it will have water output yield of 11 L/m^2 per irrigation.

The life expectancy of the hose irrigator and sprinkler is of 10 years.

Irrigation network

The pump output will be connected to an irrigation network composed of a set of pipelines and valves, either easy connection aluminium tube segments of 5.8 m length for the travelling hose irrigators, or PVC tubes to connect to the micro- sprinklers

Source: ERM, 2018 based on Integra Ingeniería's Technical Project

3.5.2 Irrigation process

Depending on the location of each beneficiary's plot, the source of irrigation water will vary. In the majority of the cases, beneficiaries will require the drilling of a groundwater well and subsequent pumping of groundwater to irrigate during the dry season. The groundwater source option has the advantage of maintaining stable water quality and quantity and is less vulnerable to surface contamination. However, in the event the beneficiary's plot is located near a surface water source, no drilled well will be required and when the water level is shallow and accessible a dug well or pit may be used as water source, to maintain a reliable source of water that does not dry up in the dry season. Both water sources options are presented in *Figure 3.6,* below.

The location of the water source for the irrigation system on each beneficiary's plot will be selected by the beneficiary themselves, always ensuring it is situated away from other water sources (e.g., other existing groundwater wells) and away from potential contamination sources.

During the allocation of the Project irrigation equipment, to be undertaken by SAG-PIU, it is possible that more than one set could be assigned to a single beneficiary depending on that particular beneficiary's land availability and resources, while also taking into account the objective of assigning irrigation sets to the highest number of beneficiaries possible. It is expected that the majority of beneficiaries will receive one Project irrigation equipment set and will need one water source (groundwater well or dug well/pit). For the beneficiaries that receive more than one set and require more than one water source, the criteria regarding the location of the water source in the beneficiary's plot will stand.

The irrigation system has been designed so that a groundwater well will hold the submergible pump that will provide water directly to the pipeline system, avoiding the need for most beneficiaries of any water buffer or tank.

The well has been designed to prevent groundwater pollution due to inflow of surface water through the wells. The design adopted assumes that water will be channelled directly through the distribution network and any fertilisers will be supplied through a control valve that will avoid any accidental contamination. Additionally, the mouth of the well cannot be opened easily. *Figure 3.5* presents a sample image of similar design.

Figure 3.5 Water well design

Source: Integra Ingeniería 2018

From the water source, the pumped water will go to irrigate the beneficiary's plot using the irrigation equipment supplied by PAA Project Finance:

- *A mobile component*, made up of the diesel motor pump orgenerator and two hose reel irrigators with integrated sprinkler, or micro-sprinklers. This mobile component can be adequately moved and stored away by the beneficiary during the rainy season when irrigation will not be necessary.
- *The fixed component* composed of a set of pipelines and valves, either easy connection aluminium tube segments of 5.8m length for the travelling hose irrigators, or PVC tubes to connect to the micro-sprinklers

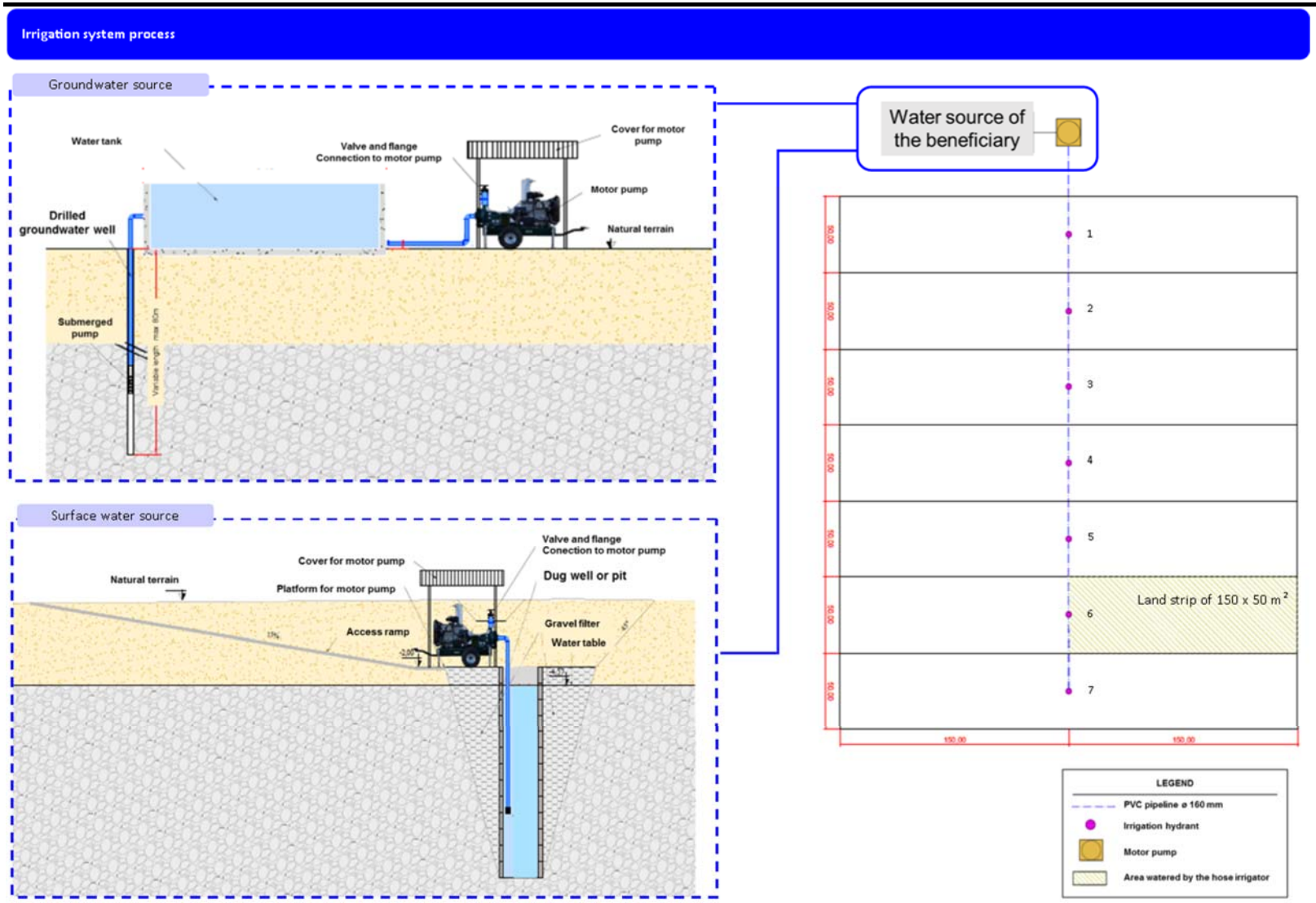
The two hose irrigators will be able to operate simultaneously, each irrigating strips of land 150x50 m^2. The travelling hose will be able to move automatically, without any human intervention, within this 150x50 m^2 strip of land. The hose will only need physically moving by the beneficiary from one irrigation hydrant to another. The travelling reels hold a hose of 125 m maximum length, which have a maximum irrigation distance of 25 m, from each hose, from irrigation hydrant locations.

There is a total of 7 different positions where the hose irrigators can be connected, considering that every 50 m of the main pipeline there is an irrigation hydrant. For each irrigation hydrant position a land strip of 150x50 m^2 can be irrigated, meaning each hose irrigator will be able to irrigate 52,500 m^2. As two travelling hoses will be operating, these will irrigate a total of 105,000 m^2, corresponding to the total irrigation unit per plot of approximately 10 ha as designed by the Project. This is illustrated in *Figure 3.6,* below.

The combination of equipment which include the micro-sprinklers connected by PVC pipes (51 units) are meant to be used for irrigation of trees (citric mainly), micro-sprinklers will have a mesh configuration of 5m x 4m (every 5 m in one direction and each 4 m in the other)

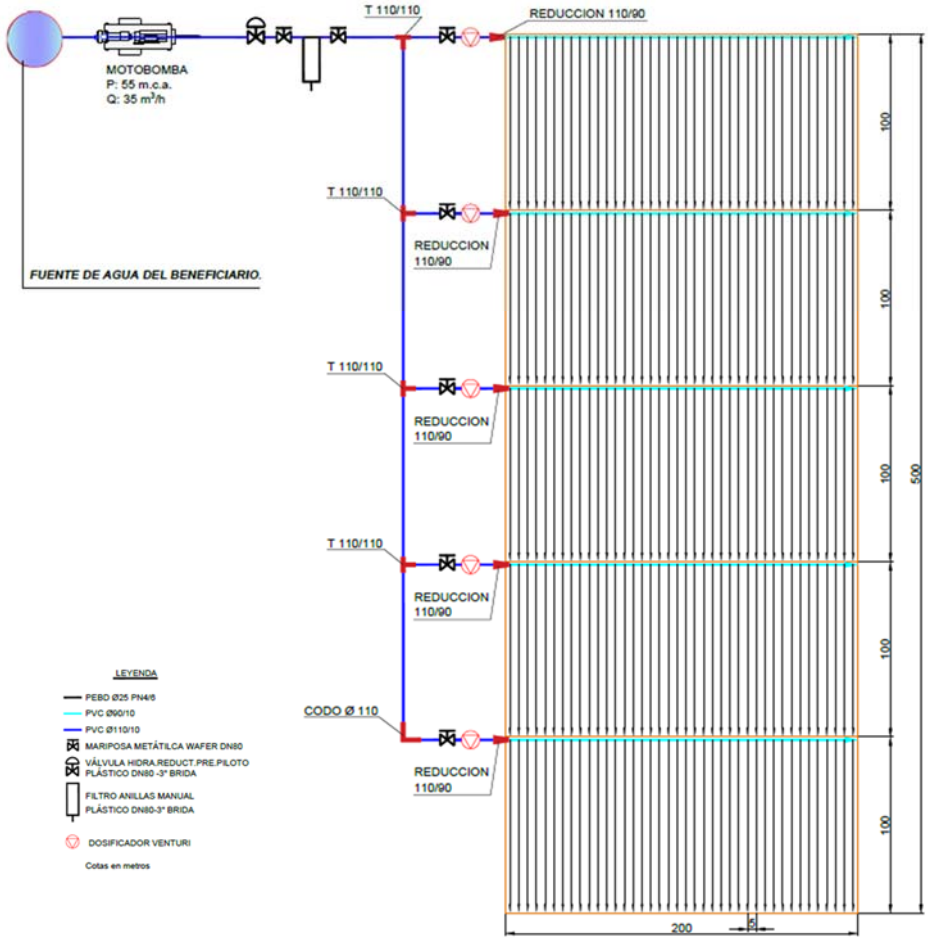
Figure 3.6 Irrigation process for the hose irrigation equipment combinations

Hose reel irrigation unit



Source: ERM, 2018 based on Integra Ingeniería's Technical Project, 2017

Microsprinkler irrigation unit



3.5.3 *Roles and responsibilities of the irrigation system*

Figure 3.7 provides an overview of the irrigation system components, in addition to identifying those that will be supplied by PAA Project Finance and those that must be contributed by each beneficiary, as well as other beneficiary responsibilities.

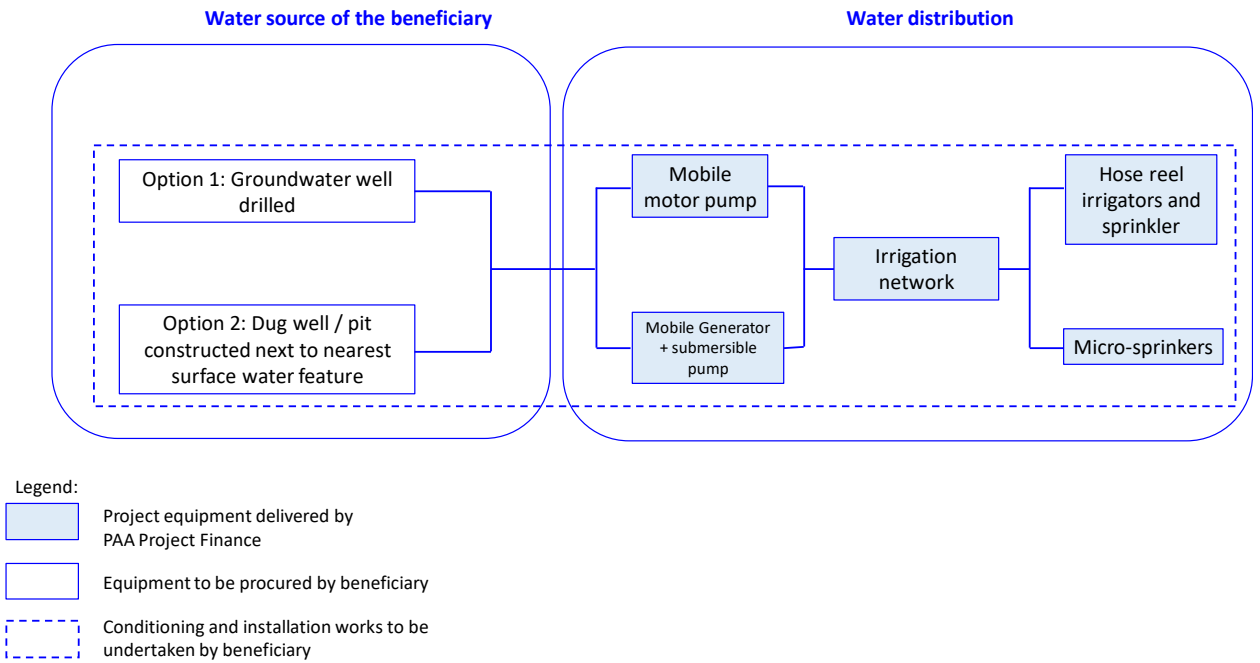
As illustrated in the figure and mentioned previously, while PAA Project Finance is only responsible for the delivery of the Project irrigation equipment, the beneficiary will be responsible for the installation of the equipment, as well as the procurement, installation, and related costs associated with the following aspects:

- In the case of requiring an underground water source: the drilling of the water well, procurement, and installation of a submersible pump and water tank; and
- In the case of having a surface water source: the construction of the dug well or pit next to the nearest surface water source.

It is planned that the drilling of groundwater wells using the Project's drilling vehicles will be undertaken by a specialist, non-governmental organization (NGO) that will be selected and supervised by the SAG-PIU. The cost associated with this activity has not yet been fixed; however, the lowest

possible cost to the beneficiary will be assured (as reported during field survey activities undertaken in June 2018). The timing of the drilling activities will depend on the required depth of each well and the geology of the site. It is estimated that for a 6 m-deep water well, drilling activities are expected to last 1 day while an 80 m-deep water well could take up to 10 days. Wells will be drilled subsequently, over a period of two years.

Figure 3.7 Components of the irrigation system and responsibilities



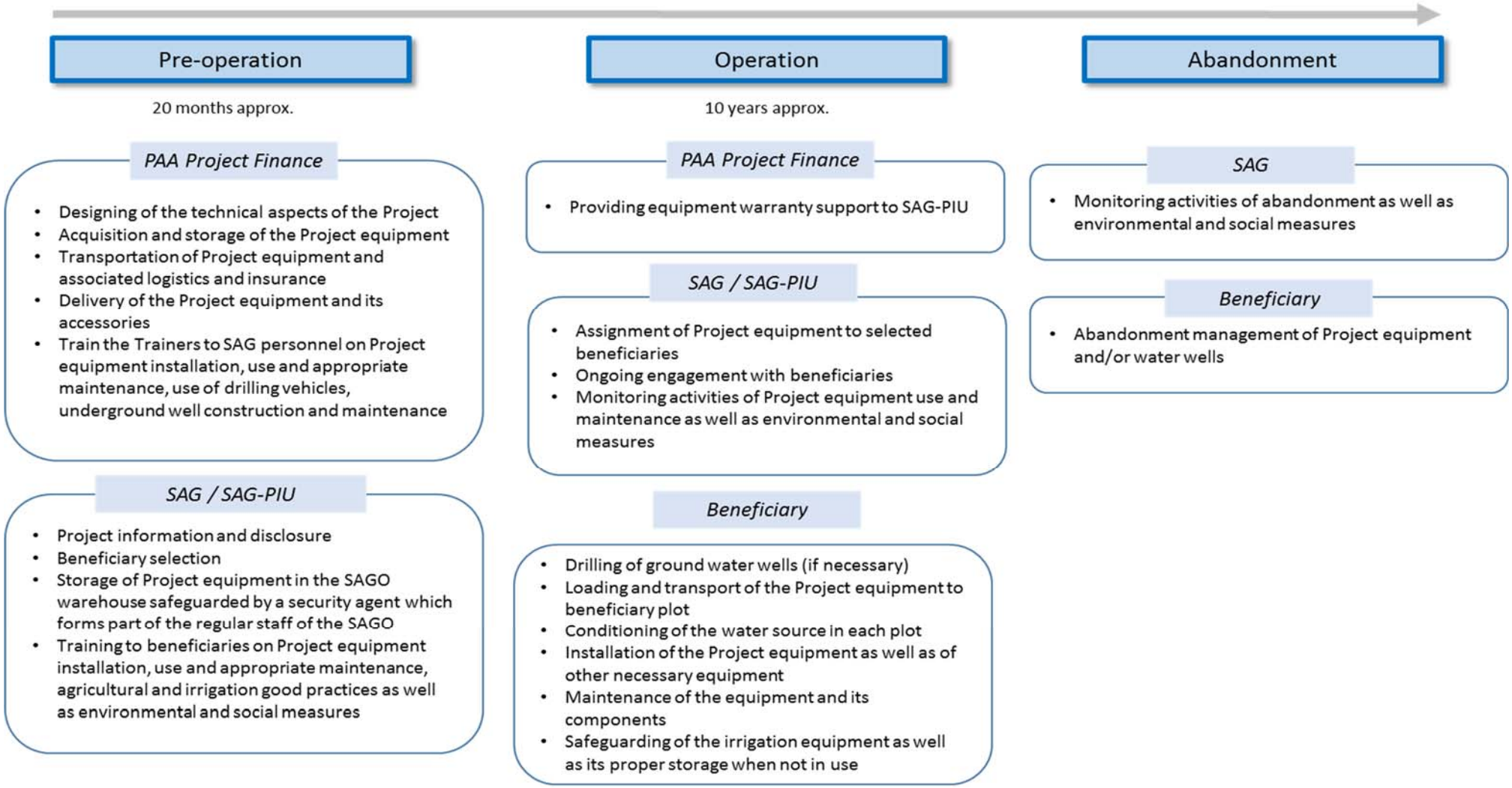
Source: ERM, 2018

3.6 *PROJECT PHASES AND ACTIVITIES*

Project activities will take place in three different phases: pre-operation, operation, and abandonment, in which the responsible parties differ from one phase to another.

Figure 3.8 summarises the main activities of each phase, the responsible parties, and estimated duration. Additional details are provided in the following sections.

Figure 3.8 Project activities for each Project phase



Source: ERM, 2018

3.6.1 Pre-operation

During the pre-operation phase, PAA Project Finance will be responsible for delivering the Project irrigation equipment to the SAG. The equipment will be stored in the SAGO warehouse in Olanchito or other place defined by SAG. The warehouse is safeguarded by a security agent who is part of the regular staff.

The Project equipment will remain in this warehouse until the selection of beneficiaries to be undertaken by the SAG-PIU has been finalised, as per the established requirements detailed in *Section 3.4,* after which the Project irrigation sets will be assigned to the beneficiaries.

In addition, PAA Project Finance, with the support of the SAG-PIU, will be responsible for preparing and delivering the necessary training to SAG technicians (in other words training the trainers) to ensure the correct use of the irrigation equipment. The technical training will address the following aspects:

- installation of the irrigation equipment, its accessories, and use of the equipment,
- maintenance and upkeep of the irrigation equipment,
- .

This training will be delivered by PAA Project Finance to SAG technicians and/or personnel designated by the SAG. These will then be responsible for delivering training to the Project beneficiaries.

In addition, other relevant training sessions will be prepared to ensure that good practices and the environmental and social measures defined in the present corresponding Environmental and Social Impact Assessment are efficiently implemented by the beneficiaries. These refer to training on irrigation good practices, recommendations for the sustainable use of water, pesticides, and fertilizers, and waste management. These will be defined in the Training Management Plan. They will be designed and delivered to the selected beneficiaries by technicians from the SAG-DICTA (Directorate of Agricultural Science and Technology), as well as other local organizations such as ASIDE, SENASA, the Health Secretary / Coordination of Environmental Health Programme of the Municipality of Olanchito.

Waste management, use of resources, and emissions

The pre-operation activities to be implemented by PAA Project Finance are limited to the delivery of the Project irrigation equipment and training activities. For this reason, waste generation will be associated with irrigation equipment packaging materials (wood, plastic, polymers), as well as domestic waste and wastewater in the offices where the training activities will take place. The generated waste will be managed by the municipality of Olanchito and appropriately disposed of in the Olanchito sanitary landfill, sewer network, or corresponding septic tanks.

The use of resources will be limited to the fuel consumption required for transporting the Project irrigation equipment to the warehouse, in addition to the mobilization of technicians to the Project Area and related vehicle exhaust emissions. Transport activities are expected to be undertaken by sea from either Denmark or Spain (depending on logistics) to San Pedro de Sula port in Honduras, where the containers will be transported by truck to the warehouse. The transport of the Project irrigation equipment will be undertaken progressively, over an overall and non-continuous period of approximately 15 months during the operation phase.

It is estimated that the pre-operation phase will last approximately 20 months.

3.6.2 Operation Phase

This phase consists of the operation of the Project irrigation system as well as associated monitoring activities.

Indeed, once the beneficiary's application has been accepted, they have received training, agreed to the conditions of use of the equipment, and paid the fee for the reception of the irrigation equipment, the beneficiary will be assigned an irrigation equipment set.

The equipment stored at the SAGO warehouse in Olanchito or other warehouse specified by SAG, must be collected by the selected beneficiaries and transported to their land plot. Each beneficiary will be responsible for conditioning their water supply (groundwater or surface water source), installing the Project irrigation set and other necessary equipment (such as the water tank, if needed), and commencing irrigation. Each beneficiary will be responsible for managing the drilling of their water wells.

As mentioned previously, along with the equipment, the beneficiary will also acquire a series of responsibilities linked to the irrigation equipment, as well as natural resource usage rights (see *Section 3.4.2*). In addition, the beneficiary will be liable for certain environmental services costs, such as those related to the use of water and electricity.

The beneficiaries will be responsible for safeguarding the irrigation equipment[1] as well as properly storing the equipment when not in use during the rainy season.

Irrigation equipment monitoring activities will be managed by the SAG directly, with the support of other organisations such as the CRELS and SAGO. During these monitoring activities, the condition and correct operation of the irrigation equipment will be verified, as will the correct implementation and management of environmental and social measures resulting from the

[1] No additional security measures will be implemented during the operation phase. Once the Project irrigation equipment is appointed to the beneficiary, they are the responsible for the security of the equipment.

environmental and social impact assessment (see *Chapter* ***¡Error! No se encuentra el origen de la referencia.*** and *Chapter* ***¡Error! No se encuentra el origen de la referencia.)***.

The operation phase is estimated to extend over the expected operational life of the irrigation equipment, corresponding to a period of 10 years[1].

Waste management, use of resources and emissions

In order to estimate the water volume necessary for the irrigation activities, it has been assumed that the irrigation water requirements per plot will be 32 L/m^2 per week and that irrigation activities will take place over 3.5 months per year (105 days), corresponding to the driest months. Taking into account the fact that a maximum of 3,110 ha are planned for irrigation (considering 311 potential beneficiaries and an irrigation unit per beneficiary plot of approximately 10 ha), the total maximum water requirement for irrigation will be 14,93 Hm^3 per year (Integra Ingeniería, 2017, updated on 2018) considering the same water demand of 32 l/m2 per week and a maximum irrigable area of 3,110 ha and a system rate use of 100%. Water meters will be installed on the irrigation systems to monitor the water consumption of each piece of irrigation equipment throughout the Project lifetime.

As for fuel consumption, each motor pump/diesel generator with submergible pump will consume approximately 3.8 L/h (Integra Ingeniería, 2017). Taking into account the fact that the total of 311 motor pumps/diesel generators are expected to be distributed among the selected beneficiaries and considering a maximum irrigation rate of 20h/day (total 2,481 m^3/year), over 3.5 months of the dry season each year, this leads to a maximum estimated diesel consumption of less than 2,500 m^3/year. The final diesel consumption will depend on the actual equipment usage according to the real irrigation needs of each beneficiary each year.

Associated with the operation of the irrigation equipment, exhaust emissions will be generated due to the consumption of fossil fuels by the motor pumps/diesel generators as well as noise emissions, again due to the operation of the same units.

In addition, lubricants are expected to be used for the start-up of the equipment. The beneficiary will be responsible for managing any lubricants used, either reusing them or selling them to a recycler. No additional waste is planned to be generated during the operation of the irrigation equipment.

The drilling of underground water wells, , will also require fuel and will have associated exhaust and noise emissions. Bentonite-based muds which do not

[1] After 10 years of operation, once the life expectancy of the irrigation equipment is achieved, the beneficiary can either continue with the operation through a change of equipment or abandon the irrigation equipment. This will depend entirely on each individual beneficiary.

contain any additives will be used for drilling the wells. Once recovered from the water well, these will be managed accordingly.

3.6.3 Abandonment

The following abandonment activities have been considered:

- The abandonment of the irrigation equipment, i.e., assuming that the equipment is no longer used for the purpose initially planned by the Project.
- The abandonment of the water wells, i.e., assuming that the water wells are no longer used for extracting water for irrigation purposes, as initially planned by the Project, or assuming that no water can be extracted.
- The abandonment of the irrigated areas, i.e., assuming that the land is no longer irrigated and no longer used for agricultural or livestock purposes, as initially planned by the Project.

These abandonment activities are considered one-off final events that depend entirely on each individual beneficiary.

The beneficiaries will be responsible for correctly abandoning the irrigation equipment and water wells. Abandoned Project irrigation equipment can be either managed and recycled by a specialist company or reused by the milk producer or farmer on other machinery, or for other purposes. In the event that the producer decides to no longer use it, the abandoned water wells will need to be decommissioned as appropriate, following good practice.

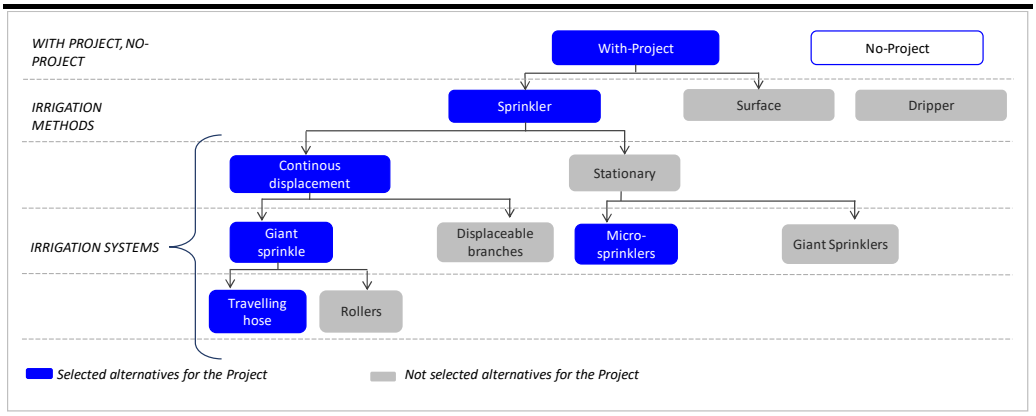
The SAG will be responsible for monitoring the correct implementation and management of the environmental and social measures relating to abandonment activities.

3.7 PROJECT ALTERNATIVES

During the design of the Project, different alternatives have been evaluated to determine the most adequate in line with the needs of the Project Area, the objectives of the SAG, best practice applicable to the agricultural activities, and the environmental and social aspects that have been considered throughout the Project design.

The *Figure 3.9,* below, presents the different alternatives evaluated. The analysis of alternatives justifies the solution adopted for the Project as described in the previous section of *Chapter* ***¡Error! No se encuentra el origen de la referencia.***.

Figure 3.9 *Alternatives considered for the Project design*



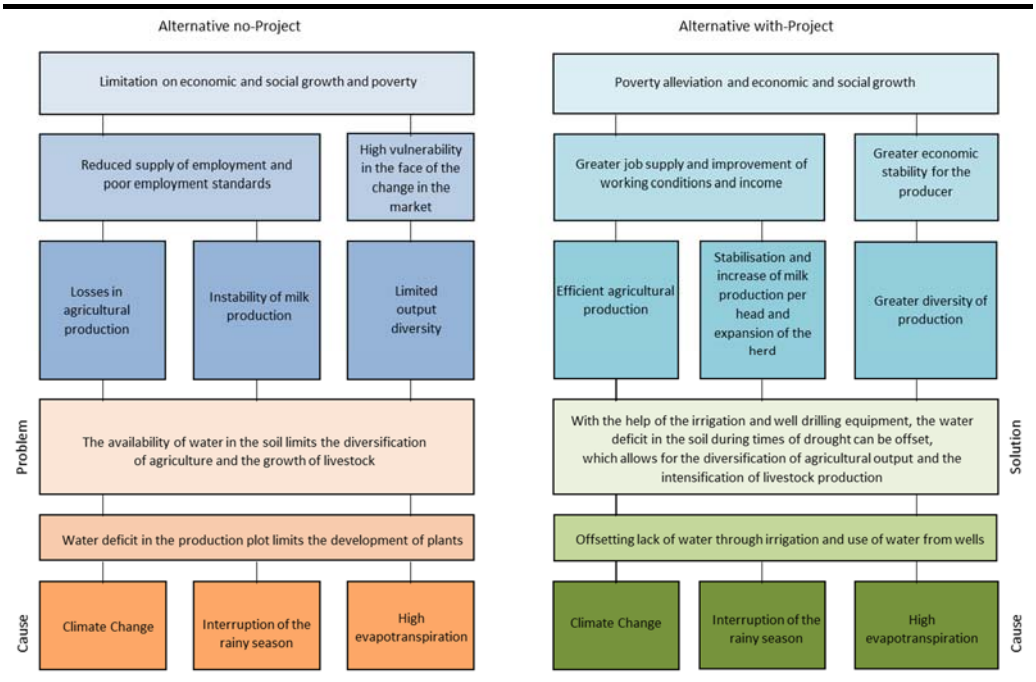
Source: ERM, 2018

3.7.1 *Alternative no-project*

As explained in *Section* ***¡Error! No se encuentra el origen de la referencia.***, the Project's commitment is to ultimately improve the economy of the area, through job creation, greater productivity of its fields, and the competitiveness of the local agricultural sector. The alternative of there being no Project would limit the economic and social growth of the Project area, meaning milk producers or farmers in the area remain vulnerable to climate conditions and market variations, among other negative effects.

The *Figure 3.10* summarizes the effects associated with the two alternatives.

Figure 3.10 *Effects of the two alternatives*



Source: PAA Project, 2017

3.7.2 Irrigation method

There are various factors that condition the three potential irrigation methods, including: sprinkler irrigation, drip irrigation, and surface irrigation.

These factors are summarised in *Table 3.2*, below.

Table 3.2 Factors conditioning the irrigation method

Factors	Surface irrigation by gravity	Sprinkler irrigation	Localized or drip irrigation
Water price	Low	Medium	High
Water supply	Irregular	Regular	Continuous
Water availability	Abundant	Medium	Limited
Water purity	Not limiting	No solids	Elevated
Soil infiltration capacity	Low to medium	Medium to high	Either
Soil storage capacity	High	Medium to low	Not limiting
Topography	Flat and uniform	Smooth profile	Irregular
Sensitivity to water deficit	Low	Moderate	High
Production value	Low	Medium	High
Workforce cost	Low	Medium	High
Energy cost	High	Medium	Moderate
Capital availability	Low	Medium to high	High
Technology demand	Limited	Medium to high	Elevated

Source: Integra Ingeniería, 2017

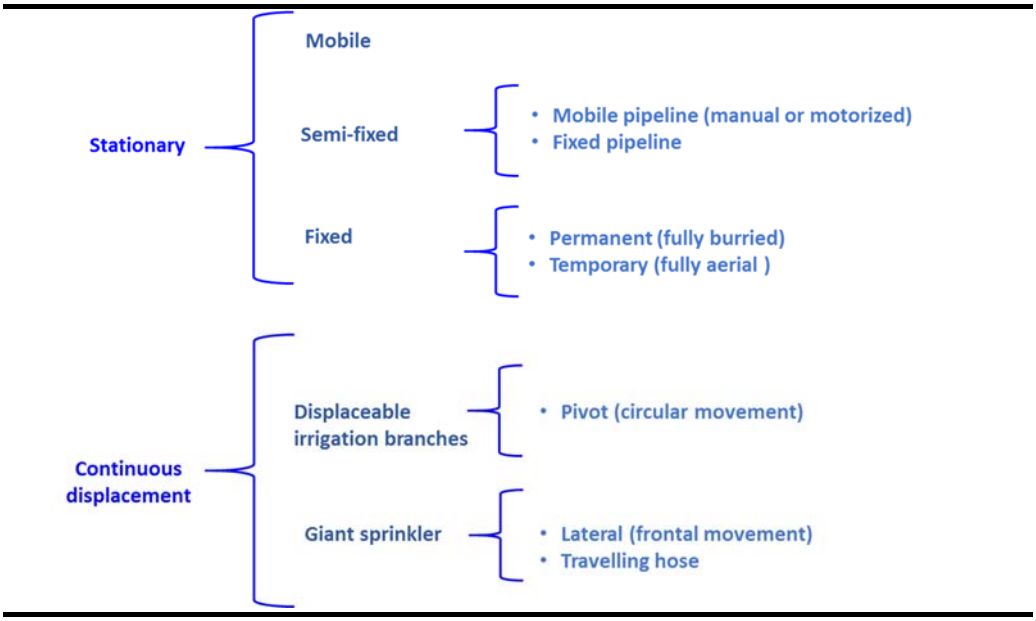
Taking into account the fact the Project area is not located in an area where there is an exceedance of water, nor where the water source is located near the land plot, the surface irrigation method is not applicable to the Project. The dripper irrigation method is also not appropriate, as this method should be used in areas that are very sensitive to a water deficit and where there is a high level of knowledge on dripper irrigation systems. Considering these arguments, together with the moderate and high energy costs of the dripper and surface irrigation systems, the most appropriate irrigation system for the Project is the sprinkler method.

3.7.3 Sprinkler irrigation system

The sprinkler method is appropriate for the majority of crops and adapts to almost all land types as sprinklers have a wide range of characteristics and capacities.

Sprinkler irrigation systems can be classified as follows:

Figure 3.11 Classification of sprinkler irrigation systems



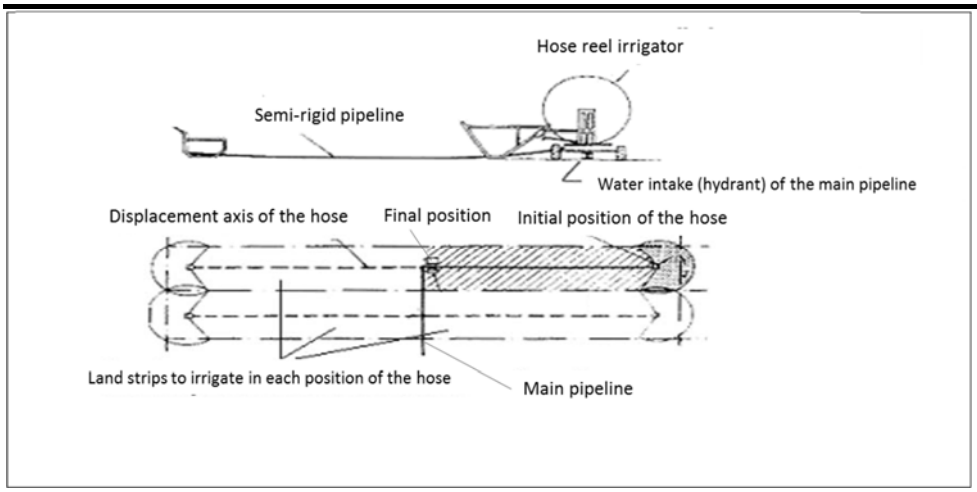
Source: Integra Ingeniería, 2017

Among the different types of sprinkler irrigation systems, the travelling hose system, and the micro-sprinklers system for trees, have been selected as most appropriate for the Project needs due to the following advantages:

- It requires a lower investment.
- It adapts perfectly to crops such as cereals (wheat, barley, and alfalfa), beetroot, leafy vegetables, pulses, and tubers.
- It can be automatized and thus requires little manpower.
- It is easily transportable and does not require a specialised workforce to transport and connect the hose reel equipment to the next irrigation position.

The following *Figure 3.12* presents the selected Project hose reel irrigator system.

Figure 3.12 Hose irrigator system



Source: Integra Ingeniería, 2017

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4 STAKEHOLDER ENGAGEMENT

4.1 INTRODUCTION

This Section provides a description of the main stakeholders of relevance to the Project, a summary of the stakeholder engagement activities during ESIA preparation in 2017 and during the ESIA update preparation in 2018.

Additionally the section provides an overview of the stakeholder engagement programme that will be implemented by the Project. This programme is designed to cover all phases of the Project and the series of actions proposed to enhance the current community grievance mechanism. This section is complemented by the *Stakeholder Engagement Plan* as presented in *Annex 1* to this report which presents a more detailed account of proposed engagement activities and well as detailed procedure for management of community grievances.

4.2 STAKEHOLDER ENGAGEMENT PRINCIPLES

Stakeholder engagement is a requirement of international lenders within the IFC Performance Standards (namely Performance Standard 1) as it is recognised that failure to engage stakeholders can create significant risks to development of a project.

PAA Project Finance understands that effective stakeholder engagement and public consultation is a cornerstone of successful Project development, and is committed to free, prior, and informed engagement with stakeholders throughout the Project lifecycle.

The key principles guiding PAA Project Finance's approach to stakeholder engagement on this Project are:

- To be open and transparent with stakeholders.
- To be accountable and willing to accept responsibility as a corporate citizen and to account for impacts associated with the Project activities.
- To have a relationship with stakeholders that is based on trust and a mutual commitment to acting in good faith.
- To respect stakeholders' interests, opinions and aspirations.
- To work collaboratively and cooperatively with stakeholders to find solutions that meet common interests.
- To be responsive and to coherently respond in good time to stakeholders.
- To be pro-active and to act in anticipation of the need for information or potential issues.
- To engage with stakeholders such that they feel they are treated fairly and their issues and concerns are afforded fair consideration.

- To be accessible and within reach of stakeholders so that they feel heard and to provide comprehensive information.
- To be inclusive and proactively anticipate, identify and include all stakeholders.

4.3 STAKEHOLDER IDENTIFICATION

Stakeholders include individuals or groups that may influence or be impacted by the Project, as described in *Box 4.1*.

Box 4.1 Definition of a Stakeholder (1)

"Stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively. Stakeholders may include locally affected communities or individuals and their formal and informal representatives, national or local government authorities, politicians, religious leaders, civil society organizations and groups with special interests, the academic community, or other businesses."

The level of interest and impact of any given group of stakeholders is dependent on a number of factors including level of authority, socio-economic context, influence, education and cultural factors.

Stakeholder identification began at Project inception and planning and has continued through the various stages of the Project development. Stakeholders identified to date represent the organisations and individuals who may be directly or indirectly (positively or negatively) affected by the Project or who may have an effect on how the Project is implemented.

Stakeholders identified for inclusion in engagement activities meet one of the following criteria:

- have an interest in the Project;
- would potentially be impacted by or have an influence on the Project (negatively or positively); and/or,
- could provide commentary on issues and concerns related to the Project.

Next Table resents an overview of the main stakeholder groups of relevance to the Project. A more complete list of stakeholders in included in *Annex 1- Stakeholder Engagement Plan*.

(1) IFC (2007) Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets Available at: http://www.ifc.org/wps/wcm/connect/938f1a0048855805beacfe6a6515bb18/IFC_StakeholderEngagement.pdf?MOD=AJPERES (Accessed 05.06.16)

Table 4.1 Overview of stakeholder groups

Stakeholder Categories & Groups	Stakeholders	Connection to the Project
Internal Stakeholders Project Owner and Project Partner	Farming and Livestock Secretariat (SAG), Irrigation Department PAA Project Finance Project technical support consultancies (Engineers and advisors)	Approves the design, provides resources, approves applications, delivers equipment, trains, and monitors; Commercial Agreement
Implementing Partners National Government agencies	SAG-Irrigation Department, Project Implementation Unit SAG Olanchito (SEFIN	Collaboration agreements with other government bodies; Budget management; Surveillance and communication and engagement with local population; Reforestation Plan
Financial Institution Lender	ING Bank, Bank Nederlandse Gemeenten (BNG) and EKF's Denmak Export Credit Agency	Loan agreement and funding
Project Partners (External) National & Regional associations and federations University and research centres	FENAGH SAGO National Agrarian Institute (*Instituto Nacional Agrario* – INA) Fund for Agricultural Development *(Fondo Internacional de Desarrollo Agrícola* - FIDA*)* Honduras Land Administration Program *(Programa de Administración de Tierras de Honduras* – PATH*)* Regional University Centre of Aguan Valley (CURLA) of Honduras National Autonomous University Universidad (UNAH) CREL	Formal, legal and functional organizations with credibility in the area and experience in other project implementations.
National Government National Regulatory bodies	MiAmbiente (DECA / Water Authority) ICF Ministry of Health - Property Institute *(Instituto de la Propiedad* – IP*)* Honduran Institute of Anthropology and History (*(Instituto Hondureño de Antropología e Historia* - INAH) National Council of Potable Water and Sanitation (CONASA) State Secretariat for Indigenous and Afrohonduran Peoples (SEDINAFROH) Secretariat of Labour / Social Security Institution	National Government are of primary national political importance throughout all stages of the Project life cycle, in charge of licensing, granting permits/authorizations for the Project; monitoring and enforcing compliance with Honduran Law.

Stakeholder Categories & Groups	Stakeholders	Connection to the Project
Municipal Government Municipal Authorities and Government bodies	Olanchito and El Arenal Municipal corporation Municipal Environmental Unit (*Unidades Municipales de Ambiente – UMA*) Department of Human Resources (Employment) Municipal Administration (*Administración municipal) of u*rban areas, rural areas, the Municipal Administration's Governance and Transparency Department Municipal Water and Sanitation Commission (*Comisión Municipal de Agua Potable y Saneameinto* - COMAS) Municipal representative of the Honduran Society of Administrative Boards of Water Systems (*Asociación Hondureña de Juntas Administradoras de Sistemas de Agua - AHJASA*) Health Centers	Regional and local government are responsible for implementation of legislation, and development plans and policies at the Regional and Local levels. Municipal corporations also responsible for granting permits to the farms as well as water extraction permits. Municipal environmental units involved in the monitoring of the fulfilment of the environmental control measures.
Project Potential Beneficiaries Selected livestock and milk producers and farm workers	Potential beneficiaries of the Project	Livestock and milk producer with no or up to extensive experience in irrigation. Interests and expectations lie in improving economic income, reducing vulnerability to drought and improving income stability.
Potentially affected stakeholders Landowners and farm workers in the area Residents / other water users Water boards (resident associations) Downstream communities	Hamlets (*aldeas*) and settlements (*caseríos*) in the Project Area Hamlets located downstream of Project Area Landowners and farm workers not selected as beneficiaries Residents or other water users Water Administration Boards *(Juntas Administradoras de Agua - JAAS)* in each hamlet (*aldea*)	Users of water for human consumption and livestock and agriculture.
Vulnerable and Indigenous Persons/Groups Vulnerable groups within the Project Area	Vulnerable people within the hamlets in the Project Area Representatives of Indigenous and Afro-descendant groups residing /working in the Project Area: Federation of Xicaque Tribes of Yoro (*Federación del Tribu Xicaque de Yoro* - FETRIXY) and Association of Indigenous Tolupan Communities of La Montaña de la Flor *(Asociación de Comunidades Indígenas Tolúpanes de la Montaña de la Flor - Acitmfm)*	Vulnerable groups may be affected by the Project by virtue of their physical disability, social or economic standing, limited education, lack of employment or access to land. No indigenous communities are found within the Project Area, nonetheless indigenous individuals live among non-indigenous communities. Furthermore, the Project Area is located downstream from indigenous settlements.

Stakeholder Categories & Groups	Stakeholders	Connection to the Project
Civil Society Community-Based Organisations (CBOs) Local Associations Research and Academic Institutions (national and local)	ASIDE Alfalit in Honduras CARE-PASOS FUPNAPIB - Protection, Conservation and Responsible Use of Natural Resources Present in Pico Bonito National Park CURVA University National Institute for Professional Training *(Instituto Nacional de Formación Profesional - INFOP*) SAGO CRELs Olanchito Red Cross	Organisations with direct interest in the Project, and its social and environmental aspects and that are able to influence the Project directly or through public opinion. Such organisations may also have useful data and insight and may potentially become partners to the Project in areas of common interest such as the implementation of training programs, etc.
Non-Governmental Organizations (NGOs) International National Local	National and international NGOs present in the area: ASIDE, Alfalit in Honduras, FUPNAPIB and other potential international NGOs and Pressure Groups.	NGOs with direct interest in the Project (social and environmental aspects) with the ability to directly influence the project or through public opinion.
Other interest groups Media Private sector / multinational companies Law enforcement	Local and municipal media Banana plantations (DOLE) Palm trees plantations Dairy product producers Police and law enforcement National Processing Companies Local artisanal cheese producers	Multinational companies are economic actors with strong economic and political influence.
Potential partners Contractors. Suppliers and service providers. Other businesses operating within the community Local and international banks Other	Indirect beneficiaries of the project: micro and small entrepreneurs, workshop supplies.	Organisations, businesses and individuals with direct interest in the Project e.g. running businesses or providing services and supplies to the Project.

4.4 ESIA CONSULTATION ACTIVITIES

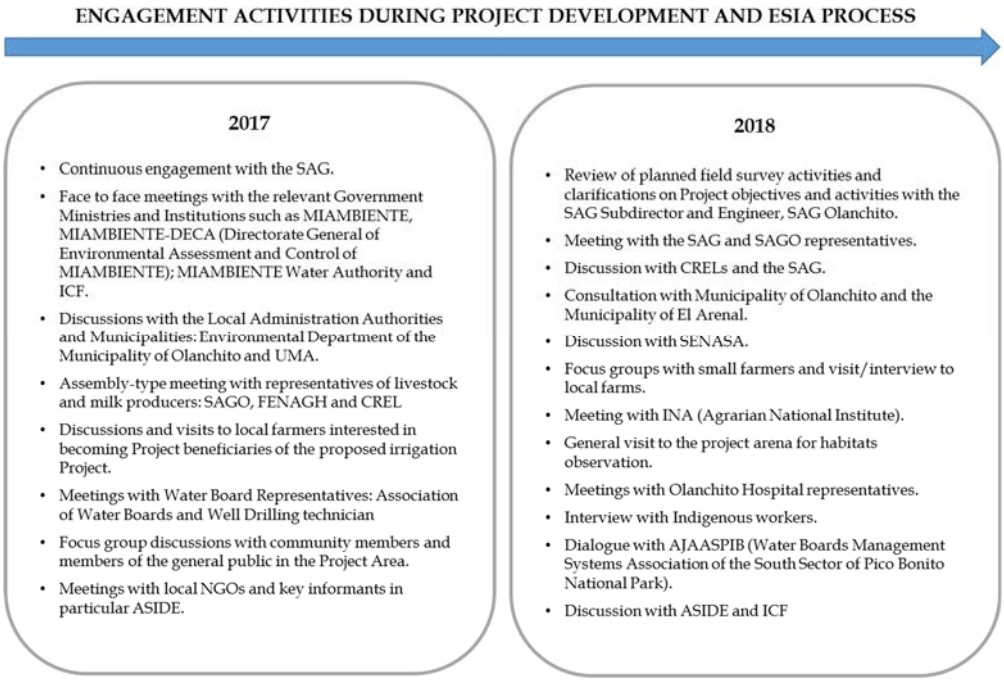
Stakeholder consultations for the Project began during Project planning phase and has been continuous through the feasibility studies, Environmental and Social Impact Assessment (ESIA) update including field visit for new engagement with key stakeholders conducted in June 2018.

Engagement as part of the project development and ESIA process for lenders was conducted between 2016 and 2018. Initial consultations took place with the Government ministries and departments, the interested farmers, the Local Administration Authorities as well as social institutions in the area. Both public and private stakeholders were included in the engagement process, which was undertaken in 2017.

In the field visit performed in June 2018 as part of the ESIA update process, additional engagement meetings have been conducted to fill data gaps and reconfirm assessment of impacts.

A summary of the stakeholder engagement activities during ESIA preparation in 2017 and during the ESIA update preparation in 2018 is showed in *Figure 4.1*. Details on the engagement activities are provided in *Annex 1*.

Figure 4.1 Engagement activities undertaken in 2017 and 2018



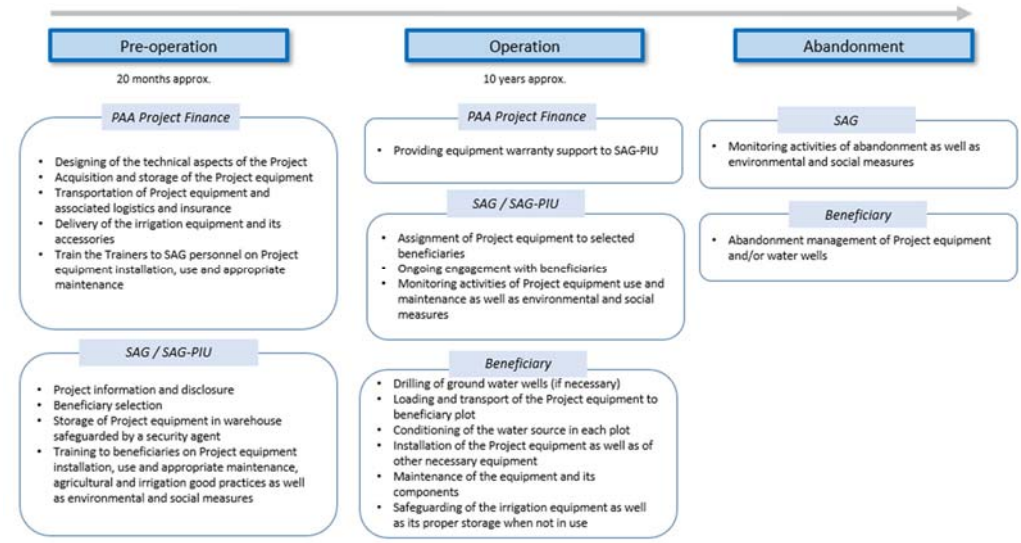
4.5 CONSIDERATIONS FOR FUTURE STAKEHOLDER ENGAGEMENT

Stakeholder engagement activities are planned to cover all phases of the Project. However, PAA Project Finance will hand over the Project to the SAG once the irrigation equipment is installed and the training for beneficiaries has been completed. During the operation phase, PAA Project Finance's

responsibilities regarding the irrigation project will be limited to supplying spare parts. In this regard, all engagement activities during the operation will be managed and promoted by the SAG.

The general objectives of stakeholder engagement are outlined in *Figure 4.2* as well as the Project activities.

Figure 4.2 Stakeholder engagement objectives for each Project phase



Source: ERM, 2018

Specific planning and engagement activities will be necessary at each Project phase. These are presented in *Annex 1*.

The activities that will be ongoing throughout the entire Project cycle and therefore common to the different phases include the following:

- Regular update and revision of the stakeholder register including stakeholder analysis and re-evaluation as necessary throughout the different Project phases.
- Addressing comments, questions, and grievances regularly and through appropriate channels, and issuing information to stakeholders. This includes regular refreshers to stakeholders about the Grievance Mechanism and related processes.
- Regular reporting to the different stakeholders as appropriate.
- Regular Project Monitoring reports.

4.6 GRIEVANCE MECHANISM

The Community Grievance Mechanism enables any stakeholder, including farm workers, to make a complaint or a suggestion about the way the Project is being implemented. Grievances may take the form of specific complaints for

damages/injury, concerns about routine Project activities, or perceived incidents or impacts.

The purpose of the Community Grievance Mechanism Procedure is to implement a formalised process (identification, tracking and redress) to manage complaints/grievances from communities and other local stakeholders in a systematic and transparent manner that could potentially arise from the Irrigation Project.

4.6.1 Grievance Procedure

The SAG has currently in place a grievance mechanism that allows identifying negative attitudes with the aim to systematically transform concerns into positive experiences through an adequate response protocol.

It includes:

- A grievance mechanism form on the following webpage: http://premperhn.com/sag-new/formulario-de-denuncias.
- Contact details to report any concern, as indicated below:

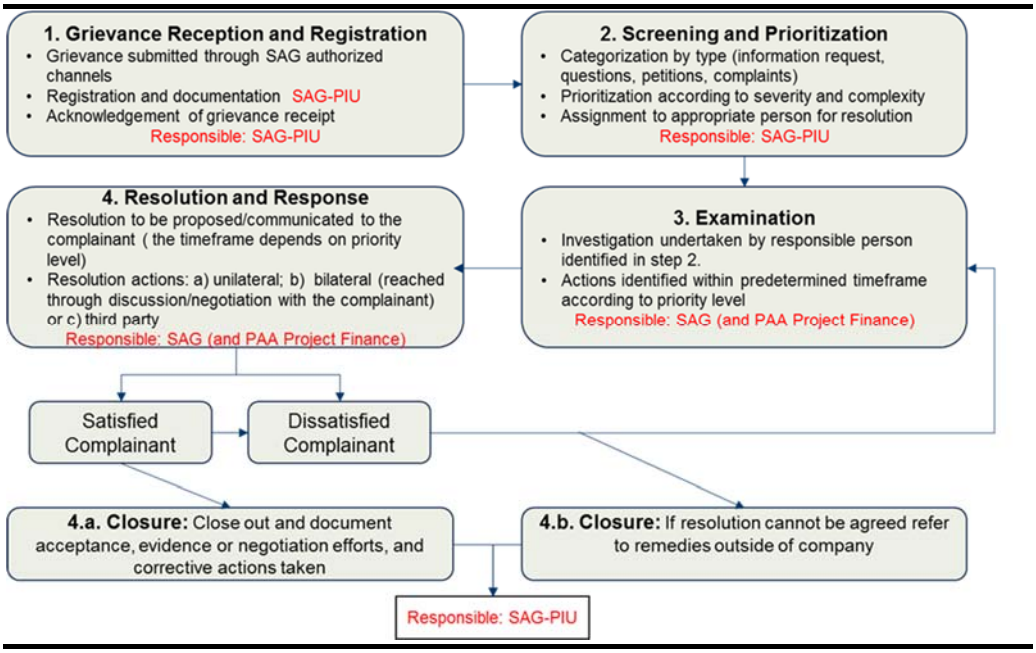
SAG - Secretaría de Agricultura y Ganadería Honduras
Colonia Loma Linda, Avenida La FAO, Bulevar Centroamérica. Tegucigalpa Honduras
Teléfono PBX: **(504) 2232-5029**
Correo electrónico: **infoagro@infoagro.hn**

Horario de atención: 9:00am a 5:00pm

Although grievance management during pre-construction and operation is a responsibility of the SAG, PAA Project Finance will propose a series of actions (as a minimum) to the SAG in order to enhance the current grievance mechanism to have clear procedures that make filing grievances easy for communities with various levels of literacy and access to infrastructure. PAA Project Finance will also ensure that consultation on design of the mechanism provides for inclusion and participation of women in the grievance process, facilitating women's access. These include: various access points and mechanisms to receive complaints and the definition of the procedure to follow once a grievance is received. These detailed grievance management procedure is presented in detail in *Section 6- Community Grievance Mechanism* in *Annex 1*.

The grievance procedure in *Figure 4.3 i*s proposed to ensure an effective and timely response to community complaints and maintain good community and stakeholder relations, and incorporates relevant provisions in the SAG's general grievance procedure.

Figure 4.3 Grievance mechanism



Source: ERM, 2018

4.7 MONITORING AND REPORTING STAKEHOLDER ENGAGEMENT ACTIVITIES

It will be important to monitor and report on the on-going stakeholder engagement activities to ensure that the desired outcomes are being achieved, and to maintain a comprehensive record of engagement activities and the issues raised.

4.7.1 *Monitoring*

Monitoring of the irrigation equipment will be conducted by the PIU in collaboration with the SAGO, FENAH and UMA of Olanchito. Involvement of beneficiaries and project-affected stakeholders in monitoring Project implementation can assist in addressing their concerns and promote transparency. This can also empower communities as it enables them to have a role in addressing Project-related issues that affect their lives. This, in turn, strengthens relationships between the Project and its stakeholders.

Stakeholder involvement in monitoring of this Project will include the following:

- CRELs and stockbreeder's representatives will be involved in the technical inspections and monitoring of the irrigation equipment
- Involvement of affected stakeholders when selecting methods for any social surveys and in the analysis of results. Training will be conducted where needed to build capacities.
- Observations of audit activities by affected parties.

- Grievance follow-up meetings and calls with affected stakeholders in relation to installation of pumps, beneficiary selection and capacity building program.

4.7.2 Reporting

The SAG will prepare regular reports, which mainly describe as a minimum:

- Progress with implementation of the project
- Action Plans on issues that involve on-going risk to or impacts or concerns on affected stakeholders.
- A summary of engagement activities and all resolved grievances

Other reporting modes that shall be prepared are presented in *Annex 1*.

The internal schedule of preparation and dissemination of all formal disclosures shall be determined by the SAG and shall be communicated to PAA Project Finance.

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5 BASELINE DESCRIPTION

5.1 OVERVIEW

This baseline section provides a description of the environmental and social characteristics of the Project Area, which covers a surface area of about 60,000 ha in the Alto Aguan Valley in the Olanchito and Arenal municipalities in the Honduran department of Yoro. The approximately 3,110 ha of agricultural land that will be irrigated is located within this area.[1]

The Project Area is shown in *Figure 5.1*.

Figure 5.1 Project Area

Source: ERM, 2018

The baseline section provides specific data on the Project Area combined with the national context, whenever needed, to facilitate a thorough understanding of the issues involved.

5.2 DATA COLLECTION AND LIMITATIONS

The main sources of information consulted in the preparation of this baseline report are the previous assessments prepared by CINSA and PAA Project Finance in 2017 and the Project Technical Design prepared by Integra Ingeniería in 2017.

[1] The agricultural land to be irrigated would be limited to a maximum of 3.110 ha, to be located within the project area. The location of these ha will be defined after selecting potential beneficiaries.

This desktop assessment was completed with a search of publicly available information, when the information cited above was not sufficient to describe the baseline in detail, including reliable and internationally recognized internet sources, e.g. such as those of the United Nations Development Programme (UNEP) and International Union for Conservation of Nature (IUCN).

In addition to the existing desktop information, a more recent field survey was undertaken in June 2018 to complement the preparation of this ESIA report and to collect the specific information required to complete a number of information gaps identified in a preliminary assessment of the existing information conducted by the lenders and ERM in early 2018.

Data collection activities included meetings and interviews with the SAG, SAGO, CRELs, and personnel from the municipalities of Olanchito and Arenal. One Focus Group Discussion (FGD) was also conducted with six small producers, including three women; however, FGDs with medium and large producers could not be conducted due to time constraints. The field survey also involved visits to five farms of different sizes in the Project Area belonging to potential beneficiaries (three small, one medium, and one large), which included habitat observation as well as brief interviews with the farm owners to collect information on water extraction, farm management, production, and so on. A full list of data collection and stakeholder engagement activities undertaken during this field survey (June 2018) is presented in *Annex 1 Stakeholder Engagement Plan*.

Note that as the sample pool for the June 2018 survey was relatively small (approx. 15, mostly small producers and CREL members) the information collected was not representative of the different producer categories (small, medium, and large), and was not always consistent across the different sources. The SAGO and CRELs, for instance, reported slightly different figures in terms of average production and incomes for the different groups. This limitation was addressed by triangulating the information with the larger sample of 301 producers from which preliminary data was collected in 2017 (CINSA & PAA Project Finance, 2017). However, data on some important indicators such as milk production and number of cattle head per farm was not collected in 2017. For such indicators the information comes primarily from the June 2018 field survey results.

Limitations were also identified in the preparation of the physical and biological baseline, including:

- Historical climatological information in Honduras is scarce and the network of climatological stations is limited.
- Lack of air quality information in Honduras and the Project Area due to the absence of air quality monitoring stations – only referred to in Tegucigalpa and San Pedro Sula.

- No noise background data in the Project Area.
- Soil quality information is limited to the information gathered from soil type maps at national level. No information is available from soil samples taken in the Project Area.
- Gauging stations in Honduras and the Project Area are limited. In most cases, only emergency stations are present.
- No information is available on surface water quality based on analytical results.
- No registration of groundwater wells. Consequently, there is no accurate list of groundwater wells in the Project Area.
- Biodiversity inventories in the Project Area are limited to the *Refugio de Vida Silvestre Colibrí Esmeralda Hondureño* or RVSCEH.
- Additional biodiversity inventories conducted in the RVSCEH are still pending publication and therefore not yet available for consultation. These include monitoring of insects conducted in 2014 and Addendum to Flora Management Plan.

5.3 PHYSICAL ENVIRONMENT

5.3.1 Climate

Overview

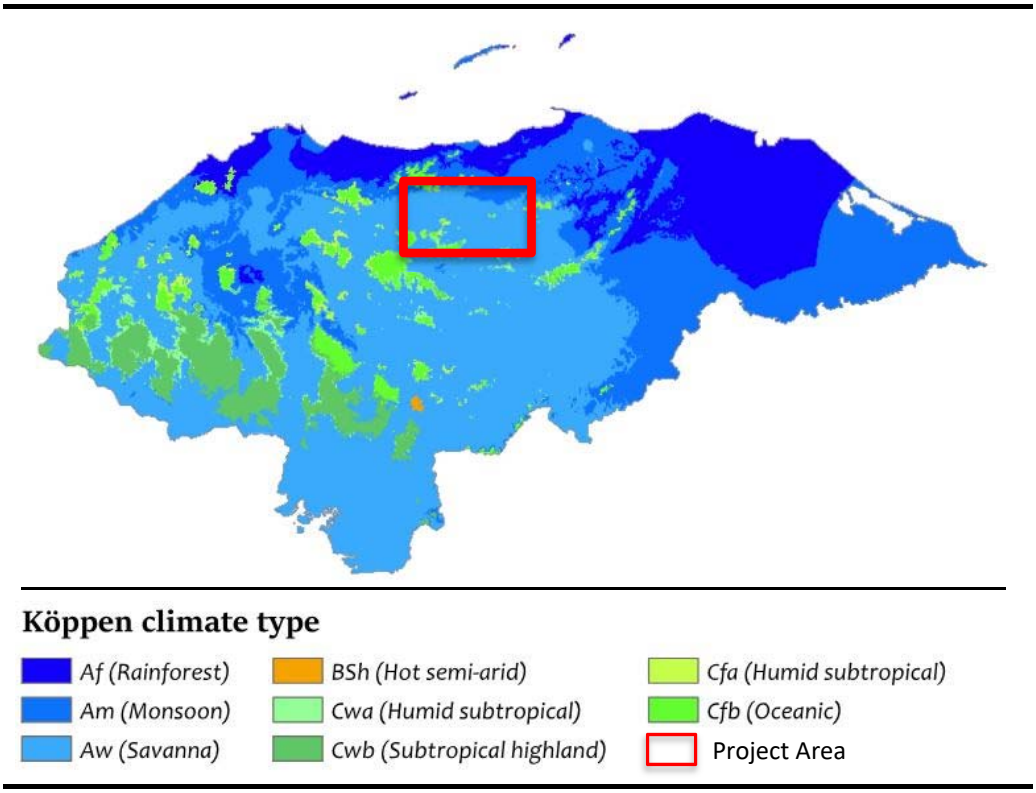
Unfortunately, Honduras has no institution with a long history of climatological data records and universal accessibility[2].

Overall, the climate in Honduras is tropical and temperate, according to the Köppen climate classification. Areas with a tropical climate are characterized by average temperatures of above 20°C, while areas with a temperate climate are characterized by average temperatures in the coldest month of between -3°C and 18°C, and by average temperatures in the hottest month of more than 10°C.

Figure 5.2 shows the climate types in Honduras, based in the Köppen climate classification.

[2] Although there is currently a reliable data collection network, the coverage of this information has been lost across most of the country. In addition, the information that several institutions are presently collecting is not freely available to general users. Despite a significant number of existing telemetric stations, these do not measure all the climatological parameters. There is also no technology for updating the information or interpreting it adequately.

Figure 5.2 Climate types in Honduras



Source: Adam Paterson, 2016[3]

[3] https://es.m.wikipedia.org/wiki/Archivo:Honduras_K%C3%B6ppen.svg

The climate in Honduras is characterized by three differentiated factors: (1) the Intertropical Convergence Zone of the Trade Winds (ITCZ) during the rainy season, when large amounts of rain falls due to tropical storms and hurricanes; (2) cold fronts and polar air masses accompanying the dry season; and (3) the national orography.

Three main climate areas in Honduras (Asesora, 2009) are:

- Lowlands along the Caribbean;
- Highlands in the interior of the country; and
- Lowlands along the Pacific Ocean characterized by a warm tropical climate (average temperatures around 26ºC) that change gradually towards the interior of the country, where it is milder (temperatures ranging from 16ºC to 24ºC, although it can be colder than 16ºC at altitudes above 2,100 m ASL).

In the case of the climate conditions in the Project Area, located between the lowlands along the Caribbean and the highlands within the country, the presence of the *Sierra Nombre de Dios* is particularly significant. This mountain range acts as a barrier that prevents the humidity of the Atlantic Ocean reaching the area, making the climate warm and dry (Asesora, 2009).

The following subsections provide specific information on the main parameters defining the climate conditions: temperature, rainfall, evapotranspiration, and a brief reference to extreme weather events. These are complemented with a subsection providing some key data on the climate parameters in the Olanchito municipality.

Temperature

Figure 5.3 shows the average temperature in the Project Area, from 26 - 27°C.

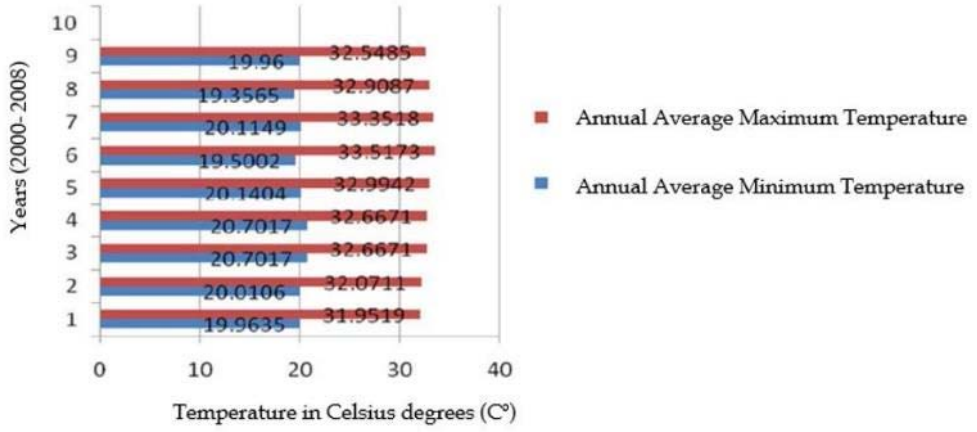
Figure 5.3 ***Annual average temperature in the Project Area***

Source: SINIT – National System of Territory Information (*Sistema Nacional de Información Territorial*) – modified by ERM, 2018

In addition to this, based on information provided by Dole Fruit Company, the minimum average temperature in the Coyoles is about 20°C, whilst the maximum average temperature is about 32.7°C. These temperatures are consistent with those described previously for lowlands (average temperatures around 26ºC).

Figure 5.4 shows the temperature chart provided by Dole Fruit Company for the period 2000 – 2008 (Asesora, 2009).

Figure 5.4 ***Annual average minimum and maximum temperatures in Coyoles (municipality of Olanchito) (2000 – 2008)***



Source: Asesora, 2009 – modified by ERM, 2018

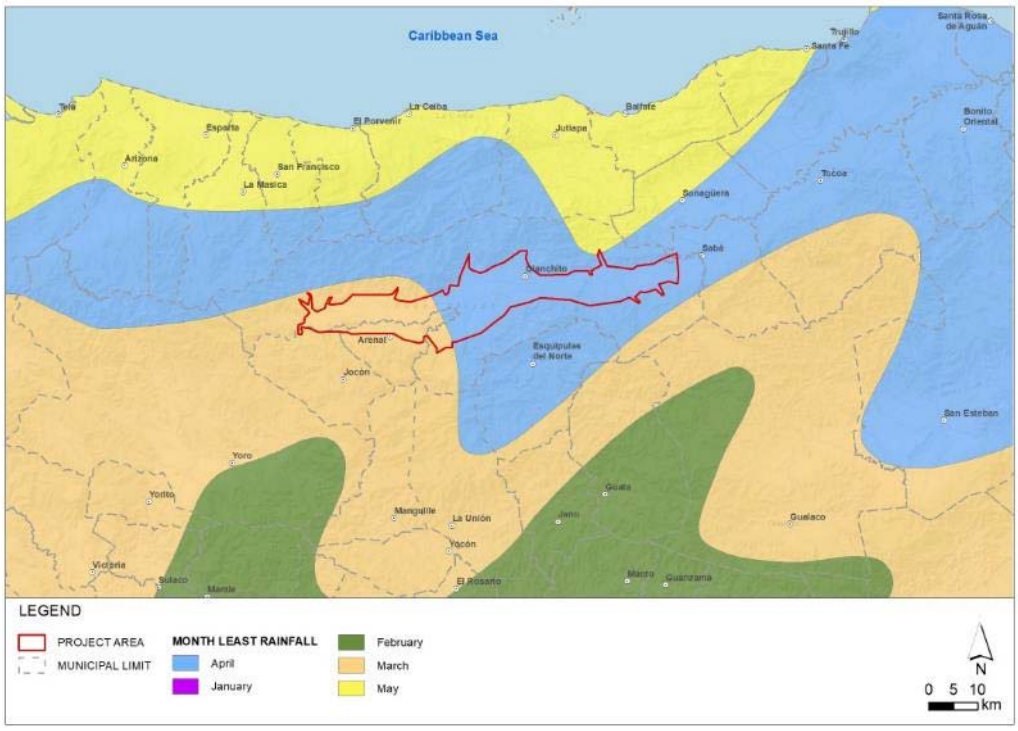
Rainfall

The climate in Honduras is characterized by two differentiated seasons: rainy and dry, with a very variable rainfall distribution throughout the year. In summary:

- Dry season in the Project Area occurs from January to April.
- In the rest of the year, the monthly rainfall ranges from 80 mm/month to 160 mm/month (Asesora, 2009). June and September are the months with the highest rainfall. This rainy season is the result of the Inter-Tropical Convergence Zone of the Trade Winds (ITCZ) and the East Tropical Waves. These two phenomena simultaneously influence Central America, with the following rainfall pattern:
    - They generate and maintain the rainy season across almost the entire country (Honduras), but with a lower intensity along the Atlantic coast.
    - These two phenomena are most influential in June and September. Under their influence, the rains come in the form of storms with electrical activity and cumuliform clouds, increasing the average of rainy days.
    - The east to west movement of the East Tropical Waves brings continuous rain to Honduras. Sometimes these waves intensify the effect of the ITCZ, generating "rainstorm" conditions. This effect is felt less in the Project Area than other parts of the country. When rain events last longer than 48 h, the risk of floods increases.
- During July and August, there is a combination of the rainy season and a "heat wave" thanks to the Bermuda Anticyclone, a circulation of winds characteristic of a cold air mass that remain stationary over Bermuda. This anticyclone causes a decrease in rainfall in Honduras during July and August. However, this effect is not particularly evident in the Project Area, taking into account the local wind circulation and the presence of *Sierra Nombre de Dios* that acts as a barrier.

Figure 5.5 shows the months with the lowest level of rainfall, March (western section of the Project Area) and April (eastern section of the Project Area).

Figure 5.5 Months with least rainfall

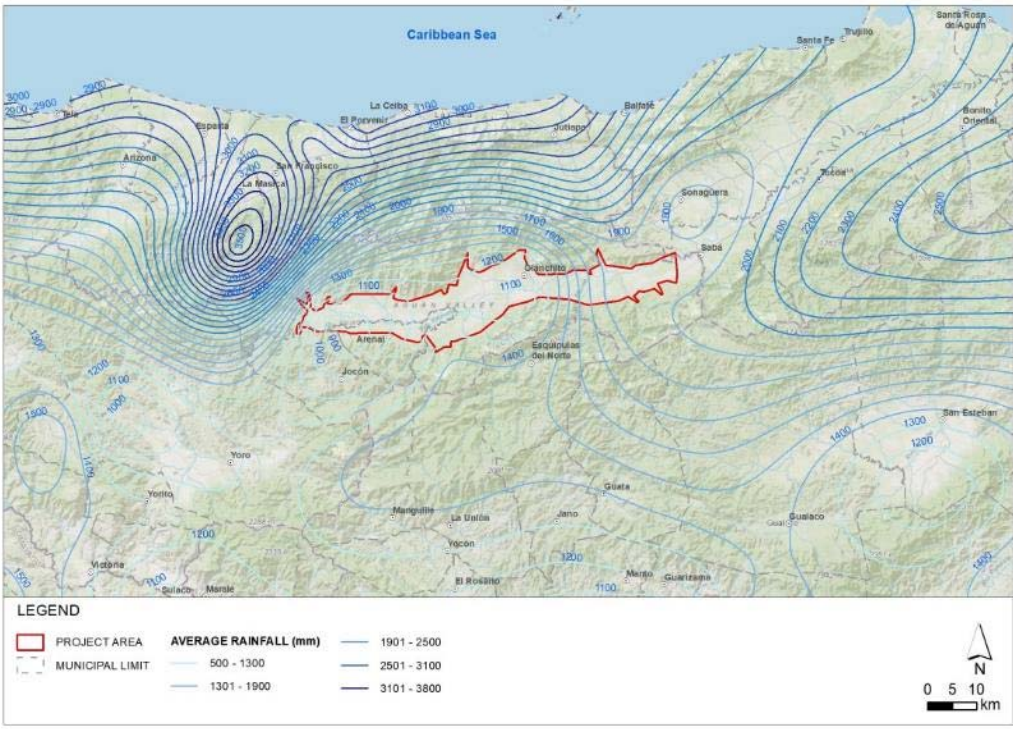


Source: SINIT – National System of Territory Information (*Sistema Nacional de Información Territorial*) – modified by ERM, 2018

Rainfall in the Project Area is affected by the *Sierra Nombre de Dios* mountain range, which prevents the humidity from the Atlantic Ocean reaching the Project Area. Because of this, the annual rainfall in the Project Area is only about a third of that recorded north of the *Sierra Nombre de Dios*, next to the Caribbean Sea (Atlantic Ocean), as described below.

Figure 5.6 shows the average rainfall in the Project Area, which ranges from 900 mm/year in the western section to 1,700 mm in the eastern section of the Project Area. This range is much lower than the rainfall observed in the basin north of the Sierra Nombre de Dios, where it rains more than 2,500 mm/year (maximum isocline: 3,500 mm). This basin to the north of the Sierra Nombre de Dios is located about 20 km from the western border of the Project Area, showing how clearly the mountain range affects the precipitation in the Project Area.

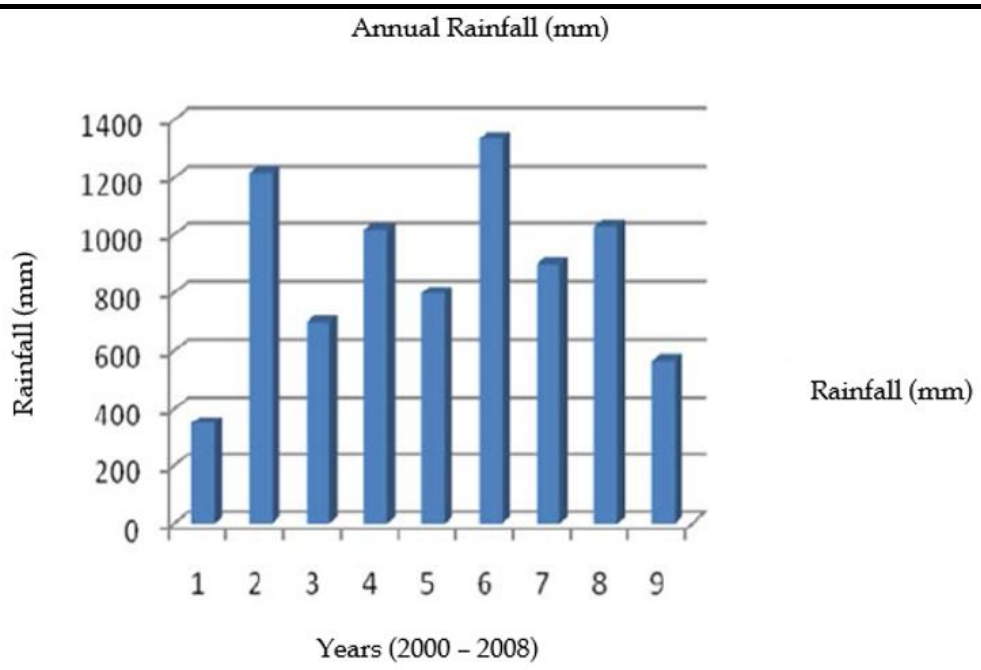
Figure 5.6 Average rainfall in the Project Area (shown by isoclines)



Source: SINIT – National System of Territory Information (*Sistema Nacional de Información Territorial*) – modified by ERM, 2018

In addition to this, information provided by Dole Fruit Company (Asesora, 2009) shows the average rainfall ranged from less than 400 mm/year in 2000 to less than 1,400 mm/year in 2005 in Coyoles (see *Figure 5.7*).

Figure 5.7 Yearly rainfall in Coyoles (Olanchito municipality) (2000 – 2008)



Source: Asesora, 2009 – modified by ERM, 2018

Additional rainfall data from Coyoles is included in *Table 5.1*. The annual rainfall can be seen to range from 800 mm to 1,400 mm in the period 1985 - 2012.

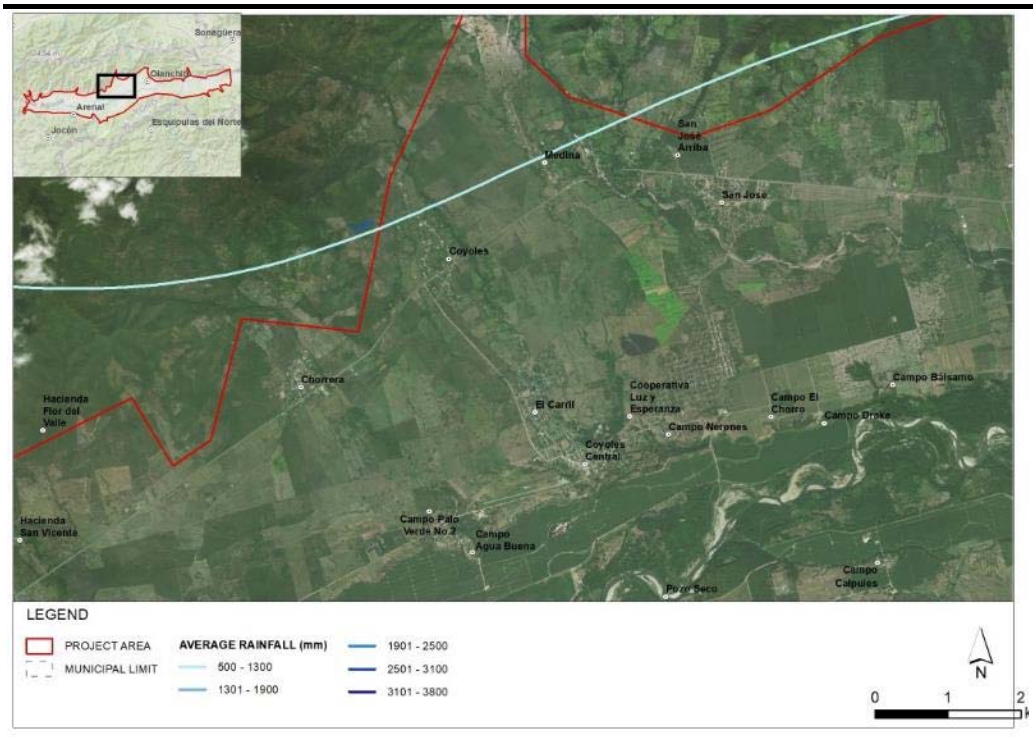
Table 5.1 Rainfall in the Project Area

Pd.	Prom 10 years		Total Rainfall (mm)							
	85-94	95-04	2005	2006	2007	2008	2009	2010	2011	2012
1	45.36	59.60	56.71	37.50	51.93	62.38	39.00	34.83	117.21	63.29
2	22.00	53.57	8.92	49.31	31.31	22.63	84.50	33.95	19.63	34.92
3	33.97	37.22	33.90	3.89	66.65	53.68	16.63	49.88	15.02	54.33
4	14.84	24.57	9.46	19.63	20.65	56.75	21.88	115.32	0.75	30.38
5	22.73	51.83	33.05	66.16	4.75	4.75	113.38	51.46	57.79	95.779
6	86.84	107.53	207.80	201.02	195.75	153.00	37.88	168.92	155.24	265.42
7	81.83	92.05	123.58	108.27	93.00	91.50	89.00	129.21	83.67	61.33
8	108.71	105.54	112.56	101.29	69.43	106.38	51.38	118.49	74.58	56.00
9	88.87	94.82	67.21	115.68	128.88	53.75	146.88	121.78	74.58	102.50
10	120.99	108.15	184.23	74.05	117.50	188.38	71.63	254.92	135.08	80.83
11	128.52	152.15	151.55	97.14	79.50	375.95	101.88	63.97	237.58	87.29
12	94.35	100.74	299.78	42.79	144.43	62.38	50.92	56.11	36.83	89.79
13	71.16	53.33	53.01	139.37	27.13	38.00	50.33	32.46	51.75	39.75
Tot.	**920.17**	**1041.10**	**1341.73**	**1056.08**	**1030.89**	**1269.50**	**881.25**	**1231.28**	**1059.72**	**1061.63**

Source: CINSA and PAA Project Finance, 2017

Coyoles is a community located in the central section of the Project Area, as shown in *Figure 5.8*.

Figure 5.8 Location of Coyoles



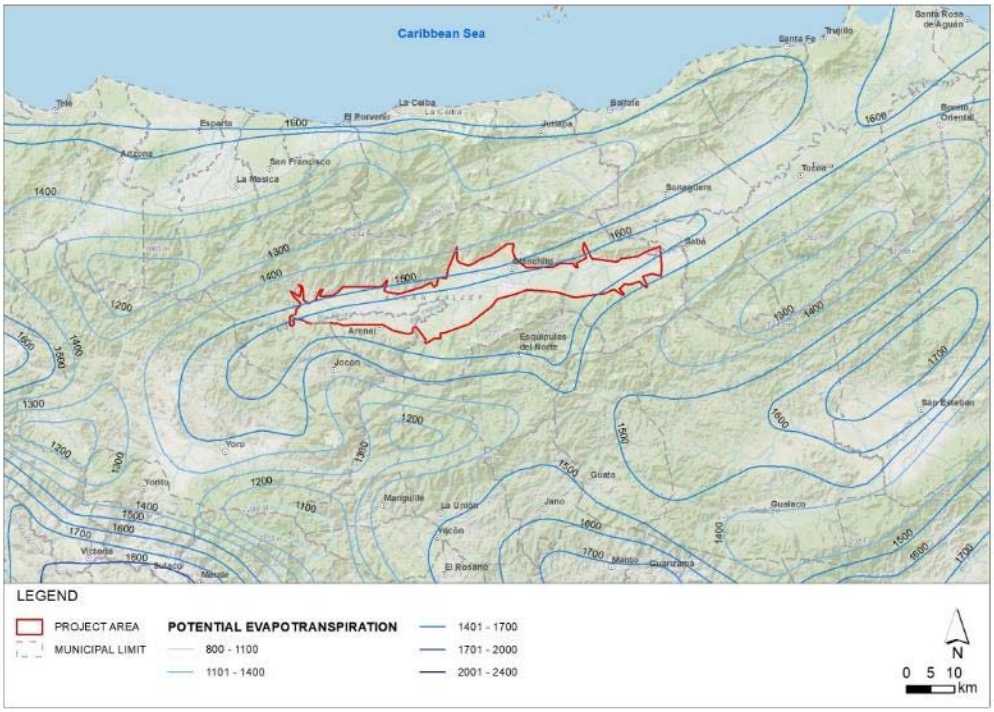
Source: ERM, 2018

Evapotranspiration and relative humidity

According to Asesora (2009), the evapotranspiration in the Project Area ranges between 1,400 mm/year and 1,600 mm/year. The high levels of evapotranspiration compared to low rainfall values (about 900 mm/year) result in a situation of water deficit for the vegetation, especially during the dry season. In addition, the annual relative humidity is 72.3%.

Figure 5.9 shows the potential evapotranspiration in the Project Area.

Figure 5.9 Potential evapotranspiration in the Project Area



Source: SINIT – National System of Territory Information (*Sistema Nacional de Información Territorial*) – modified by ERM, 2018

Extreme weather events

Hurricanes and tropical storms occur most often between June and October. However, this varies substantially from year to year. Regular events do not alter the country's general climate and their influence is limited to short periods (displacement though the Honduras Gulf). However, in some cases, these extreme weather events can be catastrophic, as in the case of Hurricane Fifi (1974) and Hurricane Mitch (1998), which had dramatic consequences including thousands of deaths, massive damage to the country's economy and infrastructures, failure of the water supply, and disease.

As in the rest of Central America, the *El Niño* climate phenomenon results in changes to the meteorological conditions: if *El Niño* is very intense, the likelihood of hurricanes and tropical storms in the Atlantic is lower and therefore, the average rainfall is lower, especially along the Pacific Coast.

Data from the municipality of Olanchito

To conclude, some specific climate data corresponding to the municipality of Olanchito is included in *Box 5.1,* complementing the previous climate baseline information.

Box 5.1 Specific climate conditions in the Olanchito municipality

- Average rainfall: 1,046 mm/year.
- Rainiest months: June and September.
- Driest months: March and April.
- "Heat wave" is stronger in July.
- Annual average temperature: 26º C.
- Hottest months: April and May, with monthly average temperatures of 34.6ºC and 36.6ºC, respectively.
- Coldest months: December, January and February, with monthly average temperatures of around 18ºC.
- Annual average relative humidity: 72.3%.
- Predominant wind direction: from the northeastern quadrant.

Source: CINSA and PAA Project Finance, 2017 – modified by ERM, 2018

Key findings - field survey (June 2018)

During the meetings in the Olanchito and Arenal municipalities, it was attempted to ascertain whether local meteorological stations were in existence in the Project Area. It was confirmed that the only currently operational meteorological stations are located in the banana plantations owned by Dole Fruit Company, which have a record going back more than 40 years. However, it was not possible to organize a meeting with this company during the field survey, so no additional meteorological information was gathered. The University of Olanchito is planning to install a meteorological station, but it is not yet in operation.

According to the information recorded in the meetings with the municipalities mentioned earlier, prior to 1990 there were more meteorological stations in the Project Area, when agriculture was more important than it is today.

A vandalized meteorological station was found on a bridge on the Aguan River during the field survey (*Figure 5.10*). The location of this meteorological station is included in *Annex 4 (Field Survey Map- Physical Baseline).*

Figure 5.10 View of the vandalized meteorological station in the Aguan River

Source: ERM, 2018

5.3.2 *Air quality, GHG emissions and climate change*

Overview

Information on air quality in Honduras and specifically in the Project Area is very scarce. Honduras is reported to have only one air quality station, located in Tegucigalpa (UNEP, 2015).

An article published by the Mario Molina Centre in 2008 (National Plan for Air Quality Management in Honduras) provides an overview of the air quality in Honduras.

According to this article, in Honduras the air quality has been monitored by CESCCO (Pollutant Control and Study Centre) since 2001, after the installation of four automatic monitoring stations: three in Tegucigalpa and one in San Pedro Sula. However, these were not in operation due to a lack of maintenance and trained personnel.

The same article explains that there are no air quality standards to enable limits to be set to protect the population from the harmful impacts of air pollutants (total suspended particles, TSP; and particulate matter of less than 10 micrometres, PM10). The article reports that these two parameters are more than 9 and 4 times, respectively, above the average annual limits set by the World Health Organization (WHO). However, these values should onlybe considered representative of the air quality conditions in large cities, such as San Pedro Sula and Tegucigalpa, where the monitoring stations were located.

The Department of Statistics from the Ministry of Health provided the following data about air quality in Honduras:

- In 2004, it reported that there were more than one million cases of respiratory diseases in Honduras.
- 27% of these diseases occurred in Tegucigalpa, the majority in children aged less than 5 years old.

- In 2007, the World Bank estimated that more than 500 premature deaths per year could be attributed to urban air pollution in Honduras.
- The costs associated with indoor air pollution are as much as 59.3 million dollars a year.
- In addition to this, the number of deaths attributable to air pollution in Honduras has risen from 3,978 in 2000 to 4,507 in 2016

Air emission sources in Honduras

According to the 2008 publication by the Mario Molina Centre (National Plan for Air Quality Management in Honduras), the main air emissions sources in Honduras are the transport and electricity sectors. These two activities, together with mining, are the largest fossil fuel consumers in the country. Of these air emissions sources, only transport and electricity were identified in the Project Area.

In the case of transport, it was estimated that the number of vehicles could double in the next five years, since distances travelled are increasing due to urban sprawl. Furthermore, there is a high proportion of vehicles around 10-years old with no emissions control equipment. This, along with the use of high-sulphur fuels and poor maintenance practices, results in the transport sector being an important source of atmospheric smoke and gaseous pollutants.

As for the electricity sector, energy consumption is growing rapidly in the country. Historically, Honduras generated electricity through hydroelectric power stations. However, over the last 15 years, these have been displaced by thermal power stations, which are now the main source of electricity in the country. This resulted in the quantity of fuel consumed between 2001 and 2006 doubling.

Air quality conditions in Honduras

As described in the 2008 publication by the Mario Molina Centre (National Plan for Air Quality Management in Honduras), particulate matter (measured as TSP and PM10) concentrations measured (e.g., in Tegucigalpa) exceed the air quality standards established in other countries and the WHO standards.

The main reasons for this exceedance are likely to be emissions generated by urban transport, re-suspension of dust in the streets, unpaved street emissions and eroded areas, and lime and brick kiln plants operating in urban surroundings.

In addition to the poor air quality conditions reported in urban areas in Honduras, rural areas also face problems of air quality because of forest fires and agricultural burning, which produce emissions of suspended particles.

Table 5.2 includes an additional overview of the air quality in Honduras.

Table 5.2 Overview of the Air Quality in Honduras

Current Status	Policies and Programmes
General overview	
• Ranked 23rd worst country for air pollution by the WHO, mainly due to transport and electricity generation. • Indoor air pollution is an issue in rural areas. • Insufficient resources for monitoring and enforcement. • Air quality monitoring system only in Tegucigalpa.	• Lack of National Ambient air quality standards. • Lack of National Air Quality Policy. • Environmental Policy provides general objectives but does not provide specific goals. • No legislation for managing air quality. • National Plan for Air Quality Management provides suggestions with regard to urban transport, land use planning, cleaner production, and energy efficiency improvements.
Emissions from industries	
• Industries with the potential to impact air quality: mining (gold, silver, lead, zinc, cadmium); brick kilns. • Industry share of GDP ($19 billion): 27%. • Electricity sources: petrol power plants (53%), hydro (42%), coal, gas, co-generation. •	• Since 2011, the regulation "For the Control of Emissions from Stationary Sources" has set parameters per industry and type of fuel used, as well as sensitive areas. • No regulation for emissions from small installations. • National renewable energy target of 60% electricity from renewable sources by 2022; renewable energy law provides income tax and customs tax exemptions, but does not address off-grid power plants and so favours larger, grid-connected plants; the sustainable energy action plan also does not promote off-grid projects; recently inaugurated the largest photovoltaic park in Latin America. • No tax incentives for energy efficiency measures, such as: subsidies, labelling, rebates, etc. • Small tax incentives for clean production and installation of pollution prevention technologies.
Emissions from transport	
Key transport-related air quality challenges: • No emission standards. • Growing fleet. • Possibly high-sulphur fuel.	• No vehicle emission limit: since 1999, regulation "To adjust Gas Emissions Pollutants and Smoke from motor vehicles". This regulation should be reviewed, since it has never been achieved in the absence of technical and technological capacities. • Fuel sulphur content: 5,000 ppm (fuel is imported, so could lower standard). • Restriction on used car importation: vehicles more than 7 years old (10

Current Status	Policies and Programmes
	years for public transport vehicles) are banned. • No incentives known for promoting non-motorized transport: sidewalks and bike lanes in new road projects, car-free areas, etc.
Emissions from open burning of agricultural and municipal wastes	
• Agricultural burning and forest fires, slash-and-burn agriculture.	• Legal framework: "Law on Waste Management" and the law "zero illegal burning". • Action to prevent open burning of municipal waste and/or agricultural waste.

Source: UNEP, 2015

The Project Area does not present any particular sources of air emissions such as industries, mining activities and power plant apart from traffic-related emissions. Livestock production activities are the dominant economic activity in the Project Area, however industrial milk-processing centres, which are potentially air emission source are located outside the Project Area. As so, the air quality is not likely to be highly degraded in the Project Area, despite the country problems with it.

GHG emissions in Honduras and its contribution to climate change

The contribution of Honduras to climate change is relatively low, with lower than average greenhouse gas emissions (GHGs) for Latin American and Caribbean countries and other lower-middle income countries. Energy production and land use changes (deforestation in particular) are considered the major factors in GHG emissions in Honduras.

However, even though Honduras does not contribute substantially to GHG production, it does suffer from changes brought about by increased coastal water levels.

According to the residents and producers interviewed during the field survey conducted in 2017 by CINSA and PAA Project Finance, another potential consequence of climate change is a reduction in the available water, especially during the dry season (January to April). However, there is no scientific study confirming this statement and this must therefore be considered a potential threat only, based on interviews with the local population.

In 2010, Honduras adopted a policy framework for climate change through the National Climate Change Strategy (ENCC - *Estrategia Nacional de Cambio Climático*). The ENCC includes seven priority sectors: water resources, agriculture, soils and food security, forests and biodiversity, coastal and marine systems, human health, risk management, and hydroelectric power. Most of the lines of action focus on adapting the country to the new conditions: reducing vulnerability and improving its capacity to respond to

weather phenomena. In addition, a GHG emissions inventory was prepared in Honduras, as described at the end of this section.

The report "Honduran agriculture and climate change. Where are the priorities for adaptation?" (CGIAR, CCAFS, 2015) assessed the vulnerability of Honduran municipalities to climate change. The main conclusions of this report with regard to climate change were the following:

- Honduras is considered to have the highest vulnerability to climate change in Central America.
- Climate change effects (increasing temperatures and decreasing rainfall) will have a significant impact on the agriculture sector in the country.
- The agriculture sector in the Olanchito and Arenal municipalities is considered to have low vulnerability within Honduras.
- The rural population in the Olanchito and Arenal municipalities is considered highly adaptable, based on access to basic services, innovative resources, and organizational and working capacities.

Climatological data analysis for assessing the climate change occurring in the country is not feasible taking into account the lack of long-term historical climatological data records and universal accessibility (see *Section 5.3.1*). For example, it apparently rains more now, but the data sets are too short to be able to confirm this statistically (e.g., according to *Table 5.1*, the rainfall in 2012 was similar to the rainfall in the period 1995-2004). In general, to be able to reach definitive conclusions, high-quality information spanning a longer period is needed, and this is not possible in Honduras.

The National Autonomous University of Honduras has conducted some research in this area, but their studies are not conclusive and have not been able to establish representative climate scenarios due to the lack of meteorological data, hyetographs, and so on.

Some additional data (*Table 5.3*) on climate change is available from the UNDP website (United Nations Development Programme).

Table 5.3 GHG emissions in Honduras

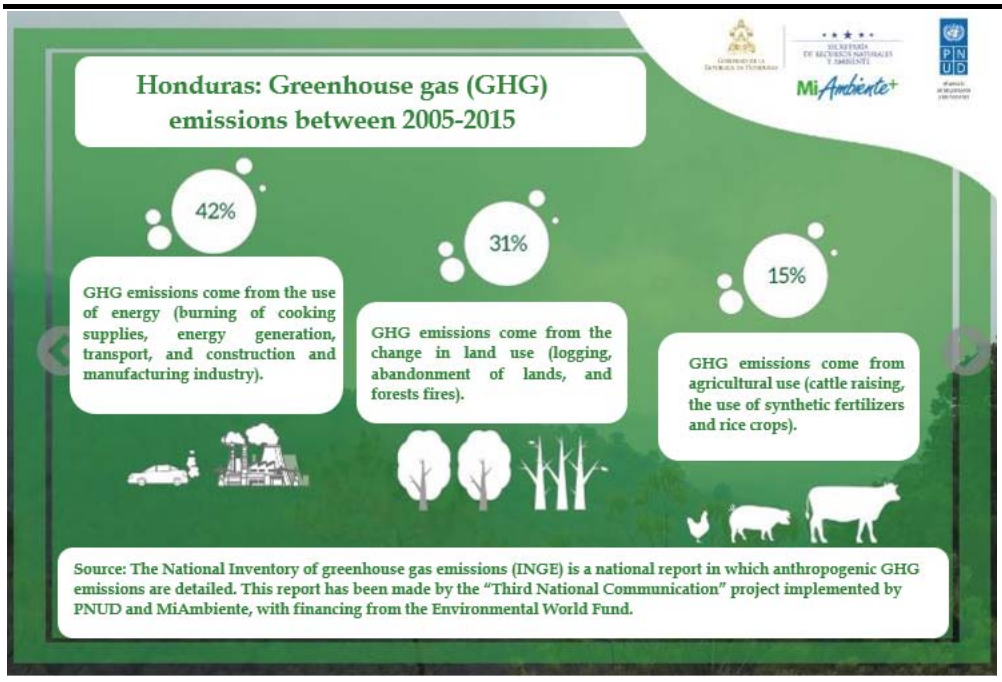
Parameter	Value
Baseline GHG emissions (LULUCF sector - Land Use, Land-Use Change and Forestry)	3,749.83 Gg CO_2 equivalent (2010)
GHG emissions objective for 2021	3,562.34 Gg CO_2 equivalent
Difference	187.49 Gg CO_2 equivalent
Reduction needed	5%

Source: UN website (http://hn.one.un.org/content/unct/honduras/es/home/manud/tasa-de-asistencia-escolar18.html)

The UNDP website also provides information on GHG emissions and climate change in Honduras. The main conclusions from this are:

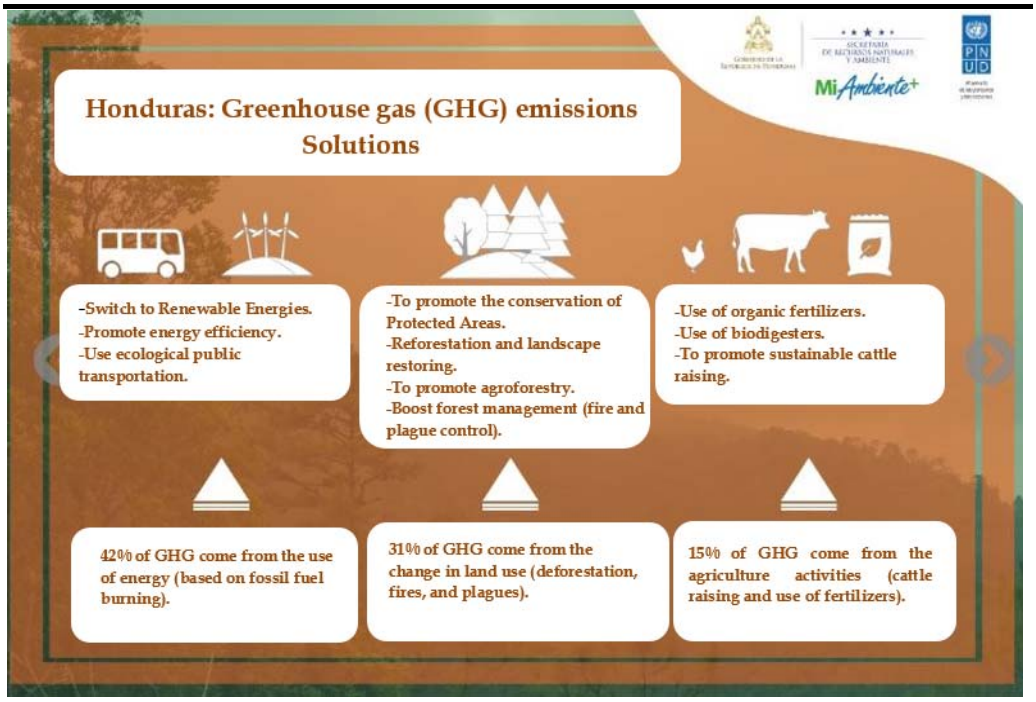
- About 90% of GHG emissions in Honduras are from the following sectors: energy, agriculture, and land-use-related sources (National Inventory of GHG emissions), split as follows: 42% (energy); 31% (land-use-related); and 15% (agriculture), see *Figure 5.11*.
- Knowing and understanding GHG emissions (mainly CO_2, CH_4 and N_2O) is part of the commitment of Honduras to comply with the United Nations Framework Convention on Climate Change (UNFCCC) to take the actions needed to reduce GHG emissions, and therefore mitigate climate change effects. Further information on actions for reducing GHG emissions in Honduras is included in *Figure 5.12*.
- The GHG emissions inventory has been developed as part of the project "Third National Communication on Climate Change" (*Tercera Comunicación Nacional sobre Cambio Climático*), by PNUD and MiAmbiente.

Figure 5.11 Overview of GHGs and climate change in Honduras



Source: PUND website (http://www.hn.undp.org/content/honduras/es/home/stories/gases-de-efecto-invernadero-y-cambio-climatico.html) – modified by ERM, 2018

Figure 5.12 Actions planned for reducing GHG emissions in Honduras



Source: PUND website (http://www.hn.undp.org/content/honduras/es/home/stories/gases-de-efecto-invernadero-y-cambio-climatico.html) – modified by ERM, 2018

Key findings - field survey (June 2018)

Three main observations potentially related to climate change were reported during the field survey conducted in June 2018:

- Lack of availability of water, especially in the dry season (January to April), when the need for water is higher to keep the forage in good conditions (this was also reported during the field survey conducted in 2017).
- Dry and rainy seasons are less stable now (more unpredictable) which affects the annual planning of the farmers. Because of this, some crops can only have one cycle per year (from seeding to harvesting), although in the past two cycles were possible.
- The main sources of GHGs observed during the field survey were road traffic and cattle raising.

As described previously, in the absence of scientific studies confirming these statements, they are to be considered potential issues based on interviews with the local population.

5.3.3 Acoustic environment

Information on the acoustic environment in Honduras, and specifically the Project Area, is very scarce. Therefore, this section includes a general noise baseline description limited to expected noise conditions in different types of environments (urban areas, rural areas and remote areas). No noise recording was performed during the field surveys. However, Project activities are

unlikely to significantly affect the acoustic baseline conditions, so a general description is considered sufficient.

It is expected that noise levels in urban areas (e.g., Tegucigalpa) are high, taking into account the typically dense traffic: levels around 75 dBA are common in busy urban areas, and levels up to 85 dBA occur near major freeways and airports.

In very remote areas, far from any human activities, the sound level is determined by natural sources such as water (rain, rivers and waterfalls), and the wind making waves and blowing through the vegetation.

The Project Area is located in a rural area, characterized by relatively low ambient noise levels, particularly at night. However, some noise sources (e.g., traffic) are present, but these are more limited than in the urban areas. In small towns (e.g., Olanchito), the noise levels are likely to be around 50 or 60 dBA, being higher at day than at night. In wilderness areas (e.g., protected areas) or remote rural areas (sparsely populated areas, such as small communities and farms in the Project Area), the noise levels may be below 27 dBA (night) and 30 dBA (day)[1].

5.3.4 Topography

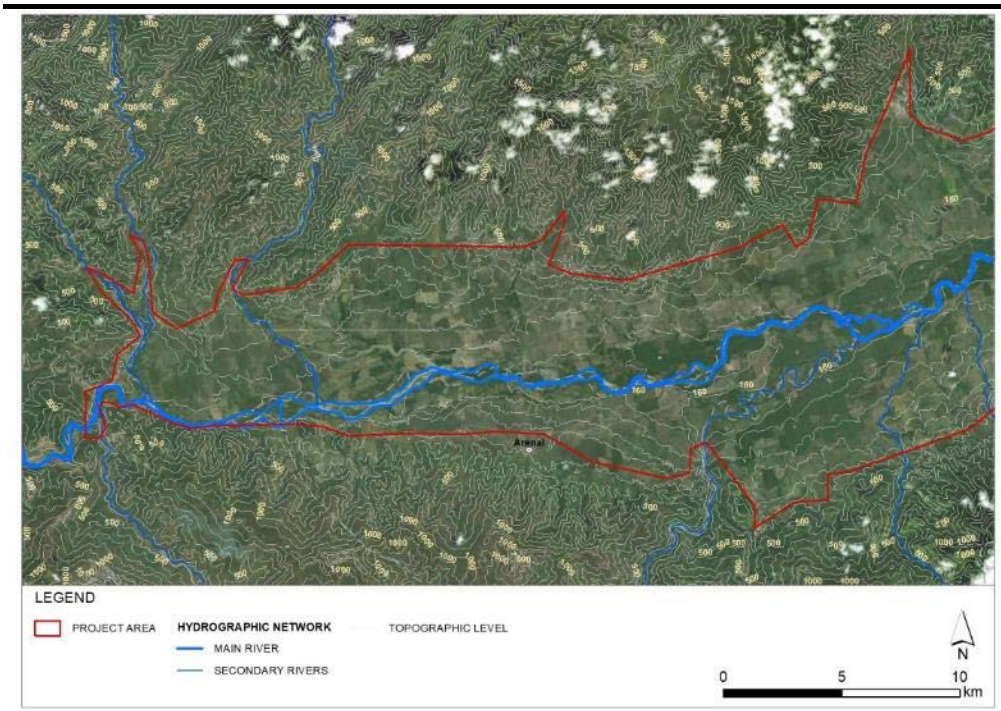
Overview

Figure 5.13 and *Figure 5.14* show the topography in the Project Area. It can be seen that most of the Project Area is relatively flat, corresponding to the bottom of the Aguan River Valley. The upper section of the Aguan River Valley (west section of the Project Area), has an altitude of about 500 m ASL, whilst the lower section (east section of the Project Area), has an altitude of about 100 m ASL.

The Project Area is surrounded by hills and mountains on both sides of the valley: those in the north correspond to the *Sierra Nombre de Dios* and those in the south correspond to the *Sierra La Esperanza*.

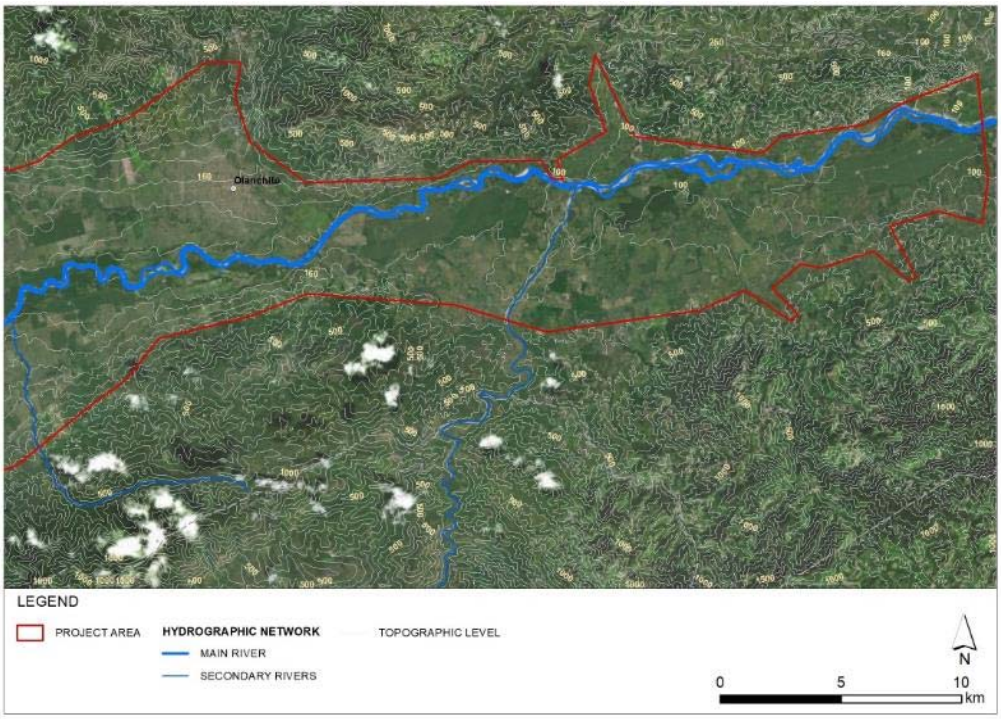
[1] Waugh, D. Durucan, S. Korre, A. Hetherington, O. O'Reilly, B. Environmental Quality Objectives – Noise in Quiet Areas, Report 2000-MS-14-M1, EPA-Ireland

Figure 5.13 Topography in the Project Area (western section)



Source: Integra Ingeniería, 2017 – modified by ERM, 2018

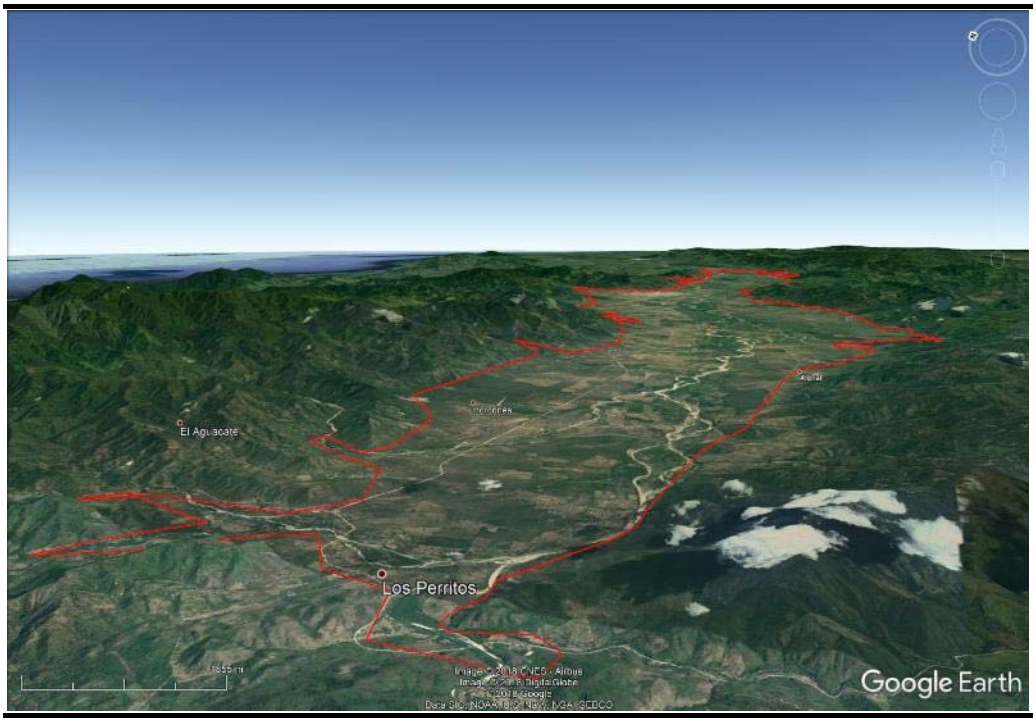
Figure 5.14 Topography in the Project Area (eastern section)



Source: Integra Ingeniería, 2017 – modified by ERM, 2018

Figure 5.15 shows a Google Earth Pro view of the overall topography of the Project Area, showing that the Aguan River Valley, where the Project Area is located, is very flat.

Figure 5.15 Topography in the Project Area – Google Earth Pro



Source: Google Earth Pro – modified by ERM, 2018

Key findings - field survey (June 2018)

No specific observations on topography were recorded during the field survey conducted, taking into account the fact that no significant impact on the topography of the Project Area is expected as a result of the Project activities.

The following photographs (*Figure 5.16*) confirm the flat topography of the Project Area. They show the main road crossing the Aguan River Valley, surrounded by mountain chains on either side of the valley.

Figure 5.16 Panoramic photographs taken in the Project Area

Source: ERM, 2018

5.3.5 Geology

National geological context

Honduras is located on the Palaeozoic basement Chortis Block (*Bloque Chortis*). This block comprises variably metamorphosed sedimentary rocks. There are two main types of rocks: phyllites (*filitas*) and granitic schists (*esquistos graníticos*). Other rocks with different levels of metamorphism may occur, such as gneiss, migmatite, quartzite, and marble. This group of facies is known as the Cacaguapa Group or Cacaguapa Schists, and is present throughout the country (see blue polygon in *Figure 5.17*).

Mesozoic and Cenozoic sedimentary materials lie discordantly above this Palaeozoic basement. The Mesozoic sediments are from the Jurassic and Lower Cretaceous periods and were deposited under continental or shallow marine conditions. They are known as the Honduras Group (see red polygon in *Figure 5.17*).

During the Upper Cretaceous some carbonate rocks (limestone) formed, followed by detritic deposition. The limestones are shallow water reefal limestone, known as the Yojoa Group (see green polygon in *Figure 5.17*). The detritic rocks comprise conglomerates, sandstones, marls, and limestones, and are known as the Angels Valley Group (see orange polygon in *Figure 5.17*).

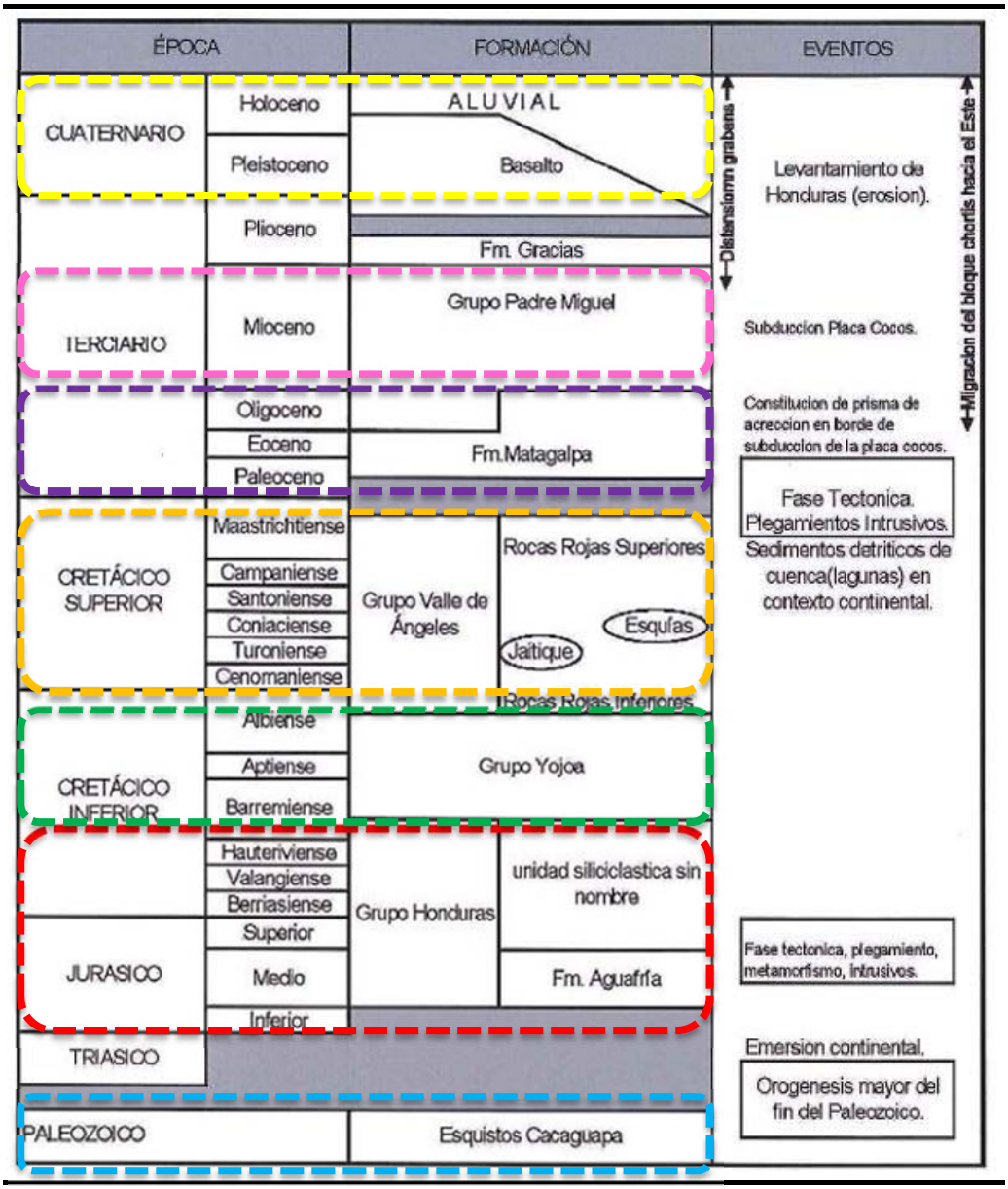
Volcanic processes occurred during the Tertiary. These resulted first in the Matagalpa Group, a volcanic pre-ignimbrite unit found discordantly overlying the Cretaceous rocks. It is a basic unit with predominant andesites, basalts, and pyroclastic flows (see purple polygon in *Figure 5.17*). Overlying the Matagalpa Group is the Padre Miguel Group consisting of ignimbrites, rhyolitic tuffs, and andesitic tuffs (see pink polygon in *Figure 5.17*).

At the end of the Tertiary, there was uplift of the Chortis Block and the previously described facies were eroded. Products resulting from this erosion were transported and sedimented in low basins, mostly along the coast.

Finally, during the Quaternary, basalts were extruded in several areas of Honduras. The most recent materials include detritic sediments formed in alluvial, deltaic and colluvial environments (see yellow polygon in *Figure 5.17*).

Figure 5.17 depicts the stratigraphic column for Honduras, showing all the geological groups described above.

Figure 5.17 Stratigraphic column of Honduras

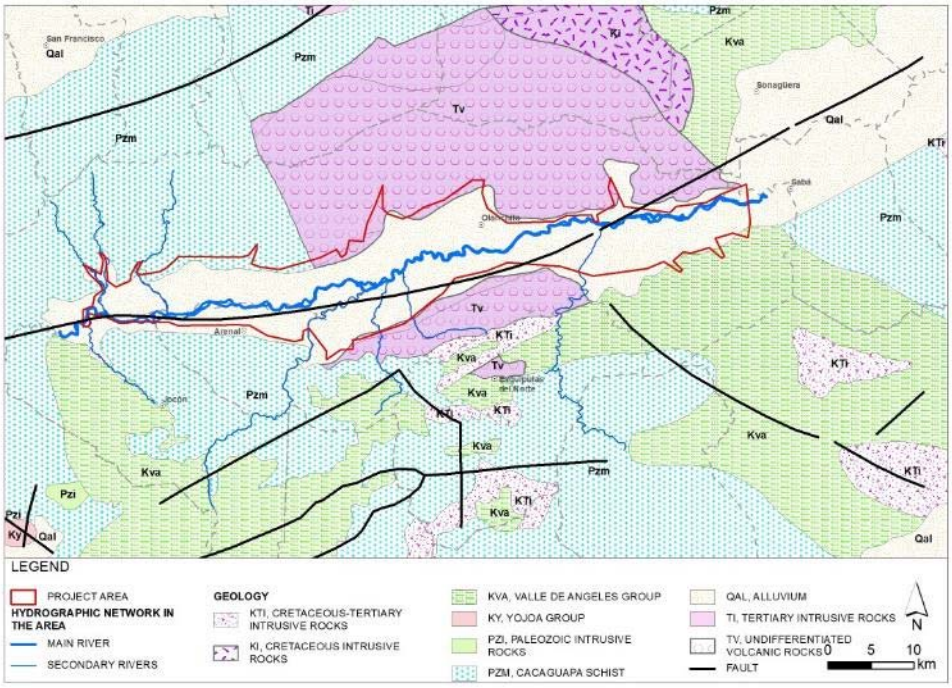


Note: Text is in Spanish, see description provided in the main text in English.
Source: Honduras stratigraphic column. Modified by Rogers, R.D. (1992) and Serna, Geominh-BRGM (1987-1992) – Modified by ERM, 2018

Local geological context

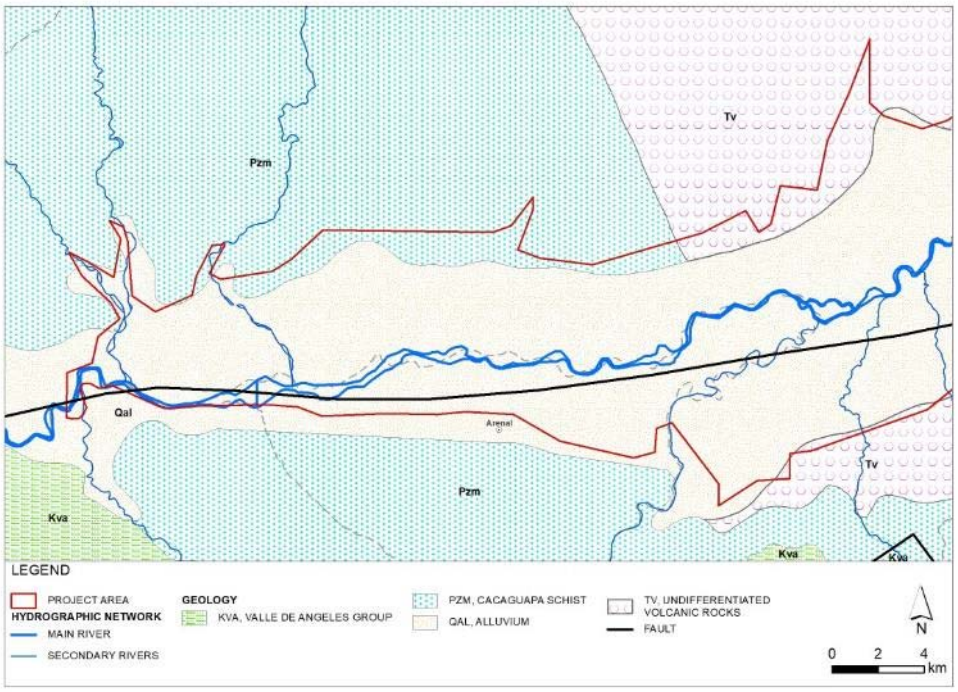
The geology of the Project Area is shown in *Figure 5.18*, *Figure 5.19* and *Figure 5.20*.

Figure 5.18 Geology of the Project Area (general view)



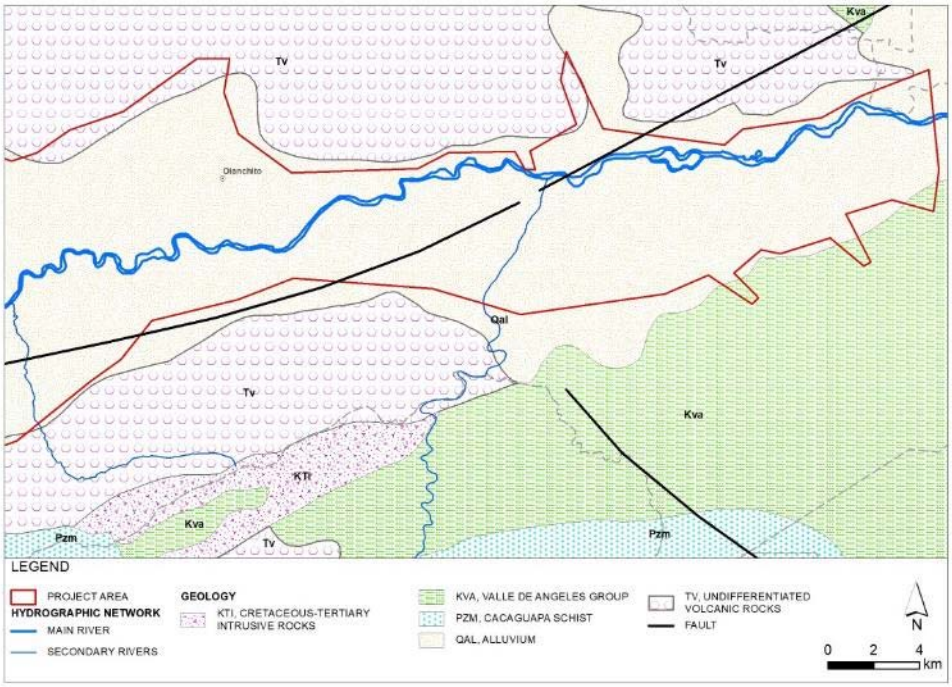
Source: Integra Ingeniería, 2017 - modified by ERM, 2018

Figure 5.19 Geology – zoom in view (western section)



Source: Integra Ingeniería, 2017 - modified by ERM, 2018

Figure 5.20 Geology – zoom in view (eastern section)



Source: Integra Ingeniería, 2017 - modified by ERM, 2018

The following geological units are found in the Project Area:

- *Palaeozoic materials of the Chortis Block* (Palaeozoic basement) (see "Pzm" in the geology map legends). Outcrops of this unit are found in the western section of the Project Area, in the hills around the valley: the Cacaguapa Group or Cacaguapa Schists formed by metamorphic materials, mostly schists, slates, quartzite and gneiss. This unit acts as a basement, overlain by the other units in the Project Area (valley and hills). Outcrops of this unit within the Project Area only represent 3.5% of the total surface area of the Project Area.
- *Angels Valley Group* (see "Kva" in the geology map legends): reddish clastic layers (continental origin) deposited during the Cretaceous. They mostly comprise quartz conglomerates in a cemented matrix, together with reddish sands and clays; these have some surficial porosity but are quite compacted too. Outcrops of this unit are found in the eastern section of the Project Area, mostly in the hills in the south of the valley, and they represent 0.4% of the total surface area of the Project Area.
- *Cretaceous plutonic intrusions* (see "KTi" and "Ki" in the geology map legends): monzogranitic composition. Found in fractures and between metasediment strata. Outcrops of this unit follow the undifferentiated plutonic rocks found in the hills in the south of the valley; they are not found in the Project Area, but about 5 km to the south.
- *Undifferentiated plutonic rocks* (see "Tv" in the geology map legends): rhyolitic ignimbrites with quartz phenocrysts. This unit replaces the Palaeozoic basement in the eastern section of the Project Area.

Outcrops of this unit are found in the central section of the Project Area, in the hills around the valley; and in the eastern section of the Project Area, in the hills to the north of the valley. They represent 4.7% of the total surface area of the Project Area

- *Alluvial deposits* (see "QA" in the geology map legends): materials in the alluvial plain of the Aguan River and its tributaries. They are composed mainly of gravels and gravels with silts. This is the predominant geological unit in the Project Area. There is no available information on the thickness of this unit. However, according to some records from abstraction wells in the Project Area (see *Annex 4*), the thickness of this unit is at least 20-40 m (the gravel levels of the lithological profile correspond to the alluvial deposits, while the clays define the beginning of a different unit). These alluvial deposits represent 91.4% of the total surface area of the Project Area.

In conclusion, the Aguan River and its valley are likely to be associated to a tectonic line oriented approximately east-west. This directional pattern (east to west) can also be seen in the distribution of some of the geological materials, such as the Angels Valley Group (Kva) and the Cretaceous plutonic intrusions (KTi).

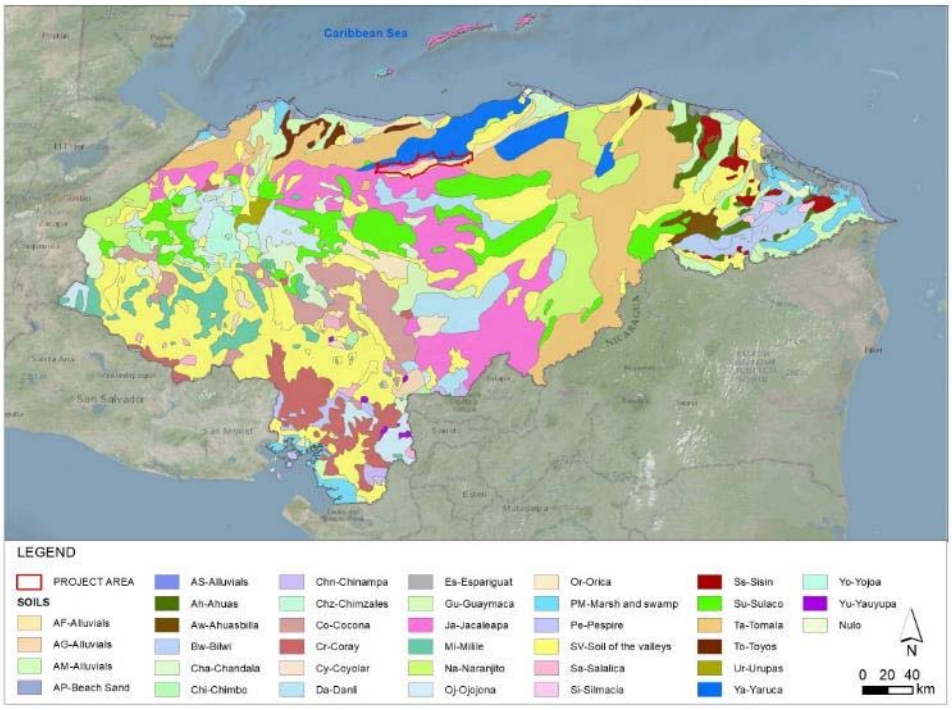
5.3.6 Soils

Overview

The types of soils in Honduras are shown in Figure 5.21, whilst Figure 5.22 and Figure 5.23 show the types of soils in the Project Area. Three main types of soils occur in the Project Area:

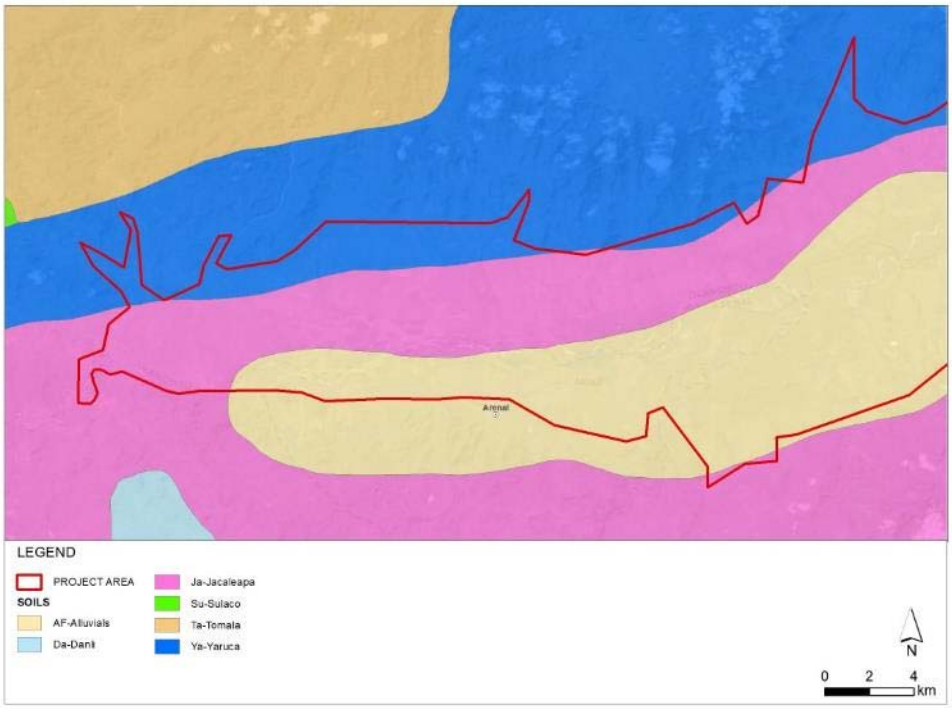
- Alluvial soils: found in the vicinity of the Aguan River. These have a well-drained fine texture referred to as AF soils in the Simmons soil classification and described as sandy and silty soils, with gravels and cobbles, with a yellow to grey colour. These soils are usually good for agriculture and although they are well drained, during the rainy season puddles may be produced on the surface. Alluvial soils occupy 50.3% of the Project Area.
- Surrounding the alluvial soils and associated with the slopes is a strip formed by the so-called Jacaleapa and Yaruca soils. Both are lithosols (i.e., soils with a high stone content or thin soils on rock). According to the potential soil use scale, they are classified as type VII (potential use for pasture and selective forest use). They are described as being not very deep, formed above a substrate of metamorphic igneous rocks. Jacaleapa soils occupy 23.9% of the Project Area, and Yaruca soils occupy 24.5%.
- There are two additional categories of soils: valley soils and Tomala soils. However, these are found very residually, and occupy less than 1% of the total surface area of the Project Area.

Figure 5.21 Soils in Honduras



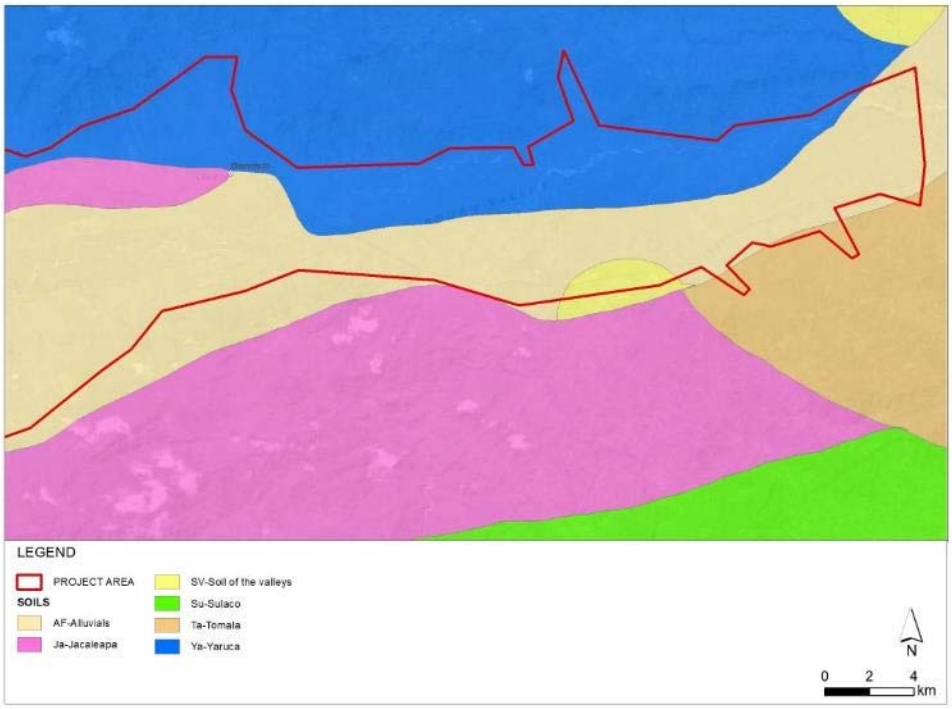
Source: Integra Ingeniería, 2017 - modified by ERM, 2018

Figure 5.22 Soils – zoom in view (western section)



Source: Integra Ingeniería, 2017 - modified by ERM, 2018

Figure 5.23 Soils – zoom in view (eastern section)



Source: Integra Ingeniería, 2017 - modified by ERM, 2018

Key findings - field survey (June 2018)

The field survey conducted in 2018 was aimed at gathering information on: (1) the soil quality conditions in the Project Area, in particular with regard to the potential effect on soil quality resulting from erroneous use of chemical products typically employed in the agricultural sector: fertilizers, pesticides, and herbicides; and (2) soil profiles.

Table 5.4 summarizes the feedback received during the field survey regarding the use of chemical products (herbicides, pesticides, and fertilizers): although chemical products are commonly utilized on the farms in the Project Area, only small quantities are used.

Table 5.4 Use of chemical products (fertilizers, pesticides, and herbicides) in the Project Area

Source	Feedback		
	Herbicides	Pesticides	Fertilizers
SAG	Common use. Small quantities.		
SENASA	Low use: once every 6 months – 1.4 l/ha. In the dry season they are not needed, due the absence of herbaceous plants. In the rainy season, mechanical hand	Low use: once every 6 months - 1.4 l/ha. Use is not recommended. In the case of the pest *Duplachinonaspis divergens* a regular detergent only is	Urea is the most common product. Also, formula: 12/24/12 (N/P/K). Low use: once / year (rainy

Source	Feedback		
	Herbicides	Pesticides	Fertilizers
	tools are recommended for removing weeds.	recommended (non-hazardous for the environment). IPC management: integrated pest control by selection of resistant crop varieties also results in low levels of pesticides.	season) – 64 kg/ha.
Meeting with group of farmers (small property profile)	Low use, but more than pesticides.	Very low use, except in the banana plantations.	Low use. Organic fertilizers preferred (e.g. manure), as cheaper.
Visit to farm 30 (small property profile)	*Combatran*.	-	Urea and formula: 12/24/12 (N/P/K).
Visit to farm 71 (medium property profile)	*Combatran*. Low use: once/year – limited to 14 ha (total property is 56 ha) – 1.4 l/ha	-	Urea and formula: 12/24/12 (N/P/K). Low use: once/year - 71 kg/ha
Visit to farm 108 (small property profile)	*Roundup*: to burn existing forage and plant new. *Tordon*: for weeds.	-	Urea and formula: 12/24/12 (N/P/K). Medium use: urea (once / 40 days) and formula 12/24/12 (once / 25 days).
Visit to farm 128 (small property profile)	*Plenum*. Low use: twice / year – 1.2 l/ha. Hand tools to remove wild weeds.	-	Urea. Low use: once to twice/year – 6 kg/ha.
Visit to farm 165 (large property profile)	*Bullgrass*. Low use: once / year.	-	Urea and formula: 12/24/12 (N/P/K). Low use: limited to 2 plots with forage (camerun and suasi).

Source: Field survey, 2018

Based on the information gathered during the field survey through interviews with the local population, soil quality conditions can be expected to be good,

as no erroneous uses of chemical products were observed. *Figure 5.24* includes a photograph of a herbicide container found on one of the farms visited.

Figure 5.24 Herbicide observed on a farm in the Project Area

Source: ERM, 2018

Two soil profiles were identified during the field survey where the horizons were exposed. In both cases the pedology comprised of gravels and pebbles with more sandy levels. *Figure 5.25* includes a view of the two soil profiles. The location of these profiles is included in *Annex 4 (Field Survey Map- Physical Baseline)*.

Figure 5.25 Soil profiles in the Project Area

Source: ERM, 2018

5.3.7 Hydrology

Overview

The Project Area is located in the macro-basin of the Aguan River, with a total surface area of about 10,266 km^2. The Aguan River Valley itself has a total surface area of about 718 km^2.

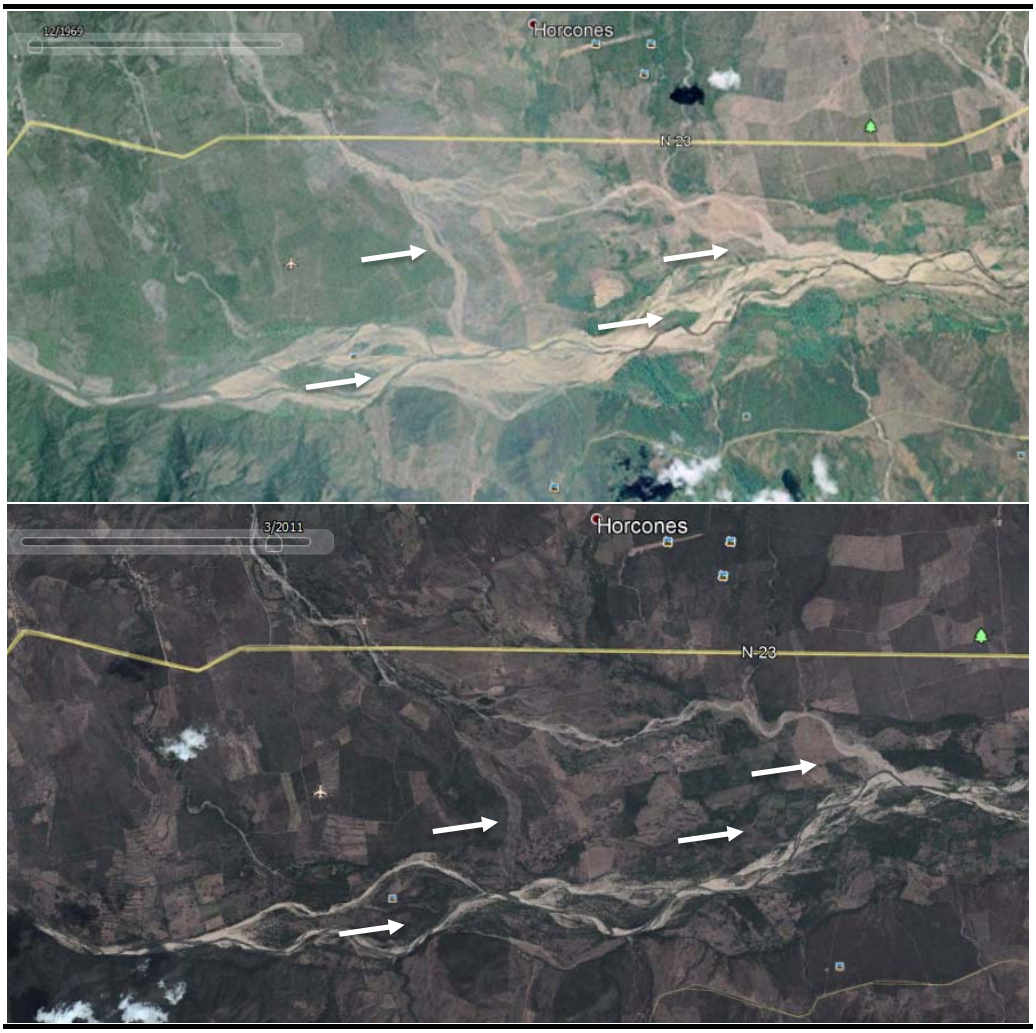
The Aguan River Basin reaches its highest altitudes in *Montaña Santa Bárbara* (2,480 m ASL) and *Pico Bonito* (2,435 m ASL). The total length of the Aguan River is about 275 km.

The Project Area is located at an average altitude of 100 – 300 m ASL in the lower part of the Aguan River Basin, close to the Caribbean Sea, into which the Aguan River flows, leading in Santa Rosa de Aguán municipality (located at about 90 km in NE direction from the Project Area).

During the rainy season, the Aguan River occupies a wider section of the river bed and the water turns brown due to the sediments carried down by the tributaries in the hillsides. In the dry season (January to April), the flow decreases significantly and the riverbed narrows creating beaches more than 800 m wide. During the dry season the river runs clear.

The Aguan River seems to be very dynamic with changes along its course and bars being formed from the sedimentary materials transported downstream. This type of river, in addition to the main watercourse, involves secondary courses that are followed occasionally based on water flow. These secondary courses can form isolated water bodies fed by the river. This can be seen from a review of the various historical aerial photographs. A good example is shown in *Figure 5.26*, where satellite photographs of one location (the Aguan River at the confluence with the San Lorenzo River) show two different years (1969 and 2011). These reveal several changes in the course followed by the river (some are highlighted with white arrows). Satellite photographs also show the wide fluvial bars in the dry season.

Figure 5.26 ***Aerial view of the Aguan River at the confluence with the San Lorenzo River in 1969 (top) and in 2011 (bottom)***



Source: CINSA and PAA Project Finance, 2017 - modified by ERM, 2018

Figure 5.27 and *Figure 5.28* show examples of fluvial bars and secondary watercourses.

Figure 5.27 Aerial view of fluvial bars

Source: Google Earth Pro - accessed and modified by ERM, 2018

Figure 5.28 Ground view of fluvial bars

Source: CINSA and PAA Project Finance, 2017

The Aguan River has many tributaries in the Project Area. Both the Aguan River and the main tributaries are highlighted in *Figure 5.29. Table 5.5* shows the main tributaries both on the right and left side.

Table 5.5 Main Aguan River tributaries in the Project Area

Tributaries on the right side		Tributaries on the left side	
Las Gemelas Stream	La Pita Stream	Chiquito River	San Marcos River
Zapamatepe Stream	El Higuero Stream	San Lorenzo Stream and River	El Ojo Stream
El Terrero Stream	El Saladillito Stream	San Felipe Stream	San Juan River

Tributaries on the right side		Tributaries on the left side	
Seca Stream	El Chile Stream	El Barro Stream	El Guayacan Stream
Yaguala River	Uluapa River	La Chorrera Stream	Coyoles River
Cerritos Stream	Potrerillos Stream	Medina Stream	Agalteca River
Puerto Escondido Stream	San Carlos Stream	La Pimienta River	Uchapa River
Mame River	San Francisco River	Charatí Stream	Uyuca River
Jaguaca River		Santa Barbara River	

Source: CINSA and PAA Project Finance, 2017 – Edited by ERM, 2018

The flow in the tributaries is very variable, as described previously, with a seasonal pattern. *Table 5.6* provides the water flow of certain tributaries after the dry season.

Table 5.6 Water flow measured (May 2016) in some Aguan River tributaries in the Project Area

Tributary name	Water flow (l/s)
San Marcos River	226
Uyuca River	600
Agalteca River	150
Coyoles River	27
San Marcos River	226
Jaguaca River	1,110

Source: CINSA and PAA Project Finance, 2017 – Edited by ERM, 2018

Table 5.7 and *Table 5.8* provide information on the water flow in the Aguan River in two locations: Sabana Larga and Olanchito. The water flow in the Aguan River is significantly higher during the rainy season than during the dry season in the two locations, according to the average water flows presented in both *Table 5.7* and *Table 5.8*.

Figure 5.29 shows the location of Sabana Larga and Olanchito. Sabana Larga is situated on the western border of the Project Area, upstream of Olanchito, which is in the centre of the Project Area, about 45 km from Sabana Larga. Because of this, water flows measured in Olanchito are higher than those measured in Sabana Larga, since between Sabana Larga and Olanchito, the Aguan River receives additional water input from tributaries in the area.

Table 5.7 Water flow in the Aguan River (Sabana Larga)

Date	Flow (m^3/s)	Season	Date	Flow (m^3/s)	Season
04/08/2000	6.92	Rainy	05/07/2005	12.12	Rainy
17/10/2000	22.15	Rainy	06/05/2006	6.03	Dry
08/05/2000	3.58	Dry	08/03/2007	23.19	Dry
12/06/2001	5.28	Rainy	08/08/2007	5.11	Rainy
21/06/2000	6.27	Rainy	15/12/2007	17.70	Rainy
23/09/2001	5.79	Rainy	07/03/2008	9.55	Dry
25/09/2001	4.74	Rainy	20/06/2008	6.93	Rainy
26/09/2001	6.46	Rainy	16/11/2008	42.15	Rainy
08/11/2001	116.19	Rainy	22/02/2009	16.36	Dry
23/08/2002	5.60	Rainy	24/05/2009	8.10	Dry
11/12/2002	8.73	Rainy	07/08/2009	11.20	Rainy
17/03/2003	6.91	Dry	11/11/2009	24.28	Rainy
01/07/2003	7.67	Rainy	21/04/2010	8.36	Dry
24/08/2003	7.60	Rainy	19/05/2010	7.33	Dry
27/08/2003	6.83	Rainy	21/10/2010	23.21	Rainy
08/10/2003	8.08	Rainy	06/03/2011	4.62	Dry
10/12/2003	33.84	Rainy	17/06/2011	4.97	Rainy
11/02/2004	10.37	Dry	23/08/2011	36.48	Rainy
24/03/2004	10.64	Dry	17/02/2010	8.19	Dry
12/05/2004	12.00	Dry	24/03/2004	15.76	Dry
26/04/2005	2.88	Dry			
Average water flow during the dry season: 9.62 m^3/s					
Average water flow during the rainy season: 23.22 m^3/s					

Notes: February to May (inclusive) are considered rainy season months, with regard to river flow. Although the dry season ends in April, values measured in May are more representative of the dry season than the rainy season. For the same reason, although the dry season starts in January, the values measured in January are more representative of the rainy season than the dry season.
Source: CINSA and PAA Project Finance, 2017 – modified by ERM, 2018

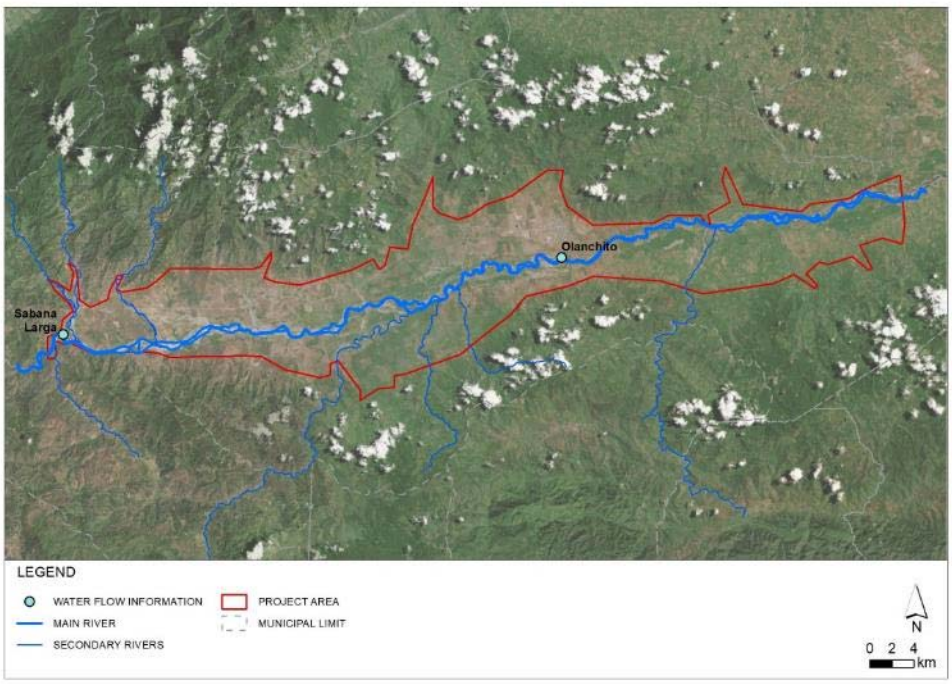
Table 5.8 Water flow in the Aguan River (Olanchito)

Date	Flow (m^3/s)	Season	Date	Flow (m^3/s)	Season
07/05/2001	10.09	Dry	10/02/2004	25.44	Dry
12/06/2001	16.61	Rainy	23/03/2004	26.17	Dry
21/06/2001	13.41	Rainy	12/05/2004	25.51	Dry
23/09/2001	31.89	Rainy	24/11/2004	30.87	Rainy
25/09/2001	23.51	Rainy	26/04/2005	7.78	Dry
26/09/2001	19.44	Rainy	05/07/2005	37.49	Rainy
22/08/2002	18.58	Rainy	05/05/2006	13.32	Dry
13/12/2002	20.37	Rainy	08/08/2007	32.34	Rainy
18/03/2003	16.81	Dry	22/05/2009	40.88	Dry
09/07/2003	24.13	Rainy	07/08/2009	25.92	Rainy
23/08/2003	36.62	Rainy	21/04/2010	32.19	Dry
24/08/2003	31.52	Rainy	07/04/2011	11.26	Dry
9/10/2003	30.24	Rainy	18/06/2011	24.64	Rainy
10/12/2003	85.86	Rainy	24/08/2011	72.67	Rainy
Average water flow during the dry season: 20.95 m^3/s					
Average water flow during the rainy season: 32.00 m^3/s					

Notes: February to May (inclusive) are considered rainy season months, with regard to river flow. Although the dry season ends in April, values measured in May are more representative of the dry season than the

rainy season. For the same reason, although the dry season starts in January, the values measured in January are more representative of the rainy season than the dry season.
Source: CINSA and PAA Project Finance, 2017 – modified by ERM, 2018

Figure 5.29 Aguan River and its tributaries in the Project Area



Source: ERM, 2018

The water flow in the Aguan River comes from two main sources: tributaries flowing towards this river; and groundwater flow towards the river from the alluvial aquifer located in the bottom of the valley (see *Section 5.3.8*).

Water from the Aguan River is mainly used by the agricultural sector, but it is also a drinking water source in the upper areas of its tributaries. In the Aguan River itself, no supplies of water for human consumption were reported during the field survey conducted in June 2018. *Figure 5.30* shows a surface water extraction system. Further information about the water consumption in the Project Area is included in *Section 5.4*.

Figure 5.30 Surface water extraction

Source: CINSA and PAA Project Finance, 2017

Key findings - field survey (June 2018)

The 2018 field survey was aimed at gathering information on the following hydrological parameters: surface water quality; use of the surface water by the local population; and the existence of gauging stations in the Project Area to measure the river water levels and flows. Some photographs taken during the field survey relating to key hydrological findings are included in *Figure 5.31*. The location of all the hydrological features visited during the field survey is included in *Annex 4 (Field Survey Map- Physical Baseline)*.

No quality analyses of the surface water were available. Therefore, the water quality can only be indirectly assessed: the field observations, summarized in *Table 5.9,* suggest a generally good condition based on biological indicators of good quality fresh water, such as fish. However, there is a potential risk of loss of quality by organic contamination as a result of the wastewater management procedures in the communities.

As described in *Section 5.3.6 - Table 5.4*, chemical products were reported to be in common use on the farms in the Project Area, although only small quantities are utilized. Erroneous or excessive use of chemical products could affect the quality of the surface waters due to organic contamination from fertilizers, and by chemical pollution from herbicides and pesticides.

Table 5.9 Observations pertinent to surface water quality in the Project Area

Source	Observations
Visit to farm 165 (large property profile)	Surface water body resulting from a secondary deviation of the Aguan River during Hurricane Mitch in 1998. Fish were observed. Reportedly, one caiman (*Caiman cocodrilus*) had been found in this water body in the past. Both biodiversity findings show good surface water quality.
Meeting with the Olanchito municipality	Wastewater treatment in the urban area of Olanchito: oxidation lake. Outside the urban areas the settlements have septic tanks where the wastewater is filtered into the subsoil. Wastewater treatment systems result in a risk of organic contamination of the surface water.
Meeting with the municipality of Arenal	Septic tanks connected to a treatment pond, ultimately connecting to the river. This wastewater treatment system results in a risk of organic contamination of the surface water.
Meeting with AJAASPIB	Reportedly, analyses of bacteria and metals are conducted on potable water. No analytical reports are available. Lack of potabilization systems (or the absence of proper maintenance of the systems) result in non-compliance with human drinking water standards. Wastewater management by septic tanks with filtration to the subsoil. These wastewater treatment systems are a risk of organic contamination of the surface water.

Note: see also *Table 5.4* for information on use of chemical products which may be related to water quality.
Source: Field survey, 2018

The main findings of the field survey with regard to the use of surface water by the local population are summarized in *Table 5.10*. River water is frequently used as a water source for the communities and on the farms. Although not reported during the field survey, low-intensity fishing (for self-consumption only) cannot be disregarded as an additional activity.

Table 5.10 Observations of surface water use in the Project Area

Source	Observations
Visit to farm 108 (small property profile)	There are three ponds formed by the Aguan River, which maintain a high level and do not dry up. Water from the ponds is given to the cattle to drink.
Visit to farm 128 (small property profile)	There are two ponds used for cleaning activities and supplying the cattle (drinking). When the water level of the Aguan River is very high, the farm gets partially flooded.
Visit to farm 71 (medium property profile)	The San Marcos River is located 500 m from the farm. It reportedly dries up during the dry season. Water from the river is given to the cattle to drink.
Meeting with the Olanchito municipality	The water sources for the urban area of Olanchito are the Pimienta and Uchapa rivers. In the rest of the municipality, surficial water is used in about 95% of the communities. Water treatment for drinking consumption is very limited: in most cases it only includes filtration and chlorination.
Meeting with the Arenal municipality	Two surface water microcatchments provide water to the municipality. During the dry season a groundwater well is also used to supplement the water supply (reportedly, during the last dry season, the emergency groundwater well was used for three days, when the two microcatchments could not provide enough water). During the rainy season, due to increased solids in suspension in the river water, the emergency groundwater well may also be needed. Water treatment for drinking consumption is very limited: in most cases it only includes filtration and chlorination.
Meeting with SAGO / CRELES	Surface water is commonly used for irrigation purposes, while the use of groundwater is marginal.
Meeting with AJAASPIB	Water for domestic use and potable water are 100% surface water resources. Water source for irrigation is also mostly surface water.

Note: Additional information on the water sources for the communities is provided in *Section 5.4*.
Source: Field survey, 2018

Table 5.11 summarizes the available information on the existence of gauging stations in the Project Area. Gauging stations are limited to the Yaguala River due to a planned hydropower project in that area[1]. In the other rivers, there are only emergency water level stations.

[1] Arenal I – II Project _ https://www.bnamericas.com/project-profile/es/planta-hidroelectrica-arenal-etapa-i-ii-planta-hidroelectrica-arenal-etapa-i-ii

Table 5.11 Observations of the gauging stations in the Project Area

Source	Observations
Meeting with the Olanchito municipality	COPECO has emergency water level stations on the bridges. They detect significant increases in the water level, activating an emergency procedure. The water volume is not calculated, since this requires a more sophisticated station.
Meeting with the Arenal municipality	Gauging stations are only located on the Yaguala River (tributary of Aguan River), where there is planned hydropower project.

Source: Field survey, 2018

Figure 5.31 Hydrological elements observed in the Project Area

Notes: Top left: Aguan River – high level of suspended sediments, characteristic of the rainy season. Top right: water pond used to provide water for the cattle. Bottom left: abandoned / vandalized emergency water level station in the Aguan River. Bottom right: observation of good water quality in a tributary of the Aguan River (lack of turbidity, plant communities, and the presence of fish).
Source: Field survey, 2018

The locations of all the hydrological bodies visited during the June 2018 field survey are included in *Annex 4 (Field Survey Map- Physical Baseline)*.

5.3.8 Hydrogeology

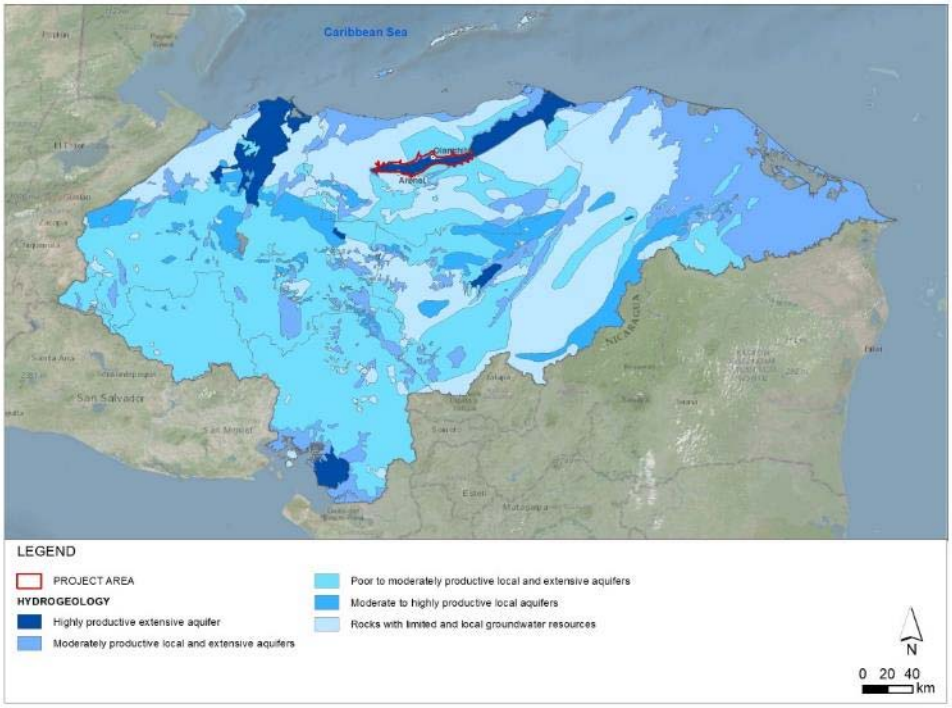
National hydrogeological context

Figure 5.32 shows the hydrogeological map of Honduras where the following types of aquifers can be identified based on the "productivity" of the unit.

- Highly productive extensive aquifers. Two locations in the north of Honduras, one location in the central section of Honduras and one location in the south of Honduras.

- Moderately productive local and extensive aquifers. Typically in the northeast of Honduras, with some secondary locations in the centre, south, and north of the country.
- Poor to moderately productive local and extensive aquifers. Mainly in the western and central sections of the country.
- Moderately to highly productive local aquifers. Several locations distributed across the central section of the country.
- Yojoa Lake in the northwest of the country.
- Rocks with limited and local groundwater resources predominant in the northern and central sections of the country.

Figure 5.32 Hydrogeological map of Honduras

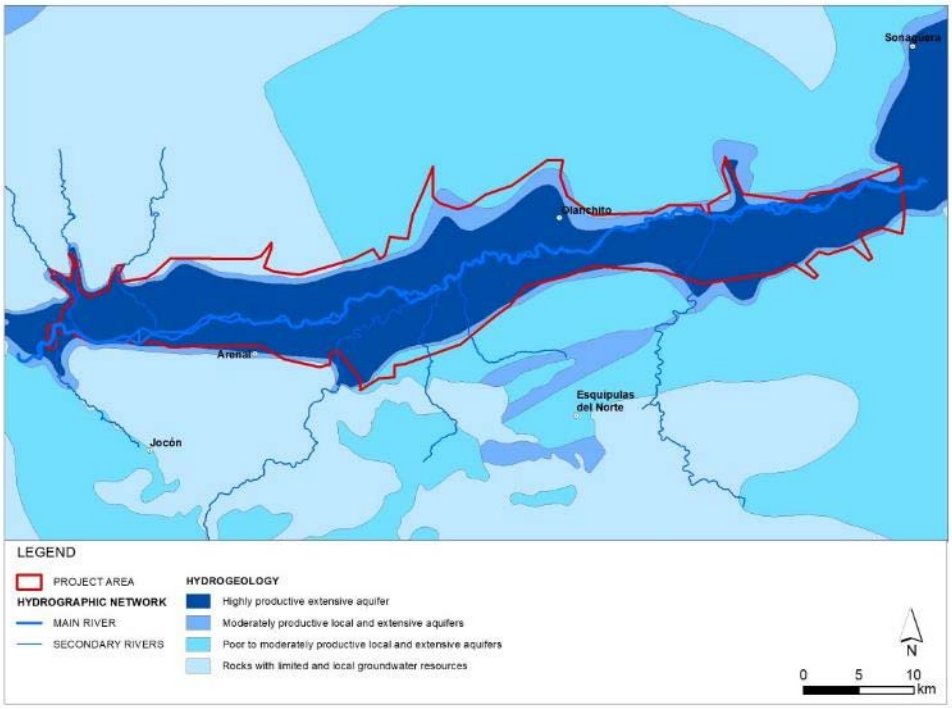


Source: National System of Territory Information (SINIT – *Sistema Nacional de Información Territorial*) – modified by ERM, 2018

Local hydrogeological context

Figure 5.33 shows a zoom view of the hydrogeological map of Honduras, focusing on the Project Area, where four categories of aquifers are found.

Figure 5.33 Hydrogeological units in the Project Area



Source: National System of Territory Information (SINIT – *Sistema Nacional de Información Territorial*) – modified by ERM, 2018

- Highly productive and extensive aquifer. This corresponds to the alluvial deposits of the Aguan River (QA level - see *Section 5.3.5*) that cover practically the entire Project Area. It is characterized by an intergranular flow that, depending the location, has a variable behaviour, from confined to unconfined. Based on the data gathered by CINSA and PAA Project Finance in 2017, the following can be indicated:
    - Confined/semiconfined condition. Wells have flows between 4 and 30 l/s, depending on the thickness of the layers of sand and gravel and well characteristics (e.g., depth and size of screen). The permeable sand and gravel layers appear interbedded with lower permeability layers, such as clays with limestones or clays with conglomerates, resulting in a confined/semiconfined aquifer.
    - Unconfined condition. Higher flows, up to 67 l/s have been reported (e.g., groundwater wells in Puerto Escondido and Méndez). The depth of these wells is around 23 and 30 m, respectively. Their transmissivity is moderate (81 – 173 m^2 /day) and their permeability is excellent.

  Overall, according to a National Water Balance carried out by CEDEX in 2003, the Aguan River aquifer transmissivity is reported to be 470 m^2/day.
- Moderately to highly productive local aquifers. These correspond to a fissured aquifer associated to the Angels Valley Group materials (Kva level –see *Section 5.3.5*) between the mountainous area of Saba and the Mame River. Groundwater wells in this aquifer provide a water flow

ranging between 1 and 20 l/s, depending on the fissures and faults present in the formation. The productive area of these aquifers is normally limited to a depth of 60 or 70 m.

- Poor to moderately productive local and extensive aquifers. These correspond to undifferentiated volcanic rocks (Tv level –see *Section 5.3.5*) comprising tuff, andesite, and pyroclastic rocks located in two areas around the municipality of Olanchito: a mountainous area to the north, from the Saba fault until approximately the community of Tacualtuste; and to the south, in the mountainous area between the Mame and Yaguala rivers.
- Rocks with limited and local groundwater resources. These correspond to the Cacaguapa Schist formation (Pzm level –see *Section 5.3.5*). They are found in the mountainous area to the northeast of the Olanchito municipality, from the Santa Barbara community to the Yoro municipality. These units are considered to have a limited groundwater potential, due to their generally low permeability and their location in mountainous areas.

Groundwater wells in the Project Area

During the field survey conducted in 2017, a total of 26 groundwater wells were identified. *Table 5.12* summarizes the key information.

Table 5.12 Groundwater wells in the Project Area in 2017

Name of groundwater well	Diameter (inches)	Depth (m)	Water level (m)	Water pump level (m)	Water flow (l/s)
Mabuhay	10	30.48	4.57	7.62	34.70
Mendez	10	36.58	4.57	7.62	41.64
Coyoles / Naranjo B	8	79.25	24.38	36.58	23.09
Los Mangos	12	125.27	38.10	54.86	69.40
Limonera	14	45.72	6.10	9.14	34.70
Coyoles Yardo	12	60.96	6.10	15.24	26.02
Coyoles Campo	10	60.96	6.10	15.24	52.05
Rosario A	8	60.96	12.19	18.29	29.72
Trojas A	10	79.25	18.29	24.38	41.01
Trojas B	10	109.73	18.29	24.38	34.70
Limones A	8	60.96	33.53	42.67	10.41
Palo Verde A	36	18.29	3.05	4.57	69.40
Palo Verde B	8	50.29	6.10	9.14	29.72
Acarsa	10	22.86	6.10	7.62	26.02
Bomba A	14	22.86	6.10	7.62	208.20
Bomba B	14	22.86	6.10	7,62	208.20
Bomba C	14	22.86	6.10	7.62	208.20
Bomba D	14	22.86	6.10	7.62	208.20
Bomba E	14	22.86	6.10	7.62	208.20
Lemon Packer A	8	42.67	33.53	42.67	10.41

Name of groundwater well	Diameter (inches)	Depth (m)	Water level (m)	Water pump level (m)	Water flow (l/s)
Lemon Packer B	12	30.48	36.58	30.48	29.65
Juan José Molina	-	27.43	15.85	-	-
Leopoldo Durán Dueñas	-	18.29	12.19	-	-
Marco Antonio Cruz	-	12.80	8.23	-	-
Miltón Puerto	-	24.99	5.18	-	-
Ligia Elizatbeth Bustillo	-	64.01	42.67	-	-

Source: CINSA and PAA Project Finance, 2017 – Edited by ERM, 2018

Photographs of some of these wells are included in *Figure 5.34*.

Figure 5.34 Groundwater wells in the Project Area identified in 2017

Notes: top left - protection stall for an underground well in Leopoldo Duran Dueñas; top right and bottom - groundwater well with pump near the Aguan River
Source: CINSA and PAA Project Finance, 2017

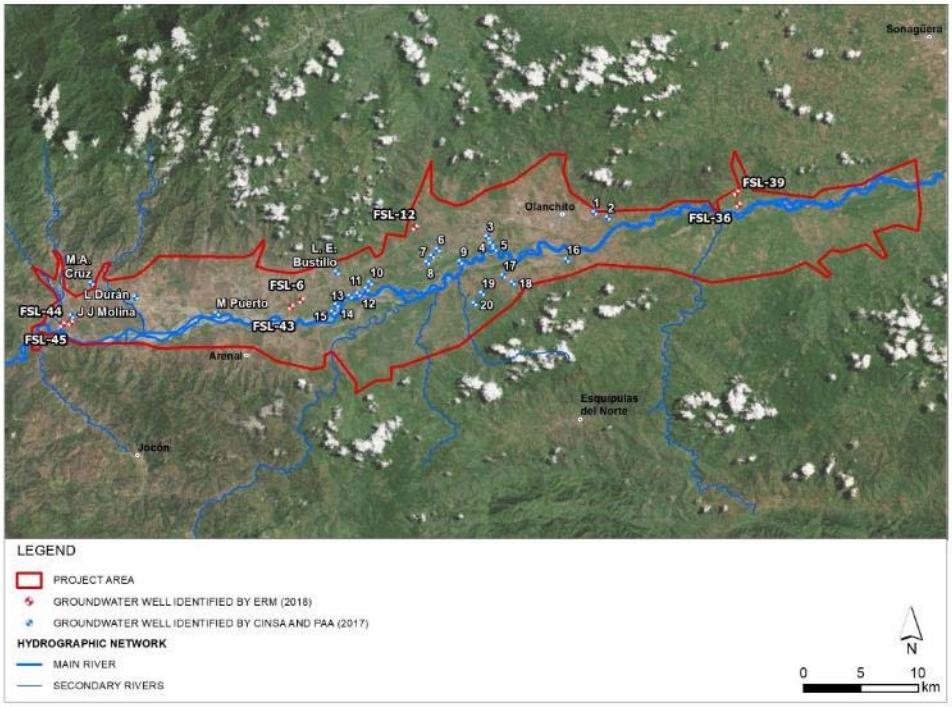
Annex 5 includes the lithological profile of 5 of these wells (*Bomba A, Bomba B, Bomba C, Bomba D and Bomba E*), together with their specific locations in the Project Area. Their stratigraphy is as follows:

- From 0 to 4.5 – 6.0 m depth: sandy silts.
- From 4.5 – 6.0 m to 18-21 m depth: fine and coarse gravels.
- From 18-21 m to 21-25 m depth: intermediate level of clays and gravels.
- In deep wells, after depths of 21-25 m, there are additional layers of coarse gravels.

The deep gravel levels, as described previously, can act as a confined/semiconfined aquifer, when there is a thick intermediate layer of low permeability clays.

Figure 5.35 shows the location of the all the groundwater wells identified in the Project Area (both in 2017 and in 2018).

Figure 5.35 Location of identified groundwater wells

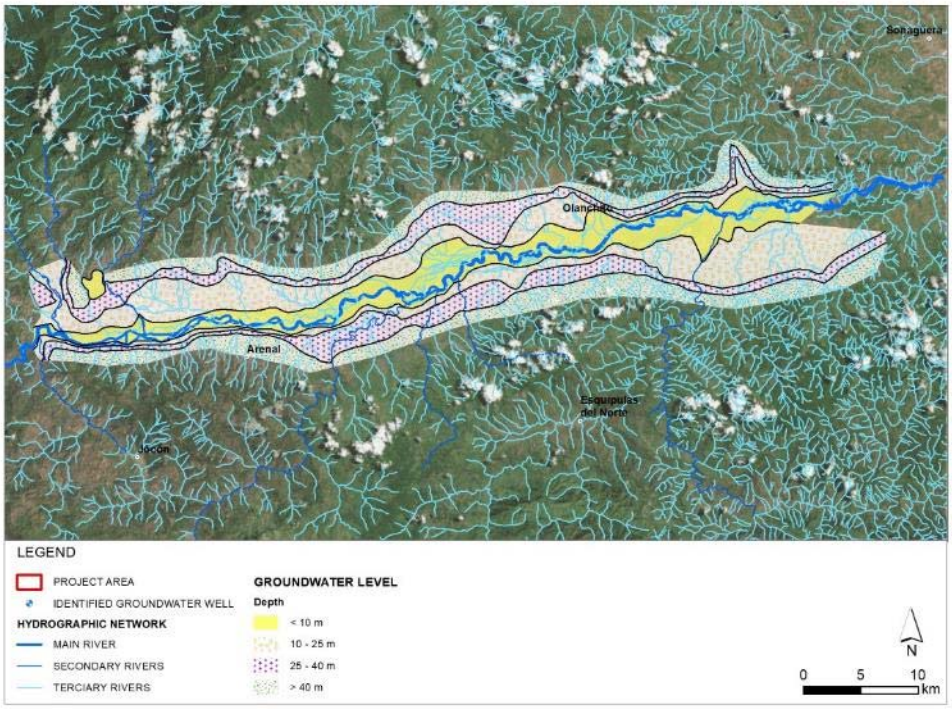


Note: the locations of the groundwater wells identified in 2017 is approximately only. The locations of the groundwater wells identified in 2018 is accurate, based on GPS coordinates taken during the field survey.
Source: ERM, 2018

Expected groundwater level in the Project Area

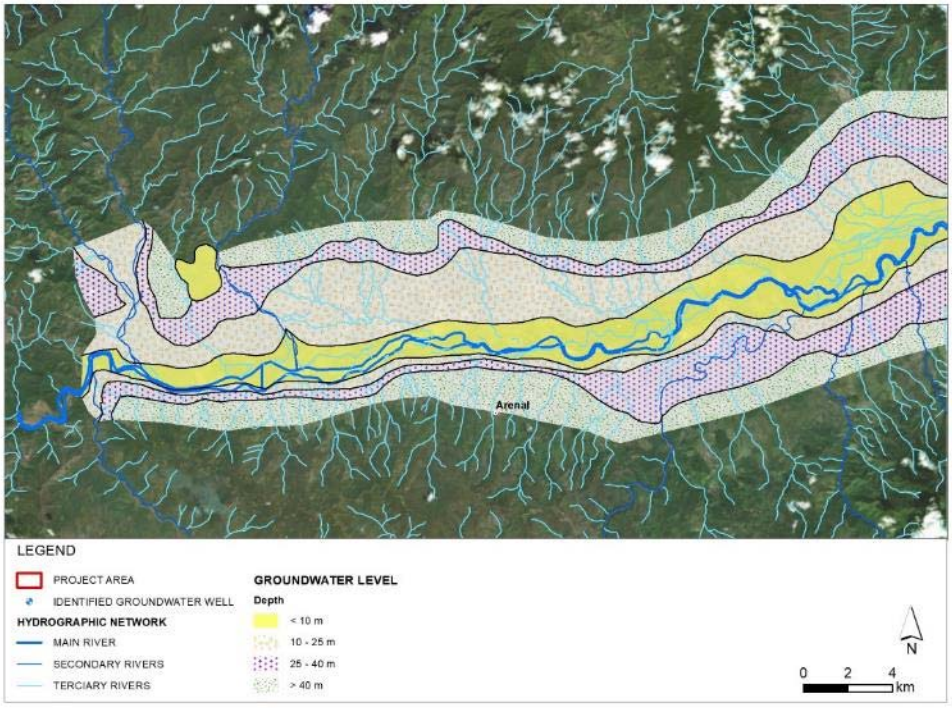
Figure 5.36 shows the expected groundwater levels in the Project Area. A view with additional zoom is provided in Figure 5.37 and Figure 5.38. Four different categories of water levels are included: < 10 m depth, 10-25 m depth, 25-40 m depth, and > 40 m depth.

Figure 5.36 Groundwater levels in the Project Area



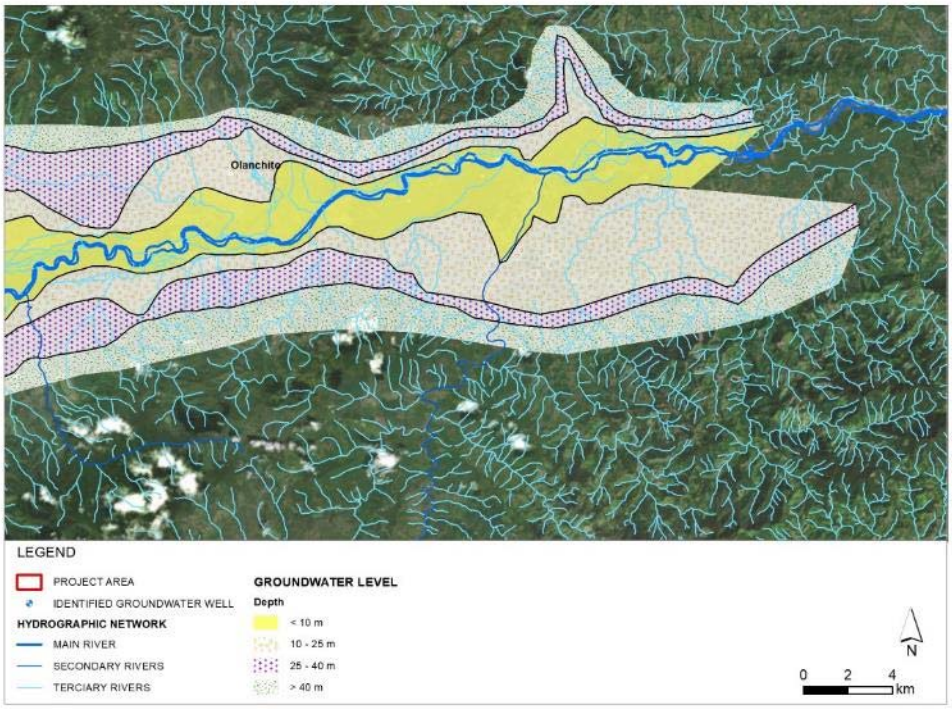
Source: Integra Ingeniería, 2017 – modified by ERM, 2018

Figure 5.37 Groundwater levels in the Project Area (zoom in view – western section)



Source: Integra Ingeniería, 2017 – modified by ERM, 2018

Figure 5.38 Groundwater levels in the Project Area (zoom in view – eastern section)



Source: Integra Ingeniería, 2017 – modified by ERM, 2018

The distribution of the water levels is symmetrical around the axis of the Aguan River, where the groundwater level is the shallowest. This distribution follows the pattern produced by the topographic and geological conditions in the Project Area: deep water levels are found in the mountainous areas, where the materials are less permeable and therefore the aquifers are less productive than in the bottom of the valley, where the alluvial aquifer is located. Although the deepest groundwater levels are found in the mountainous areas, the piezometric isoclines show the same distribution pattern as the water level, so that the general groundwater flow has a main discharge component flowing towards the alluvial axis of the Aguan River.

Groundwater quality

A selection of two samples from the sampling campaign undertaken at six different groundwater locations in the Olanchito municipality (sampling undertaken in 1997) gave the following results (*Table 5.13*):

Table 5.13 Results of the groundwater sampling campaign

Parameters	Groundwater well 1. *Well with highest salinity* (Land *Limones B2 empacadora*)	Groundwater well 2 *Well with lowest salinity* (Land *Mabujay*)
Conductivity (µS/cm)	820	339
Sodium (Na); mg/l	37	15
Calcium (Ca); mg/l	124	59
Magnesium (Mg); mg/l	24	22

Chlorine (Cl); mg/l	43	12
Boron (B); mg/l	0.072	0.04
SAR	0.81	0.42

Note: Results of two groundwater samples showing minimum and maximum sodium levels.
Source: Olanchito Municipality, 2010

The above results demonstrate that the groundwater resources of the Olanchito municipality are adequate for irrigation purposes as they have a low level of mineralization, low content of ions such as boron and sodium, and a very low (< 1) Sodium Absorption Ratio (SAR)[1]

Key findings - field survey (June 2018)

The 2018 field survey aimed to gather information on the following hydrogeological parameters: identification of groundwater wells; quality of groundwater; the local population's use of the groundwater; and the existence of monitoring wells in the Project Area.

The groundwater wells identified in the field survey are referred to above and shown in *Figure 5.35*. Some of these are also shown in *Figure 5.39,* where there are also photographs taken during the field survey. The locations of all the hydrogeological bodies visited during the June 2018 field are included in *Annex 4 (Field Survey Map- Physical Baseline)*.

The observations conducted during the field survey, summarized in *Table 5.14,* support the groundwater chemical analyses undertaken (see previous subsection *Groundwater quality*).

Based on field observations, it is expected that the main risk related to current practices is the potential impact by organic contamination due to the wastewater management procedures in the communities.

As described in *Section 5.3.6 - Table 5.4*, chemical products were reported to be in common use on the farms in the Project Area, although only small quantities seem to be utilised. Erroneous or excessive use of chemical products could affect the quality groundwater due to organic contamination from fertilizers, and chemical pollution from herbicides and pesticides.

Table 5.14 Observations of groundwater quality in the Project Area

Source	Observation
Visit to farm 108 (small property profile)	Farmer reports that groundwater from 5 water wells (used for human consumption) located in the Juncal community were analysed after their installation confirming acceptable quality for human consumption. No periodic controls are conducted on these wells.

[1] The Sodium Adsorption Ratio, SAR, is an index for evaluating the risk of irrigation water sodification. It is calculated using sodium (Na), calcium (Ca), and magnesium (Mg) levels.

Source	Observation
Visit to farm 71 (medium property profile)	The water was analysed after the construction of the well and confirmed to be fit for human consumption. It is unknown if further analysis have been conducted subsequently.

Note: see *Table 5.4* for information on the groundwater quality in the Project Area.
Source: Field survey, 2018

Observations on the use of groundwater by the local population, recorded during the field survey, is summarized in *Table 5.15*. It can be concluded that the use of groundwater resources is minor in comparison with the use of surface water and mostly associated with farming activities (cleaning and water for the cattle), but in a few cases, it is also used as a water source by the local communities.

There are two main categories of groundwater wells based on their construction characteristics: dug wells, shallow and built using hand tools; and drilled wells, deeper and built using drilling equipment.

It should also be noted that there is no official register of groundwater wells. Therefore, accurate information on the exact number of groundwater wells in the Project Area is not available.

Table 5.15 Observations of groundwater use in the Project Area

Source	Observations
Meeting with SAG	There are few groundwater wells in the Project Area. There is no registration system for groundwater wells. Water for human consumption is most likely to be extracted from surface water bodies. There are few irrigation systems in the area.
Visit to farm 30 (small property profile)	One groundwater well observed on the farm. Used for irrigation. Well characteristics: • Built in 2012 –drilled mechanically. • Diameter: 8''. • Depth: 35 m. • Water flow: 24.6 l/s. Farmer reports that he knows about other 2 wells in the proximity of his farm: one at 500 m and other at 1 km distance. Farmer reports that he has never observed changes in the groundwater levels in the well.
Visit to farm 108 (small property profile)	One groundwater well observed on the farm. Used for cleaning activities and to provide water for the cattle. Well characteristics: • Dug well built with hand tools. • Diameter: 1 m. • Depth: 6 m. • Water level: 3.6 m. In the dry season the water level decreases to 4.9 m. • Water flow: 3.5 l/s. Farmer reports that water for human consumption is taken from 5 water wells located in Juncal (a nearby community).

Source	Observations
Visit to farm 108 (small property profile)	No groundwater wells on the farm. However, there is one water well in the banana plantation located next to the farm. Groundwater level in the water well in the banana plantation thought to be about 3 m depth. Farmer reports no conflict between the ponds in his farm and water well in the banana plantation.
Visit to farm 71 (medium property profile)	Two groundwater wells observed on the farm. One to provide water for the cattle. Well characteristics: • Dug well built with hand tools. • Diameter: 32''. • Depth: 11 m. • Water level: 6 m. The other well supplies water to people living on the farm. Well characteristics: • Dug well built with hand tools. • Diameter: 25''. • Depth: 7.6 m. • Water level: 5.8 m.
Meeting with the Arenal municipality	Emergency groundwater well, used only when the surface water resource is bad quality (increased turbidity) and the stream flows decrease. In the last dry season they used it for 3 days. Well characteristics: • Depth: 97 m –drilled mechanically. • Water level: 43 m. Only two small communities within the municipality have groundwater wells as a water source. In both cases, these are dug wells, built with hand tools, with a shallow water level (1.5 m depth).
Meeting with SAGO / CRELES	Groundwater wells are used as a water resource for irrigation purposes, mainly during the dry season. • Near the river: shallow dug wells, approximately 4-6 m deep. • Far from the river: drilled wells, since the water level is deeper. In some drought periods, groundwater levels can drop below the pump intake.
Meeting with AJAASPIB	Water well profiles are as follows: • Most are dug wells: 9 m depth. • When they are deeper than 60 m, they are drilled mechanically. • Few groundwater wells. For example, only two farmers in the CREL have wells.

Note: Additional information on the water sources for the communities is provided in *Section 5.4*.
Source: Field survey, 2018

Personnel of the Olanchito and Arenal municipalities report that there are no monitoring wells in the Project Area for measuring the groundwater and/or taking groundwater samples.

Figure 5.39 Hydrogeological elements observed in the Project Area

Notes: Top left: pump providing water from the groundwater well in the community of El Juncal. Top right: dug well connected to pump. Bottom left: groundwater well constructed using a drilling machine. Bottom right: WC connected to a septic tank with the wastewater outlet infiltrating into the subsoil.
Source: Field survey, 2018

5.4 BIOLOGICAL ENVIRONMENT

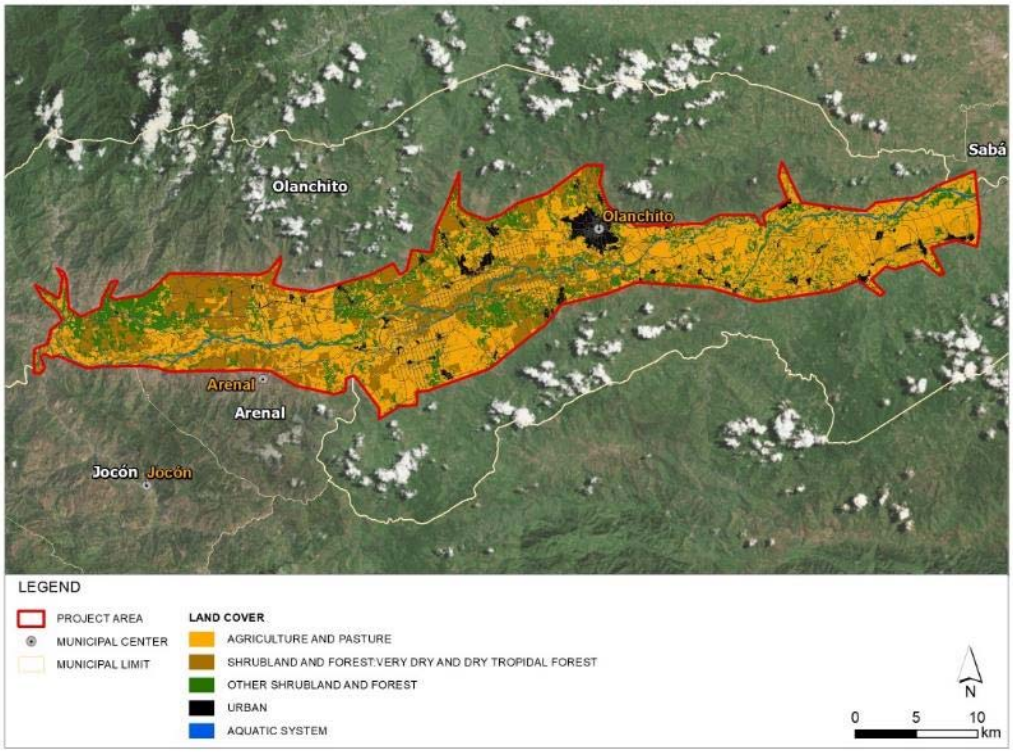
5.4.1 Habitats

Overview

As shown in *Figure 5.40*, the following habitats occur in the Project Area:

- Agricultural fields and pastures.
- Grassland.
- Aquatic systems.
- Urban and rural areas.
- Shrubland and forest.

Figure 5.40 Habitats in the Project Area



Source: ERM, 2018

Each is of these habitats is described separately in the following subsections.

Urban and rural areas

The main urban area in the Project Area is Olanchito, but there are also small rural communities spread along the Aguan River Valley.

According to the information available in the Atlas of the Municipality of Olanchito (2015)[1], the surface corresponding to urban and rural areas is 2,880 ha, which represents 4.8% of the total surface area of the Project Area (60,000 ha). This area corresponds to the following land cover categories considered in the Atlas: continuous urban area; discontinuous urban area; and roads.

Figure 5.41 shows two communities within the Project Area, visited during the June 2018 field survey: Juncal and Coyoles.

Figure 5.41 View of rural areas in the Project Area

Notes: communities of Juncal (left) and Coyoles (right)
Source: ERM, 2018

Agricultural fields and pastures

These include areas dedicated to agriculture and livestock. In the eastern section of the Project Area, the agricultural areas are mostly irrigated banana and African palm plantations. However, the agricultural areas in the central and western sections of the Project Area are mostly pasture and non-irrigated crops for feeding the livestock.

According to the information available in the Atlas of the Municipality of Olanchito (2015), the surface corresponding to agricultural and fields and pastures is about 30,510 ha, which represents about 50.5% of the total surface area of the Project Area (60,000 ha). This area corresponds to the following land cover categories considered in the Atlas: technified agricultural land; African palm; and pastures and crops.

Overall, agriculture field and pasture area has increased over recent decades. *Figure 5.42* includes a historical sequence available in Google Earth, showing how the areas dedicated to agricultural fields and pastures have increased. Although no significant changes occurred between 1970 and 2002, these can be appreciated between 2002 and 2011. The yellow circle highlights an area where the mentioned habitat change is very evident, particularly between 2002 and 2011, with a very typical agricultural pattern in the satellite image from 2011, which was previously present.

[1] http://www.atlasmunicipal.org/?q=node/310

Figure 5.42 Satellite image of the confluence of the San Marcos and Chiquito rivers over the years 1970 – 2002 - 2011 (Google Earth)

Source: Google Earth Pro – modified by ERM, 2018

Figure 5.43 shows agricultural fields and pastures within the Project Area, visited during the June 2018 field survey.

Figure 5.43 View of agricultural fields and pastures in the Project Area

Notes: top left (ploughed field next to camerun crop – Pennisetum purpureum – with irrigation system); top right (pastures and livestock), bottom left (African palm plantation, young palms); and bottom right (banana plantation)

Source: ERM, 2018

Grassland

Grassland is seasonal and is not present during the dry season, due to the absence of water. Dominant grassland families include the Gramineae, Cyperaceae, and certain ferns, as well as other species. Grassland in the Project Area is generally found in abandoned areas that were previously used for livestock. Because of this, when reviewing the Atlas of the Municipality of Olanchito (2015), it was not feasible to calculate the surface of grassland in the Project Area. The grassland areas are therefore included within the general surface area and percentage provided for agricultural fields and pastures.

Figure 5.44 shows a grassland area observed in the Project Area during the June 2018 field survey.

Figure 5.44 View of grassland in the Project Area

Source: ERM, 2018

Aquatic systems

The aquatic systems in the Project Area are the Aguan River and its tributaries, together with small lakes, ponds, and artificial lagoons. In the past, these aquatic systems were associated with dense gallery forests. However, most of these gallery forests have been converted into agricultural fields and pastures.

According to the information available in the Atlas of the Municipality of Olanchito (2015), the surface area corresponding to aquatic systems is about

1,100 ha, which represents about 1.8% of the total surface area of the Project Area (60,000 ha). This area corresponds to the following land cover categories considered in the Atlas: anthropic water features, and other surface water bodies.

Figure 5.45 shows four different aquatic systems observed in the Project Area during the June 2018 field survey.

Figure 5.45 View of aquatic systems in the Project Area

Notes: top left (pond), top right (Aguan River with gallery forest on the left side), bottom left (creek, tributary of the Aguan River, with gallery forest on both sides) and bottom right (creek, tributary of the Aguan River, with gallery forest limited to the background, while foreground presents more degraded vegetation as a result of livestock activities)
Source: ERM, 2018

Shrubland and forest

There are a number of different vegetation units within this general habitat category, including deciduous forests, conifer forests, deciduous shrubland, and mixed areas, where the previous units occur together with other habitats such as pastures. Due to their biodiversity values, two specific types of forest are described in detail:

- Very dry tropical forest.
- Dry tropical forest.

According to the information available in the Atlas of the Municipality of Olanchito (2015), the surface area corresponding to very dry and dry tropical forest is about 13,900 ha, which represents about 23% of the total surface area of the Project Area (60,000 ha). This area corresponds to the following land cover category considered in the Atlas: deciduous broad-leaved forest. Since other deciduous broad-leaved forests may occur in the Project Area (e.g.,

Quercus sp.), the surface of very dry and dry tropical forest is considered to be less than 13,900 ha, as described in the specific subsections.

The remaining types of shrubland and forest in the Project Area cover approximately 12,000 ha, which represents about 20% of the total surface area of the Project Area.

Very Dry Tropical Forest

The very dry tropical forest has a very high biodiversity value, taking into account the level of endemism in the flora and fauna in this habitat, even though it is exposed to a high level of anthropic pressure.

This habitat only occurs in two locations in Central America: the Motagua Valley, in Guatemala; and the Aguan Valley, in Honduras (Holdridge, 1966).

This habitat in Honduras was first protected by Legislative Decree 159-2005, through the designation of the Honduran Emerald Hummingbird Wildlife Refuge (RVSCEH – *Refugio de Vida Silvestre Colibrí Esmeralda Hondureño*).

The very dry tropical forest in the Aguan Valley is found at an altitude of between 220 and 240 m ASL on the south side of the Aguan River, and between 280 and 300 m ASL on the north side of the river. The riverbanks are very old and characterized by sandy, unproductive soils (Sherry Thorn, et al., 2000).

This habitat is characterized by trees and cactus up to 15 m in height:

- Arborescent cactus, such as *Pilosocereus lecuocephalus* and *Stenocereus yunckerii*.
- Tree species such as *Phyllostylon rhamnioides*, *Bursera simaruba*, *Gyrocarpus americanus*, *Jacquinia schipii*[1] and *Guaiacum sanctum*[2] (Sherry Thorn, et al., 2000).

Other smaller, thorny tree species in the very dry tropical forest include *Acacia deamii*, *Caesalpinia yucatanensi (*subsp. *hondurensis)*, *Haematoxylon brasiletto*, *Leucaena lempirana*, *Chloroleucon mangense*, *Pithecelobium unguis-cati, Pyllocarpus septentrionalis, Opuntia hondurensis*, *Achatocarpus nigricans*, *Coccoloba acapulensis*, *Eugenia hypargyrea*, *Eugenia coyolensis*, *Sideroxylon stenospermum*, *Capparis admirabilis*, *Malpighia glabra*, *Zizyphus guatemalensis* and *Randia cookii*. Although these smaller trees can be very diverse, in some areas they are dominated by a single species, *Acacia deamii*, which can cover up to 90% of the total surface area (Sherry Thorn, et al., 2000).

Below the trees and cactuses, there is a shrubland level, including species such as *Acacia costarricensis*, *Cordia coyueana*, *Croton cortesianus*, *Cnidoscolus urens*,

[1] *Jacquinia schipii* is only found in Honduras in the Aguan Valley.
[2] Categorized by CITES as one of the most endangered medicinal plants in the world.

Casearia corymbosa, *Bakeridesia molinae*, *Solanum hirtum*, *Solanum diaboli*, *Senna palida* and *Acanthocereus pentagonus*.

During the rainy season, there is an additional level of plants, including *Portulaca pilosa*, *Evolvulus alsinoides*, *Pectris prostrata*, *Oxalis neaei*, *Croton lobatus*, *Ocimum campechianum*, *Cleome viscosa*, *Dichondra sericea*, *Chamaesyce dioica,* and *Senna uniflora*.

Another group of flora in this habitat are the perennial succulents, such as *Pedilanthus camporum*, *Melocactus curvispinus, Bromelia plumieri*, *Furcraea cabuya,* and *Hechtia guatemalensis*.

Almost all the species of trees and shrubs in the very dry tropical forest are deciduous (Sherry Thorn, et al., 2000).

Although epiphytes are not very abundant in the very dry tropical forest, there are a few very well adapted species, such as the orchids *Myrmecophylla tibicis,* which live in big groups on the largest species of cactus, *Encyclia nematocaulon* and *Laelia rubescens*. The following epiphytes are found in the largest trees: *Aechmea bracteata* and *Tillandsia fasciculata*, which are a good source of food for the Honduran emerald hummingbird (*Amazilia luciae*) (Sherry Thorn et al., 2000).

The surface area covered by very dry tropical forest has decreased significantly. According to INOCSA et al. (2010), the main conservation issue for the very dry tropical forest is deforestation. It is thought that the existing cover of this habitat is only 2% of its original surface area (Asesora, 2009):

- In 1938, the surface area of very dry tropical forest was about 30,000 ha.
- In 2000, the surface area was estimated as 8,495 ha.
- In 2009, the surface area was estimated as 2,962.8 ha.

In addition to the high reduction in the cover of this habitat, it is also very fragmented. Because of this, the RVSCEH is formed by a number of isolated areas scattered across the Aguan Valley, as described in *Section 0.0.-1556586336*.

Figure 5.46 shows two different photographs of very dry tropical forest taken during the field survey conducted in in the Project Area (June 2018).

Figure 5.46 View of very dry tropical forest in the Project Area

Notes: left (very dry tropical forest next to the road) and right (very dry tropical forest in RVSCEH)
Source: ERM, 2018

Dry Tropical Forest

The dry tropical forest is found at higher altitudes than the very dry tropical forest, between 280 and 600 m ASL.

The presence of the species *Dioon mejiae* is a key indicator of the dry tropical forest. This plant is similar to a palm and is predominantly found in shrubland and deciduous forests, but not in the very dry tropical forest. *Dioon mejiae* can live for more than 1,000 years, and is the longest-lived species in Honduras.

Other typical flora of the dry tropical forest includes *Zamia standleyi, Dracaenea americana, Leucaena lempirana*, *Acacia deamii*, *Opuntia hondurensis*, *Pilosocereus chrysacanthus*, *Enterelobium cyclocarpum*, *Quercus* sp., *Pinus oocarpa*, *Anacardium excelsum*, *Samanea saman*, *Tabebia rosea*, *Hymenaea courbaril*, *Cochlospermum vitifolioum*, *Calycophyllum candidissimum* and *Ceiba* sp.

The main differences with the very dry tropical forest are (Fournier, 1980) (USIGME, 2004):

- It is found at higher altitude than the very dry tropical forest (280-600 m ASL versus 220-300 m ASL).
- Some of the flora of the dry tropical forest is semi-deciduous.
- There is a lower plant density than in the very dry tropical forest.
- The flora is not as thorny.
- Flowering during the dry season in the dry tropical forest is more evident than in the very dry tropical forest.

Key findings - field survey (June 2018)

The field survey was aimed at: (1) gathering information on the dynamics of the habitats in the Project Area; and (2) observing the different habitats existing in the Project Area.

Interviews held with local environmental experts[1] confirmed that one of the current reasons for natural habitat loss (dry and very dry tropical forest) in the Aguan River Valley is the search for new grazing areas for the cattle during the dry season. During the rainy season, the cattle is kept at the bottom of the valley, where there is sufficient food. However, food is not as abundant during the dry season, and farmers take the cattle to higher areas in the hills, where they chop down forest to create new grazing areas where they can feed the cattle.

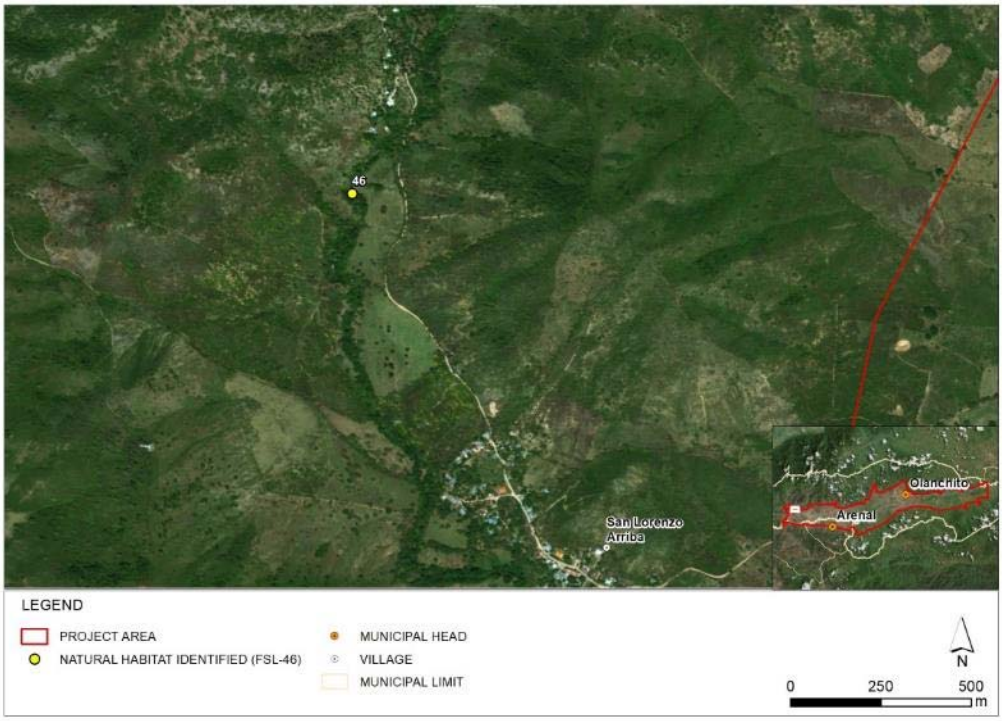
Figure 5.47 shows an example of an area that has been transformed from natural habitat to pasture. It can be seen that the area is in the upper part of the valley (it is quite hilly) rather than at the bottom. In the background, some remaining natural habitats can be observed. Next to the fields shown in the photographs is a creek used to provide water for the cattle (see *Figure 5.45* – bottom left). The location of this area is shown in *Figure 5.48*.

Figure 5.47 View of natural habitat degradation into pasture in the dry season

Source: ERM, 2018

[1] Interview with the engineer Anke Alvarado Bejarano, from CINSA.

Figure 5.48 Location of natural habitat identified during the field survey degraded into pasture



Source: ERM, 2018

Visits conducted during the field survey allowed habitats to be recorded, supporting the preparation of *Figure 5.40*.

5.4.2 *Flora*

Overview

According to the Honduran Catalogue of Vascular Flora (Cirilo Nelson, 2008 - *Catálogo de las Plantas Vasculares de Honduras*), there are 7,276 species of plants in Honduras, distributed between 270 families and 2,028 genera. Taking into account all the species, subspecies and varieties, there are 10,127 different plant types. These include: 41 species that, although expected in the country, have not yet been found; 214 endemic species; 414 cultivated species; and 107 naturalized species.

With regard to the flora in the Project Area, conservation and management reports from the Honduran Emerald Hummingbird Wildlife Refuge (RVSCEH, acronym in Spanish)[1] provide a very detailed assessment of the flora found in the protected area, based on scientific flora inventories. These reports summarize a study of the flora conducted over a very large area of the Alto Aguan and reflect a large quantity of flora, some of which is endangered according to national and international classifications.

[1] RVSCEH – *Refugio de Vida Silvestre Colibrí Esmeralda Hondureño*

The RVSCEH is split into different zones across the Project Area (see further details in *Section 0.0.-1556586336*). Because of this, the flora in the RVSCEH is considered to be representative of the overall flora in the Project Area, excluding cultivated species, which although common in the agricultural fields and pastures do not occur in the RVSCEH. However, these cultivated areas do not have any specific biodiversity value in terms of flora.

Flora in the Project Area

Table 5.16 provides a list of flora in the Project Area, based on a desktop review of the available information, together with the information gathered during the June 2018 field survey.

Although the RVSCEH covers a small surface area, it includes heterogeneous shrubland and forest in the low areas (near the bottom of the Aguan River Valley) and forest in the upper areas, characterized by irregular topography. This results in an interesting and important community of flora, as described in the description of the very dry and dry tropical forest habitat (see *Section 5.4.1*).

A total of 306 species[1] of plants are listed in *Table 5.16*. The species highlighted in bold are more significant, considering their level of protection and conservation concern based on: (1) international references such as the IUCN and CITES; (2) their level of endemicity; and (3) a list of flora and fauna of special concern in Honduras. *Section 2.1.7* provides a description of the international and national references considered.

These more significant species (50 in total) are also included in *Table 5.17*, where further details of their protection, conservation, and sensitivity (see *Section 6.2.2* for further references on sensitivity) are included. The remainder of the species (256 in total) are likely to be common and widespread, and therefore less likely to be of concern in terms of conservation and protection. Because of this, their level of sensitivity is defined as low.

Based on the information included in *Table 5.17,* it can be concluded that the most significant findings with regard to flora in the Project Area are:

- The following families are the most numerous: Cactaceae (17 species) and Fabaceae (11 species).
- Up to 10 species are endemic, with a distribution limited to Honduras: *Bakeridesia molinae, Caesalpinia yucatanensis (*subsp. *Hondurensis), Capparicordis yunckeri, Dioon mejiae, Eugenia lempana, Eugenia coyolensis, Leucaena lempirana, Lonchocarpus trifolius, Opuntia hondurensis* and *Zamia standleyi.* The other species are not endemic and are therefore also found in other countries in America, and even on other continents.

[1] The final number of species is higher than 306, since *Table 5.16* also includes ten genera of flora present in the Project Area, but without defining particular species. These are *Agonandra spp., Ceiba spp., Eucalyptus spp., Ficus spp., Leucaena spp., Oplismenus spp., Pennisetum spp., Quercus spp., Salix spp.* and *Trichilia spp.*

- Up to 11 species are assessed as threatened by the IUCN. The remainder have not been assessed by IUCN or if they have, were assessed as Near Threatened (NT), Least Concern (LC) or Data Deficient (DD). Those species regarded as threatened by the IUCN are distributed as follows:

    - Six Vulnerable (VU) species: *Acanthocereus chiapensis (Peniocereus chiapensis)*, *Cedrela odorata*, *Leucaena lempirana*, *Swietenia macrophylla*, *Swietenia humilis* and *Zamia standleyi*.
    - Two Endangered (EN) species: *Parathesis vulgate* and *Vanilla planifolia.*
    - Three Critically Endangered (CR) species: *Eugenia coyolensis*, *Lonchocarpus trifolius* and *Lonchocarpus yoroensis*.

- Up to 26 species are included in the Appendices of CITES:

    - Only one species is included in Appendix I: *Swietenia macrophylla*.
    - 24 species are included in Appendix II: *Acanthocereus tetragonus, Acanthocereus chiapensis (Peniocereus chiapensis), Dalbergia glabra, Dioon mejiae, Guaiacum sanctum, Monstera spruceana, Melocactus curvispinus, Nyctocereus guatemalensis, Opuntia hondurensis, Opuntia guatemalensis, Opuntia deamii, Opuntia decumbens, Opuntia lutea (Nopalea lutea), Opuntia pubescens, Pilosocereus maxonii, Pilosocereus leucosephalus, Stenocereus yunckeri, Selenicereus testudo, Swietenia humilis, Stenocereus pruinosus, Stenocereus aragonii, Trigonidium egertonianum* and *Zamia standleyi.*
    - Only one species is included in Appendix III: *Cedrela odorata.*

- Only one species is classified as a Species of Special Concern in Honduras: *Nyctocereus guatemalensis*.
- Up to 16 species, although included in *Table 5.17*, are only assessed by the IUCN as species of Least Concern (LC) or Data Deficient (DD).
- Up to 14 species are considered high sensitivity (endemic and / or CR / EN by IUCN). They are included in *Annex 6*, where additional information (habitat, ecology, and distribution) of high sensitivity flora and fauna is included. The remainder of the species (low / medium sensitivity) are likely to be common and widespread, and therefore less likely to be of concern with regard to conservation and protection.

Table 5.16 List of flora in the Project Area

Scientific name	Scientific name	Scientific name	Scientific name
A			
Agave americana	*Asclepias curassavica*	***Acanthocereus tetragonus***	*Acacia tenuifolia*
Aphelandra deppeana	*Anthurium schlechtendalii*	*Aechmea bracteata*	*Achatocarpus nigricans*
Amaranthus spinousus	*Ageratum conyzoides*	*Arrabidea candicans*	*Agonandra* sp.
Acrocomia mexicana	*Acalypha diversifolia*	***Acanthocereus chiapensis***	*Amyris elmifera*
Aristolochia anguicida	*Acalypha formula*	***Acacia riparia***	*Acacia collisii*
Aristolochia maxima	***Andira inermis***	*Acacia deamii*	*Acacia fernesiana*
Acacia costarricensis	*Acanthocereus pentagonus*	*Anacardium excelsum*	*Aloe vera*
Annona muricata	*Agave seemannii*	*Acalypha villosa*	*Acacia angustissima*
Amphilophium paniculatum	*Acanthocereus acapulcensis*	*Albizia adinocephala*	*Acacia pennatula*
Apoplanesia paniculata	*Asclepias curassavic*	*Asemnantha pubescens*	
B			
Bursera simaruba	*Bahuinia divaricata*	*Bahuinia glabra*	*Bromelia pinguin*
Bromelia plumieri	*Buddleja americana*	*Byrsonima crassifolia*	***Bakeridesia molinae***
Bourreria andrieuxii	*Boerhaavia diffusa*		
C			
Calotropis procera	*Catharanthus roseus*	***Ceiba pentandra***	*Cordia dentata*
Curatella americana	*Cnidoscolus urens*	*Ctenocereus yunkeri*	*Cecropia peltata*
Capparis admirabilis	*Cnidoscolus aconitifolius*	*Calliandra houstoniana*	*Calyptranthes hondurensis*
Cleome spinosa	***Chloroleucon mangense***	*Canavalia villosa*	***Commelina diffusa***
Cratavea tapia	*Croton ciliatogladulifer*	*Cassia gradis*	***Cedrela odorata***
Crossopetalun parviflorum	*Croton glandulosus*	***Caesalpinia yucatanensis* (subsp. *hondurensis)***	*Coccoloba acapulcensis*
Chenopodium ambrisiodes	*Croton guatemalensis*	*Casearia corymbosa*	*Capsicum annus*
Combertum fruticosum	*Croton pendens*	*Chloris rufenscens*	*Caesalpinia bahamensis*
Cordia coyueana	*Croton cortesianus*	*Croton lobatus*	*Cleome viscosa*
Chamaesyce dioica	*Cochlospermum vitifolioum*	*Calycophyllum candidissimum*	*Ceiba* sp.
Capparicordis yunckeri	*Chiococca alba*	*Cnidosculus tubulosus*	*Cecropia obtusifolia*

Scientific name	Scientific name	Scientific name	Scientific name
Cissus cacumensis	*Cyperus ochraceus*		
D			
Dracaena americana	*Dichaea glauca*	*Desmathodium guatemalensis*	***Dalbergia glabra***
Dioon mejiae	*Dioscorea spiculiflora*	*Desmodium sericophyllum*	***Delonix regia***
Diphysa spinosa	*Dichondra sericea*	*Diphysa carthagense*	*Digitaria insularis*
Dicraspidia donnell-smithii			
E			
Echites yucatenensis	*Enterolobium cyclocarpum*	*Evolvulus ovatus*	*Enterelobium cyclocarpus*
Eugenia coyolensis	*Encyclia nematocaulon*	*Erythroxylum rotundifolium*	***Eugenia lempana***
Eugenia hypargyrea	*Evolvulus alsinoides*	*Eucalyptus* sp.	*Ehretia tinifolia*
Epidendrum xipheres			
F			
Furcraea cabuya	*Ficus* sp.		
G			
Gliricidia sepium	*Guapira linearibracteata*	***Guaiacum sanctum***	*Guazuma ulmifolia*
Gyrocarpus americanus	*Guattarda deami*		
H			
Hisbucus grandiflorus	*Heliotropiuim angiospermum*	*Hylocerus undatum*	*Hechtia guatemalensis*
Haematoxylum brasiletto	*Hypericum gniodioides*	*Hyptis suaveolens*	*Hylocereus minutiflora*
Hylocereus undatus	*Hymenaea courbaril*	*Hyperbaena mexicana*	
I			
Irisine diffusa	*Inga vera*		
J			
Jatropha curca	*Jacquinia nitida*	*Jatropha gossipiifolia*	*Jacquinia schipii*
K			
Karwinskia calderonii			
L			
Lonchocarpus minimiflorum	*Ludwigia octovalis*	*Lobelia laxiflora*	*Lueha candida*
Lonchocarpus trifolius	***Leucaena lempirana***	*Laelia rubescens*	*Leucaena* sp.
Lonchocarpus yoroensis	*Lueha speciosa*	*Leonotis nepetifolia*	*Lygodium clavatum*
Lysiloma auritum	*Lippia graveolens*		

Scientific name	Scientific name	Scientific name	Scientific name
M			
Mangifera indica	*Macfadyaena anguis-cati*	***Melocactus curvispinus***	*Muntigia calabura*
Mimosa albida	*Momordica charantia*	***Mimosa pudica***	*Malipighia glabra*
Melinis repens	*Miconia mexicana*	*Miconia albicans*	*Miconia glaberrima*
Myrmecophylla tibicis	*Mammellaria eichlamii*	*Mammillaria colombiana*	*Melocatus curvispinus*
Malpighia glabra	***Monstera spruceana***	*Machaerium pittieri*	*Melochia tomentosa*
Merremia umbellata	*Maclura tinctoria*	*Malvaviscus arboreus*	
N			
Nopalea guatemalensis	*Neomeollspaughia paniculata*	*Neea psychotrioides*	***Nyctocereus guatemalensis***
Nopalea hondurensis			
O			
Opuntia hondurensis	*Ocimum campechianum*	*Oncidium carthagenense*	*Oplismenus* sp.
Opuntia guatemalensis	***Opuntia decumbens***	***Opuntia lutea (Nopalea lutea)***	***Opuntia pubescens***
Opuntia deamii	*Oxalis neaei*		
P			
Plumeria rubra	*Perymenium ghiesbreghtii*	*Peniocereus hirschtianum*	*Pilosocereus chrysacanthus*
Philodendron hederaceum	*Pedilanthus camporum*	*Pithecellobuim dulce*	*Psidium guajava*
Panicum maximun	*Phoradendron quadrangulare*	***Persea americana***	*Podopterus mexicanus*
Paspalum botterii	*Psittacanthus schiedeanus*	*Pteridium aquilinum*	*Polygonum hydropiper*
Pennisetum sp.	*Psittacanthus rhynchanthus*	*Paullinia fuscescen*	*Portulacca pilosa*
Phyllostylon brasilienses	***Parathesis vulgata***	*Petiveria alliacea*	*Peperomia acuminata*
Pilosocereus leucosephalus	*Phyllostylon rhamniodes*	*Phytolacca rivinoides*	*Piper aduncum*
Pilosocereus maxonii	***Pereskia lychnidiflora***	*Pesudosamnea quachapele*	*Piper auritum*
Piper koepperi	*Piper jacquemontianum*	*Pithecelobium unguis-cati*	*Pyllocarpus septentrionalis*
Pectris prostrata	*Pinus oocarpa*	*Phyllostylon rhamnoides*	*Pennisetum setaceum*
Pithecellobium lanceolatum	*Petrea volubilis*	*Philodendron scandens*	*Passiflora holosericea*
Paullinia cururu	*Pisonia aculeata*		
Q			
Quercus sp.			
R			
Rauvolfia tetraphylla	*Randia armata*	*Randia cookii*	*Rivina humilis*

Scientific name	Scientific name	Scientific name	Scientific name
Rehdera trinervis			
S			
Sanicula liberta	*Spondias mombis*	*Stevia ovata*	***Stenocereus yunckeri***
Samanea saman	***Setaria parviflora***	*Stigmatiphyllum lindenianum*	***Salix humboldtiana***
Senna alata	*Simarouba glauca*	*Sida acuta*	*Sideroxilon obtusifolium*
Senna reticulata	*Schomburgkia lueddemanii*	*Sideroxilon capiri*	*Sideroxylon stenospermum*
Solanum capsioldes	***Selenicereus testudo***	***Swietenia humilis***	***Stenocereus eichlamii***
Solanum diaboli	*Solanum diaboli*	***Swietenia macrophylla***	***Stenocereus pruinosus***
Solanum dysanthum Brandegee	***Stenocereus aragonii***	*Solanum hirtum*	*Senna palida*
Senna uniflora	*Salix* sp.	*Schoepfia schreberi*	*Sarjania goniocarpa*
T			
Tabernamontana alba	*Tillandsia schlechtendalii*	***Tillandsia fasciculata***	*Telanthophora grandifolia*
Tabernamontana amygdalifolia	*Terminalia catappa*	*Tillandsia balbisiana*	*Talium paniculatum*
Trichocentrum cebolleta	*Tournefortia voluvilis*	*Trema micrantha*	*Thouinia decandrum*
Trigonidium egertonianum	*Trichilia* sp.	*Tillandsia bracycaulus*	*Trichilla americano*
Tamarindus indica	*Tabebia rosea*	*Tabebuia ochracea*	*Tabebuia neochrysantha*
Tillandsia butzii	*Tillandsia schiedeana*	*Tillandsia caput-medusae*	
V			
Virola guatemalensis	*Vatairea lundellii*	***Vanilla planifolia***	*Vitex gaumerii*
X			
Xilosma flexuosum	*Ximenia americana*		
Z			
Ziziphus mauritiana	***Zamia standleyi***	*Zea mayz*	*Zizyphus guatemalensis*

Species in **bold** are included in *Table 5.17*
Source: ERM, 2018 (based on the bibliography consulted – see *Section 5.1*)

Table 5.17 Significant flora species in the Project Area

Scientific name	Common name (English)	Common name (Spanish / Local)	Family	Endemic	IUCN	CITES	Species of Special Concern in Honduras	Sensitivity
Acanthocereus tetragonus	Triangle cactus	Pitaya	Cactaceae	-	LC	Appendix II	-	Medium
Acanthocereus chiapensis (Peniocereus chiapensis)	-	-	Cactaceae	-	VU	Appendix II	-	Medium
Acacia riparia	-	Jamacuau	Fabaceae	-	LC	-	-	Low
Andira inermis	Cabbage tree	Almendro de río	Fabaceae	-	LC	-	-	Low
Bakeridesia molinae	-	Gallinazo	Malvaceae	Yes	-	-	-	High
Caesalpinia yucatanensis (subsp. *hondurensis)*	-	Aguán	Fabaceae	Yes	-	-	-	High
Capparicordis yunckeri	-	-	Capparaceae	Yes	-	-	-	High
Cedrela odorata	Spanish cedar	Cedro rojo	Meliceae	-	VU	Appendix III	-	Medium
Ceiba pentandra	-	Ceiba	Malvaceae	-	LC	-	-	Low
Chloroleucon mangense	-	Espino verde	Fabaceae	-	LC	-	-	Low
Commelina diffusa	Climbing dayflower	-	Commelinaceae	-	LC	-	-	Low
Dalbergia glabra	-	-	Fabaceae	-	-	Appendix II	-	Medium
Delonix regia	Flame tree	-	Fabaceae	-	LC	-	-	Low
Dioon mejiae	-	Palma teosinte	Zamiaceae	Yes	LC	Appendix II	-	High
Eugenia lempana	-	Guayabo de cerro	Myrtaceae	Yes	-	-	-	High
Eugenia coyolensis	-	Mestizo	Myrtaceae	Yes	CR	-	-	High
Guaiacum sanctum	Holywood lignum vitae	Guayacán	Zygophyllaceae	-	NT	Appendix II	-	Medium
Leucaena lempirana	-	-	Fabaceae	Yes	VU	-	-	High
Lonchocarpus trifolius	-	-	Fabaceae	Yes	CR	-	-	High
Lonchocarpus yoroensis	-	-	Fabaceae	-	CR	-	-	High
Mangifera indica	Mango	Mango	Anacardiaceae	-	DD	-	-	Low

Scientific name	Common name (English)	Common name (Spanish / Local)	Family	Endemic	IUCN	CITES	Species of Special Concern in Honduras	Sensitivity
Mimosa albida	-	-	Fabaceae	-	LC	-	-	Low
Mimosa pudica	Sensitive Plant	Dormilona	Fabaceae	-	LC	-	-	Low
Monstera spruceana	-	Canculunco	Araceae	-	-	Appendix II	-	Medium
Melocactus curvispinus	-	-	Cactaceae	-	LC	Appendix II	-	Medium
Nyctocereus guatemalensis	-	Cola de Coyote	Cactaceae	-	LC	Appendix II	Yes	Medium
Opuntia hondurensis	-	Tuna oreja de vaca	Cactaceae	Yes	-	Appendix II	-	High
Opuntia guatemalensis	-	Oreja de Vaca	Cactaceae	-	LC	Appendix II	-	Medium
Opuntia deamii	-	-	Cactaceae	-	-	Appendix II	-	Medium
Opuntia decumbens	-	-	Cactaceae	-	LC	Appendix II	-	Medium
Opuntia lutea (Nopalea lutea)	-	-	Cactaceae	-	DD	Appendix II	-	Medium
Opuntia pubescens	-	-	Cactaceae	-	LC	Appendix II	-	Medium
Pilosocereus maxonii	-	Barba de Viejo	Cactoideae	-	-	Appendix II	-	Medium
Parathesis vulgata	-	-	Myrsinaceae	-	EN	-	-	High
Persea americana	Avocado	Aguacate	Lauraceae	-	LC	-	-	Low
Pereskia lychnidiflora	-	Pitittache	Cactaceae	-	LC	-	-	Low
Pilosocereus leucosephalus	-	-	Cactaceae	-	-	Appendix II	-	Medium
Stenocereus yunckeri	-	-	Cactaceae	-	CR (*)	Appendix II	-	High
Swietenia macrophylla	Big leaf mahogany	Caoba	Meliaceae	-	VU	Appendix I	-	Medium
Selenicereus testudo	-	Pitaya de tortuga	Cactaceae	-	-	Appendix II	-	Medium
Salix humboldtiana	-	Sauce	Salicaceae	-	LC	-	-	Low
Swietenia humilis	Honduras mahogany	Caoba de Honduras	Meliaceae	-	VU	Appendix II	-	Medium
Stenocereus eichlamii	-	-	Cactaceae	-	DD	-	-	Low
Stenocereus pruinosus	-	-	Cactaceae	-	LC	Appendix II	-	Medium
Stenocereus aragonii	-	-	Cactaceae	-	LC	Appendix II	-	Medium
Setaria parviflora	Marsh brittlegrass	-	Poaceae	-	LC	-	-	Low

Scientific name	Common name (English)	Common name (Spanish / Local)	Family	Endemic	IUCN	CITES	Species of Special Concern in Honduras	Sensitivity
Trigonidium egertonianum	-	-	Orchidaceae	-	-	Appendix II	-	Medium
Tillandsia fasiculata	Cardinal air plant	Gallito	Bromeliaceae	-	LC	-	-	Low
Vanilla planifolia	-	Vainilla mansa	Orchidaceae	-	EN	Appendix II	-	High
Zamia standleyi	-	Camotillo	Zamiaceae	Yes	VU	Appendix II	-	High

Notes: Flora included in *Table 5.16* but not in *Table 5.17* is considered to have a low level of sensitivity. (*) See *Annex 6* for further clarification.
Source: Documents RVSCEH – Edited by ERM, 2018

Use of Flora in the Project Area

The local population in the Project Area use certain species of plants for the following purposes:

- Grazing livestock, both forage plants and natural shrub vegetation.
- Medicinal plants, used for various health problems. It should be noted that the guayacan (*Guaiacum sanctum*) is commercially used to treat renal diseases. It is the only Honduran species listed in Appendix II of CITES for medicinal plants.
- Provision of wood: most of the tree species are used for the construction of fences, firewood, and as a construction material.

Table 5.18 includes a list of some of the species of plants commonly used by the local population.

Table 5.18 Medicinal and lumber plants in the Project Area

Scientific name	Common name (Spanish / Local)	Main use
Guaiacum sanctum	Guayacán	Medicinal / wood
Phyllostylon rhamnoides	Palo blanco	Wood
Ocimun campechianum	Orégano	Medicinal
Lippia graveolens	Oreganillo	Medicinal
Bromelia plumieri	Piñuelo	Medicinal
Solanum diaboli	Frutica	Medicinal
Cnidoscolus aconitifolius	Chayo	Medicinal
Acacia deamii	Jamacuau	Wood
Leucaena lempirana	-	Wood
Haematoxylum brasiletto	Brasileto	Wood
Diphysa carthagense	Guachipilin	Wood
Chloroleucon mangense	Espino verde	Wood
Cedrela odorata	Cedro	Wood
Trichilla americano	Cedrillo	Wood
Pennisetum setaceum	Zacate verde	Medicinal
Aloe vera	Sábila	Medicinal
Annona muricata	guanabana	Medicinal
Eucalyptus sp.	-	Medicinal
Guazuma ulmifolia	Caulote	Medicinal
Enterolobium cyclocarpum	Guanacaste	Wood
Swietenia macrophylla	Caoba	Wood

Source: Asesora, 2009 – Modified by ERM, 2018

Key findings - field survey (June 2018)

The field survey aimed to gather information on: (1) use of medicinal plants; (2) lumbering activities; and (3) the flora present in the area. *Annex 4 (Field Survey Map- Biological Baseline)* shows the locations where specific information on flora was gathered during the field survey.

Table 5.4 summarizes the feedback on medicinal plants received during the field survey. The use of medicinal plants has decreased and is currently only

residual. However, some medicinal plan are still employed. Figure 5.49 includes a photograph of "sábila" (*Aloe vera*), used on one of the farms visited.

Table 5.19 Use of medicinal plants in the Project Area

Source	Feedback
Meeting with group of farmers (small property profile)	Not much use of medicinal plants.
Visit to farm 71 (medium property profile)	Use of medicinal plants was more common in the past. Now they use "zacate verde" (*Pennisetum setaceum*) as a relaxant. They also use "sábila" (*Aloe vera*) as a medicinal plant.
Visit to farm 108 (small property profile)	Although they are not used very much, some are still collected. For example, fruits from the "guanabana" (*Annona muricata*) are used for hypertension.
Visit to farm 128 (small property profile)	Two uses of medicinal plants were reported: (1) eucalyptus (*Eucalyptus* sp.) for flu and coughs; and (2) "caulote" (*Guazuma ulmifolia*) for diarrhoea in the cattle.

Source: Field survey, 2018

Table 5.20 summarizes the feedback on lumber received during the field survey. The use of trees for wood is currently a common practice in the Project Area. Limited chopping of branches is more frequent than chopping of entire trees, which is associated with tree plantations for wood production, and where appropriate permits are required. *Figure 5.49* shows a photograph of people transporting recently chopped wood.

Table 5.20 Use of lumber in the Project Area

Source	Feedback
Meeting with group of farmers (small property profile)	Trees used for fence construction. For example, "jamacuau" (*Acacia deamii*). Only branches are taken, not the entire tree.
Visit to farm 71 (medium property profile)	They do not fell entire trees, only the branches.
Visit to farm 108 (small property profile)	Reference to the tree species "guanacaste" (*Enterolobium cyclocarpum*), used for lumber.
Visit to farm 128 (small property profile)	Reference to the tree species "jamacuau" (*Acacia deamii*). Only branches are taken. New branches replace the chopped ones. Other species referred to are the caoba tree (*Swietenia macrophylla*) and cedar tree (*Cedrela* sp.), which are chopped down entirely but only when they are 20 years old, so that they are profitable. Permits for felling are required.

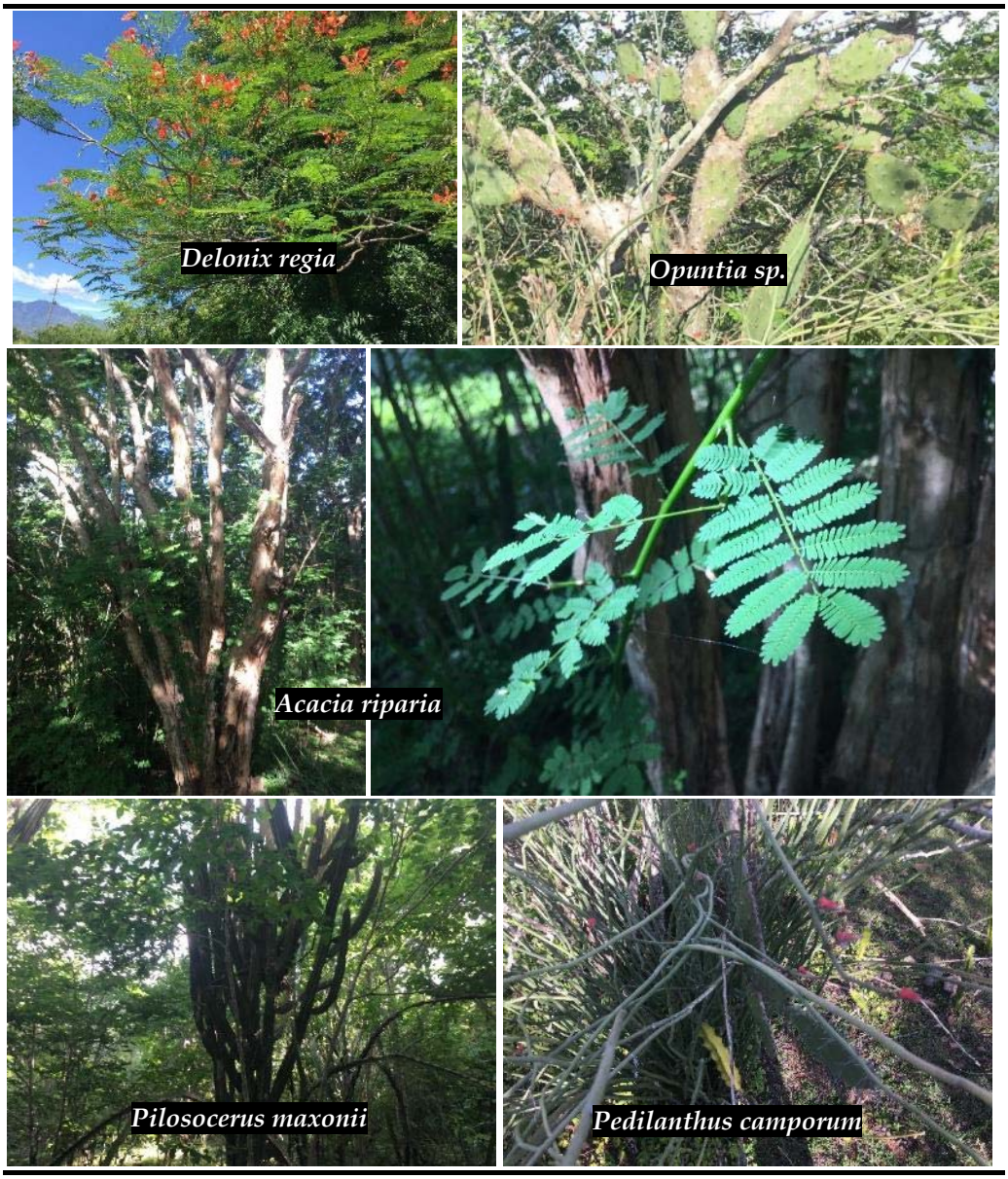
Source: Field survey, 2018

Figure 5.49 Lumber and medicinal plants in the Project Area

Source: ERM, 2018

Figure 5.50 includes a selection of photographs of flora taken during the field survey.

Figure 5.50 Flora observed in the Project Area



Source: ERM, 2018

5.4.3 Fauna

Overview

Conservation and management reports on the fauna in the Project Area from the Honduran Emerald Hummingbird Wildlife Refuge[1] provide a very detailed assessment of the existing fauna, based on scientific fauna inventories. These reports summarize the study of fauna conducted over a very large area of the Alto Aguan. The study reflects a large quantity of fauna, some of which is endangered according to national and international classifications.

The RVSCEH is split into different zones across the Project Area, as described in *Section 0.0.-1556586336*. The fauna found in the RVSCEH can also be observed in neighbouring areas where natural habitats occur (e.g., very dry and dry tropical forest). In absence of natural habitats (i.e., in agricultural fields and pastures), the presence of the fauna described in the RVSCEH is only occasional (limited to specific activities, such as searching for food) and limited to species with a wider range of suitable habitats and / or which are more mobile (e.g., birds).

The following groups of fauna are described separately in specific sections: fish, amphibians, reptiles, birds, and mammals.

Fish

According to Matamoros et al. (2009), there are at least 172 species of fish in Honduras, inhabiting mainland and insular freshwater systems. Six of these species are exotic species, while the remaining 166 are native. The actual number of fish species in Honduras is likely to be higher, taking into account the variety of remote areas in the country that are still unstudied.

Inventories of fauna conducted in the RVSCEH do not provide a list of fish species. However, the list of fish in the article published by Matamoros et al. (2009) is organized by major drainage basins in Honduras, incluing the Aguan River as one of the major basins in the country.

Table 5.21 includes the specific list of fish identified by Matamoros et al. (2009) in the Aguan River Basin: this can be considered very representative of the fish species potentially found in the Project Area.

For each species, *Table 5.21* also includes a level of protection, conservation concern, and sensitivity (see *Section 6.2.2* for further references on sensitivity) based on: (1) international references such as the IUCN and CITES; (2) the level of endemicity; and (3) a list of species of flora and fauna of special

[1] RVSCEH – *Refugio de Vida Silvestre Colibrí Esmeralda Hondureño*

concern in Honduras. *Section 2.1.7* provides a description of the international and national references considered.

Based on the information included in *Table 5.21,* the most significant findings on fish potentially present in the Project Area are:

- Up to 33 species of fish are potentially present in the Project Area.
- The following families are the most numerous: Ciclidae (8 species) and Poeciliidae (8 species).
- None of the species is endemic. All the species are found in other countries in America, and even on other continents.
- Only one species is assessed as threatened by the IUCN: *Megalops atlanticus* (VU). The other species have not been assessed by the IUCN or if they have, were assessed as Least Concern (LC) or Data Deficient (DD).
- None of the species is included in Appendixes of CITES.
- Two species are classified as Species of Special Concern in Honduras: *Agonostomus monticola* and *Joturus pichardi*.
- All the species of fish are considered to be of low and medium sensitivity. They are likely to be common and widespread, and therefore less likely to be of concern in terms of conservation and protection. Therefore, none of the fish species is included in *Annex 6,* which includes additional information (habitat, ecology and distribution) on high sensitivity flora and fauna.

To conclude, *Figure 5.51* includes some fish observed during the June 2018 field survey in the Project Area.

Figure 5.51 Fish observed in the Project Area

Source: ERM, 2018

Table 5.21 List of fish in the Aguan River drainage basin

Scientific name	Common name (English)	Common name (Spanish / Local)	Family	Endemic	IUCN	CITES	Species of Special Concern in Honduras	Sensitivity
Alfaro huberi	-	Olomina de Huber	Poeciliidae	-	-	-	-	Low
Phallichthys amates	Merry widow livebearer	Bubuchita de amates	Poeciliidae	-	-	-	-	Low
Belonesox belizanus	Top minnow	Picudito	Poeciliidae	-	-	-	-	Low
Gambusia nicaraguensis	Nicaraguan mosquitofish	Bubuchita de Nicaragua	Poeciliidae	-	-	-	-	Low
Heterandria anzuetoi (Pseudoxiphophorus anzuetoi)	-	Olomina de Anzueto	Poeciliidae	-	-	-	-	Low
Poecilia gilli	-	Olomina de Gill	Poeciliidae	-	-	-	-	Low
Poecilia catemaconis	Miller's molly	Olomina de Miller	Poeciliidae	-	-	-	-	Low
Poecilia orri	Mangrove molly	Olomina de manglar	Poeciliidae	-	-	-	-	Low
Synbranchus marmoratus	Marbled swamp eel	Anguila de lodo	Synbranchidae	-	-	-	-	Low
Pomadasys crocro	Burro grunt	Corocoro crocro	Haemulidae	-	DD	-	-	Low
Agonostomus monticola	Mountain mullet	Tepemechín	Mugilidae	-	LC	-	Yes	Medium
Joturus pichardi	Bobo mullet	-	Mugilidae	-	-	-	Yes	Medium
Amatitlania nigrofasciata	Convict cichlid	Conguito convicto	Cichlidae	-	-	-	-	Low
Amphilophus longimanus	Red breast cichlid	Mojarra de pecho rojo	Cichlidae	-	-	-	-	Low
Amphilophus robertsoni	False firemouth cichlid	Mojarra hondureña	Cichlidae	-	-	-	-	Low
Cryptoheros cutteri	-	Congo hondureño	Cichlidae	-	-	-	-	Low
Oreochromis niloticus	-	Tilapia de Nilo	Cichlidae	-	LC	-	-	Low
Parachromis dovii	-	Guapote blanco	Cichlidae	-	-	-	-	Low

Scientific name	Common name (English)	Common name (Spanish / Local)	Family	Endemic	IUCN	CITES	Species of Special Concern in Honduras	Sensitivity
Parachromis loisellei		Guapote amarillo	Cichlidae	-	-	-	-	Low
Vieja maculicauda	Blackbelt cichlid	Machaca	Cichlidae	-	-	-	-	Low
Dormitator maculatus	Fat sleeper	Dormilón del Atlántico	Eleotridae	-	LC	-	-	Low
Eleotris amblyopsis	Large-scaled spinycheek sleeper	Dormilón oscuro.	Eleotridae	-	LC	-	-	Low
Eleotris perniger	Smallscaled spinycheek sleeper	Guavina espinosa	Eleotridae	-	LC	-	-	Low
Gobiomorus dormitor	Bigmouth sleeper	Guavina del Atlántico	Eleotridae	-	LC	-	-	Low
Awaous banana	River goby	Gobio de río	Gobiidae	-	-	-	-	Low
Megalops atlanticus	Tarpon	Sábalo	Megalopidae	-	VU	-	-	Medium
Astyanax aeneus	Banded tetra	Sardina	Characidae	-	-	-	-	Low
Rhamdia guatemalensis	Pale catfish	Barbudo de Guatemala	Heptapteridae	-	-	-	-	Low
Rhamdia laticauda	Filespine chulin	Chulín	Heptapteridae	-	-	-	-	Low
Gymnotus cylindricus	-	Pez cuchillo	Gymnotidae	-	-	-	-	Low
Atherinella milleri	Miller's silverside	Plateadira de Miller	Atherinopsidae	-	LC	-	-	Low
Pseudophallus mindii	Freshwater pipefish	Pez pipa	Syngnathidae	-	DD	-	-	Low

Source: Matamoros et al., 2009 – Edited by ERM, 2018

Amphibians

According to McCranie (2009) there are 129 species of amphibians in Honduras, from three different orders: two species of caecilian (order Apoda), 31 species of salamander (order Caudata) and 96 species of frogs and toads (order Anura).

When considering amphibians together with reptiles (herpetofauna) the number of species in Honduras is higher than in neighbouring countries: there are 389 species of herpetofauna in Honduras; only 130 species in El Salvador (Köhler, Vesely and Greenbaum, 2005); and in 244 in Nicaragua (Sunyer, J., 2009). On the other hand, the number of herpetofauna species in Honduras is lower than in countries like Costa Rica, where there are 432 species (Bolaños et al., 2009). However, some areas of Honduras have not yet been studied, so the actual number of herpetofauna species might be higher.

Table 5.22 shows the list of amphibians in the Project Area, based on a desktop review of availalable information together with the information gathered during the June 2018 field survey.

For each species, *Table 5.22* also includes the level of protection, conservation concern and sensitivity (see *Section 6.2.2* for further references about sensitivity) based on: (1) international references such as the IUCN and CITES; (2) the level of endemicity; and (3) a list of species of flora and fauna of special concern in Honduras. *Section 2.1.7* provides a description of the international and national references considered.

Based on the information included in *Table 5.22*, the most significant findings on the amphibians present in the Project Area are:

- Up to 15 species of amphibians present in the Project Area.
- The most numerous family is Hylidae, with four species.
- None of the species is endemic. They are all found in other countries in America.
- None of the species is assessed as threatened by the IUCN. They are assessed as Least Concern (LC).
- None of the species is included in the Appendices of CITES.
- None of the species is classified as a Species of Special Concern in Honduras.
- All the species of amphibians are considered to be of low sensitivity.They are likely to be common and widespread species, and therefore less likely be of concern in terms of conservation and protection. Therefore, none of the amphibian species is included in *Annex 6*, which includes additional information (habitat, ecology and distribution) on high sensitivity flora and fauna.

Figure 5.52 includes some amphibians observed during the field survey conducted in the Project Area in June 2018. It was not possible to identify the species. In the first case (photograph on the left), this was because the

individual was in a very bad condition (flattened and dehydrated). In the second case (photograph on the right), beause they were only tadpoles.

Figure 5.52 Amphibians observed in the Project Area

Source: ERM, 2018

Table 5.22 List of amphibians in the Project Area

Scientific name	Common name (English)	Common name (Spanish / Local)	Family	Endemic	IUCN	CITES	Species of Special Concern in Honduras	Sensitivity
Bolitoglossa mexicana	Mexican mushroomtongue salamander	Salamandra de vientre oscuro	Plethodontidae	-	LC	-	-	Low
Rhinella marina	Cane toad	Sapo común	Bufonidae	-	LC	-	-	Low
Incilius valliceps	Southern Gulf coast toad	Sapo comun de crestas grandes	Bufonidae	-	LC	-	-	Low
Incilius luetkenii	Yellow toad	-	Bufonidae	-	LC	-	-	Low
Dendropsophus microcephalus	Small-headed treefrog	Ranita trepadora amarilla	Hylidae	-	LC	-	-	Low
Smilisca baudinii	Common Mexican treefrog	Rana trepadora común	Hylidae	-	LC	-	-	Low
Trachycephalus venulosus	-	Rana trepadora lechosa	Hylidae	-	LC	-	-	Low
Scinax staufferi	Stauffer's treefrog	Rana trepadora nariguda	Hylidae	-	LC	-	-	Low
Engystomops pustulosus	Tungara frog	Sapito tungara	Leptodactylidae	-	LC	-	-	Low
Leptodactylus fragilis	American white lipped frog	Ranita de charco	Leptodactylidae	-	LC	-	-	Low
Leptodactylus melanonotus	Sabinal frog	Ranita de charco de dos espinas	Leptodactylidae	-	LC	-	-	Low
Hypopachus variolosus	Mexican narrow-mouthed toad	-	Mycrohylidae	-	LC	-	-	Low
Lithobates brownorum (Lithobates berlandieri / Rana brownorum)	Rio Grande leopard frog	Rana leopardo	Ranidae	-	LC	-	-	Low
Lithobates vaillanti	Vaillant's frog	-	Ranidae	-	LC	-	-	Low
Rhinophrynus dorsalis	Burrowing toad	Sapo borracho	Rhinophrynidae	-	LC	-	-	Low

Source: Documents RVSCEH – Edited by ERM, 2018

Reptiles

According to McCranie (2009), there are 260 species of reptiles in Honduras, from four different orders: two species of crocodiles (order Crocodylia), 31 species of turtles (order Testudines), 93 species of lizards (order Squamata) and 134 species of snakes (order Squamata).

As described in the amphibians section, when considering reptiles together with amphibians (herpetofauna), the number of species in Honduras is higher than in the neighbouring countries of El Salvador and Nicaragua, although lower than other Central American countries like Costa Rica. However, because areas of Honduras remain unstudied, the actual number of herpetofauna species might be higher.

Table 5.23 shows the list of reptiles in the Project Area, based on a desktop review of availalable information together with the information gathered during the June 2018 field survey.

For each species *Table 5.23* also includes a level of protection, conservation concern, and sensitivity (see *Section 6.2.2* for further references on sensitivity) based on: (1) international references such as the IUCN and CITES; (2) the level of endemicity; and (3) a list of species of flora and fauna of special concern in Honduras. *Section 2.1.7* provides a description of the international and national references considered.

Based on the information included in *Table 5.23,* the most significant findings of the reptiles present in the Project Area are as follows:

- Up to 40 species of reptiles are present in the Project Area.
- The following families are the most numerous: Colubridae (11 species) and Dipsadidae (6 species).
- Two species are endemic, with a distribution that is limited to Honduras: *Ctenosaura melanosterna* and *Sphaerodactylus dunni*. The other species are not endemic and therefore are also found in other countries in America, and even on other continents.
- Only one species is assessed as threatened by the IUCN: *Ctenosaura melanosterna* (CR). The other species have not been assessed by the IUCN or, if they have, they are of Least Concern (LC) or Near Threatened (NT).
- Three species are included in the Appendices of CITES: *Ctenosaura melanosterna* (Appendix II); *Crotalus simus* (Appendix III); and *Caiman crocodilus* (Appendix I and II).
- None of the species is classified as a Species of Special Concern in Honduras.
- Two species of reptiles (*Ctenosaura melanosterna* and *Sphaerodactylus dunni*) are considered high sensitivity (endemic and / or CR / EN by IUCN). They are included in *Annex 6*, which includes additional information (habitat, ecology and distribution) on high sensitivity flora and fauna. The other species (low / medium sensitivity) are likely to

be common and widespread, and therefore less likely to be of concern in terms of conservation and protection.

To conclude, *Figure 5.53* includes some reptiles observed during the field survey conducted in the Project Area in June 2018.

Figure 5.53 Reptiles observed in the Project Area

Note: Identification of the species *Rhinoclemmys pulcherrima* and *Aspidoscelis motaguae* is the most likely case only. The tortoise's shell was in bad condition and the observation of the lizard was only fleeting, resulting in a bad quality photo that hinders accurate identification.

Source: ERM, 2018

Table 5.23 List of reptiles in the Project Area

Scientific name	Common name (English)	Common name (Spanish / Local)	Family	Endemic	IUCN	CITES	Species of Special Concern in Honduras	Sensitivity
Ctenosaura similis	Common spiny-tailed iguana	Garrobo	Iguanidae	-	LC	-	-	Low
Ctenosaura melanosterna	Black-chested spiny-tailed iguana	Jamo negro	Iguanidae	Yes	CR	Appendix II	-	High
Conophis lineatus	-	Guardacaminos	Dipsadidae	-	LC	-	-	Low
Dryadophis melanolomus (Mastigodryas melanolomus)	Salmon-bellied racer	Sabanera	Colubridae	-	LC	-	-	Low
Drymobius margaritiferus	Speckled racer	Terciopelo	Colubridae	-	LC	-	-	Low
Imantodes cenchoa	Blunthead tree snake	Bejuquilla cabezona	Colubridae	-	-	-	-	Low
Leptophis mexicanus	Mexican parrot snake	Falso tamagas verde	Colubridae	-	LC	-	-	Low
Ninia sebae	Redback coffee snake	Coralito falso	Dipsadidae	-	LC	-	-	Low
Leptodeira annulata (Leptodeira rhombifera)	-	Falso tamagás	Dipsadidae	-	LC	-	-	Low
Sibon anthracops	Cope's snail sucker	Caracolera	Dipsadidae	-	LC	-	-	Low
Trimorphodon biscutatus (Trimorphodon quadruplex)	Central American lyre snake	Zorcuata	Colubridae	-	LC	-	-	Low
Coniophanes fissidens	Yellowbelly snake	Culebra de tierra	Dipsadidae	-	LC	-	-	Low
Xenodon rabdocephalus	-	Falso barba amarilla	Colubridae	-	-	-	-	Low
Porthidium ophryomegas	Slender hognose viper	Tamagás negro	Viperidae	-	LC	-	-	Low
Crotalus simus	Middle American rattlesnake	Cascabel	Viperidae	-	LC	Appendix III	-	Medium
Epictia ater	-	Culebra gusano	Leptotyphlopidae	-	LC	-	-	Low
Micrurus nigrocinctus	-	Coral	Elapidae	-	LC	-	-	Low

Scientific name	Common name (English)	Common name (Spanish / Local)	Family	Endemic	IUCN	CITES	Species of Special Concern in Honduras	Sensitivity
Drymarchon melanurus	Western indigo snake	Yugalan	Colubridae	-	LC	-	-	Low
Enulius flavitorques	Pacific longtail snake	-	Dipsadidae	-	LC	-	-	Low
Leptodrymus pulcherrimus	Striped lowland snake	-	Colubridae	-	LC	-	-	Low
Spilotes pullatus	-	Mica	Colubridae	-	-	-	-	Low
Tantilla armillata	-	-	Colubridae	-	LC	-	-	Low
Trachemys venusta	-	Jicotea	Emydidae	-	-	-	-	Low
Rhinoclemmys pulcherrima	-	Tortuga dragón	Geoemydidae	-	-	-	-	Low
Kinosternon scorpioides (Kinosternon acutum)	Tabasco mud turtle	Culuco	Kinosternidae	-	NT	-	-	Medium
Norops sericeus	Silky anole	Lagartija	Polychrotidae	-	-	-	-	Low
Mabuya unimarginata (Marisora unimarginata)	Central American mabuya	Lisa	Scincidae	-	LC	-	-	Low
Sceloporus olloporus (Sceloporus variabilis)	Rose-bellied lizard	Escorpión	Phrynosomatidae	-	LC	-	-	Low
Basiliscus vittatus	Brown basilisk	Charancaco	Corytophanidae	-	LC	-	-	Low
Coleonyx mitratus	Central American banded gecko	Geko	Eublepharidae	-	LC	-	-	Low
Hemidactylus frenatus	Common house gecko	Geko	Gekkonidae	-	LC	-	-	Low
Sphaerodactylus dunni	Dunn's least gecko	-	Sphaerodactylidae	Yes	LC	-	-	High
Sphaerodactylus millepunctatus	-	Geko	Sphaerodactylidae	-	-	-	-	Low
Thecadactylus rapicauda	Turniptail gecko	Geko	Phyllodactylidae	-	-	-	-	Low
Ameiva festiva (Holcosus festivus)	Middle American ameiva	-	Teiidae	-	LC	-	-	Low
Ameiva undulata (Holcosus undulatus)	Rainbow ameiva	-	Teiidae	-	LC	-	-	Low
Aspidoscelis deppei (Cnemidophorus deppei)	Blackbelly racerunner	Quijina rayada / Tijo coliazul	Teiidae	-	LC	-	-	Low

Scientific name	Common name (English)	Common name (Spanish / Local)	Family	Endemic	IUCN	CITES	Species of Special Concern in Honduras	Sensitivity
Aspidoscelis motaguae	-	-	Teiidae	-	LC	-	-	Low
Spilotes pullatus	Chicken snake	Mica	Colubridae	-	-	-	-	Low
Caiman crocodilus	Spectacled caiman	Caimán / Lagarto	Alligatoridae	-	LC	Appendix I and II	-	Medium

Source: Documents RVSCEH – Edited by ERM, 2018

Birds

According to Monroe (1968) and Bonta & Anderson (2002), there are 701 species of birds in Honduras.

Table 5.24 shows the list of birds in the Project Area, based on a desktop review of the available information together with the information gathered during the June 2018 field survey.

The species highlighted in bold are more significant, considering their level of protection and conservation concern based on: (1) international references such as the IUCN, CMS, and CITES; (2) their level of endemicity; and (3) a list of species of flora and fauna of special concern in Honduras. *Section 2.1.7* provides a description of the international and national references considered.

These more significant species (41 in total) are also included in *Table 5.25*, which includes further details on their level of protection, conservation concern, and sensitivity (see *Section 6.2.2* for further references about sensitivity).

The rest of the bird species (148[1] in total) are likely to be common and widespread, and therefore less likely to be of concern in terms of conservation and protection. Because of this, their level of sensitivity is defined as low.

Based on the information included in *Table 5.24* and *Table 5.25,* the most significant findings on the birds present in the Project Area are:

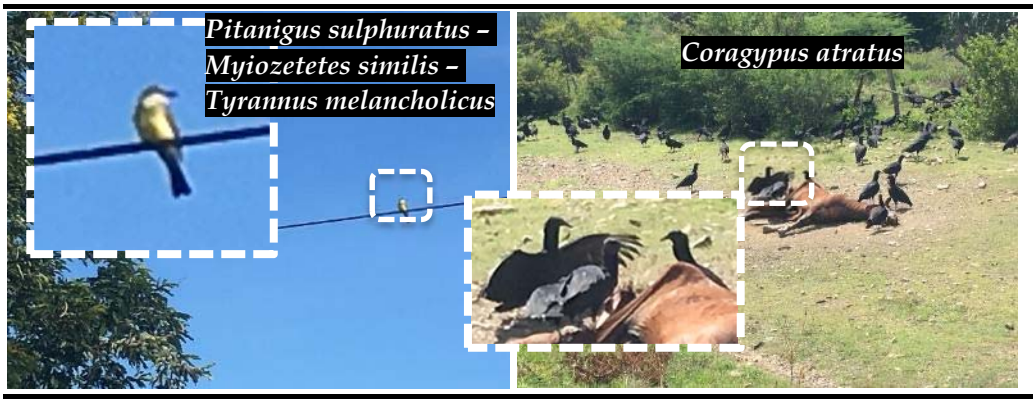
- Up to 189 species of birds are present in the Project Area.
- The following families are the most numerous: Tyrannidae (24 species), Parulidae (20 species), Icteridae (14 species) and Accipitridae (10 species).
- Only one species is endemic, with a distribution limited to Honduras: *Amazilia luciae.* The other species are not endemic and are therefore are also found in other countries in America, and even on other continents.
- Only one species is assessed as threatened by IUCN: *Amazilia luciae* (EN). The other species have been assessed by the IUCN as Least Concern (LC) or Near Threatened (NT).
- Seven species are included in Appendix II of the CMS (Convention on the Conservation of Migratory Species of Wild Animals): *Anas clypeata (Spatula clypeata), Ardea alba, Nycticorax nycticorax, Pandion haliaetus, Falco columbarius, Falco peregrinus,* and *Calidris minutilla*.
- 34 species are included in the Appendices of CITES: most in Appendix II (31 species), whilst only three of them are included in Appendix III.
- None of the species is classified as a Species of Special Concern in Honduras.

[1] All the 148 species are assessed by the IUCN as Least Concern (LC). None are endemic, nor included in the Appendices of of CITES and CMS.

- One species of bird (*Amazilia luciae*) is considered of high sensitivity (endemic and / or CR / EN by IUCN), and included in *Annex 6*, where additional information (habitat, ecology and distribution) on high sensitivity flora and fauna is included. The other species (low / medium sensitivity) are likely to be common and widespread, and therefore less likely to be of concern in terms of conservation and protection.

To conclude, Figure 5.54 and Figure 5.55 include photographs of birds taken during the June 2018 field survey.

Figure 5.54 Birds observed in the Project Area



Note: *Pitangus sulphuratus*, *Myiozetetes similis* and *Tyrannus melancholicus* have yellow bellies and white chins, and are similarly sized species. For this reason it is not possible to differentiate them from the quality of the photographs achieved.
Source: ERM, 2018

Figure 5.55 Hummingbirds observed in the Project Area

Note: Both species (*Amazilia tzacatl* and *Amazilia rutila*) are similar and from the same genus, and therefore cannot be differentiated considering the quality of the photographs achieved.
Source: ERM, 2018

Table 5.24 List of birds in the Project Area

Scientific name	Scientific name	Scientific name	Scientific name
A			
Anas discors	*Actitis macularia*	***Amazilia luciae***	*Aramides cajanea*
Anas clypeata (Spatula clypeata)	***Aratinga holochlora (Psittacara holochlorus)***	***Amazilia tzacatl***	***Anthracothorax prevostii***
Anhinga anhinga	***Aratinga nana (Eupsittula nana)***	***Archilochus colubris***	*Amblycercus holosericeus*
Ardea herodias	***Amazona albifrons***	***Amazilia rutila***	*Agelaius phoeniceus*
Ardea alba	***Amazona autumnalis***	*Amblycercus holosericeus*	
B			
Bubulcus ibis	***Buteogallus anthracinus***	***Buteo brachyurus***	***Buteo platypterus***
Butorides virescens	***Buteo nitidus***	***Buteo albonotatus***	*Bartramia longicauda*
Burhinus bistriatus	***Buteo magnirostris (Rupornis magnirostris)***	***Buteo albicaudatus***	
C			
Crypturellus cinnamomeus	*Charadrius semipalmatus*	*Crotophaga sulcirostris*	*Contopus virens*
Crypturellus soui	*Charadrius vociferus*	*Chordeiles acutipennis*	*Contopus cinereus*
Cairina moschata	***Calidris minutilla***	*Chaetura vauxi*	*Contopus pertinax*
Colinus cristatus	*Columba livia*	***Chlorostilbon canivetii***	*Cyclarhis gujanensis*
Coragyps atratus	*Columbina inca*	*Chloroceryle amazona*	*Cyanocorax morio*
Cathartes aura	*Columbina passerina*	*Camptostoma imberbe*	*Cyanocorax yncas*
Chondrohierax uncinatus	*Columbina talpacoti*	*Catharus ustulatus*	*Carduelis psaltria*
Caracara cheriway	*Coccyzus americanus*	*Ceryle alcylon*	
D			
Dendrocygna autumnalis	*Dumetella carolinensis*	*Dendroica petechia*	*Dendroica coronata*
Dromococcyx phasianellus	*Dendroica magnolia*	*Dendroica pensylvanica*	*Dendroica virens*
Dryocopus lineatus	*Dendroica dominica*	*Dendroica fusca*	*Dendroica townsendi*
Dives dives			
E			
Egretta thula	*Eudocimus albus*	*Elaenia flavogaster*	*Empidonax flaviventris*

Scientific name	Scientific name	Scientific name	Scientific name
Egretta caerulea	***Elanus leucurus***	*Euphonia affinis*	*Empidonax traillii*
Egretta tricolor	*Eumomota superciliosa*	*Euphonia hirundinacea*	*Empidonax minimus*
F			
Falco sparverius	***Falco columbarius***	***Falco rufigularis***	***Falco peregrinus***
G			
Geococcyx velox	*Geothlypis trichas*	*Geothlypis poliocephala*	***Glaucidium brasilianum***
H			
Herpetotheres cachinnans	*Henicorhina leucosticta*	*Hirundo rustica*	*Helmitheros vermivorum*
Himantopus mexicanus	***Hylocichla mustelina***		
I			
Ictinia mississippiensis	*Ictinia plumbea*	*Icterus spurius*	*Icterus pectoralis*
Icterus galbula	*Icterus gularis*	*Icterus chrysatertyr*	
J			
Jacana spinosa			
L			
Leptotila verreauxi			
M			
Mycteria americana	*Myiarchus tyrannulus*	*Megarhynchus pitangua*	*Myiodynstes luteiventris*
Micrastur semitorquatus	*Mionectes oleagineus*	*Myiozetetes similis*	*Mniotilta varia*
Morococcyx erythropygus	*Mylarchus tuberculifer*	*Mimus gilvus*	*Megaceryle alcyon*
Melanerpes aurifrons	*Myiarchus crinitus*	*Molothrus aeneus*	*Molothrus oryzivorus*
Momotus momota			
N			
Nycticorax nycticorax	*Nyctidromus albicollis*		
O			
Ortalis vetula	*Oporornis formosus*		
P			
Phalacrocorax brasilianus	*Pachyramphus aglaiae*	*Pheucticus ludovicianus*	*Psarocolius montezuma*
Platalea ajaja	*Progne subis*	*Passerina cyanea*	*Passer domesticus*
Pandion haliaetus	*Progne chalybea*	*Patagioenas flavirostris*	*Parula americana*
Porphyrio martinica	*Polioptila albiloris*	***Pionus senilis***	*Psarocolius wagleri*

Scientific name	Scientific name	Scientific name	Scientific name
Piaya cayana	*Pteroglossus torquatus*	*Pitangus sulphuratus*	
Q			
Quiscalus mexicanus			
S			
Sarcoramphus papa	*Seiurus aurocapillus*	*Stelgidopteryx serripennis*	*Setophaga ruticilla*
Streptoprocne zonaris	*Sporophila torqueola*		
T			
Tachybaptus dominicus	*Trogon melanocephalus*	*Thamnophilus doliatus*	*Tyrannus forficatus*
Tringa solitaria	*Trogon elegans*	*Todirostrum cinereum*	*Tyrannus savana*
Tapera naevia	*Trogon violaceus*	*Tolmomyias sulphurescens*	*Tyrannus melancholicus*
Tyrannus tyrannus	*Tachycineta thalassina*	*Thryothorus maculipectus*	*Tityra semifasciata*
Troglodytes aedon	*Tachycineta albilinea*	*Thryothorus modestus*	*Turdus grayi*
U			
Uropsila leucogaster hawkinsi			
V			
Vireo griseus	*Vireo gilvus*	*Vireo flavoviridis*	***Vermivora chrysoptera***
Vireo flavifrons	*Vireo philadelphicus*	*Vermivora pinus*	*Vermivora peregrina*
W			
Wilsonia citrina			
Z			
Zenaida asiática	*Zenaida macroura*	*Zimmerius vilissimus*	

Species in **bold** are included in *Table 5.25*
Source: Documents RVSCEH – Edited by ERM, 2018

Table 5.25 Significant birds in the Project Area

Scientific name	Common name (English)	Common name (Spanish / Local)	Family	Endemic	IUCN	CMS	CITES	Species of Special Concern in Honduras	Sensitivity
Dendrocygna autumnalis	Black-bellied whistling-duck	Pichiche común	Anatidae	-	LC	-	Appendix III	-	Medium
Anas clypeata (Spatula clypeata)	Northern shoveler	Pato pico de cuchara	Anatidae	-	LC	Appendix II	-	-	Medium
Ortalis vetula	Plain chachalaca	Chachalaca	Cracidae	-	LC	-	Appendix III	-	Medium
Ardea alba	Great white egret	Garzón blanco	Ardeidae	-	LC	Appendix II	-	-	Medium
Nycticorax nycticorax	Black-crowned night-heron	Garza nocturna corona negra	Ardeidae	-	LC	Appendix II	-	-	Medium
Sarcoramphus papa	King vulture	Rey zope	Cathartidae	-	LC	-	Appendix III	-	Medium
Pandion haliaetus	Osprey	Aguila pescadora	Pandionidae	-	LC	Appendix II	Appendix II	-	Medium
Chondrohierax uncinatus	Hook-billed kite	Milano pico de gancho	Accipitridae	-	LC	-	Appendix II	-	Medium
Elanus leucurus	White-tailed kite	Milano de hombros negros	Accipitridae	-	LC	-	Appendix II	-	Medium
Ictinia mississippiensis	Mississippi kite	Milano migratorio	Accipitridae	-	LC	-	Appendix II	-	Medium
Ictinia plumbea	Plumbeous kite	Milano plúmbeo	Accipitridae	-	LC	-	Appendix II	-	Medium
Buteogallus anthracinus	Common black hawk	Gavilán cangrejero	Accipitridae	-	LC	-	Appendix II	-	Medium
Buteo nitidus	Grey-lined hawk	Gavilán gris	Accipitridae	-	LC	-	Appendix II	-	Medium
Buteo magnirostris (Rupornis magnirostris)	Roadside hawk	Gavilán de caminos	Accipitridae	-	LC	-	Appendix II	-	Medium
Buteo platypterus	Broad-winged hawk	Gavilán ala ancha	Accipitridae	-	LC	-	Appendix II	-	Medium
Buteo brachyurus	Short-tailed hawk	Gavilán chingo	Accipitridae	-	LC	-	Appendix II	-	Medium

Scientific name	Common name (English)	Common name (Spanish / Local)	Family	Endemic	IUCN	CMS	CITES	Species of Special Concern in Honduras	Sensitivity
Buteo albonotatus	Zone-tailed hawk	Gavilán tincute	Accipitridae	-	LC	-	Appendix II	-	Medium
Buteo albicaudatus (Geranoaetus albicaudatus)	White-tailed hawk	Gavilán cola blanca	Accipitridae	-	LC	-	Appendix II	-	Medium
Micrastur semitorquatus	Collared forest-falcon	Halcón montés	Falconidae	-	LC	-	Appendix II	-	Medium
Caracara cheriway	Crested caracara	Pecho blanco cara cara	Falconidae	-	LC	-	Appendix II	-	Medium
Herpetotheres cachinnans	Laughing falcon	Guaco	Falconidae	-	LC	-	Appendix II	-	Medium
Falco sparverius	American kestrel	Lis-lis	Falconidae	-	LC	-	Appendix II	-	Medium
Falco columbarius	Merlin	Halcón palomero	Falconidae	-	LC	Appendix II	Appendix II	-	Medium
Falco rufigularis	Bat falcon	Halcón murciélago	Falconidae	-	LC	-	Appendix II	-	Medium
Falco peregrinus	Peregrine falcon	Halcón peregrino	Falconidae	-	LC	Appendix II	-	-	Medium
Burhinus bistriatus	Double-striped thick-knee	Alcaraván	Burhinidae	-	LC	-	Appendix III	-	Medium
Calidris minutilla	Least sandpiper	Playerito menudo	Scolopacidae	-	LC	Appendix II	-	-	Medium
Aratinga holochlora (Psittacara holochlorus)	Green parakeet	Perico verde	Psittacidae	-	LC	-	Appendix II	-	Medium
Aratinga nana (Eupsittula nana)	Jamaican parakeet	Perico azteco	Psittacidae	-	NT	-	Appendix II	-	Medium
Pionus senilis	White-crowned parrot	Lora cabeza blanca	Psittacidae	-	LC	-	Appendix II	-	Medium
Amazona albifrons	White-fronted amazon	Lora frente blanca	Psittacidae	-	LC	-	Appendix II	-	Medium

Scientific name	Common name (English)	Common name (Spanish / Local)	Family	Endemic	IUCN	CMS	CITES	Species of Special Concern in Honduras	Sensitivity
Amazona autumnalis	Red-lored amazon	Lora cariamarilla	Psittacidae	-	LC		Appendix II	-	Medium
Glaucidium brasilianum	Ferruginous pygmy-owl	Piza piedras	Strigidae	-	LC	-	Appendix II	-	Medium
Anthracothorax prevostii	Green-breasted mango	Colibrí Pecho Verde	Trochilidae	-	LC	-	Appendix II	-	Medium
Chlorostilbon canivetii	Canivet's emerald	Esmeralda de Canivet	Trochilidae	-	LC	-	Appendix II	-	Medium
Amazilia luciae	Honduran emerald	Colibrí esmeralda hondureño	Trochilidae	Yes	EN	-	Appendix II	-	High
Amazilia tzacatl	Rufous-tailed hummingbird	Colibrí cola rufa	Trochilidae	-	LC	-	Appendix II	-	Medium
Archilochus colubris	Ruby-throated hummingbird	Colibrí de garganta roja	Trochilidae	-	LC	-	Appendix II	-	Medium
Amazilia rutila	Cinnamon hummingbird	Colibrí canelo	Trochilidae	-	LC	-	Appendix II	-	Medium
Hylocichla mustelina	Wood thrush	Tordo de bosque zorzal	Turdidae	-	NT	-	-	-	Medium
Vermivora chrysoptera	Golden-winged warbler	Chipe ala dorada	Parulidae	-	NT	-	-	-	Medium

Notes: Species of birds included *Table 5.24* but not in *Table 5.25* are considered of low level of sensitivity.
Source: Documents RVSCEH – Edited by ERM, 2018

Mammals

According to the Honduran National Biodiversity Strategy (Miambiente, 2017), there are 221 species of mammal in Honduras, distributed between 36 different families.

Table 5.26 shows the list of mammals in the Project Area, based on a desktop review of the available information together with the information gathered during the June 2018 field survey.

For each species, *Table 5.26* also includes a level of protection, conservation concern, and sensitivity (see *Section 6.2.2* for further reference on sensitivity) based on: (1) international references such as the IUCN and CITES; (2) their level of endemicity; and (3) a list of species of flora and fauna of special concern in Honduras. *Section 2.1.7* provides a description of the international and national references considered.

Based on the information included in *Table 5.26,* the most significant findings on the mammals present in the Project Area are:

- Up to 40 species of mammals are present in the Project Area.
- The most numerous family is Phyllostomidae, with 15 species.
- None of the species is endemic. They are all found in other countries in America.
- Only one species is assessed as threatened by the IUCN: *Spilogale putorius* (VU). The other species were assessed as Least Concern (LC).
- Five species are included in the Appendices of CITES: *Puma yagouaroundi (Herpailurus yagouaroundi)* and *Puma concolor* (Appendices I and II); and *Dasyprocta punctate*, *Odocoileus virginianus* and *Dasyprocta punctate* (Appendix III). In addition, *Tamandua Mexicana* is included in Appendix III, but only for Guatemala, not Honduras; and the IUCN has suggested that *Conepatus mesoleucus* be included in Appendix II.
- None of the species is classified as a Species of Special Concern in Honduras.
- All the species of mammals are considered to be of low / medium sensitivity. Therefore, none are included in *Annex 6*, where additional information (habitat, ecology and distribution) on high sensitivity flora and fauna is included. They are likely to be common and widespread, and therefore less likely to be of concern in terms of conservation and protection.

To conclude, *Figure 5.56* includes photographs of mammals taken during the June 2018 field survey.

It should be noted that they were observed in a tourist centre, in fenced enclosures. Moreover, *Cebus capucinus* has not been identified in the fauna inventories conducted in the RVSCEH and is therefore not included in *Table 5.26*. However, since it is a widespread species in Honduras, it is very likely

that this species can be found in the mountains around the Aguan River Valley, near the Project Area.

Figure 5.56 Mammals observed in the Project Area

Source: ERM, 2018

Table 5.26 List of mammals in the Project Area

Scientific name	Common name (English)	Common name (Spanish / Local)	Family	Endemic	IUCN	CITES	Species of Special Concern in Honduras	Sensitivity
Dasypus novemcinctus	Nine-banded armadillo	Cusuco / pitero	Dasypodidae	-	LC	-	-	Low
Sylvilagus floridanus	Eastern cottontail	Conejo	Leporidae	-	LC	-	-	Low
Dasyprocta punctata	Central American agouti	Guatuza	Dasyproctidae	-	LC	Appendix III	-	Medium
Canis latrans	Coyote	Coyote	Canidae	-	LC	-	-	Low
Odocoileus virginianus	White-tailed deer	Venado cola blanca	Cerviade	-	LC	Appendix III	-	Medium
Didelphis marsupialis	Common opossum	Comadreja grande	Didelphidae	-	LC	-	-	Low
Didelphis virginiana	Virginia opossum	-	Didelphidae	-	LC	-	-	Low
Philander opossum	Grey four-eyed opossum	Comadreja de cuatro ojos	Didelphidae	-	LC	-	-	Low
Tamandua mexicana	Northern tamandua	Oso hormiguero	Myrmecophagidae	-	LC	Appendix III (Guatemala)	-	Low
Noctilio leporinus	Greater bulldog bat	-	Noctilionidae	-	LC	-	-	Low
Pteronotus parnellii	Common moustached bat	-	Mormoopidae	-	LC	-	-	Low
Pteronotus personatus	Wagner's moustached bat	Murciélago Bigotón de Wagner	Mormoopidae	-	LC	-	-	Low
Pteronotus davyi	Davy's naked-backed bat	-	Mormoopidae	-	LC	-	-	Low
Moormoops megalophylla	Ghost-faced bat	-	Mormoopidae	-	LC	-	-	Low
Artibeus lituratus (Artibeus intermedius)	Great fruit-eating bat	-	Phyllostomidae	-	LC	-	-	Low

Scientific name	Common name (English)	Common name (Spanish / Local)	Family	Endemic	IUCN	CITES	Species of Special Concern in Honduras	Sensitivity
Artibeus jamaicensis	Jamaican fruit-eating bat	-	Phyllostomidae	-	LC	-	-	Low
Artibeus phaeotis	Pygmy fruit-eating bat	-	Phyllostomidae	-	LC	-	-	Low
Artibeus watsoni (Dermanura Watsoni)	Thomas's fruit-eating bat	-	Phyllostomidae	-	LC	-	-	Low
Sturnira ludovici	Highland yellow-shouldered bat	-	Phyllostomidae	-	LC	-	-	Low
Sturnira lilium	Little yellow-shouldered bat	-	Phyllostomidae	-	LC	-	-	Low
Vampyressa pusilla	Little yellow-eared bat	-	Phyllostomidae	-	LC	-	-	Low
Uroderma bilobatum	Tent-making bat	-	Phyllostomidae	-	LC	-	-	Low
Phyllostomus discolor	Pale spear-nosed bat	-	Phyllostomidae	-	LC	-	-	Low
Tonatia silvicola (Lophostoma silvicolum)	White-throated round-eared bat	-	Phyllostomidae	-	LC	-	-	Low
Carollia perspicillata	Seba's short-tailed bat	-	Phyllostomidae	-	LC	-	-	Low
Carollia brevicauda	Silky short-tailed bat	-	Phyllostomidae	-	LC	-	-	Low
Glossophaga soricina	Pallas's long-tongued bat	-	Phyllostomidae	-	LC	-	-	Low
Glossophaga leachii	Grey long-tongued bat	-	Phyllostomidae	-	LC	-	-	Low
Desmodus rotundus	Vampire bat	-	Phyllostomidae	-	LC	-	-	Low
Myotis nigricans	Black myotis	-	Vespertilionidae	-	LC	-	-	Low

Scientific name	Common name (English)	Common name (Spanish / Local)	Family	Endemic	IUCN	CITES	Species of Special Concern in Honduras	Sensitivity
Rhogeessa tumida	Black-winged little yellow bat	-	Vespertilionidae	-	LC	-	-	Low
Urocyon cinereoargenteus	Grey fox	Gato cervan	Canidae	-	LC	-	-	Low
Puma yagouaroundi (Herpailurus yagouaroundi)	Jaguarundi	Jaguarundi / tigrillo	Felidae	-	LC	Appendix I and II	-	Medium
Puma concolor	Puma	León americano	Felidae	-	LC	Appendix I and II	-	Medium
Conepatus mesoleucus	American hog-nosed skunk	Zorrillo	Mephitidae	-	LC	Suggested by IUCN to be included in Appendix II	-	Medium
Mephitis macroura	Hooded skunk	Zorrillo	Mephitidae	-	LC	-	-	Low
Spilogale putorius	Eastern spotted skunk	Zorrillo manchado	Mephitidae	-	VU	-	-	Low
Sciurus variegatoides	Variegated squirrel	-	Sciuridae	-	LC	-	-	Low
Dasyprocta punctata	Central American agouti	Agoutí rojizo	Dasyproctidae	-	LC	Appendix III	-	Low
Liomys salvini		Raton semiespinoso	Dasyproctidae	-	LC	-	-	Low

Source: Documents RVSCEH – Edited by ERM, 2018

Key findings - field survey (June 2018)

The field survey was aimed at gathering information on: (1) hunting and bushmeat activities; (2) presence of fauna; and (3) observation of fauna. *Annex 4 (Field Survey Map- Biological Baseline)* shows the locations where specific information on fauna was gathered.

Table 5.27 summarizes the feedback on hunting and bushmeat received during the field survey. Hunting and bushmeat are associated with low economic resources. Although it is reportedly only occasional, bushmeat hunting still occurs, and includes protected species such as the black-chested spiny-tailed iguana (*Ctenosaura melanosterna*).

Table 5.27 Hunting and bushmeat in the Project Area

Source	Feedback
Meeting with group of farmers (small property profile)	No hunting of wildlife is reported.
Visit to farm 71 (medium property profile)	Hunting and bushmeat is associated with people with low levels of economic resources. Wildlife hunted includes rabbits and armadillo. Hunting of *Ctenosaura melanosterna* is very limited because it is a protected species. However, bushmeat hunting is residual only, the main sources of meat being farmed species, such as cows, pigs and chickens.
Visit to farm 108 (small property profile)	Hunting and bushmeat is associated with people with low levels of economic resources. Wildlife hunted includes the protected species *Ctenosaura melanosterna*. However, bushmeat hunting is residual only, the main sources of meat being farmed species, such as cows, pigs and chickens.
Visit to farm 128 (small property profile)	Hunting and bushmeat occur occasionally. Wildlife species hunted include the *Ctenosaura melanosterna* and birds such as the "chachalaca" (*Ortalis* spp.). However, bushmeat hunting is residual only, the main sources of meat being farmed species, such as cows, pigs and chickens.

Source: Field survey, 2018

Table 5.28 summarizes the feedback received on the presence of fauna, during the field survey, in particular protected species. The black-chested spiny-tailed iguana (*Ctenosaura melanosterna*) and the Honduran Emerald Hummingbird (*Amazilia luciae*) have been described both within the protected area (RVSCEH – see *Section 5.4.4*) and beyond. Although *Amazilia luciae* can be observed in various habitats, especially when searching for food, *Ctenosaura melanosterna* is a more specialized species which is mostly found within the very dry tropical forest.

Table 5.28 Presence of fauna in the Project Area

Source	Feedback
Meeting with the Arenal municipality	• Both *Ctenosaura melanosterna* and *Amazilia luciae* are reported to also occur outside the protected area (RVSCEH – see *Section 5.4.4*).
Meeting with SAGO	• Both *Ctenosaura melanosterna* and *Amazilia luciae* are reported to also occur outside the RVSCEH. This is a consequence of the declaration of the protected area, which has enabled these species to consolidate their populations inside the protected areas, and enabling some individuals to spread to other areas with appropriate habitats.
Meeting with group of farmers (small property profile)	• *Ctenosaura melanosterna* farms are thought to be a good idea to provide an additional source of food for the people used to eating this species of iguana. • *Amazilia luciae* is reported to be more frequent within the RVSCEH.
Visit to farm 30 (small property profile)	• *Ctenosaura melanosterna* is not very frequent due to being hunted (bushmeat). • *Amazilia luciae*: the farmer explains that he keeps 17.5 ha of his property with natural habitat, with no agricultural or livestock activity on it, in order to contribute to the conservation of *Amazilia luciae*. Since this area is not part of the RVSCEH, he does not receive financial benefit for this. He is, however, keen to do it because of his personal interest in the conservation of the species and its habitats.
Visit to farm 71 (medium property profile)	• *Ctenosaura melanosterna*: regular presence. • *Amazilia luciae*: occasional presence. • Both the protected species, although more frequent in the RVSCEH, also occur in non-protected areas. • A group of mantled howlers (*Alouatta palliata*) used to live on the farm many years ago (20-30 years ago, approximately). The grandparents of the farmer tried to feed them, but unsuccessfully, since these monkeys are very wary of human beings.
Visit to farm 108 (small property profile)	• *Ctenosaura melanosterna*: regular presence. Individuals in the area are described to have a whitish colour. • *Amazilia luciae*: regular presence.
Visit to farm 128 (small property profile)	• *Ctenosaura melanosterna*: regular presence. • *Amazilia luciae*: absent.
Visit to farm 165 (big property profile)	• A caiman (*Caiman crocodilus)* was observed once on the farm, in a surface water body near the river. • *Ctenosaura melanosterna*: occasional presence. • *Amazilia luciae*: regular presence.

Source: Field survey (2018)

Figure 5.51 to *Figure 5.56* above include a selection of photographs of fauna taken during the field survey conducted in the Project Area (June 2018).

5.4.4 Protected areas

Overview

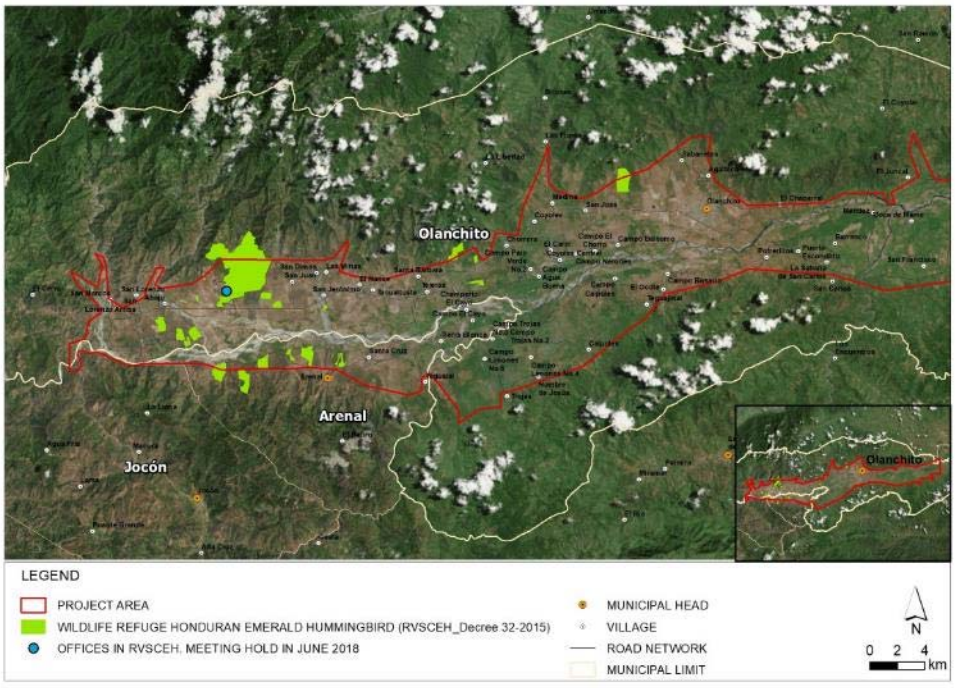
Protected areas in Honduras are managed by the ICF (Institute of Conservation of Forestry, Protected Areas and Wildlife – *Instituto de Conservación Forestal, Áreas Protegidas y Vida Silvestre*).

All the protected areas in Honduras are part of the SINAPH (National System of Protected Areas – *Sistema Nacional de Areas Protegidas*), whose main objective is to conserve the biodiversity of the country and the ecosystem services this provides to Honduran society.

The ICF has developed a co-management system involving various stakeholders, such as public sector bodies, municipalities, universities, and NGOs. This co-management system enables effective management of the protected areas.

There is one protected area within the Project Area: Honduran Emerald Hummingbird Wildlife Refuge (RVSCEH – *Refugio de Vida Silvestre Colibrí Esmeralda Hondureño*). *Figure 5.57* shows the location of this protected area, within the limits of the Project Area.

Figure 5.57 Map of the Protected Area in the Project Area: Honduran Emerald Hummingbird Wildlife Refuge (RVSCEH – Refugio de Vida Silvestre Colibrí Esmeralda Hondureño)



Source: Integra Ingeniería, 2017 – Edited by ERM, 2018

Honduran Emerald Hummingbird Wildlife Refuge (RVSCEH - Refugio de Vida Silvestre Colibrí Esmeralda Hondureño)

The RVSCEH is located in the western section of the Aguan Valley, between the municipalities of Olanchito and Arenal in the Department of Yoro. The limits of the RVSCEH limits are:

- North: *Pico Bonito* National Park.
- East: municipality of Olanchito.
- West: villages of San Lorenzo Abajo and San Lorenzo Arriba.
- South: municipality of Arenal.

The RVSCEH was declared a protected area by Legislative Decree 159-2005 and it is part of the SINAPH. The original protected surface are as per the Legislative Decree 159-2005 was 1,217.46 ha, mostly owned by the government (1,157.4 ha), with 60.07 ha being private property. However, in 2011, Legislative Decree 159-2005 was modified and new areas were also declared protected (another 835 ha). This modification meant the total surface area of the RVSCEH increased to 1,992.7 ha.

The RVSCEH comprises 27 separated zones, all with different levels of conservation and surface areas, ranging from small (2 ha) to the large zone historically managed by the Air Forces of Honduras (1,200 ha). Twentysix of the 27 areas are private property. Private properties are preserved by Environmental Services Payments (PSA - *Pagos por Servicios Ambientales*) agreed with the landowners. These private zones represent about 600 ha of the total surface area of the RVSCEH.

In the case of the RVSCEH, the co-management system developed by the ICF for the protected areas in Honduras involves the following organisations:

- ICF.
- Ministry of Defence.
- The Olanchito and Arenal municipalities.
- IHT (Honduran Tourism Institute – *Instituto Hondureño de Turismo*).
- Secretary of Public Works and Transport.
- National Autonomous University of Honduras.
- Ministry of Education and Secretary of Natural Resources and the Environment.
- ASIDE (Research Association for Ecological and Socioeconomic Development - *Asociación de Investigación para el Desarrollo Ecológico y Socioeconómico*).

The main ecological features in the RVSCEH are as follows (Asesora, 2009):

- Fauna: Honduran emerald hummingbird (*Amazilia luciae*), and Black-chested spiny-tailed iguana (*Ctenosaura melanosterna*), both endemic to Honduras.

- Flora: there are 10 endemic species occurring only in the RVSCEH or nearby. This concentration of endemic species is the highest in Honduras. These species are *Bakeridesia molinae, Caesalpinia yucatanensis (*subsp. *hondurensis), Capparicordis yunckeri, Dioon mejiae, Eugenia lempana, Eugenia coyolensis, Leucaena lempirana, Lonchocarpus trifolius, Opuntia hondurensis* and *Zamia standleyi.*
- Habitats: very dry tropical forest, dry tropical forest, and humid subtropical forest. Most of the RVSCEH is within very dry tropical forest and dry tropical forest zones, representing one of the very few areas of this habitat in the tropics. In Central America, there are only two areas with this habitat: the Motagua Valley, in Guatemala; and the Aguan Valley, in Honduras, where the RVSCEH is located. Further descriptions of the two types of habitats are included in *Section 5.4.1*.

Although the RVSCEH documents consulted during the desktop review do not refer to the IUCN categories for protected areas, the RVSCEH could be considered a type IV protected area (Habitat/Species Management Area). This is defined by the IUCN as follows: protected area that usually helps protect, or restore: 1) a flora species of international, national, or local importance; 2) a fauna species of international, national, or local importance including resident or migratory fauna; and/or 3) habitats. The size of the area varies but can often be relatively small; this is however not a distinguishing feature. Management will differ depending on need. Protection may be sufficient to maintain particular habitats and/or species. However, as category IV protected areas often include fragments of an ecosystem, these areas may not be self-sustaining and will require regular and active management interventions to ensure the survival of specific habitats and/or to meet the requirements of particular species.

In addition to this, it should be noted that the RVSCEH is not included in the UNESCO World Heritage List.

Key findings - field survey (June 2018)

The field survey included a meeting in the RVSCEH with some of the members responsible for managing the protected area (ASIDE and ICF). The meeting was aimed at gathering information on: (1) the management of the protected area; (2) conservation concerns; (3) expectations of the implementation of the irrigation project; (4) additional inventories of fauna and flora in the protected area; and (5) observation of flora and fauna in the protected area.

The information provided by ASIDE and ICF during the meeting held in the RVSCEH on the management of the protected area is summarized in *Box 5.2*.

Box 5.2 Management of the RVSCEH

- A technical committee manages the protected area. It comprises: the Air Force, ICF, ICEP, Autonomous University of Honduras, Olanchito and Arenal municipalities, ASIDE, MiAmbiente, and IHT.
- ASIDE is a NGO co-managing the protected area with a 5 years contract.
- MiAmbiente is not participating in the co-management because their closest office is in La Ceiba.
- IHT (Honduran Institute of Turism - *Instituto Hondureño de Turismo*): is not participating in the co-management because their office is in Tegucigalpa.
- Management of the protected areas is economically supported by an escrow set up in 2011 with $1 million. In 2018, the escrow had generated 15 million lempiras in interest, which has been used to develop the environmental baseline of the protected area and pay the farmers with lands within the protected area for the environmental services of their land as part of the protected area.
- The first management plan for the protected area was produced in 2009. In 2011, an addendum was produced.
- An update of the management plan is being written (draft prepared in March 2018 is under review by the Department of Protected Areas).
- The management plan prepared in 2009 included the concept of buffer zones (*zonas de amortiguamiento*). However, buffer zones could not be implemented due to lack of engagement (insufficient economic benefit) of the farmers whose lands would have been within these buffer zones.
- The updated management plan (under review) will clarify that there are no buffer zones in the protected area.
- The Honduran Air Force provides security for the protected area. In 1988, the area where part of the protected area is located was assigned to the Air Force. Because of this, when the area was designated a protected area (2005), the Air Force was assigned to provide security. They patrol the protected area 3-4 times a day, by foot or in a vehicle, and at various times (morning, afternoon, evening and night). They report that illegal activities occasionally occur in the protected area, such as hunting (for bushmeat - black-chested spiny-tailed and deers; and for selling - parrots).
- Other partners helping in the management of the protected area: ABC (American Birds Conservation – collaborated in the past, but not anymore), TNC (The Natural Conservancy), World Bank, the Spanish Government.
- Decree 32/2014 did not include the geographical system considered in the limits of the protected area. PAT (Lands Management Program - *Programa de Administración de Tierras*) reviewed the protected area limits and systematically adopted the geographical system WGS84.

Source: Field survey, 2018 – meeting with ASIDE and ICF

Information provided on conservation concerns for the protected area and its biodiversity, by ASIDE and ICF during the meeting held in the RVSCEH, is summarized in *Box 5.3*.

Box 5.3 Conservation concerns in the RVSCEH

- Landowners in the RVSCEH and the Project Area already respect the wildlife. Awareness activities should be focused on farm workers and the populations of nearby communities.
- No changes in land use has been observed within the protected area. Four monitoring events are conducted per year to identify any incompliance regarding hunting, fires, vegetation chopping, and livestock. Economic penalties are not applied in case of incompliance, taking into account the reduced economical benefit given to landowners with land within the protected area, for the economical services provided. The landowner is present during the monitoring, so that he can explain and be advised about any incompliance observed, in order to avoid the incompliance happening again. This positive approach is considered to be more successful than a negative approach involving economic penalties.
- The economic benefit received by landowners with lands within the protected area is very small, more symbolic than a real environmental service payment. Because of this, the main reasons why landowners keep part of their lands within the protected area (and therefore, unexploited) are: (1) they have more land outside the protected area, which they exploit; and (2) personal opinions on the importance of keeping protected areas for the conservation of natural habitats and biodiversity.
- Both the black-chested spiny-tailed iguana (*Ctenosaura melanosterna*) and the Honduran Emerald hummingbird (*Amazilia luciae*) occur outside the limits of the protected area. *Ctenosaura melanosterna* is mostly limited to other areas where the very dry tropical forest has been preserved. *Amazilia luciae* can be observed in other habitats, especially when searching for food. Both species are endemic in Honduras.
- The main conservation concern for *Amazilia luciae* is the loss of suitable habitat (very dry tropical forest), because of the increase in areas dedicated to forage crops and pasture for livestock.
- The main conservation concern for *Ctenosaura melanosterna* is the loss of suitable habitat (very dry tropical forest), as in the case of *Amazilia luciae*, because of the increase in areas dedicated to forage crops and pasture for livestock. Another conservation concern for *Ctenosaura melanosterna* is hunting (bushmeat).
- Changes in land use can therefore affect these two species, due to the loss of suitable habitat. This has actually occurred due to the historical transformation of natural habitats (including the very dry tropical forest) into areas dedicated to agricultural fields and pastures.

Source: Field survey, 2018 – meeting with ASIDE and ICF

Regarding the expectations towards the implementation of the irrigation project, information provided by ASIDE and ICF during the meeting held in the RVSCEH is summarized in *Box 5.4*.

Box 5.4 Expectations of the irrigation project

- According to ASIDE / ICF, diversification is important in the conservation of the protected areas. Diversification due to two main elements: development of agriculture, rather than economic activity limited to livestock; and processing activites linked to meat and milk.
- ASIDE / ICF should be involved in coordinating the irrigation project, in implementing the mitigation measures related to the biodiversity and the protected area. For example, ASIDE / ICF could provide environmental training on biodiversity conservation. This has been implemented in other areas, such as Trujillo, where the CREA (Environmental Training Regional Center - *Centro Regional de Educación Ambiental*) provided training on environmental management in African palm plantations. Thanks to the training, the farmers are now more aware of the importance of the wildlife on their land, and this helps in the consolidation of biodiversity corridors.
- ASIDE / ICF suggested that landowners with land within the limits of the protected area should benefited from the irrigation project too, so that they can implement the irrigation project in the land they own outside the protected area. Although the project designation criteria are not yet defined, a deduction in the irrigation project fee for these people might be fair compensation for their contribution in terms of environmental services.
- According to ASIDE / ICF, if farmers are capable of improving the productivity of their lands (e.g., through implementation of an irrigation project, such as the Alto Aguan Irrigation Project), they will not need to increase the areas dedicated to agricultural fields and pastures. In this way, the risk of losing additional areas of natural habitats to be transformed in agricultural fields and pastures is reduced. This would be very beneficial for the conservation of the very dry tropical forest, and subsequently for the key species within this habitat, such as the Honduran emerald hummingbird (*Amazilia luciae*) and the black-chested spiny-tailed iguana (*Ctenosaura melanosterna*).
- ASIDE / ICF wondered about additional crops that could be developed in the Project Area through the irrigation project. According to the SAG personnel from Olanchito attending the meeting, the main species to be considered are corn (a variety suitable to dry areas or areas with drought periods) and forage plants. Both would enable storage in silos, so that food is available for the cattle during the dry season. This technical development would also avoid the farmers buying concentrated food (expensive) and implementing bad management practices (e.g., feeding the cattle with oranges during the dry season, resulting in acidic milk).
- The Technical Committee has approved a proposal for an escrow interest for productive projects, very much aligned with the irrigation project: promoting productive projects compatible with biodiversity conservation.

Source: Field survey, 2018 – meeting with ASIDE and ICF

Regarding the existence of additional inventories of flora and fauna in the protected area, information provided by ASIDE and ICF during the meeting held in the RVSCEH is summarized in *Box 5.5*.

Box 5.5 Additional inventories of flora and fauna in the RVSCEH (post-2012)

- Insect monitoring was conducted in 2018. It is still pending publication. Preliminary data refers to more than 400 species of insects in the Project Area. Some key findings are: (1) up to 24 species of lepidoptera never previously found in Honduras; and (2) a potential new species of lepidoptera (currently under taxonomic review).
- Monitoring of Honduran Emerald hummingbird (*Amazilia luciae*) in the RVSCEH confirms the populations are stable. The monitoring was conducted by ASIDE / ICF and Rosalina Martínez, from CURLA University (Atlantic Coast Regional University Center - *Centro Universitario Regional del Litoral Atlántico*). The results of the monitoring have not yet been published.
- Overall, there is a high degree of endemism in the RVSCEH.
- Addendum to the Flora Management Plan is pending approval.

Source: Field survey, 2018 – meeting with ASIDE and ICF

The flora and fauna observations in the RVSCEH made during the field survey are included in *Section 5.4.2* and *Section 5.4.3*, including photographs of flora and fauna taken in the RVSCEH. *Figure 5.58* shows some additional photographs taken during the meeting with ASIDE and ICF in the RVSCEH.

Figure 5.58 Visit to the RVSCEH

Notes: top left (ASIDE personnel explaining biodiversity in the RVSCEH); top right (offices in the RVSCEH where the meeting was conducted), bottom left (meeting in the RVSCEH); and bottom right (former landing strip in the RVSCEH used by the Air Force)
Source: ERM, 2018

5.4.5 Critical Habitats

This is described and developed in detail in *Annex 9* of this report, Critical Habitat Assessment. In terms of baseline the objective of the assessment is to determine which areas within the Project footprint constitute natural habitat, which areas constitute modified habitats, and which habitats (natural or modified) and species found within the ecological landscape in and around the Project footprint may be regarderd as critical habitat (CH) triggers by the provisions of IFC Performance Standard 6. The main conclusions of the Critical Habitat Assessment in this regard are that the Aguan River Valley is a mosaic of natural and modified habitats, and available evidence discards for the latter the possibility of being classified as Critical. For the natural habitats within the area, some of them could be classified as Critical Habitats The nature of these CH will be restricted to very dry and dry forests, as recognized by local and international institutions.

The majority of those CHs in the Project total footprint (the area encompassing the envelope of all potential beneficiaries plots) are within the current protected area, but as stated in the previous *Section 5.4.4* of this ESIA, the size and footprint of the protected area is a mix of biological features (areas where the very dry forest patches are better preserved) and socio-economic (areas where landowners have volunteered to relinquish land use change. In any case, as stated above, the modified habitats, including the socioeconomic features, located in the Project total footprint cannot be classified as CH. The irrigation equipment will be located on agricultural land as opposed to natural or Critical Habitats and will therefore no affected any critical habitat located within the protected area.

5.5 SOCIOECONOMIC ENVIRONMENT

5.5.1 Social Study Area

The Social Study Area largely corresponds to the Project Area covering an area of 60,000 ha where most potential socioeconomic impacts are expected. The Project Area is composed mostly of the municipality of Olanchito (88.9%) with a smaller area in El Arenal (10.3%) and an even smaller portion touching upon the municipalities of Jocon to the West (0.4%) and Sabá (0.4%) to the East.

The baseline description of the Study Area will therefore focus on the municipalities of Olanchito and El Arenal, and to the extent possible, on the communities of these two municipalities that are located inside the Project Area. The communities included in the Project Area are shown in *Figure 5.59* in the following section.

5.5.2 Administrative structure

Administrative divisions

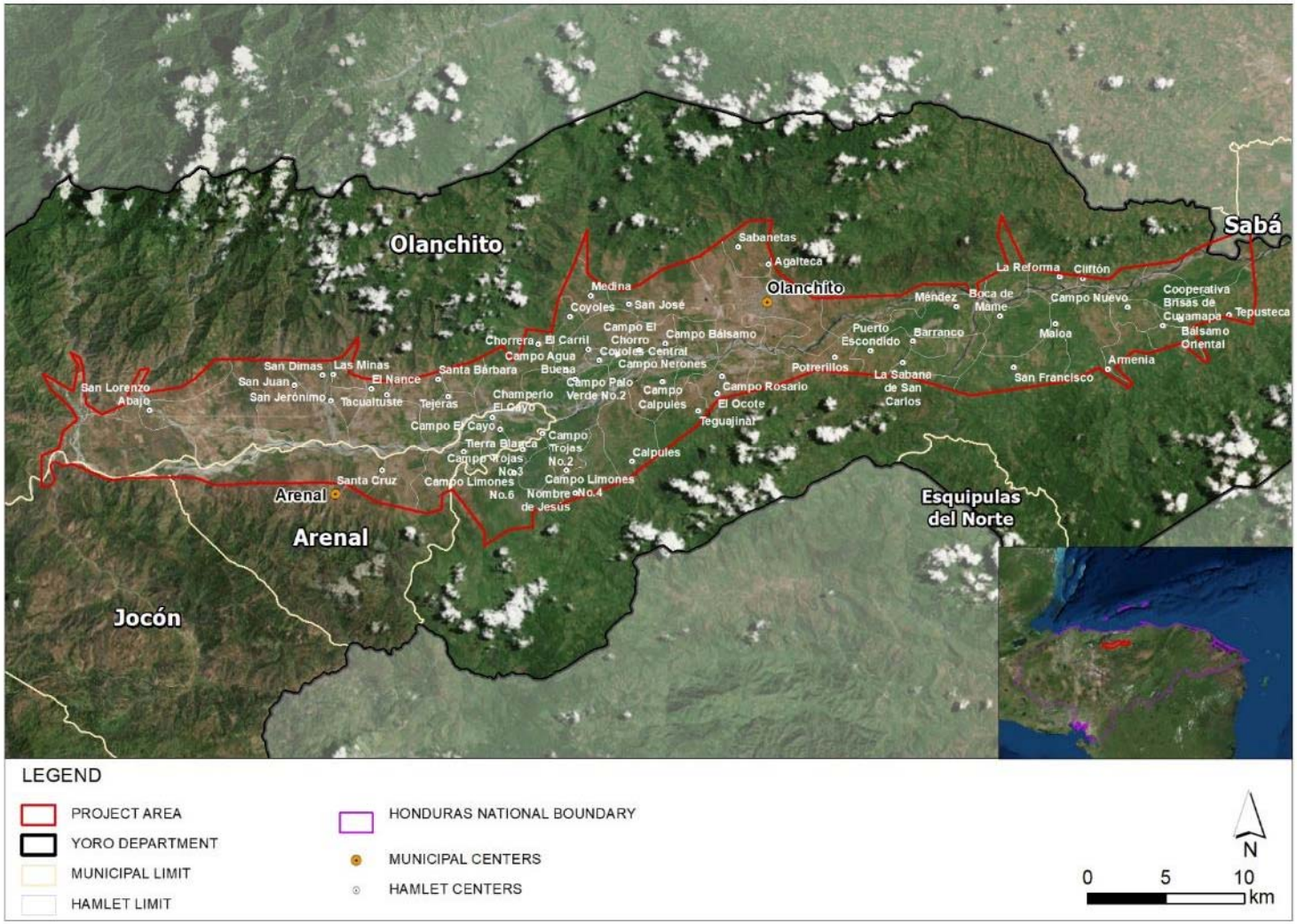
The territory of Honduras extends over 112,492 km^2 and is organised into 18 departments. The department of Yoro, where the Project Area is located covers an area of 7,781 km^2 and is divided into 11 municipalities. Each municipality is further divided into hamlets (*Aldeas)* and settlements (*Caseríos).* [1]

The Project Area is divided into a total of 61 hamlets (*Aldeas)* and 147 settlements (*Caseríos),* of which 54 hamlets and 132 settlements belong to the municipality of Olanchito, and five (5) hamlets and 12 settlements to Arenal. The remaining hamlets and settlements belong to the municipalities of Sabá and Jocón.

The administrative divisions and hamlets in the Project Area are shown in *Figure 5.59* below. A list of the hamlets (*aldeas)* and settlements (*caseríos)* found in the Project Area is provided in *Annex 7*.

[1] *Aldeas* are settlements with over 100 inhabitants while *caserío*s are smaller settlements with less than 100 inhabitants.

Figure 5.59 Administrative divisions in the Project Area



Source: ERM, 2018

Olanchito covers an area of approximately 2,000 km² (200,000 ha) and is located in the Aguán Valley. It borders *Nombre de Dios* mountain range to the North and the *Sierra de la Esperanza* mountain range to the South. The municipality of Olanchito is divided into 81 hamlets or "*aldeas*" and 392 smaller settlements or "*caseríos*".[1] The urban centre of Olanchito town is composed of eight (8) neighbourhoods (*barrios)* and 48 smaller neighbourhoods (*colonias).* The rural area also includes eight (8) banana plantations (Rosario A, Rosario B, Palo Verde Finca, Trojas A, Trojas B, Nerones, Limones 4, and Limones 6).[2]

The municipality of El Arenal covers an area of approximately 180 km² (18,000 ha) and borders with the municipality of Olanchito to the North and East, Mangulile (Olancho department) to the South, and with Jacón to the West. Arenal municipality is primarily rural and is divided into seven (7) hamlets (*aldeas)*, eight (8) settlements *(caseríos),* seven (7) neighbourhoods (*barrios),* and three (3) colonies (*colonias).*[3]

Local governance

According to the Law of Municipalities (*Ley de Municipalidades)*, municipalities are autonomous entities governed by a municipal corporation (*corporación municipal)* and administered by the municipal administration (*administración municipal).* The municipal corporation is the highest authority at the municipality level. It is headed by a Mayor (*alcalde),* a vice mayor *(vice alcalde)* and four (4) to 10 councillors or aldermen (*regidores*) depending on the size of the municipality elected directly by the people.[4] The municipal administration is the administrative body composed of the specific departments. In rural areas, both *aldeas* and *caseríos* are governed by an assistant mayor (*Alcalde Auxiliar)* selected in a communal assembly and appointed by the municipal corporation.

The municipal administration is organized into specialized units including an Environment Unit (*Unidad de Medioambiente* or UMA). The municipal environment units are responsible for planning, promoting, implementing, coordinating and supervising all activities related to the environment in the municipality. This includes coordination with the relevant National Secretaries (i.e. Environment, Arts and Culture, National Tourism Institute, and the Anthropology and History Institute). The UMA is also responsible for conducting environmental inspections and for ensuring compliance with

[1] Olanchito Strategic Municipal Development Plan for 2004-2020 (2004) and Colibri Esmeralda Habitat Management Plan (ICF and the Nature Conservancy, 2009).

[2] Olanchito Strategic Municipal Development Plan for 2004-2020 (2004) and Colibri Esmeralda Habitat Management Plan (ICF and the Nature Conservancy, 2009).

[3] Arenal Municipality Website: https://portalunico.iaip.gob.hn/portal/index.php?portal=318 . Accessed August 2018 and Strategic Development Plan for the Municipality of Arenal (2013).

[4] Law of Municipalities (*Ley de Municipalidades),* Articles 25 and 26.

environmental norms of exploitation and commercialization of natural resources, related contracts and operations.[1]

Water boards operate the drinking water systems at the local level and are composed of members selected among an assembly of water users for a period of one to two years. Membership and services provided by the boards are voluntary and to the community's benefit. The boards are therefore self-organized by local residents with supervision and support from the Municipal Corporation. Water boards are explained in more detail in *Section 5.5.12*. The municipal administration's Governance and Transparency Department (previously referred to as Community Development Department) is responsible among other things to provide capacity building and assistance to the Water Boards in collaboration with the Honduran Association of Water Administration Boards (*Asociación Hondureña de Juntas Administradoras de Agua* or AHJASA).[2]

Olanchito's Farmers and Livestock Breeders Society (*Sociedad de Agricultores y Ganaderos de Olanchito* or SAGO) and local Milk Collection Centres (*Centros de Recolección de Leche* or CRELES) also play a role in local administration and governance of the agriculture and milk production sectors, which represent the most important economic sectors of the area. The roles of the SAGO and CRELES are described in more detail in *Section 5.5.8.*

5.5.3 Overview of potential project beneficiaries

The beneficiaries of the Aguan Irrigation Project will be chosen among all the livestock breeders and milk producers present in the area. Currently, there are approximately 350 milk producers and farmers members of the SAGO; most of whom are also members of the 16 CRELES present in the Project Area.[3] All milk producers and farmers of Olanchito and El Arenal will be able to apply to become beneficiaries provided they meet the criteria set by the SAG and PAA Project as described in the Project Description Chapter (*Chapter 3*).[4] All applications will be reviewed and the decision-making on the selection of the final beneficiaries will be based on strict selection criteria. Considering that 75% of the 301 milk producers and farmers surveyed by CINSA and PAA Project Finance in November 2017 as part of their preliminary assessment met the pre-established criteria (see *Section 3.4.1*), it is envisaged that the project could benefit between 260-300 milk producers in the area. CINSA & PAA preliminary findings also show that these producers cultivate 70% of the cultivated and pasture land in the Project Area, over 16,000 ha of land. This finding is aligned with the land use distribution in the Project Area explained

[1] Environmental Unit Primary Functions (*Unidad Municipal del Ambiente (UMA) Atribuciones Principales).* Official Arenal Municipality Website: https://portalunico.iaip.gob.hn/portal/ver_documento.php?uid=MTMwOTI0ODkzNDc2MzQ4NzEyNDYxOTg3MjM0Mg==

[2] Olanchito Municipality Institutional and Financial Diagnostic (2005).

[3] It was reported during the June 2018 field survey that two new CRELES are being established which indicates that the number of milk producers in the Project Area could be close to 400.

[4] Land plots eligible for the Project should meet the following criteria: (a) Belong to the beneficiary (landowner); (b) Not to be located in protected areas; (c) Land plot not to be installed within natural habitats such as shrubland or forest; (d) Have water availability, either surface or underground water; (e) Have a flat land; (d) Not to be located in indigenous land.

in *Section 5.5.7*.These will be able to apply for a number of irrigation sets depending on land availability and resources, and will be required to meet a set of responsibilities with regards to the Project (*Chapter 3*).

As stated above, during the preliminary survey conducted by CINSA & PAA Project Finance in 2017, a sample of 301 out of approximately 350 SAGO livestock breeders, milk producers and farmers were visited and interviewed, which represents 86% of the current estimated population of livestock breeders,milk producers and farmers. The preliminary survey included 47 women, and 52 independent producers who do not belong to any CREL (of which 8 women). As such, the information collected through this process is considered representative of the total livestock,milk producer and farmer population in the area. Most producers are located in the municipality of Olanchito (91%) and a few are located in the municipalities of El Arenal (8%) and Jocon (1%). The distribution of the 301 producers and farmers per CREL and Municipality is presented in *Table 5.29* below.

Table 5.29 Distribution of farmers and milk producers per CREL and municipality in the Project Area

#	CREL	Members in Olanchito	Members in El Arenal	Members in Jocon
1	Andino Munguía	18		
2	Armín Jerónimo Figueroa	13		
3	Bustillo Martínez	30		
4	Cárcamo Martínez	23		
5	CRELCA	11		
6	Cruz Nuñez	19		
7	Fabricio Puerto	19		
8	Heberto Chirinos Ponce	20		
9	Leopoldo Duran Dueñas	9		
10	Martinez Hernández	1		
11	Martínez Lobo	2	23	
12	Mejía Rodríguez	15		
13	Puerto Lozano	14		
14	Salinas Gonzales	15		
15	Salvador Figueroa	3		
16	Superación	11		3
	Total CREL Members	**223**	**23**	**3**
	Independent Producers	51	1	
	Total Farmers and Milk Producers	**274**	**24**	**3**
	TOTAL	**301**		

Note: The number of potential beneficiaries may increase considering that new CRELs are being created and the distribution may change.
Source: Field survey 2017

Basic information was collected during the initial field survey (2017) in order to obtain a preliminary understanding of the socioeconomic characteristics of

the potential beneficiaries (including CREL membership, community and municipality where they are located, ownership title, farm size, land available for irrigation, type of water source available for irrigation, type of production and crops, average monthly income, etc.). Preliminary findings show that 70% of potential beneficiaries do not have access to a source of surface water for irrigation and would therefore require underground wells.

Note that these preliminary visits were not conducted as part of any formal beneficiary selection process. The final list of beneficiaries will be confirmed only after potential beneficiaries have presented their applications and after closure of the application process which will be managed by the SAG-PIU.

This preliminary information was subsequently complemented with more detailed data collected during the June 2018 field survey through interviews with the SAGO, CRELES and a sample of 13 producers (of which eight (8) are new potential beneficiaries that were not surveyed in 2017). The information collected serves as a basis for the socioeconomic baseline description presented in this Chapter.

The following subsections present the socioeconomic characteristics of the general population in the Project Area with a focus on livestock breeders,milk producers and farmer populations and economic sector.

5.5.4 Demographics

Population

Based on the latest population census conducted in 2013, the total population of Honduras as of 2013 is of 8,303,771 with an annual growth rate of 1.99%, which represents a 37% increase from 6,076,885 in 2001. A large portion of the population still resides in rural areas although the urban population has been increasing steadily over the years showing a tendency towards urbanization with 53.4% of the population residing in urban areas in 2013 compared to 46% in 2001.[1] The urbanization rate is expected to continue to increase with an estimated annual rate of change at 2.75% between 2015 and 2020, leading to an estimated 57.1% of urbanized population in 2018.[2] The population in Honduras is fairly young with over 40% under 19 years of age, and only a minority (less than 10%) above 60. Gender distribution is balanced with approximately 48% male and 52% female.[3]

As of 2013, the population in the Department of Yoro is of 570,595. In line with gender distribution and urbanization levels at the national level, the population of Yoro is 49% male and 51% female, with 52% residing in urban areas versus 48% in rural areas.[4] At the municipality level, the population numbers in Olanchito and El Arenal municipalities amounted to 104,609 and

[1] INE, Population Census 2013 and 2001.

[2] CIA, World Factbook. Web: https://www.cia.gov/library/publications/the-world-factbook/geos/ho.html. Accessed 08 Aug. 2018.

[3] INE, National Households and Housing Survey, 2013.

[4] INE population census 2013.

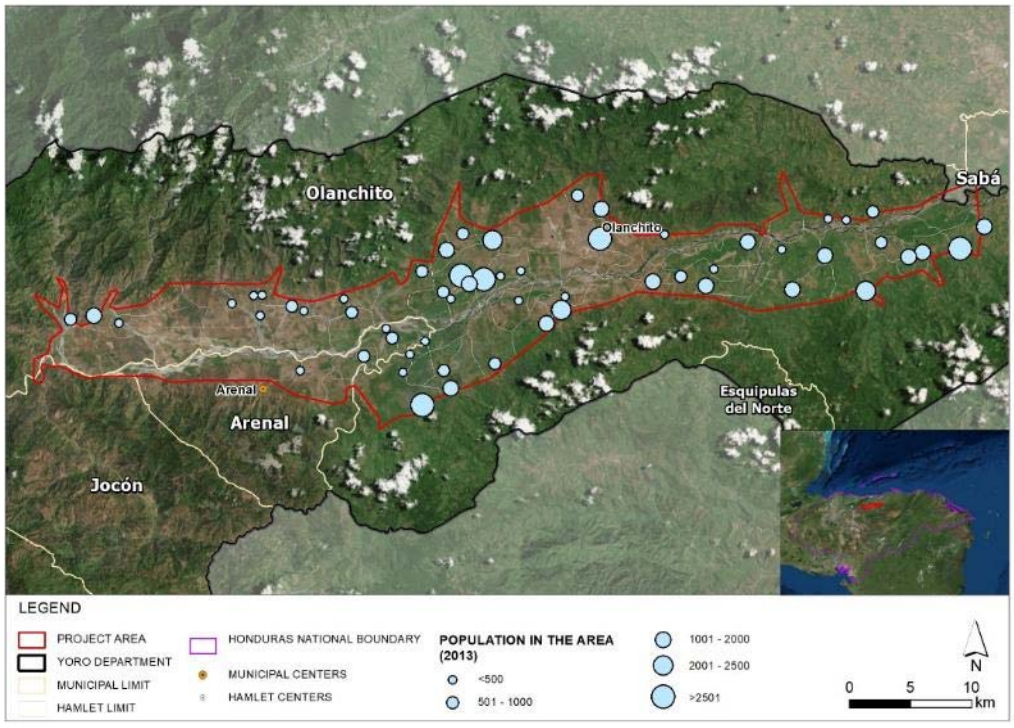
5,949 in 2013, representing around 18% and 1% of the population of Yoro respectively. Since 2001, the population of Olanchito and Arenal have increased by 25% and 17% respectively, and both municipalities are experiencing an urbanization trend with an increasing number of people living in urban areas.

The population of Arenal remains primarily rural, with around 64% residing in rural areas and 36% in urban areas, versus 49% rural and 51% urban for Olanchito. The population density as of 2013 in Olanchito is of 52 inhab/km^2 and 34 inhab/km^2 for Arenal. More recent estimates for 2015 calculate the population density for Olanchito and Arenal at 51 inhab/km^2 and 30 inhab/km^2 respectively, which is considerably lower than the country average of about 75 inhab/km^2.[1]

Within the Project Area, according to the 2013 population census, the total population is of 89,166 inhabitants, with 84,894 included in the municipality of Olanchito and 4,272 in the municipality of Arenal. This represents 86% of the population of Olanchito, and 76% of the population of Arenal in 2013. For Olanchito and Arenal combined, the Project Area therefore represents 86% of the total population of both municipalities as of 2013. The information collected for Olanchito and Arenal municipalities as a whole is therefore considered representative of the situation in the Project Area.

The population density in the Project Area at the hamlet (*aldea)* level is presented in *Figure 5.60*.

Figure 5.60 Population distribution per hamlet in the Project Area (2013)



Source: INE Population Census 2013 modified by ERM (2018).

[1] ICF, Olanchito Atlas Forestal Municipal, 2015. Accessed at: http://icf.gob.hn/wp-content/uploads/2015/09/1807-Olanchito-Atlas-Forestal-Municipal.pdf

Age and gender distribution

In line with demographic trends at the national and regional levels, the population in the municipalities of Olanchito and Arenal is quite young, with approximately 49% below 19 and less than 10% is aged 60 and over. About 53% of the population is of working age (age group 15 to 54).

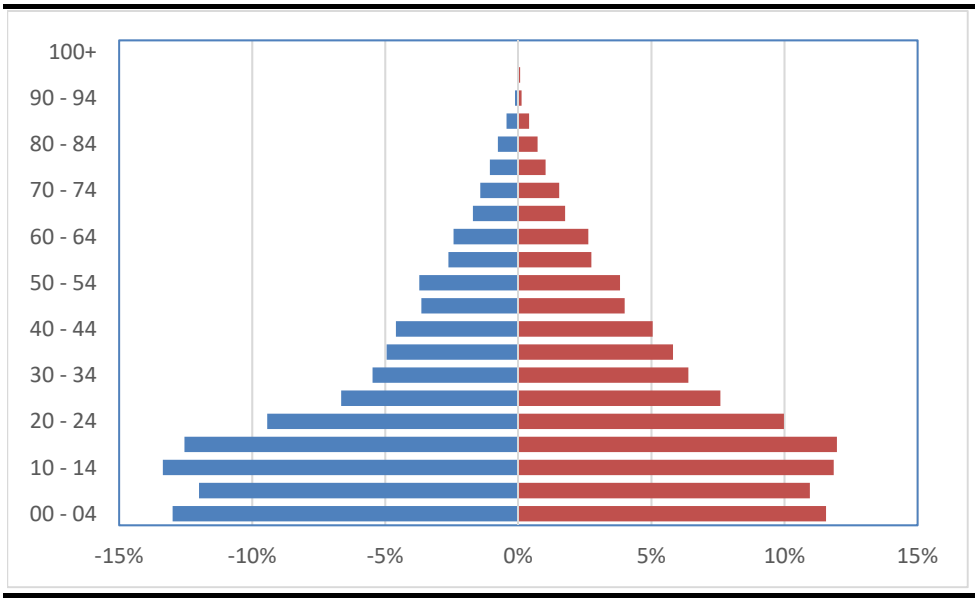
The age and gender distribution in Olanchito and Arenal is summarized in *Table 5.30*, while *Figure 5.61* and *Figure 5.62* present the gender pyramids for the two municipalities.

Table 5.30 Age and gender distribution in Olanchito and Arenal municipalities

	Olanchito		Arenal	
Age group	**Male**	**Female**	**Male**	**Female**
0-9	11974	11385	668	624
10-19	12411	12046	735	716
20-29	7712	8884	446	427
30-39	4994	6170	304	358
40-49	3950	4574	243	247
50-59	3041	3318	189	194
60+	3835	4178	223	258
Total	**47917**	**50555**	**2808**	**2824**

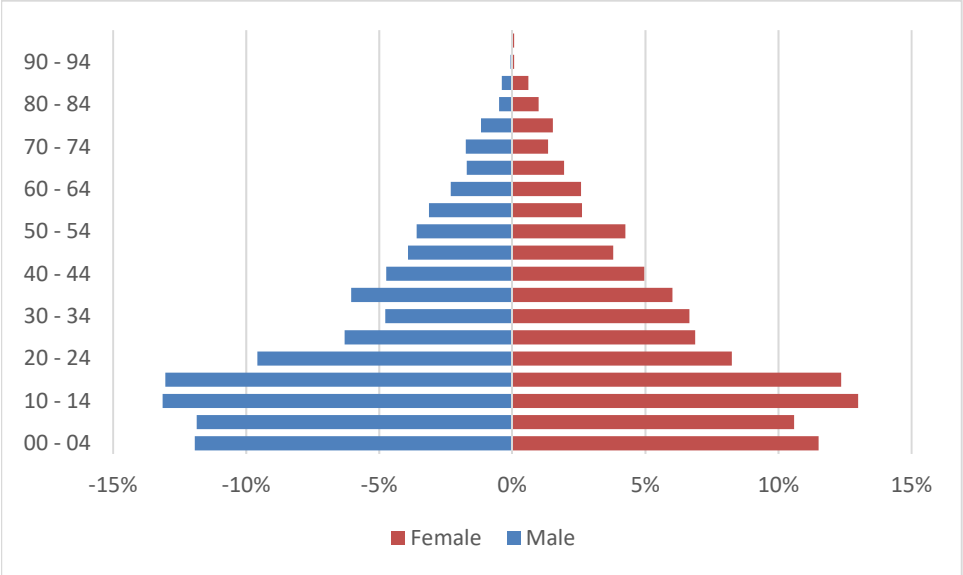
Source: INE population census, 2013.

Figure 5.61 Gender distribution in Olanchito (2013)



Source: Prepared by ERM, 2018 based on INE population census, 2013.

Figure 5.62 Gender distribution in El Arenal (2013)



Source: Prepared by ERM, 2018 based on INE population census, 2013.

The specific age and gender distribution per hamlet (*aldeas*) included in the Project Area is summarized in *Table 5.31* below based on the population census of 2013.

Table 5.31 Population distribution in the Project Area per municipality (2013 official census)

Hamlet (Aldea)	Total Population	Male	Female	Age 0-9	Age 9-19	Age 20-29	Age 30-39	Age 40-49	Age 50-59	Age 60+
Agalteca	1,233	50%	50%	24%	25%	19%	10%	9%	7%	7%
Armenia	2,133	49%	51%	25%	26%	18%	11%	7%	5%	7%
Bálsamo Oriental	1,833	49%	51%	24%	27%	17%	10%	8%	5%	8%
Barranco	411	45%	55%	25%	30%	16%	13%	7%	3%	6%
Boca de Mame	309	51%	49%	22%	27%	16%	13%	7%	7%	8%
Calpules	656	53%	47%	24%	22%	18%	9%	10%	7%	9%
Campo Agua Buena	56	52%	48%	27%	29%	20%	14%	9%	0%	2%
Campo Bálsamo	51	59%	41%	16%	22%	18%	10%	6%	16%	14%
Campo Calpules	194	51%	49%	19%	26%	21%	11%	10%	8%	6%
Campo El Chorro	30	50%	50%	27%	27%	13%	13%	10%	10%	0%
Campo Limones No.4	545	50%	50%	20%	22%	18%	14%	11%	8%	6%
Campo Limones No.6	298	49%	51%	17%	23%	18%	10%	16%	11%	4%
Campo Nerones	3,492	48%	52%	22%	25%	17%	12%	9%	8%	8%
Campo Nuevo	812	49%	51%	23%	26%	18%	11%	8%	7%	8%
Campo Palo Verde No.2	522	49%	51%	21%	21%	20%	13%	9%	9%	6%
Campo Trojas No.2	56	52%	48%	30%	20%	14%	21%	7%	4%	4%
Campo Trojas No.3	2	50%	50%	0%	0%	0%	100%	0%	0%	0%
Chorrera	995	50%	50%	25%	25%	14%	11%	10%	7%	8%
Cliftón	185	54%	46%	30%	23%	20%	9%	4%	6%	9%
Cooperativa Brisas de Cuyamapa	1,479	50%	50%	26%	27%	18%	11%	8%	5%	5%
Cooperativa Doce de Diciembre	1,800	49%	51%	25%	26%	18%	11%	7%	7%	7%
Coyoles	1,181	49%	51%	26%	26%	13%	10%	9%	7%	8%
Coyoles Central	1,049	50%	50%	19%	23%	16%	12%	11%	9%	9%
El Carril	2,801	47%	53%	23%	24%	17%	11%	8%	7%	10%
El Chaparral	472	53%	47%	22%	29%	14%	11%	8%	6%	10%
El Nance	559	50%	50%	23%	23%	16%	11%	10%	9%	9%
El Ocote	2,239	49%	51%	22%	24%	16%	10%	10%	7%	10%
La Reforma	195	54%	46%	26%	26%	18%	10%	4%	10%	8%
La Sabana de San Carlos	1,018	49%	51%	28%	25%	17%	12%	6%	4%	7%
Las Hicoteas	576	51%	49%	24%	26%	15%	13%	9%	6%	6%

Hamlet (Aldea)	Total Population	Male	Female	Age 0-9	Age 9-19	Age 20-29	Age 30-39	Age 40-49	Age 50-59	Age 60+
Las Minas	235	51%	49%	21%	27%	14%	13%	7%	7%	12%
Maloa	1,095	51%	49%	27%	26%	15%	11%	8%	6%	7%
Medina	675	49%	51%	25%	21%	19%	11%	9%	8%	7%
Méndez	1,089	49%	51%	27%	26%	16%	12%	7%	5%	6%
Nombre de Jesús	1,893	50%	50%	25%	25%	18%	11%	9%	6%	7%
Olanchito	32,702	46%	54%	22%	25%	17%	12%	9%	7%	7%
Potrerillos	1,132	51%	49%	27%	27%	14%	12%	8%	6%	6%
Puerto Escondido	571	51%	49%	21%	25%	16%	11%	10%	9%	8%
Sabanetas	796	52%	48%	22%	26%	21%	12%	7%	5%	7%
San Dimas	249	49%	51%	23%	19%	15%	11%	10%	6%	15%
San Francisco	1,294	48%	52%	22%	24%	18%	10%	10%	6%	11%
San Jerónimo	120	51%	49%	18%	17%	19%	15%	12%	5%	16%
San José	2,274	48%	52%	24%	22%	18%	11%	10%	6%	10%
San Juan	222	48%	52%	27%	21%	18%	7%	8%	6%	13%
San Lorenzo Abajo	296	49%	51%	27%	26%	15%	9%	9%	6%	7%
San Lorenzo Arriba	1,194	52%	48%	21%	24%	14%	13%	9%	9%	10%
San Marcos	647	52%	48%	22%	27%	15%	13%	9%	6%	9%
Tacualtuste	343	49%	51%	22%	24%	15%	13%	7%	4%	16%
Teguajinal	1,156	48%	52%	20%	19%	15%	11%	11%	9%	15%
Tejeras	523	50%	50%	21%	27%	19%	10%	9%	6%	7%
Tepusteca	5,407	49%	51%	26%	25%	17%	10%	8%	6%	7%
Trojas	3,799	52%	48%	27%	25%	17%	10%	7%	6%	7%
Total Olanchito	**84,894**	**41,009**	**43,885**	**19,886**	**20,974**	**14,415**	**9,616**	**7,469**	**5,576**	**6,958**
Arenal	2423	51%	49%	23%	25%	16%	11%	9%	7%	0.09
Campo El Cayo	631	48%	52%	21%	22%	18%	13%	10%	8%	0.07
Champerío El Cayo	88	49%	51%	39%	24%	5%	11%	8%	7%	0.06
Santa Cruz	290	49%	51%	25%	18%	15%	14%	9%	9%	0.1
Tierra Blanca	840	49%	51%	24%	29%	15%	13%	7%	6%	0.06
Total El Arenal	**4272**	**2,123**	**2,149**	**995**	**1,069**	**665**	**510**	**371**	**304**	**358**
Total Project Area	**89166**	**43,132**	**46,034**	**20,881**	**22,043**	**15,080**	**10,126**	**7,840**	**5,880**	**7,316**

Source: INE, Population Census 2013. Note: Census data for 2013 is not available for two hamlets of Olanchito: Campo Rosario and Santa Bárbara.

Ethnicity and religion

Based on 2013 census data, the indigenous population in Honduras represents approximately 8% of the total population, including 6% who identify themselves as Amerindian and 2% as AfroHondurans. [29] Over 90% of the population are considered *Mestizos* or a mix between European and Amerindian, and less than 1% of the population belongs to other ethnic groups of Palestinian, Arab-Honduran, and Chinese descent.[30]

As of 2014, the majority of the population is primarily Christian with 46% of Roman Catholics and 41% of Protestants. One percent of the population is considered atheist, 2% have other religions, and 9% reportedly have no religion. [31]

Migration and population change

Honduras, like other Central American countries, has serious limitations in retaining its population, mainly due to the lack of jobs and insecurity. The general migration pattern observed since the beginning of the twentieth century, currently remains the same. The internal migrants leave from the South, West and Center of the country towards the north coast and towards Francisco Morazán where Tegucigalpa is located, the capital of the country.[32]

In fact, the 2013 population census has shown that approximately 15% of the population reside outside their department of origin. Most internal emigration occurs from the departments of Copán and Valle with emigration rates of 22% and 26%, while the main "pull" departments are departments presenting more attractive employment and education opportunities such as Cortés and Francisco Morazán with lower emigration rates of 8%. In Yoro, 19% of the population has emigrated to other departments in 2013 compared to 81% of the population who is native from Yoro and remained in Yoro. The emigration rate in Yoro is therefore greater than the national average.

Migration outside of the country is also quite important, and it is expected that population growth and limited job prospects outside of agriculture will continue to drive emigration. In fact, net migration is negative in Honduras, with - 1.1 migrant(s) per 1,000 population based on estimates for 2017, with remittances representing about a fifth of the national GDP. (33) In fact in 2012, The Central Bank of Honduras, in its document on remittances, affirms that there are around 963,000 Hondurans living in the United States, both legal and illegal. According to data from the Census Bureau and the US Department of

[29] INE population census 2013.

[30] CIA, World Factbook. Web: https://www.cia.gov/library/publications/the-world-factbook/geos/ho.html . Accessed 08 August 2018.

[31] CIA, World Factbook. Web: https://www.cia.gov/library/publications/the-world-factbook/geos/ho.html . Accessed 08 August 2018

32 Migration, Labor Market and Poverty in Honduras 2006. Secretary of State in the Presidential Office

http://prejal.oit.org.pe/prejal/docs/bib/200803110054_4_2_0.pdf

[33] CIA, World Factbook. Web: https://www.cia.gov/library/publications/the-world-factbook/geos/ho.html . Accessed 08 August 2018

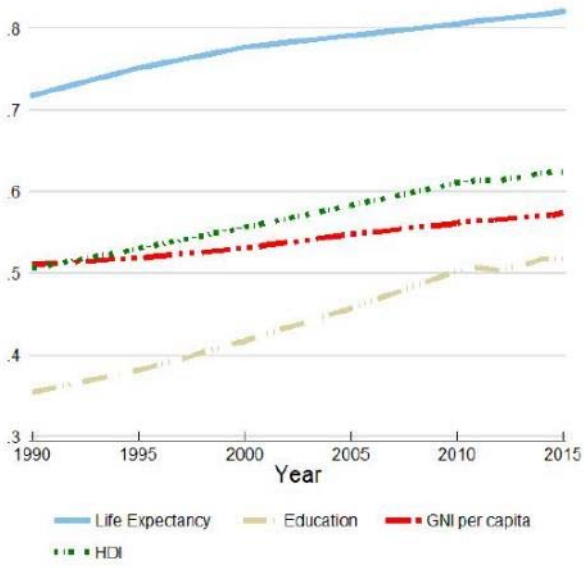
Homeland Security, in the last decade there has been a significant increase in Honduran migration to that northern country: 191.1% for those who are legalized and 106.3% for illegal immigrants.[34]

In 2005, 28% of the population migrated out of the municipality of Olanchito, including 10% who emigrated to the United States in search of employment opportunities and education. [35] During the field survey conducted in the Project Area, no migrants were identified in the area and the workforce was reportedly primarily local.

Human development and poverty

Honduras' latest Human Development Index (HDI) value was of 0.625 in 2015, positioning it at 130 out of 188 countries and territories.[36] The HDI assesses progress in three basic aspects of human development: longevity and health (measured by life expectancy at birth), access to knowledge (years of education among the adult population), and standard of living (Gross National Income (GNI) per capita). ***Figure 5.63*** below shows the evolution of Honduras' HDI components since 1990.

Figure 5.63 Trends in Honduras' HDI component indices 1990-2015



Source: UNDP, Honduras Human Development Report, 2016

Honduras is one of the poorest countries in Latin America with 64.50% of the population in 2013 living in poverty with income levels below the cost of a basic "consumption basket" including food and other basic goods and services. Although poverty rates are higher in rural areas, more than half of the households in urban areas also live under the poverty line (60.4% for urban areas versus 68.5% for rural areas). In terms of basic needs, 40.8% of

[34] Central Bank of Honduras. Half-yearly Survey of Family Remittances sent by Hondurans living abroad and expenses incurred in the country during their visits. January 2012
[35] Institutional and Financial Diagnosis of Olanchito, 2005.
[36] UNDP, Human Development Report 2016, Honduras. Accessed at: http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/HND.pdf

households in Honduras have some of their basic needs unsatisfied (48.9% rural versus 32.3% urban). [37] Poverty is also higher in the south, west, and along the eastern border than in the north and central areas where most of Honduras' industries and infrastructure are concentrated.[38]

- At the municipality level, the 2015 dynamic categorization framework categorizes the municipalities according to their municipal development indicator, which is calculated based on a combination of factors, including the following:[39] Satisfaction of basic needs, which considers access to water and sanitation, access to primary education, subsistence capacity (i.e. employment status of household members), number of individuals per room, and housing status. This indicator is calculated using the Unsatisfied Basic Needs indicator (*Necesidades Básicas Insatisfechas* or NBI).
- Human Development Index (i.e. life expectancy, access to education, and GNI).
- Level of urbanization and access to basic infrastructure and services.
- Access to electricity.
- Financial and fiscal autonomy and capacity of the municipal administration, including savings, financial dependency with respect to the central government, tax management, and local investment.

Within this municipality categorization framework, the municipality of Olanchito is classified as a category B municipality ("Satisfactory Development Category") and Arenal as category C ("Low Development Category").[40]

Arenal's official municipal website reports that 51% of households of the municipality live in conditions of extreme poverty with some of their basic needs unmet (i.e. access to water and sanitation, education, etc.)[41] The level of basic needs unmet in Olanchito and Arenal is summarized in *Table 5.32* below. NBI 0 refers to the number of households with no basic needs unmet while NBI 1 to 4+ refers to the number of basic needs that are unmet. Most of the unmet needs have to do with sanitation and the number of dependent individuals per household members employed. Access to sanitation is discussed in detail in *Section 5.5.12.*

[37] INE, Encuesta Permanente de Hogares de Propósitos Múltiples, 2013.

[38] CIA, World Factbook. Web: https://www.cia.gov/library/publications/the-world-factbook/geos/ho.html . Accessed 08 August 2018

[39] Municipal Categorization in Honduras, 2015. Accessed at: http://observatoriodescentralizacion.org/descargas/wp-content/uploads/2017/08/categorizacion_municipal_2014.pdf

[40] ICF, Olanchito Atlas Forestal Municipal, 2015. Accessed at: http://icf.gob.hn/wp-content/uploads/2015/09/1807-Olanchito-Atlas-Forestal-Municipal.pdf

[41] Arenal municipality website, 2018. Accessed at: https://portalunico.iaip.gob.hn/portal/index.php?portal=318

Table 5.32 Households per number of Basic Needs Unmet (NBI 0 to 4+) in 2013

Basic Needs Unsatisfied Olanchito	Cases	%	Acumulated %
Homes with 0 NBI	10777	46.5	46.5
Homes with 1 NBI	6220	73.34	73.34
Homes with 2 NBI	2765	95.26	85.26
Homes with 3 NBI	2075	94.91	94.22
Homes with 4 + NBI	1340	100	100
Total	**23177**	**100**	**100**
Basic Needs Unsatisfied Arenal	**Cases**	**%**	**Acumulated %**
Homes with 0 NBI	500	39.73	39.73
Homes with 1 NBI	371	69.26	69.26
Homes with 2 NBI	167	82.55	82.55
Homes with 3 NBI	130	92.91	92.91
Homes with 4 + NBI	89	100	100
Total	**1257**	**100**	**100**

Source: INE, Population Census 2013

5.5.5 Indigenous groups

Overview

The IFC Performance Standard 7 (PS7) recognized indigenous peoples as "*social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population*". "*In many cases, their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development*". This makes them more vulnerable to project impacts than non-indigenous communities.[42]

Population

National level

There are nine recognized indigenous and African-Honduran peoples in Honduras, representing about 8% of the population in 2013 (compared to 7% in 2001). According to the 2001 population census, the distribution is as follows: Lencas (4.6%), Misquitos (0.85%), Tolupanes (0.16%), Pech (0.06%) Maya-Chorti (0.57%), Tawahka (0.04%), Garífunas (0.76%), Nahoas or Paya (0.06%), and English-speaking islanders of African Descent (Creoles) belonging to four linguistic branches including Chipchas Hokan Siux, Maya, Aztec and African (0.20%). [43]

The largest indigenous groups are therefore the Lenca (63.5% of the indigenous population) followed by the Mískitu (11.7%) and the Garífuna (10.5%). The population size, geographical distribution, and linguistic families of the indigenous groups is summarized in *Table 5.33* below.

[42] IFC Performance Standard 7, 2012

[43] FIDA, Nota técnica de país sobre cuestiones de los pueblos indígenas, República de Honduras, 2017

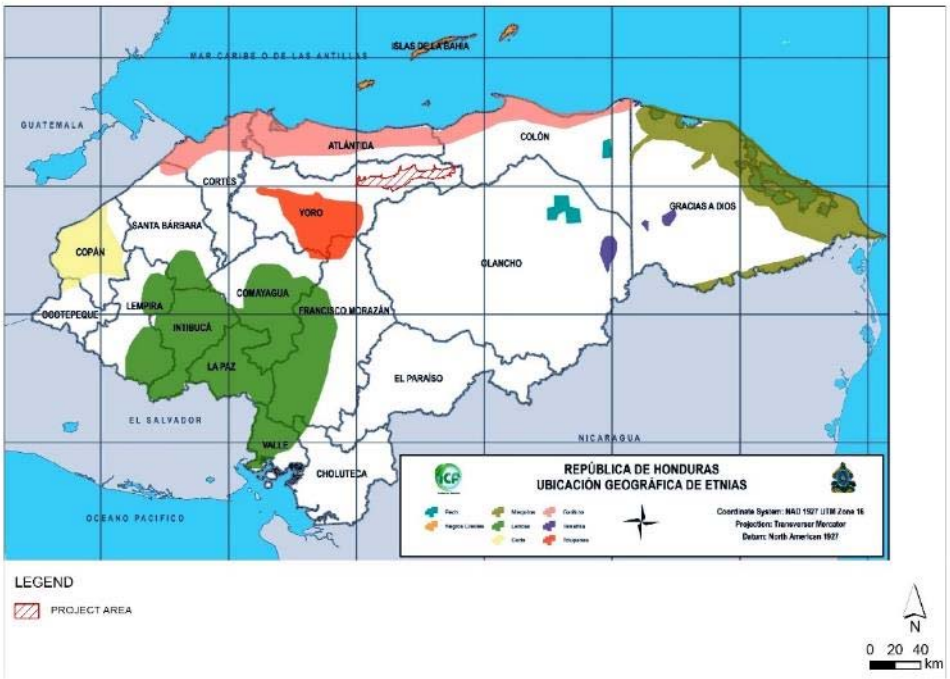
Table 5.33 Indigenous and afro honduran peoples in Honduras

Town	Population (2001)	%	Linguistic family	Geographic location by Departments
Lenca	27,9507	63.5	Chibcha	Intibucám, Lempira, Ocorepque, Comayagua, and small towns in La Paz, Santa Bárbara, Copán, Valle and Francisco Morazán.
Misquitos	51,607	11.7	Misumalpa	Gracias a Dios, and Small conglomerates in larger cities.
Cho'rti'	34,453	7.8	Maya	Copán, Ocoteque.
Tolupán	9,617	2.2	Tronco Hokan	**Yoro**, Francisco Morazán.
Pech	3,848	0.9	Chibcha	Olancho, Colón, Gracias a Dios, and small towns in Puerto Cortés, Francisco Morazán, Lempira and Intibucá.
Tawahka	2,463	0.6	Misumalpa	Río Patuca, El Paraíso, Gracias a Dios, Olancho.
Nahoa	-	-	-	Olancho, El Paraíso and Catacamas.
Garífuna	46,448	10.5	Arawak	Cortés, Atlántida, Colón, Gracias a Dios, Islas de la Bahía, Cayos Cochinos and main cities.
English-speaking islanders of African Descent	12,370	2.8	Aru o Jaqi	Cortés, Atlántida, Colón, Gracias a Dios and Islas de la Bahía.

Note: no detailed data available for the Nahoa population.
Source: FIDA, 2017

Figure 5.64 below shows the geographical distribution of indigenous communities and ancestral lands in Honduras.

Figure 5.64 Location of indigenous communities in relation to the Project Area



Source: MOSEF, 2017.[44] Modified by ERM, 2018.

As shown in *Figure 5.64* the Project Area is located downstream from indigenous settlements, with little interference to soil and water resources located upstream. Similarly, interference with water resources of the Garífunas located further downstream is also not expected and has been scoped out from the assessment of potential impacts (see *Chapter 6*).

Project Area

In the municipalities of Olanchito and Arenal the presence of indigenous groups is limited. In Olanchito, indigenous groups represent less than 3% of the population of the municipality in 2013 with a majority of Tolupán people (1.49%), followed by other non-indigenous minority ethnic groups such as Palestinians, Arab-Hondurans, and Chinese (0.39%).

The Tolupanes are organised into the Federation of the Xicaque Tribes of Yoro (*Federación del Tribu Xicaque de Yoro* or FETRIXY) created in 1985, and the Association of Tolupan Indigenous Communities of La Montaña de la Flor (*Asociación de Comunidades Indígenas Tolúpanes de la Montaña de la Flor* or Acitmfm).

In Arenal, the indigenous groups and other minority groups account for 0.42% of the municipality population, of which the majority (0.22%) belong to non-

[44] MOSEF (2017). Forestry Analysis of Honduras (*Análisis Forestal de Honduras*). Accessed at: http://mosef.org.hn/wp-content/uploads/2017/01/Analysis-del-Sector-Forestal-_2016.pdf

indigenous minority ethnic groups. The distribution of indigenous and ethnic groups in Olanchito and Arenal in 2013 is presented in *Table 5.34* below.

Table 5.34 Distribution of indigenous groups in the municipalities of Olanchito and Arenal (2013)

Indigenous group	Number	% of Indigenous Pop	% of Municipality Pop
Olanchito			
Maya -Chortí	127	4.43	0.12
Lenca	243	8.48	0.23
Miskito	182	6.35	0.17
Nahua	120	4.19	0.11
Pech	21	0.73	0.02
Tolupán	1,562	54.48	1.49
Tawahka	26	0.91	0.02
Garífuna	170	5.93	0.16
Negro de habla inglesa	13	0.45	0.01
Otro	403	14.06	0.39
Total Olanchito	**2,867**	**100**	**2,72**
Arenal			
Maya -Chortí	1	4	0.02
Lenca	5	20	0.08
Nahua	5	20	0.08
Tawahka	1	4	0.02
Otro	13	52	0.22
Total Arenal	**25**	**100**	**0,42**

Source: INE, Population Census 2013

The Field surveys conducted in November 2017 (CINSA & PAA 2017) and June 2018 have shown that individuals from indigenous communities come down from the mountains to find employment opportunities in the Valley. In fact, interviews with CRELs and potential beneficiaries have confirmed that the farms in the area also employ indigenous individuals and that these individuals are also well integrated into the labour and commercial activities of the Valley.

The June 2018 Field survey has also shown that a small population of Tolúpan individuals reside and work in the Valley and in the Project Area, as part of non-indigenous communities. Settlements where indigenous populations can be found in the Project Area includes the hamlets of Agalteca 1km northeast of Olanchito town as well as El Aguacate, El Chorro, Carboneras, and El Aleman, with an average of 30 - 40 households composed of 3-4 members per community. Indigenous people residing in these settlements are employed in the area, some as workers in farms of potential Project beneficiaries. These individuals are reportedly intermarried and have assimilated into the local society.

5.5.6 Vulnerable groups

A vulnerable individual or group is one that could experience adverse impacts more severely than others, or have a limited ability to take advantage of positive impacts, due to a vulnerable or disadvantaged status. Vulnerability is

a pre-existing status that is independent of the Project but that could be exacerbated if existing sensitivities and coping mechanisms are not adequately understood or considered. Vulnerability can be exacerbated where people have inadequate or differential access to legal, political or socio-cultural structures and processes. This may be due to ethnicity, gender, language, religion, political views, sickness or disability and must be assessed in the context of a specific condition and time.

The following groups are anticipated to be more vulnerable than the 'general population':

- Beneficiaries with limited financing capacity (low income and reduced access to savings or credit): although the field survey has shown that high levels of indebtedness are not likely among stockbreeders and milk producers, the initial investment related to the purchase and installation of the irritation kit and the well drilling may still present a financial burden for beneficiaries with lower incomes.
- Small producers (potential beneficiaries): Small producers are more vulnerable to overhead costs and capital investments as they have smaller economies of scale than the larger farms and therefore higher production costs. These producers may have more difficulty absorbing the equipment fee to be paid to the SAG – the amount has not yet been determined but is expected to be relatively small covering only a small portion of the equipment's real cost.
- Small-scale subsistence farmers (non-beneficiaries) with lower incomes and reduced access to savings or credit: subsistence farmers are either landless farmers who need to rent land to cultivate, or have limited access to land to cultivate. Landless farmers tend be employed as labour with the livestock breeders and milk producers of the area or with the larger multinationals. [45] These individuals are less able to cope with financial / livelihood changes and may be more disproportionally affected by potential Project impacts such as degradation of water quality and availability. This being said these landless farmers may benefit from increased and more stable employment opportunities with Project beneficiaries. Subsistence farmers identified during the field survey also included farmers who cultivate small parcels of land and are employed in another sector. These are considered less vulnerable as they do not rely entirely on agriculture. [46]
- Potential female landowner beneficiaries (approximately 50 individuals) and female-headed households who may experience limits on amount of income generating activities they can undertake due to primary care duties.
- Individuals or households where the household head is elderly or disabled and therefore the household members have less opportunity to maximise

[45] Plan Estrategico de Desaarrollo Municipal de Olanchito, 2004-2020

[46] Overall, small scale subsistence farmers may be more present in Arenal municipality where agriculture is a more important economic sector and income levels are reportedly lower

potential income-generating opportunities due to travel, physical or capacity limitations or the need to provide care.

- Employed children: children below 14 years old may be employed as farm labour in livestock and milk production farms. These children would be most vulnerable to occupation health and safety issues and labour rights issues related to the Project. Child labour is discussed in more detail in *Section 5.5.8* under *Working practice and labour rights.*
- Individuals belonging to indigenous groups or of indigenous background who may find themselves marginalized or unable to fully benefit from opportunities related to the Project. In the Project Area, no indigenous communities were identified; rather indigenous individuals live among non-indigenous communities and represent a small percentage of the population. They are mainly there for work, including in livestock and milk production farms where they reportedly benefit from the same working conditions as other workers. Indigenous groups are described in *Section 5.5.6* above.

5.5.7 Land use and ownership

Land use

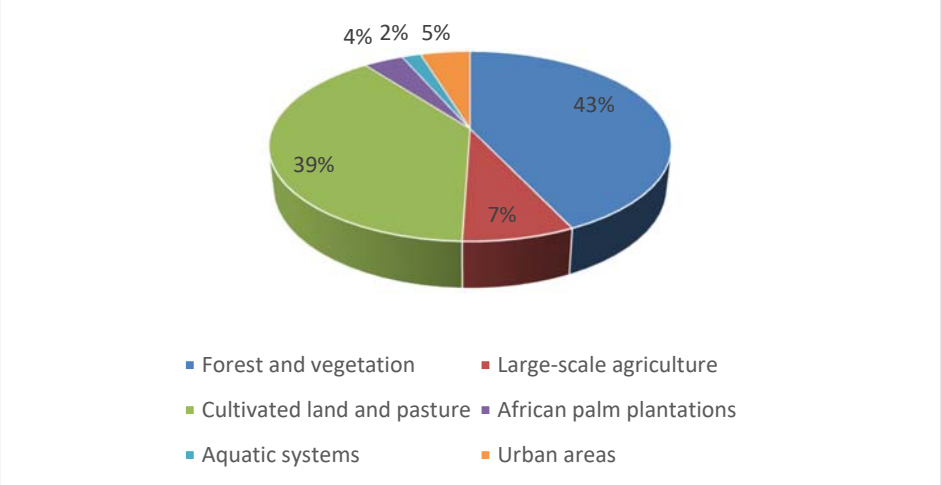
In line with the description of habitats described in *Section 5.3.1*, the main land uses of interest present in the Project Area are the following:

- Agricultural land
- Shrubland and forest
- Urban and residential areas

Agricultural land is the predominant land use representing 50.5% of land coverage in the Project Area, followed by shrubland and forested areas which represent 43% of the area, while residential areas represent less than 5% of the total area.

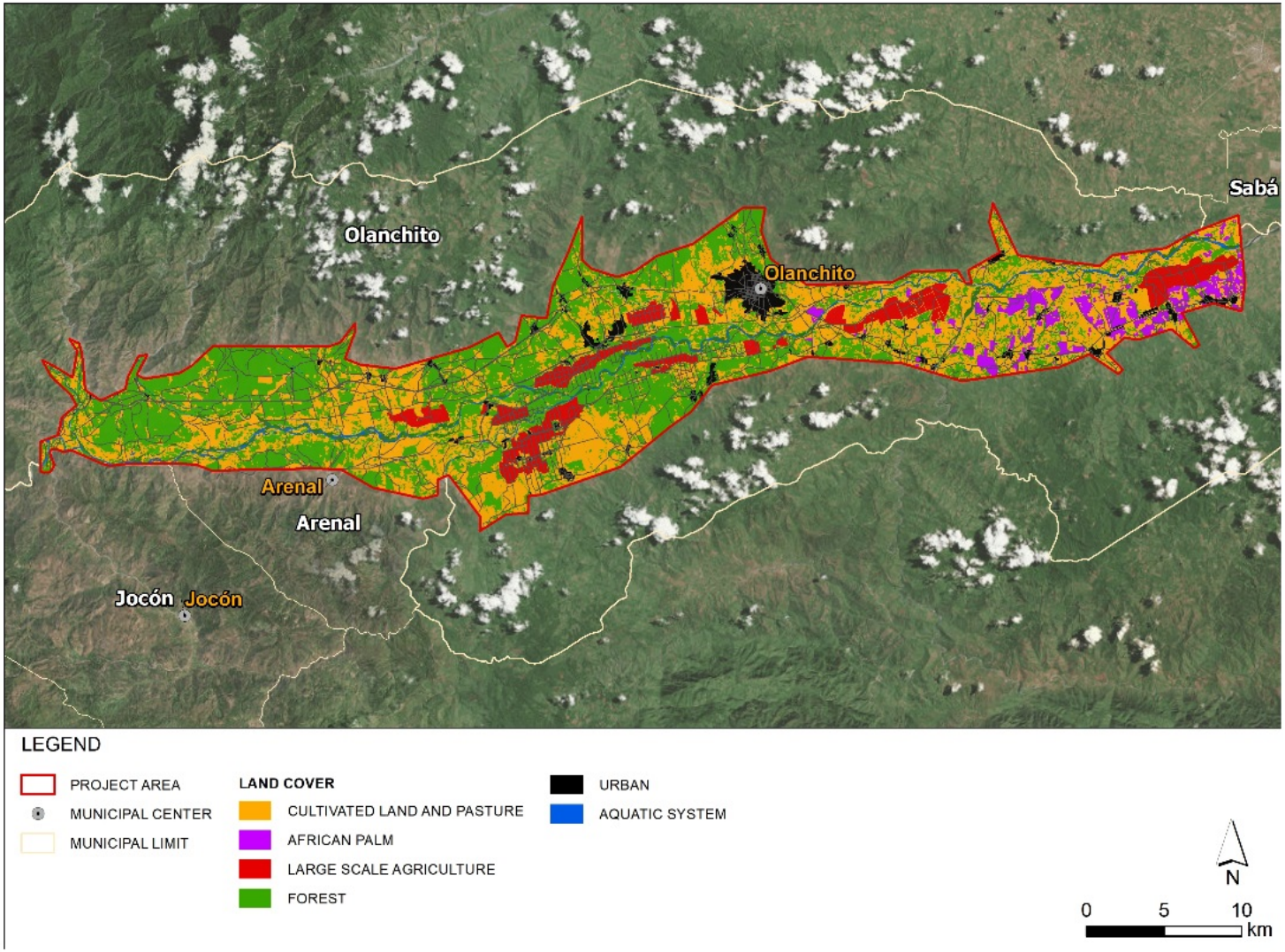
The prevalence of different land use types in the Project Area is presented in *Figure 5.65* below and their geographical distribution in *Figure 5.40*.

Figure 5.65 Land use distribution in the Project Area



Source: ERM, 2018

Figure 5.66 Land uses in the Project Area



Source: ERM, 2018

Shrubland and forested areas are composed of tropical forests with high biodiversity value and include the protected areas where most medicinal plants and wood used for fuel and building fences are found. Residential areas include urban and rural areas where the population resides and where main infrastructure is found. The main urban center in the Project Area is Olanchito town. Other residential areas are mostly rural spread out along the Aguan River Valley. A detailed description of forested areas, shrublands and urban areas is presented in *Section 5.3.1*.

Agricultural land in the Project Area is composed primarily of cultivated and pasture land for livestock, which represents 77.5% of agricultural land in the Project Area and 42.9% of the total Project Area. In contrast, large-scale agriculture (mainly banana) represents 15% of agricultural land and 7.6% of the total Project Area, while African palm plantations represent 7.5% of agricultural land and 38% of the total Project Area. Based on feedback obtained during the field survey (June 2018) most of the cultivated land in the Project Area is used for livestock feed cultivation and cattle breeding. The breakdown of the agricultural land use is summarized in the following table.

Table 5.35 Agricultural land use types in the Project Area

Agricultural land use type	Percentage of Agriculture land use	Percentage of Project Area
Cultivated and pasture land	77.5%	39.1%
African palm cultivation	7.5%	3.8%
Large scale agriculture	15%	7.6%
Total	**100% (30,509)**	**50.5%**

Source: ERM, 2018

Figure 5.67 View of agriculture fields and pastures in the Project Area

Notes: top left (plowed field next to camerun forage crop with irrigation system); top right (pastures and livestock), bottom left (African palm plantation, young palms); and bottom right (banana plantation). All pictures taken in June during the rainy season.
Source: ERM Field Survey June 2018

Land tenure and ownership

According to the Food and Agriculture Organization (FAO), land tenure in Honduras is grouped into the following categories: [(1)]

- State property
- Individual private property
- "*Ejidal*" or Municipal Land (i.e. stated land conceded to the municipality)
- Leasing and sharecropping
- Ancestral Indigenous land holdings

In line with these categories, information collected for Olanchito and Arenal through municipality meetings during the June 2018 field survey is summarized in *Table 5.36* below.

Table 5.36 Land tenure in Olanchito and Arenal (2018)

	Olanchito		Arenal	
Land Tenure Category	**Description**	**(%) of Territory**	**Description**	**(%) of Territory**
State property	Mountainous area	40	Mountainous areas	10

[1] FAO, Gender and Land Rights Database. Web: http://www.fao.org/gender-landrights-database/country-profiles/countries-list/land-tenure-and-related-institutions/en/?country_iso3=HND. Accessed on 09/09/2018.

	Olanchito		Arenal	
Land Tenure Category	**Description**	**(%) of Territory**	**Description**	**(%) of Territory**
Individual private property	Mostly land owned by farmers dedicated to livestock breeding and to a lesser extent to timer activity.	50	Mostly land owned by farmers and livestock breeders (55%) and by one banana planation (5%).	60
Ejidal or Municipal Land	Urban area of Olanchito (1,280 blocks) as well as hamlets and settlements (4,000 blocks) are property of the municipality.	10	Urban area along with hamlets and smaller settlements are property of the municipality.	30
Leasing and sharecropping	Very few people rent their land to the National Agrarian Institute (*Instituto Nacional Agrario* or INA).	Close to 0%	No information provided.	Close to 0%
Ancestral land holdings	No information provided.	Not available	No information provided.	Not available

Note: Ancestral land holdings in Olanchito are primarily found in the occidental side of the municipal territory, in the mountains surrounding the Aguan Valley outside the Project Area to the West.
Source: ERM Field Survey (June 2018). Municipality Meetings.

Private land ownerships

There are two types of private land ownerships:

- Full ownership (*dominio pleno)*: transfers all rights in the immovable property, including disposal, use and usufruct, to the owner. The owner has a land ownership title.
- Useful ownership (*dominio útil*): de facto ownership where the owner does not have a land ownership title, but it is commonly agreed that they are the owner having used the land over many years.

Based on feedback collected during the field survey (June 2018), both full ownership and useful ownership are common types of land tenure in the Project Area (according to the SAGO). According to other sources (CREL members), full ownership is the most common situation, with most producers having formal land titles, as proof of full ownership is required to obtain credit from banks. Ownership titles are registered in the Ownership Institute (*Instituto de la Propiedad* or IP) and in the National Agrarian Institute (*Instituto Nacional Agrario* or INA).

Most of the time, ownership is inherited and land is passed down through generations. Note that all potential beneficiaries are required to be formal landowners with formal titles (Full Ownership) – See *Chapter 3*.

Land leasing

Based on feedback collected in June 2018 through interviews with the municipality and CRELs leasing of agricultural land was consistently reported as an infrequent type of land tenure in the Project Area. Rather, workers

employed by livestock producers in the area sometimes receive a parcel of land to cultivate for their own consumption in addition to their salary, but without any rental agreement. This finding is also aligned with information provided in Arenal Strategic Municipal Development Plan (2013), which states that less than 1% of households rent their land, while 8.21% of the population cultivates land that is "borrowed", i.e. land for which the owner has allowed them to cultivate on, as in the case of workers receiving a portion of land to cultivate. [1]

Nevertheless, the Strategic Municipal Development Plan for Olanchito for 2004 – 2020 (published in 2003) identifies land leasing as one of the tenure-related issues in Olanchito affecting mostly small agricultural producers and subsistence farmers who do not own any land. This being said, the Strategic Plan does not specify whether these farmers represent a large or a small portion of the population and based on the latest information collected during the field survey (June 2018) through official sources, it is safe to assume that land leasing applies to a limited portion of the population in the Project Area, if any.

In addition to landless farmers, the Strategic Municipal Development Plan for Olanchito (2004-2020) identifies subsistence farmers who cultivate small parcels of land but are employed in another sector and do not rely entirely on agriculture.

Both landless subsistence farmers and those with limited access to land are considered in *Section 5.5.5* on Vulnerable Groups.

Ancestral indigenous lands

As discussed previously in *Section 5.5.5*, indigenous communities represent a small minority (less than 3%) of Olanchito's population. These communities are located primarily in the occidental side of the municipal territory, in the mountains surrounding the Aguan Valley west of the Project Area where indigenous ancestral land holdings of the Tolúpan tribe are mainly found.[2]

This being said, the Tolupan people residing in the hamlet of Agalteca (approx. 1 km northeast of Olanchito town) have claimed ancestral ownership over land in the hamlet. According to a 2011 report of the Honduras Land Adminisitration Program (P*rograma de Administración de Tierras de Honduras* or PATH), the Tolupan people residing in Agalteca reported holding ancestral ownership titles granted by the State in 1838 over land located in Agalteca. However, subsequent investigations by the PATH have shown that the land that the Tolupanes of Agalteca claimed as ancestral land had been registered in 1942 as state land of communal nature ("*ejidal*") belonging to the hamlet of Agalteca. Despite the offical resolution, Tolupan community leaders have

[1] Plan Estratégico de Desarrollo Municipal de Arenal (2013).

[2] Plan Estratégico de Desarrollo Municipal de Olanchito 2004-2020

stressed that any activity in the sense of promoting land tenure security in the area should consider the remediation and delimitation of the area that was historically considered as part of the Tolupan indigenous territory. [1]

It is important to note however, that the land in the hamlet of Agalteca is considered urban with no agricultural activities and therefore no potential beneficiaries for the Project identified.

Background of land-related conflicts

Land-related conflicts in the Alto Aguan Valley and in the Project Area specifically have not been reported. However violent conflicts have been ongoing in the Bajo Aguan Valley just downstream of the Project Area since the 1990s resulting in more than 120 people being killed between 2008 and 2013, mostly peasants (90), but also security guards (10) and one police officer.[2] According to a report by the US embassy in Honduras, the roots of the conflict date back to the 1970s and 1990s when the Honduran government introduced a process of agrarian reform through collective land ownership turning over mostly public lands to farmer (*campesino)* cooperatives. In 1992, the land reform started being reversed with the Government authorizing the sale of collectively-held land to individual landowners, which resulted in land being sold by *campesino* collectives to large, individual landowners.[3] The vast majority of the arable land in the Lower Aguán Valley was then converted for the production of African palm oil. Some groups have disputed the legality of these land sales, some through legal claims in the court system, and others through land occupations resulting in violent conflicts between *campesinos*, security guards hired by the large plantations, and police forces.

The land conflict in the Bajo Aguan was also mentioned in the June 2018 field survey during the meeting with the National Agrarian Institute, stating that some of the land bought by the Dinant Corporation to produce African Palm was later bought by the Dole Food Company owning banana plantations in the Project Area (see *Section 5.5.8*). Local farmers in the area had reportedly pressured the government to recover the lands, resulting in 4,000 *manzanas* (2,789 ha) being bought back by the government and redistributed to the local farmers.

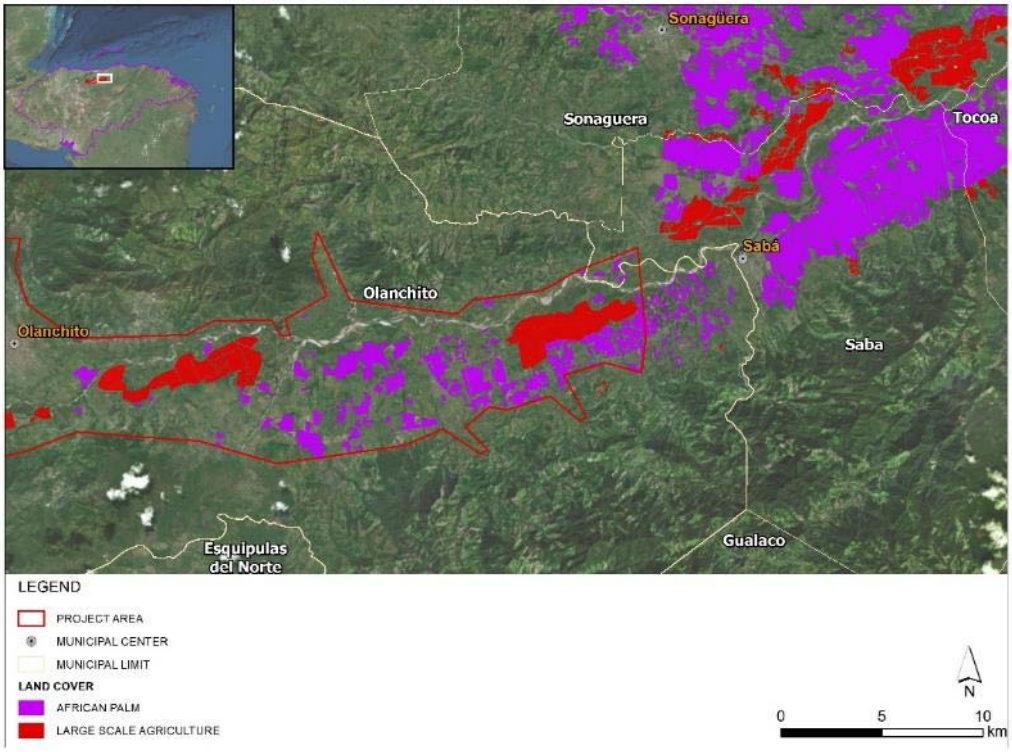
The distribution of African oil plantations downstream of the Project Area are shown in *Figure 5.68* below.

[1] Honduras Land Administration Programme (PATH). Indigenous Participation Plan for PATH Phase II. June 2011.

[2] Irish times. "Death Valley: the Land War Gripping Honduras". May 2015. Accessed at: https://www.irishtimes.com/news/world/death-valley-the-land-war-gripping-honduras-1.2205506

[3] US Embassy in Honduras, July 2014. Accessed at: https://hn.usembassy.gov/our-relationship/policy-history/current-issues/lrc-bajo-aguan/

Figure 5.68 Location of African Palm plantations in the middle and lower Aguan River Valley with respect to the Project Area



Source: ERM, 2018

5.5.8 *Economy and employment*

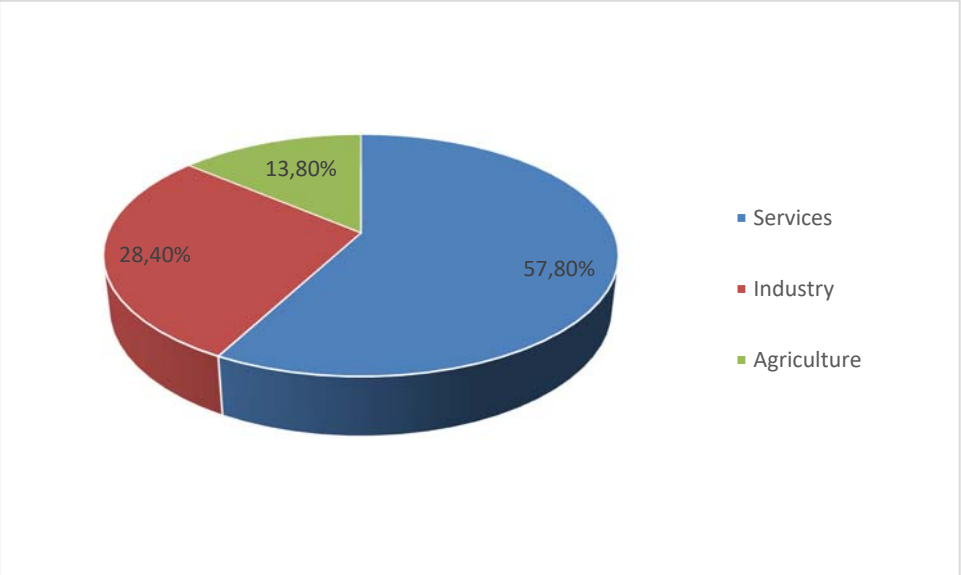
National overview

Overview

Honduras, is the second poorest country in Central America, and presents unequal income distribution along with high underemployment levels. In 2017 5.9% of the population was unemployed however, one-third of the occupied population is considered underemployed. The economy registered modest economic growth of 3.1%-4.0% from 2010 to 2017 with $46.2 billion in GDP in 2017. As of 2017, the services sector is the main economic sector in terms of contribution to the GDP (57.8%), followed by industry (28.4%) and agriculture (13.8%). [1] The GDP composition by sector is shown in *Figure 5.69* below.

[11] Honduras World Factbook, CIA. 2017. Accessed at: https://www.cia.gov/library/publications/the-world-factbook/geos/ho.html

Figure 5.69 Honduras GDP composition by Sector (2017)



Source: CIA World Factbook, 2017 adapted by ERM (2018)

The milk production and milk processing sectors are important sectors in terms of contribution to the national economy and the country's commercial balance. In 2017, total milk production reached 900 million litres increasing from 650 million in 2008. [1] According to El País, national newspaper, milk production has increased by 5% per year with an associated $70 million reduction in the deficit of the commercial balance. Of the total produced, 80% is acquired by artisanal milk-processors and the remaining by the industrial milk-processing companies. About 20-25% of the final product is exported to El Salvador and Guatemala. [2] The national exports value of dairy products has reportedly increased by 35% from 2016 to 2017 according to the Honduran Association of Milk Processors. [3] Milk processing centers are primarily located in the department of Olancho and in San Pedro Sula (department of Cortés).

However, based on a 2011 study of the dairy value chain in Honduras and Nicaragua, the average growth rate of the milk production sector is not considered sufficient to meet the growing domestic demand, which is primarily "exacerbated by high seasonal fluctuations in milk availability with markedly reduced production levels during the dry period". [4]

[1] http://www.elheraldo.hn/economia/1114647-466/producci%C3%B3n-de-leche-superar%C3%A1-900-millones-de-litros-en-el-pa%C3%ADs

[2] http://www.elpais.hn/2018/06/27/bajan-precio-derivados-la-leche-produccion/

[3] http://www.latribuna.hn/2017/10/21/5-ciento-anual-crece-produccion-leche-honduras/

[4] Dairy value chain in Honduras and Nicaragua: Background proposals for the CGIAR Research Program on Livestock and Fish. https://cgspace.cgiar.org/bitstream/handle/10568/16971/LivestockFish_DairyVCHondNicarag.pdf?sequence=1

Employment

Based on the 2013 national household survey, the economically active population (*Población Economicamente Activa*[1] or PEA) in Honduras represented 53.7% of the population of working age, including 63% of men and 37% of women. Out of the PEA, 96% of the population is employed or self-employed, and 4% is unemployed. Note however that one third of the occupied population is underemployed.

In Honduras, 35.8% of the occupied population works in the agriculture sector, 24.1% in commerce and 12.7% in the industry sector. These three fields of activity concentrate more than 70% of the employed population in the country.

Project Area

Employment

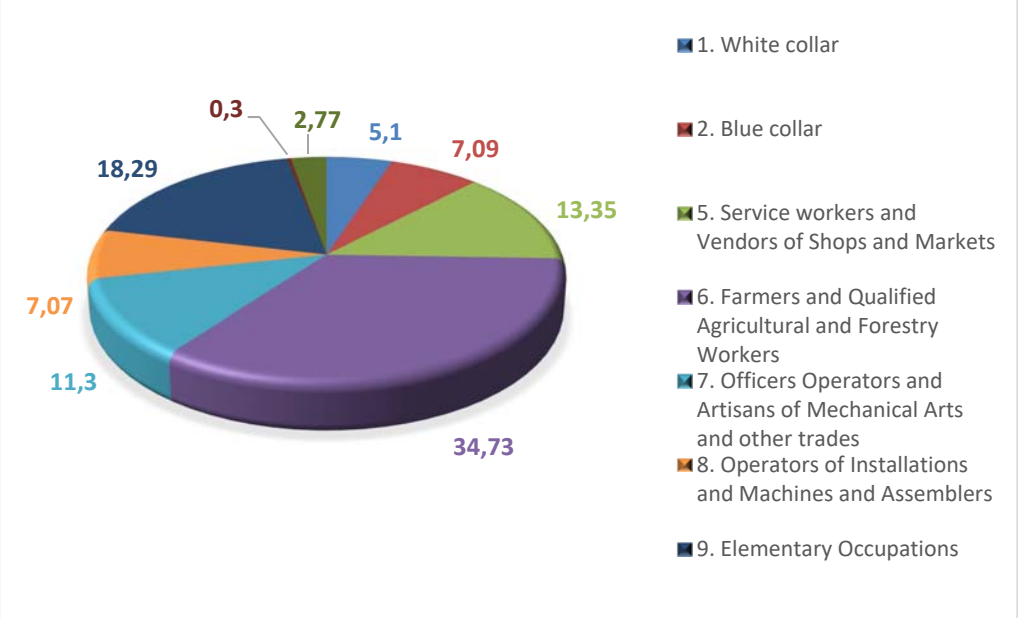
In the department of Yoro, 76% (433,416) of the population is of working age (*Población en edad de trabajar* or PET) of which 37% (160,543) is employed or self-employed. In other words, 63% of the population of working age is either inactive or unemployed.

As shown in *Figure 5.70*, the occupied population is primarily composed of qualified farmers and agricultural and forestry workers (35%), followed by 18% of low-skilled workers (*ocupaciones elementales*), and 13% of workers in commerce and services. Technicians, mechanics and artisans represent 11% of the labour force and machinery operators and installers 7%. Note that low-skilled employment category also includes low-skilled workers employed in agricultural and livestock holdings (*peones de explotaciones agrícolas y ganaderas),* which represent 12.5% of occupations in Yoro. The agricultural, livestock and forestry sector therefore employs about 48% of the population in Yoro.

A further breakdown of 2013 census data shows that the milk processing sector employs 0.11% of the population in Yoro. As discussed in the previous section, industrial milk-processing centres are located outside the Study Area and constitute an important economic sector at the national level.

[1] The Economically Active Population (PEA) is defined by the National Statistics Institute of Honduras as: all persons over 10 years of age who claim to have a job, or do not have one but have actively searched for work or seek for the first time. The PEA is composed of employed and unemployed.

Figure 5.70 Occupation distribution in Yoro Department



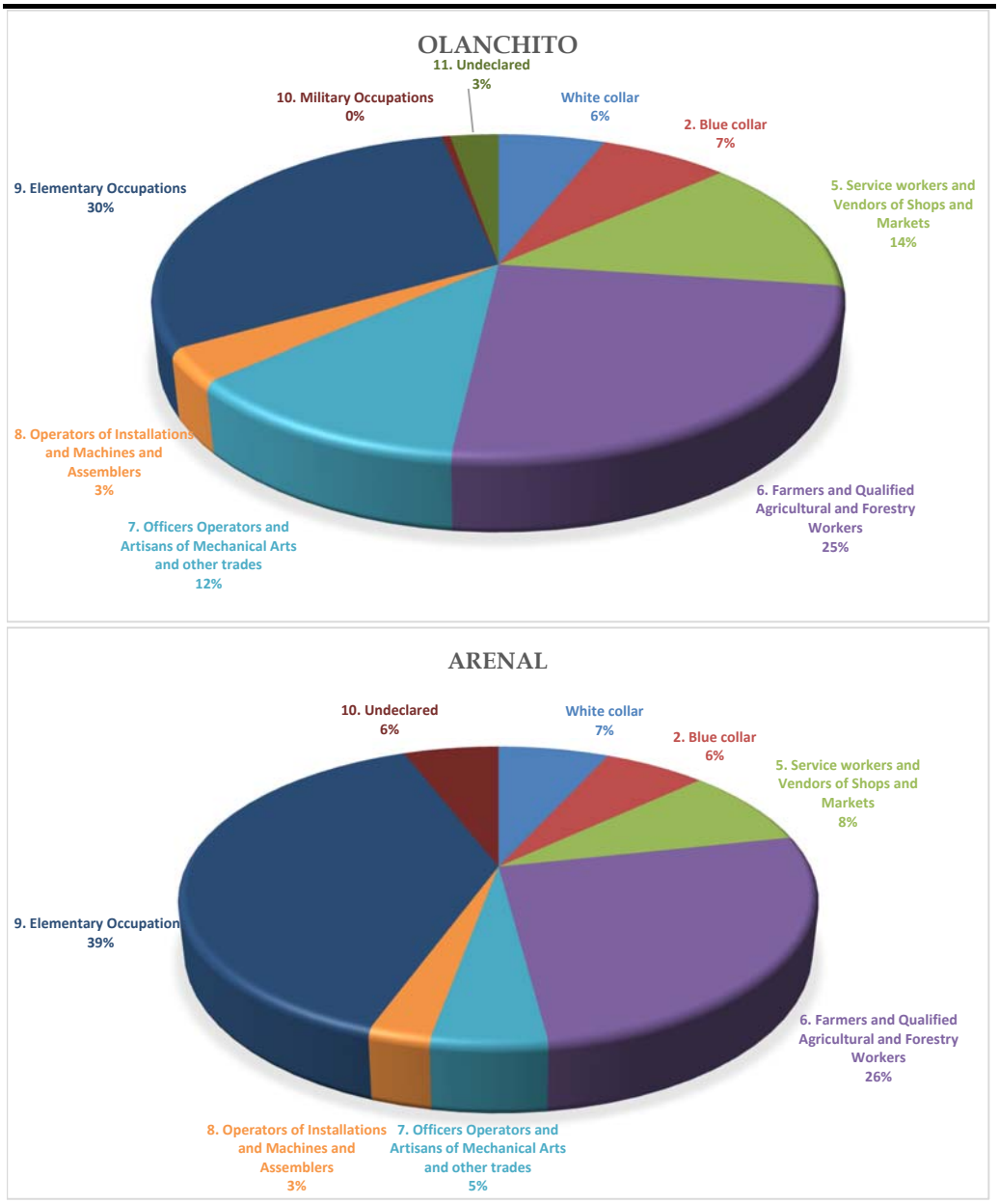
Note: white collar employees include directors and managers in various sectors as well as scientific professionals and intellectuals. The blue collar category groups technicians and medium level professionals as well as administrative support employees.
Source: INE, 2013 adapted by ERM, 2018.

In 2013 in Olanchito, the economically active population (*población economicamente activa* or PEA) is of approximately 29,000 people and represents 34% of the population of working age in the municipality (82,000 people). Approximately 97% of the PEA (28,000) is employed while 3% is unemployed. Similarly, in Arenal, the PEA (approximately 1,380 people) represents 29% of the working age population of 4,500. Approximately 98% of the PEA (approximately 1,400 people) is employed and 2% unemployed. In line with employment trends at the department and national levels, underemployment is predominant in the Study Area (80% in Olanchito according to the Municipality).

In Olanchito, 25% of the occupied population (7,000 people) is employed as qualified farmers and workers in the agriculture, livestock and forestry sector, while 23% (5,980 people) are employed as low-skilled farm labour or farmhand (*peones)*. In Arenal 27% (370 people) of the occupied population is employed as qualified farmers and workers and 30% (414 people) as low-skilled labour. Overall therefore, agriculture, livestock and forestry employs 48% and 57% of the population in Olanchito and Arenal respectively. In turn, milk processing represents only 0.22% and 0.23% of employment Olanchito and Arenal.

The main sectors of occupation in Olanchito and Arenal are presented in *Figure 5.71* below.

Figure 5.71 Sectors of occupation the Olanchito and Arenal (2013)



Note: white collar employees include directors and managers in various sectors as well as scientific professionals and intellectuals. The blue collar category groups technicians and medium level professionals as well as administrative support employees.
Source: INE, 2013 adapted by ERM, 2018.

In terms of income, approximately 12% of households in Arenal in 2013 had a monthly income of less than 1,000 lempiras (around 42 USD at time of writing) and 65% of less than 4,000 lempiras (around 166 USD). Almost 11% of the households relied on remittances from abroad. [1]

In Olanchito the poorest households also rely on remittances from family members who have immigrated, mostly to the United States. [2]

[1] Arenal Strategic Municipal Development Plan 2013.

[2] Olanchito Strategic Municipal Development Plan 2004-2020

Economic sectors

In line with 2013 census results and municipality strategic development plans as well as field survey findings, the main income and employment-generating sector for households in the Project Area is livestock breeding and milk production, and employment in the large multinational banana, and to a lesser extent, African Palm production companies. Other important economic activities include agriculture and farming of basic crops and grains such as corn and beans, especially in the municipality of Arenal. Households in the area also rely on remittances from relatives who have emigrated. Additional economic activities in the area include small-scale artisanal cheese production and commerce and services in Olanchito.

The banana and African palm plantations correspond to large-scale production by multinational companies and are characterized by heavy investments in technology including the implementation of pest control, irrigation, and mechanized earthwork. In contrast, the remaining agriculture and livestock areas have varying degrees of technology and mechanization and rely mostly on low production techniques. Other large banana and African palm plantations are found downstream of the Project Area in the Lower Aguan Valley, while some are also present in the Project Area, based on field survey feedback and observations. Overall, seven out of the eight banana plantations of Olanchito are located in the Project Area, including the Dole Food Company or Dole (American agricultural multinational corporation). The location of the large-scale production companies in the Project Area and downstream are presented in *Figure 5.68* of *Section 5.5.7* above.

These multinational companies also contribute to employment in the municipalities of the Project Area. Dole in particular reportedly employs 5,000 individuals according to the Olanchito municipality. However, most workers are employed in the livestock sector in local farms. As stated above, about 30% of the occupied population in the Project Area is employed as low-skilled farm labour in the agriculture and livestock sector. A more detailed description of potential beneficiary farms and farm labour in the Project Area is presented in *Section 5.5.9*.

As discussed above, milk processing only employs a small portion of the population locally and at the department level (0.22% in Olanchito and Arenal and 0.11% in the department of Yoro). As discussed previously, the milk processing centres are located outside the Study Area, primarily in the Department of Olancho and in San Pedro Sula (department of Cortés),

Farming, livestock breeding and milk production, and forest-related activities are described in *Section 5.5.9* on Livelihoods and Income.

Working practice and labour rights

Formal employment in Honduras is overseen by the Secretariat of Labour and Social Security (*Secretaría de Trabajo y Seguridad Social*) and is primarily regulated by the National Labour Code and National Program of Employment per Hour along with the dispositions of social security and minimum wage.

According the Labour Code, employment contracts may be verbal or written, with verbal contracts authorized only in specific cases including:

- domestic service;
- temporary work of up to sixty days;
- activity remunerated at no more than 200 Lempiras to be completed within a specified timeframe of no less than sixty days; and
- farming and livestock activities excluding industrial and commercial enterprises.

For 2018, the minimum salary published by the Secretary of Labour and Social Security for the agriculture and livestock sector is set at 6,000 lempiras (around 249 USD at time of writing) per month for companies employing up to 10 employes. [1] Although beneficiary farms are not considered companies, this gives an indication of the monthly wages paid in the sector.

Child labour

According to ILO standards on child labour, the general minimum age for admission to employment or work is set at 15 years (13 for light work) and the minimum age for hazardous work at 18 (16 under certain strict conditions).

Child labor in Honduras is prevalent with 14.7% of children between 5 and 14 who work (6.1% work and study at the same time, and 8.6%drop out of school and only work), and 57.5% of working children employed in the agriculture sector (sugarcane, coffee, etc.). Working children in Honduras are either employed as salaried employees, self-employed, or unpaid family workers.[2] According to the Labor Code, children are allowed to start work at 14 as long as they continue to attend school, otherwise the minimum working age is 16.

No child labour has been observed during the June 2018 field survey on visited farms of potential beneficiaries. However it has been reported that children in some cases drop out of school at age 12 and start working. In most cases, it has been reported that children under 14 help-out at the farm on their free time outside of school. Farm labour in the Study Area is described in detail in the following *Section 5.5.9* on Livelihoods and Income.

[1] http://www.trabajo.gob.hn/tabla-de-salario-minimo-2018/

[2] http://www.ine.gob.hn/images/Productos%20ine/TrifoliosHogares/Trabajo%20Infantil.pdf; https://www.dol.gov/agencies/ilab/resources/reports/child-labor/honduras

Forced labour

Although the Labour Code sets the working hours at a maximum of 44 hours per week with overtime pay, secondary sources highlight cases of forced over-time and low pay in in the agricultural sector in Honduras. [1] This is mainly explained based on the lack of specific legal sanctions, and culture of tolerance of labour rights violations encouraged by the economic crisis, unemployment, and low salaries, etc. However no specific reports were found with respect to over time in the livestock and milk production sector.

5.5.9 Livelihoods and income

The primary livelihood activities in the Study Area are described below in the following sub-sections. These activities include agriculture, livestock and milk production, commerce and trade, and use of forest products and other natural resources.

Agriculture and livestock production

Overview

The agricultural production cycle of the Alto Aguan River Valley starts with the rainy season in the month of May and ends in November, with highest rainfall in the months of June and September (see *Section 5.3.1*). The production cycle is interrupted by the dry season (January to April), which prevent the satisfactory development of crops and animal feed which are affected by the heat and the period of drought. Although a few irrigation systems are present in the area (mostly from surface water sources), lack of irrigation in the dry season remains a major issue and the primary cause of the reduction in the production of forage crops and milk (see *Section 5.5.12* on *Irrigation networks*).

In the Project Area, most of the agricultural producers are livestock breeders whose agricultural output focuses on forage crops for livestock feed, which is mostly grass, corn and sorghum. Some producers sometimes also diversify their production with the cultivation of basic grains such as corn and beans, vegetables, African palm, sugar cane, citrus fruits, as well as livestock of minor importance such as pork, chicken, goat, and sheep. Other produce also coffee, banana, watermelon and yucca. The potential beneficiaries of the Project will be selected among these farmers and livestock breeders present in the Project Area.

The quantity, quality and daily availability of livestock feed determine the volume of milk produced by the cow. Therefore, in dairy production, the timely availability of feed for livestock is essential. This factor has limited the increase in milk production per cow, which according to livestock farmers in

[1] ASEPROLA. Flexibility: the Labor Strategy of Free Trade. An Examination of Six Basic Labour Rights in Honduras. Accessed at: https://laborrights.org/sites/default/files/publications-and-resources/HondurasLaborRights.pdf

the area averages 6 litres per head (4-5 litres in the dry season and 7-10 litres in the rainy season), and prevents increasing the population of livestock per farm (CINSA & PAA Project Finance 2017 preliminary information and ERM June 2018 field survey).

According to the Olanchito's Farmers and Stockbreeders's Society (*Sociedad de Agricultores y Ganaderos de Olanchito* or SAGO, the production in 2017 was of 50,000 litres per day or 18.2 million in total for the year.[1] The milk production is sold directly by the CRELs (or the producers themselves in the case of independent producers) to national processing companies such as LEYDE, SULA, LECHOSA, SANPILES and to local artisanal cheese producers. More detail on the organization of the milk production sector is provided in the following subsections.

As described in *Section 5.5.8*, in addition to the producers and farm owners, the agricultural and livestock sector also employs low-skilled farm workers. This category includes lower income households including individuals of indigenous background who rely primarily on agriculture and livestock breeding for income generation and livelihoods.

Box 5.6 Other Farmer Categories

Although crop farmers do exist in the Project Area, very few farmers are only dedicated to the cultivation of crops for income generation and/or subsistence. According to field survey information (June 2018), these farmers are usually small-scale farmers with limited access to land who cultivate crops for self-consumption and tend to be employed in other sectors and therefore do not rely entirely on agriculture for income and subsistence. The Olanchito Strategic Municipal Development Plan 2004-2020 also identified a category of subsistence farmers with no land titles who tend to rent land for cultivation and who seek employment as farm workers for the livestock producers in the area (see *Section 5.5.7*). However based on recent field survey information (June 2018), land leasing is reportedly very rare and is not known to occur in the Project Area. Rather, farm workers who do not own land are sometimes given a piece of land to cultivate for their own consumption in addition to the salary they receive from the landowner. Labour conditions for farm workers are discussed further below in this section.

The remainder of the section therefore focuses on the description of farmers and livestock breeders identified as potential Project beneficiaries as well as the farm workers employed in potential beneficiaries' farms. Livestock and milk producers and the farm workers represent the majority of the population involved in the agricultural sector in the Project Area.

Organization of livestock breeders and milk producers

All farmers and livestock breeders and milk producers in the area are members of Olanchito's Farmers and Stockbreeders's Society (*Sociedad de Agricultores y Ganaderos de Olanchito* or SAGO). Most of them (90-95%) are also members of Centers for the Collection and Cooling of milk (*Centro de Recogida*

[1] Note that the total milk production recorded in the Olanchito Strategic Development Plan for 2004 was of 40 million litres.

de Leche or CREL) while a minority (5-10%) are independent producers with no CREL affiliation.

The SAGO counts approximately 350 members, most of whom are organized into CRELES for the recollection and cooling of milk. CRELs were created as a result of mitigation and climate change adaptation efforts after hurricane Mitch, and have received government support for their organization as well as capacity building. They are considered associations of common interest rather than land-based cooperatives and serve as a collection points for national milk processing companies who collect their milk directly from the CREL. Payment is made directly to the CREL who then transfers the payment to the farmers and milk producers. CRELs also sometimes act as financial guarantee for farmers asking credit from the bank. In this case the CREL pays the monthly interest payment to the bank and deducts this amount from the farmer's revenue. New members are also required to contribute a fee upon joining from 50,000 to 100,000 lempiras (around 2,000 – 4,200 USD).

There are currently 16 CRELs established in the Project Area with an average of 20-25 members per CREL (see *Table 5.29*). Two new CRELs were also recently established with more independent producers joining, meaning that the total number of producers may increase beyond the 350 SAGO members identified to approximately 400. Note that SAGO and CRELs in the Project Area have been extensively consulted during the project design stages.

Figure 5.72 CREL facilities in the Project Area

Note: Left: Aerial water storage tank in CREL Eberto Chirinos Ponce. Right: Milk conservation deposits in CREL Cruz Núñez.
Source: ERM Field Survey (June 2018)

Potential beneficiaries

Farmers and Livestock breeders in the Project Area may be grouped into small, medium and large producers. Producers with farms or "*fincas*" with a total size of less than 40 ha are considered "small" producers, while producers with farmland comprised between 40 and 84 hectares are considered "medium" producers and farms of more than 84 ha are categorized as "large"

producers.[1] Based on preliminary baseline data collected by CINSA and PAA in 2017, the majority of producers in the Project Area (48%) can be considered small producers, while 33% are medium, and 19% large producers.

Table 5.37 Livestock and milk producers by size in the Project Area

Producer Size	Number	Percentage
Small (less than 40 ha)	145	48%
Medium (40 to 84 ha)	100	33%
Large (larger than 84 ha)	56	19%
Total (sample)	**301**	**100%**

Source: Potential beneficiary assessment by CINSA & PAA (2017)

Further breaking down the small producer category, most small producers (49%) have access to between 21 and 39 ha, while 23% of small producers have between 11 and 20 ha, and 28% have less than 10 ha of land. Potential beneficiaries therefore include 14% of small producers with less than 10 ha of land, 11% with 11 to 20 ha and 24% with 21 to 39 ha.

As discussed above, the vast majority of livestock breeders and milk producers in the Project Area engage primarily in cattle breeding and milk production activities, which includes the cultivation of forage crops and livestock feed such as corn, grass and sorghum. Overall, apart from forage crops and cattle feed, livestock breeders and milk producers who reportedly engage in additional agricultural activities as complementary income sources or for self-consumption represent approximately 10% of the total (CINSA & PAA 2017). Most producers sell their milk to national milk production companies and in some cases (residual only) to local artisanal cheese producers. It should be noted however that in the municipality of Arenal, over 80% of farmers and livestock breeders also cultivate crops for self-consumption. Since the Project Area is primarily located in Olanchito with only about 10% of the area included in Arenal, agriculture for self-consumption is less present in the Project Area.

Income and production levels

The average size of the farms of potential beneficiaries is of 55 h, with an average of 28 ha of irrigable land. At present only a few irrigation systems are in place to irrigate the land during the dry seasons. Irrigation systems are mainly found in the large-scale banana plantations.

Table 5.38 below presents a summary of basic characteristics of milk producers grouped by producer size. Note that this information was obtained by triangulating data collected during the June 2018 survey with preliminary data from CINSA & PAA (2017) for the sample of 301 producers.[2]

[1] Note that this classification was confirmed with the SAGO during the field survey in June 2018.

[2] Note: The June 2018 data being based on a relatively small sample, range estimates are presented rather than specific values to account for potential discrepancies, and triangulation with the larger sample of 2017 was used to provide more representative information. For indicators that were not collected by CINSA and PAA Project Finance in 2017 such as cattle

heads and milk production per cattle head in particular, information relies primarily on small meetings during the June 2018 survey. All the ranges and values presented are therefore estimates (see *Section 5.2 Data Collection and Limitations*).

Table 5.38 Producer characteristics by size

	Small farms (up to 40 ha)	Medium farms (40-84 ha)	Large farms (over 85 ha)
Cattle heads & production	Average cattle heads: 30-50 average cattle heads per farm (20 producing milk)	Average cattle heads: 40-60 average cattle heads per farm (30 producing milk).	Average cattle heads: 75 – 150 average cattle heads per farm (50 producing milk)
	Cattle to land ratio: less than 1 ha per cattle head (between 0.4 and 0.88ha) i.e. more cattle per ha and less land available for grazing per cattle head.	Cattle to land ratio: approximately 1 ha per cattle head. More land available for the cattle than with small producers.	Cattle to land ratio: 1.5-2 ha per cattle head. More land available for grazing per cattle head.
	Daily production yields: 7-8 Litres per cattle head in the rainy season vs. 3-5-4 Litres in the dry season.	Daily production yields: 8-10 litres per cattle head in the rainy season vs. 4-5 litres in the dry season.	Daily production yields: 8-12 litres / cattle head in rainy season vs. 4-5 litre / head in dry season
Family Revenue (gross profit) *	Rainy season monthly average: 20,000-40,000 lempiras (832 – 1,663 US)	Rainy season monthly average: 30,000–60,000 lempiras (1,247 – 2,495 USD)	Rainy season monthly average: 40,000–80,000 lempiras (1,663 – 3,326 USD)
	Dry season monthly average: 10,000-20,000 lempiras (416 – 832 USD)	Dry season monthly average: 20,000-30,000 lempiras (832 – 1,247 USD)	Dry season monthly average: 20,000-40,000 lempiras (832 – 1.663 USD)

*Note: * Family revenue: Lower monthly averages were reported by the SAGO and the CRELs (16,500 and 12,000 respectively). However, these were not deemed realistic as they would mean that the producers would be running at a loss considering the expenses related to the payment of labour, etc. The information presented therefore combines results from FGDs with small producers, visits to farms, and data from the sample of 301 beneficiaries (CINSA & PAA 2017).*
Source: CINSA & PAA (2017); ERM Field Survey (June 2018).

As discussed previously, milk production per cattle head reportedly varies between four and five (3-5) litres per day in the dry season and seven to ten (6-12) litres per day in the rainy season, with an overall yearly average of six to seven (6-7) litres per day per head.[1] Small producers typically have fewer cattle heads but a larger cattle to land ratio which implies less grazing land available per cattle head (less than 1 ha per cattle). In contrast, medium and large producers have more land available and a smaller cattle to land ratio with more land available for grazing, as well as a wider variety of forage crops and cattle feed, allowing them to produce larger quantities of milk, especially in the rainy season.

The litre of milk typically sells for 8.5 to 10 lempiras. During the dry season, milk production and related revenues reportedly drop by 50% due to water

[1] The average yearly range is calculated considering 6 months of rainy season and 4 months of dry season and taking into account that 48% of producers are small, 33% medium, and 19% small.

scarcity and lack of appropriate technology. It is expected that irrigation from the Project will ensure additional food for the cattle during the dry season keeping production and revenues stable throughout the year. According to the SAGO, average production and revenues for medium producers is approximately 1.5 times the production of small farms, while the average production for large producers is approximately twice the production of small farms. With large producers, agriculture production sometimes exceeds cattle feeding needs, creating an additional economic income.

Independent producers

As indicated previously, about 5-10% of the producers are independent and not members of any CREL.[1] Based on the preliminary baseline data collected in 2017, it can be assumed that the majority of independent livestock and milk producers are small producers (54%), and will typically have smaller monthly incomes. Small independent producers tend to sell their milk to local artisanal cheese makers rather than to the national milk processing companies such as LEYDE, as these companies usually collect their milk directly from the CRELs. With no CREL affiliation, these producers may be considered more vulnerable in terms of access to technical and financial backing from CRELs and access to national milk processing companies.

While small producers represented the majority of independent producers based on preliminary information from CINSA & PAA Project Finance (2017) the preliminary results also showed that 31% of independent producers are large producers with over 84 ha of land. These large producers do not need to use CREL facilities to store their milk, as they have their own facilities, including a milk deposit, to maintain the milk at low temperatures for conservation purposes.

Labour force and working conditions

Based on field survey interviews with the SAGO, CRELs and local producers, most of these farms employ local workers to conduct specific activities on the farm. There are reportedly no migrant farm workers in the area and indigenous workers are present in small numbers. As discussed in *Section 5.5.4* workers of indigenous descent in the area are mostly Tolupan living since generations in nearby communities. Workers are mostly men.

Workers do not usually live on the farms and rather tend to commute daily by bicycle, motorbike, by foot or on horseback, although there are a few cases where workers and their families do live on the farm. Some workers also receive a small portion of land to cultivate for their own consumption as well as free milk. When the family lives on the farm, children sometimes help with farm work during holidays or after school (so do children of the owner).

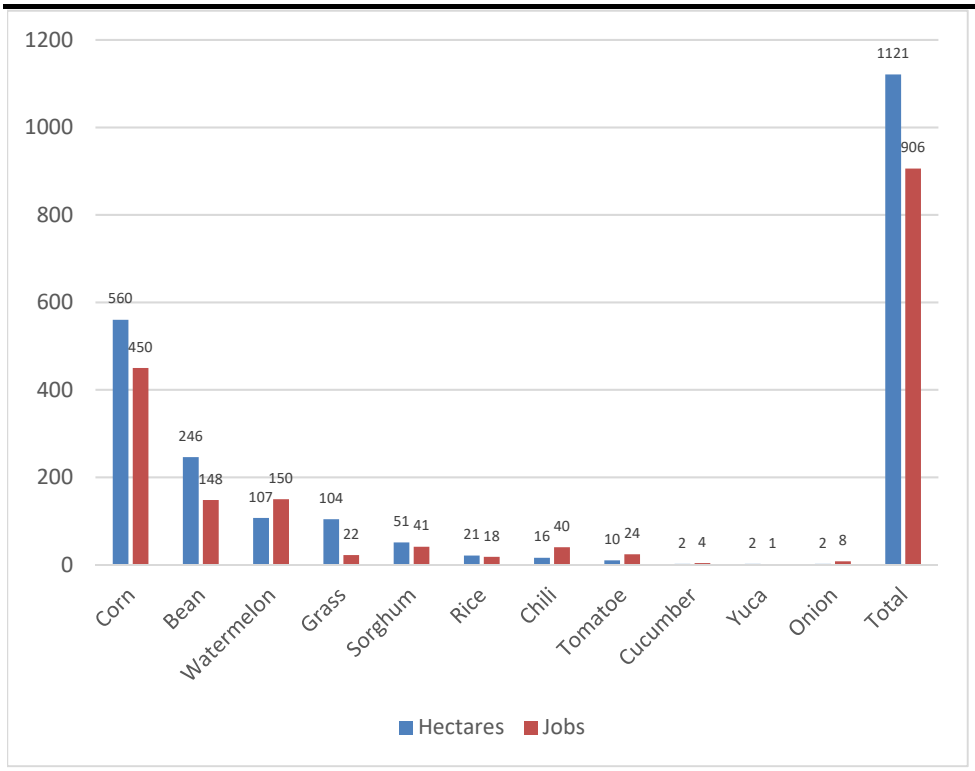
[1] Note: the information presented is based on preliminary data from CINSA&PAA (2017) and feedback obtained in June 2018. The sample of 301 producers included in the preliminary field survey is considered representative of the total number of producers in the Project Area. Information obtained can therefore be extrapolated to the total population of producers.

Workers are mostly permanent although some seasonal workers are employed at the beginning of the agricultural season in May and June, when the workforce size in a given farm tends to double. Small producers tend to employ between two (2) and four (4) permanent workers which tends to increase up to 10 in the rainy season. Medium and large producers employ 6-8 and 10-12 permanent workers respectively, doubling in the rainy season with additional seasonal workers. Since small farms represent 48% of potential beneficiaries, medium farms 33% and large farms 19%, it may be estimated that each potential beneficiary farm employs on average 6 permanent employees and 12 in the rainy season. This results in a total of approximately 1,800 permanent workers and 3,600 workers in the rainy season in potential beneficiary farms. The yearly average in both rainy and dry season is estimated at approximately 2,100 workers. These estimates are aligned with the job creation numbers obtained for a similar irrigation project implemented by the SAG in 2015 with funding from the Austrian Government. The 2015 project introduced irrigation equipment on cultivated land in multiple departments including in Yoro. [1]

Figure 5.73 below provides an estimate of jobs per hectare of land irrigated per crop for the 2015 Austrian project and *Table 5.39* calculates the number of jobs created per hectare of irrigated land for each type of crop, showing that vegetable crops are the most labour intensive. Job creation therefore depends on the type of crops. In the Project Area, producers mostly cultivate forage grass (*pasto*) as well as corn and beans and sorghum. On average these crops generate 0.55 jobs per hectare of irrigated land.

[1] Bauer, Irrigation Project for High Value Crops (*"Cultivos de Alto Valor Bajo Riego por Aspersión")*. October 2015

Figure 5.73 ***Employment creation per hectare of irrigated land in the Bauer Project Area Honduras***



Source: Bauer, 2015

Table 5.39 ***Job creation per irrigated hectare per crop***

Crop	# jobs per hectare
Corn	0.8
Bean	0.6
Watermelon	1.4
Forage grass (pasto)	0.6
Sorghum	0.2
Rice	0.85
Chili	1.53
Tomato	2.4
Cucumber	2
Yuca	0.5
Onion	4

Source: Prepared by ERM (2018) based on Bauer 2015 report

Contracts are verbal in most cases, although there may be some written contracts. Salaries are usually fixed per hour or per day and vary according to the type of activity conducted. Milking earns between 4,000-6,000 Lempiras (166 – 249 USD) per month while cleaning earns 3,000 – 4,000 Lempiras (125 – 166 USD). The chief worker (*capataz*) can get up to 7,000 lempiras (291 USD) per month. Working hours are reportedly 6am to 12pm for general tasks, and 4am to 12pm for milking. As discussed in *Section 5.5.9*, the minimum salary for the agriculture and livestock sector for 2018 is set at 6,000 lempiras

(259 USD) per month for companies employing up to 10 employees. [1] Although beneficiary farms are not considered companies, the official minimum wage may be used as an indication that farm workers may be underpaid.

Workers do not benefit from any formal medical coverage plan, although in some cases, the employer (farm owner) may cover some of the medical expenses including salary payment during the time the worker is not able to work.

Financial profile and cost structure

In addition to production levels, farm revenues are also determined by the farm's cost structure. A USDA study on the dairy farming sector in the United States indicates that smaller dairy production farms with less than 200 cattle heads incur higher costs than larger farms (500 or more cattle heads) due to lower economies of scale. Specifically, the study shows that the production costs for the large farms were 18% below average costs on farms with 200-499 cows, and that costs were much higher for farms with fewer than 200 cows. [2] According to the study, "ownership costs" in particular for milking facilities and machinery, fall sharply as the farm size increases, which suggests economies of scale for larger farms who use their equipment and structures more intensively. Labour costs per litre of milk also falls sharply. Although the potential beneficiary farms considered for the present Project have fewer cattle numbers and cattle capacity, the study's findings are still considered generally applicable.

In terms of financing, farmers and producers are reportedly used to requesting loans, mainly to banks, which lend up to 65% of the property value. Small producers consulted during the 2018 field survey reported managing their loans properly although cases of mismanagement were recorded in the 1990s. According to the municipality of Olanchito, groups of farmers who had obtained credits in the context of an economic development project had poorly managed their loans and in some cases were forced to sell their lands and emigrate to the United States.

In addition to bank financing, institutional support is available in the form of farmers associations (cooperatives), rural funding organizations or savings banks (*Cajas Rurales*) and the SAGO and CRELs. Farmers associations and rural funding organizations are mostly addressed to farmers while SAGO and CRELs focus on livestock breeders and milk producers.

Farmer associations can secure favourable credit conditions to their members through negotiation with the central bank for lower interest rate loans. These associations are also sometimes organized into savings banks (*Cajas Rurales)* through which members lend money among themselves using membership

[1] http://www.trabajo.gob.hn/tabla-de-salario-minimo-2018/

[2] USDA. Profits, Costs, and the Changing Structure of Dairy Farming. 2007. Accessed at: https://ageconsearch.umn.edu/bitstream/6704/2/er070047.pdf

fees. Some banks have also reportedly expressed interest to fund these savings banks at very low rates. At present, there are more than 80 *Cajas Rurales* in Olanchito, each of them, with more than 15 members. *Cajas Rurales* are governed by the National Agrarian Insitute (INA) and managed primarily by farmers associations rather than CRELs. However CRELs are reportedly starting to manage *Cajas Rurales* as well to secure loans for milk producers.

In the livestock and milk production sector, members of the SAGO and CRELs fund themselves their activities or get credit primarily from commercial banks as stated above. However, in some cases the SAGO and the CRELs can act as guarantees for their members as banks tend to provide credit more easily if the farmer belongs to a CREL or the SAGO since it provides some assurance as to the correct management of the farm business. CRELs may also act as guarantee for the bank by paying the monthly interest directly to the bank and deducting from the producer's revenues at month end. It has also been reported that in some cases the CREL may also lend money to members at 0% interest rates.

Commerce and trade

Based on Olanchito's Strategic Municipal Development Plan (2004-2020) households that are not involved in the agriculture sector tend to engage in commerce and trade-related activities. Individuals of indigenous background also reportedly engage in commerce to a limited extent, including the sale of artisanal artifacts created by women. The primary commerce activities in the Study Area include trading of agricultural inputs, grains, and cattle as well as the commercialization of agricultural produce, milk and milk-related products such as cheese and butter. Milk is mainly sold to national processing companies such as LEYDE, SULA, LECHOSA, SANPILES and to local artisanal producers.

The sale of consumption goods and services, and the provision of loans and credits to the agriculture sector are also activities conducted in the Municipality. [1]

In contrast commercial activity is reportedly weak in Arenal according to the Strategic Development Plan of 2013 and population census results.

[1] Plan Estrategico de Desarrollo Municipal de Olanchito 2004-2020 (2003).

Figure 5.74 Shop in the hamlet of Coyoles (Olanchito municipality)

Source: ERM Field Visit, June 2018

Forest products and other natural resources

Medicinal plants

According to information presented in *Section 5.3.2* on Flora, about 30 species of flora present in the Honduran Emerald Wildlife Refuge are used for medicinal purposes and as a source of wood. Since the Refuge is split across different areas in the Study Area, the existing flora in the Refuge considered representative of the overall flora in the Project Area, excluding cultivated agricultural fields and pastures, which do not present any specific biodiversity value in terms of flora.

Based on feedback obtained from farmers and workers during the June 2018 Field survey, some medicinal plants are collected in forested areas but this practice is not widespread and has decreased over time. Most commonly used species include the "Zacate verde" (*Pennisetum setaceum*) used as a relaxant as well as the "sábila" (*Aloe vera*) used as a medicinal plant for its soothing properties. Fruits from the "guanabana" tree (*Annona muricata*) are reportedly used for hypertension, eucalypt (*Eucalyptus sp.*) for flu and cough, and "caulote" (*Guazuma ulmifolia*) for cattle loose stool. Camomile was also reportedly used to calm headaches. As stated above these medicinal plants occur primarily in shrubland and forested areas and not in the cultivated land and pasture areas in the Project Area.

Wood collection and lumbering

Lumbering activities are also present in the area, mostly for the construction of small fences and fuel wood for cooking and were observed during the Field survey in June 2018 as shown in *Source:* Field survey, 2018
Figure 5.49 below. Limited chopping of branches is most frequent as opposed to chopping entire trees, for which special permits are required and linked to tree plantations for wood production.

Figure 5.75 Lumbering and medicinal plants in the Project Area

Note: Left: medicinal plant (savila). Right: Wood processing facility near the road.
Source: ERM Field survey (June 2018)

Bushmeat hunting

Based on feedback received during the June 2018 Field survey, bushmeat hunting is reportedly occasional and is associated with low-income households to complement sources of protein when necessary. The main source of meat remains farmed animals such as cows, pigs and chicken.

Apiculture

Apiculture activities mostly takes place in Alto Aguan area. No apiculture was found during the field survey (June 2018) except in Los Horcones where one man reportedly has some bees, but production is limited.

5.5.10 Health

In Olanchito the most common types of diseases reported in 2005 were intestinal, respiratory, and hypertension. [1] Similarly in Arenal, the most common diseases reported in 2013 were respiratory infections (42.06%) and intestinal infections or diarrheas (16.48%). [2]

Water-borne infections are the most common causes of intestinal infections and diarrheas. Based on official reports, 18% of all reported cases in Olanchito occurred among children under 5 years of age and 20% among children

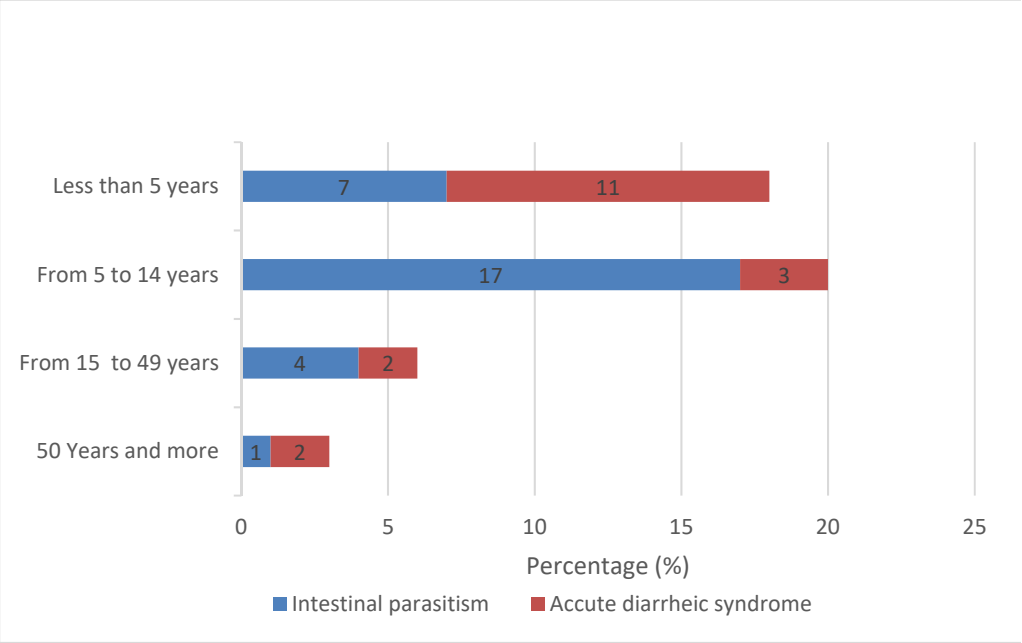
[1] Diagnostico institucional y financiero de Olanchito 2005

[2] Arenal Strategic Municipal Development Plan (2013).

between 5 and 14, which indicates that children under 14 are the most vulnerable population. [1] In fact, 21% of children between 1 and 4 years old in Honduras die of diarrhea. [2]

Figure 5.76 below presents the occurrences of Intestinal Parasites and Acute Diarrheic Syndrome (ADS) in the municipality of Olanchito for the first semester of 2016.

Figure 5.76 Occurance of water-related health cases diagnosed in the municipality of Olanchito in the first half of 2016



Source: Diagnostic and Analysis of the Rural Water and Sanitation Sector, Municipality of Olanchito, CONASA, 2016

As for vector-borne diseases in the Project Area, high occurrence of dengue fever was reported in Arenal (10.4% of reported cases), and occurrence of malaria was also reported in Olanchito, which according to the Olanchito Emergency Response and Prevention Plan of 2007, is located in an area at risk of inundations and epidemiological issues related to the presence of malaria.[3] In fact, the WHO epidemiological profile of Honduras for 2016 shows that the Project Area is located in an area where malaria occurrence is of 1 to 10 cases per 1000 population. [4]

[1] CONASA (2016). Diagnostic and Analysis of the Rural Water and Sanitation Sector, Municipality of Olanchito,

[2] CARE and Municipality of Olanchito (2009). Diagnóstico de las Condiciones del Sector Agua y Saneamiento en el Municipio de Olanchito

[3] COPECO Honduras (2007). Plan de Prevención y Respuesta Casco Urbano Municipio de Olanchito, Yoro. Accessed at: http://cidbimena.desastres.hn/RIDH/pdf/doch0056/pdf/doch0056.pdf

[4] WHO (2016). Honduras epidemiological profile. Accessed at: http://www.who.int/malaria/publications/country-profiles/profile_hnd_en.pdf?ua=1

Figure 5.77 below shows the distribution of malaria cases in Honduras with respect to the Project Area.

Figure 5.77 Occurrence of malaria cases with respect to the Project Area in 2016

Source: WHO, 2016
Note: the blue circle indicates the approximate location of the Project Area.

This being said, based on feedback obtained in June 2018 from the head of the Environmental Health Programme at the Hospital of Olanchito, malaria and dengue breakouts have been successufully controlled in the Alto Aguan Valley wih very limited occurrence of malaria and dengue fever in the Municipality of Olanchito.

5.5.11 Education

National overview

In 2013, 11% of the population above 15 years old does not know how to read or write, with higher illiteracy rates in rural areas (17.2%).[1] In the department of Yoro the illiteracy rate was of 22.1%, well above the national average and also higher than the average in rural areas.[2]

Project Area

In Olanchito and Arenal respectively 20.3% and 20.6% of the population is illiterate, resulting in an average of 20.4% in the Project Area, compared to 22.1% at the department level.

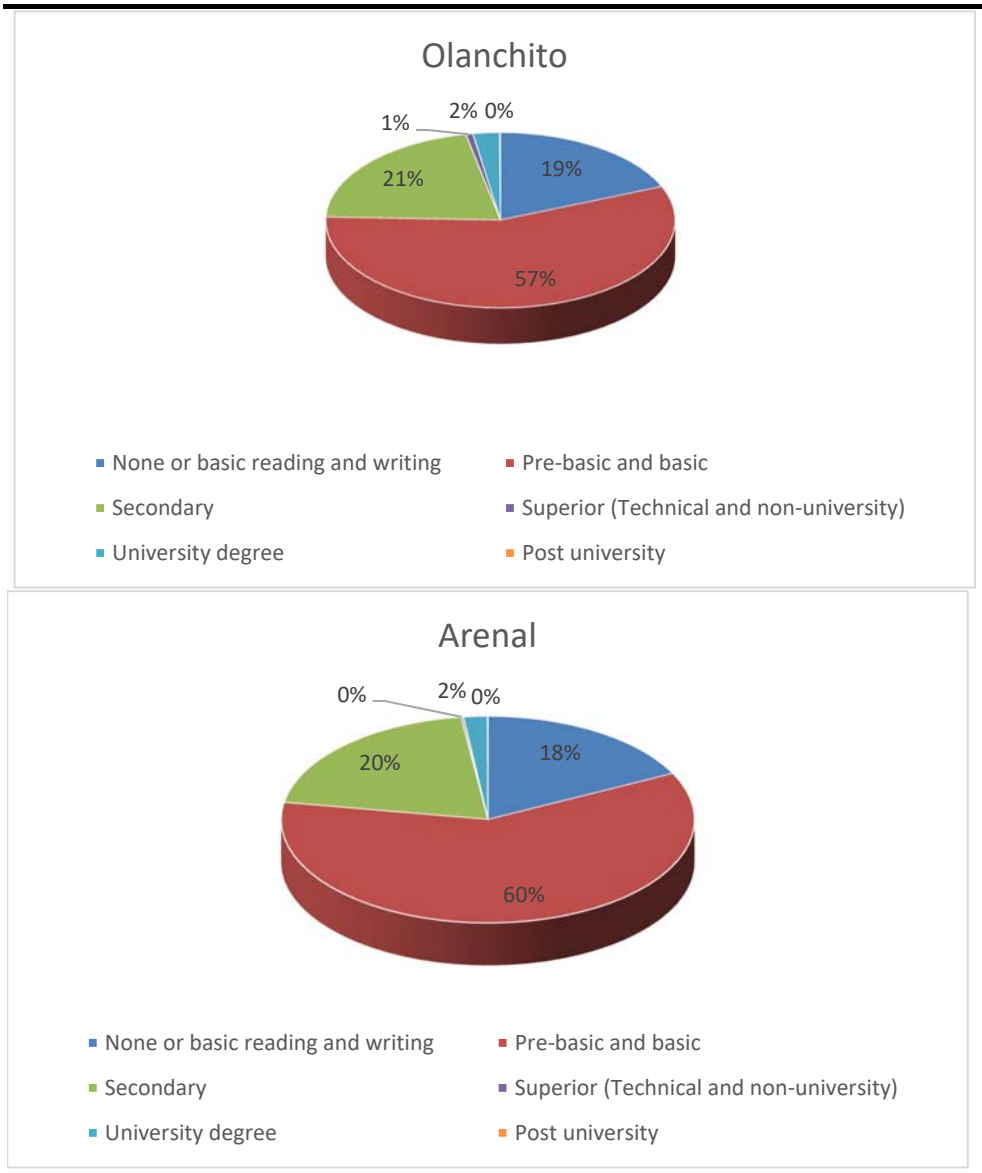
In the Study Area, 57% of the population has received basic (elementary) education and 21% has completed secondary education. The majority (78%) of the population has therefore achieved primary or secondary education levels.

[1] INE (2013). "*XLIV Encuesta Permanente de Hogares de Propósitos Múltiples*", May 2013.

[2] INE 2013 census.

Education level attainment for the population in Olanchito and Arenal is presented in *Figure 5.78* below.

Figure 5.78 Education levels in Olanchito and Arenal (2013)



Source: INE 2013 adapted by ERM, 2018

5.5.12 Infrastructure and public services

Water supply and sanitation

Water sources, access and quality

Based on field survey information collected through interviews with the municipality of Olanchito, superficial water sources represent over 95% of drinking water sources for the population in the Study Area, while underground water from wells represent less than 5% of the drinking water consumption. Specifically, according to a 2016 CONASA report on Water and Sanitation in the Municipality of Olanchito, there are 82 water supply systems

in operation that are supplied by 98% of surface sources driven by gravity whereas 2% are pumped from drilled wells. Water for domestic uses other than drinking are also mainly sourced from surface water bodies through the municipal water supply systems. Over 30% of the water supply systems are between 20 and 30 years old and require repairs or replacement.

Figure 5.79 below provides an example of water extraction from surface water sources observed in the Study Area.

Figure 5.79 Extraction of water from surface water feature

Source: CINSA & PAA Project Finance Field survey (November 2017)

Superficial water for domestic consumption is sourced primarily from river affluents and watersheds located upstream of the main rivers and flowing down from the mountains. In Honduras, as of 2010, 7% of the forested areas that form the watersheds and water supply systems for human consumption are formally declared and protected to guarantee proper water supply and avoid contamination (i.e. no activities of any sort including agriculture, grazing, logging, construction, or exploitation of resources). According to the National Strategy on the Management of Micro basins in Honduras, 575 micro basins are declared as protected, including 31 in the Department of Yoro covering 26,224.03 ha.

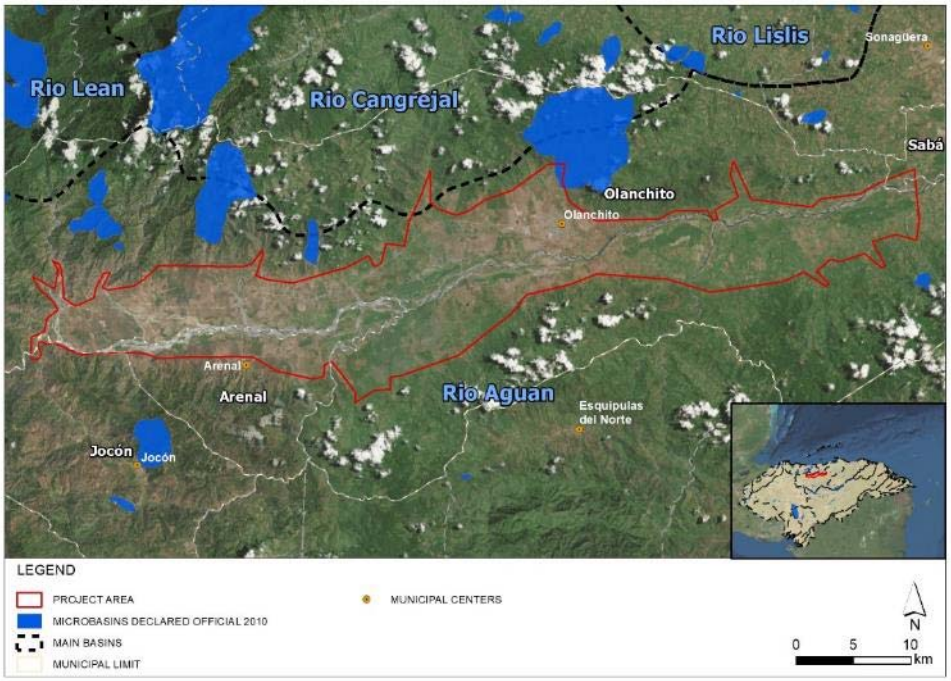
In the Project Area, the municipality of Olanchito has six (6) micro-basins associated to the Aguan River Basin as shown in *Table 5.40* below. As for the municipality of El Arenal, based on field survey findings, two (2) micro catchments of surface water provide water to the municipality, except during the dry season when the catchments dry up and water is extracted from an emergency groundwater well instead. *Figure 5.80* shows the location of declared micro basins in Honduras between 1987 and 2010 in relation to the Project Area. More information on the hydrology of the area in *Section 5.2.7*.

Table 5.40 Basins and micro basins in Olanchito municipality

Nº	Basin and Sub-basin of Aguan River
A	Aguan Basin
Sub basins of Aguan River	
a	Mame River
b	Nombre de Jesús y Calpules River
c	San Marcos, San Lorenzo and San Juan Rivers
d	Coyoles, Agalteca, Uchapa and Pimienta River
e	Uyuca River
f	Maloa, Jaguaca, Qda. Bálsamo, Tepusteca and Terrero River

Source: Diagnostic and Analysis of the Rural Water and Sanitation Sector, Municipality of Olanchito, CONASA, 2016

Figure 5.80 Location of declared microbasins in Honduras (1987 - 2010) vs. Project Area



Source: National Strategy for the Management of Basins in Honduras ("*Estrategia Nacional de Manejo de Cuencas en Honduras*"), ICF 2010. Adapted by ERM, 2018.

In terms of access to water, CONASA's report indicates that as of November 2015, 88.29% of the population of Olanchito municipality had access to drinking water via the 82 water systems in place and administered by the 100 Water Boards (*Juntas de Aguas*), also referred to as water providers. In other words, 11.7% of the population of Olanchito municipality was not connected to the water supply systems, which translated into 2,968 households in 345 communities without access. Most of these communities are small settlements composed of 1 to 10 houses that rely on small springs, private wells, rivers, streams, etc. for water consumption. In Arenal, the Strategic Development Plan for 2013 reports that 65% of the population had access to water, with the

majority (61.5%) receiving water through the aqueducts of the municipal distribution network, and the remaining few relying on private wells (2.25%) and water from the water streams (1.27%).

Table 5.41 Water supply system coverage in Olanchito

	With Access to Service	Without Access to service	Total
Settlements	105	345	450
Households	22,377	2,968	25,345

Source: Diagnostic and Analysis of the Rural Water and Sanitation Sector, Municipality of Olanchito, CONASA, 2016

According to the 2016 CONASA report, water quality measurements according to two chemical and bacteriological parameters have shown that only about 10% of the 82 water systems of Olanchito municipality provide water that is safe for human consumption. Based on feedback collected during the June 2018 field survey through interviews with the SAGO and with farmers and milk producers in the area, the use of chemical herbicides, pesticides, and fertilizers is punctual and usually limited to once or twice a year in relatively small quantities. The use of pesticides is also regulated by the municipality with regular compliance checks, which reduces the risk of drainage and related surface water contamination. More information on the use of chemical products in the agricultural sector in *Section 5.2.6* and *Section 5.2.7.* Rather, the sanitation and wastewater management system poses a greater risk of organic water contamination due to potential wastewater leakages from sceptic tanks. This being said, the presence of fish in the surface waters observed during the field survey indicate that the water is still in good conditions (see *Section 5.2.7*).

The methods used to purify drinking water in the Study Area consist in water filtration and adding chlorine. This basic approach is widely used throughout the Study Area in most of the settlements with very few exceptions.

Sanitation and wastewater management

Sanitation coverage in Olanchito municipality is 88%, while 12% of the rural population has no access to any form of sanitation. The preferred sanitation system is the latrine with hydraulic lock (60%), followed by the simple pit present in 17% of homes, and the septic tank (11% of homes).

In Arenal, coverage in excreta disposal is 93.84%, distributed in sewer service having 39.88% and 53.96% with latrines. [1]

The most common latrine problems include the risk of latrine or pit sinking, pit overflow, deterioration of the house/structure enclosing the latrine or pit, and poor conditions of the pit latrine slab or platform.

[1] Plan Estrategico de Desarrollo Municipal de Arenal (2013)

Water and sanitation governance

At the municipality level, the municipal government has the key role of overseeing and managing the water and sanitation sectors for the municipality through the Municipal Water and Sanitation Commission or "*Comisión Municipal de Agua y Saneamiento*" (COMAS). Water management at the municipal level is governed by the Law of Municipalities and the Municipal Plan of Taxes and Fees (*Plan de Arbitrios Municipal)*. The plan specifies the taxes and fees that municipality members are required to pay for connection to the various networks and services provided by the municipality, including the drinking water. [1]

At the community level Water Administration Boards or "*Juntas Administradoras de Agua (JAAS)*" operate the water supply systems. According to the CONASA 2016 report, there are 100 Water Boards in Olanchito Municipality as of November 2015, meaning that 5 of the communities with access to the municipality water supply systems do not have a Water Board. Water Boards are usually composed of 5 to 7 members selected among an assembly of beneficiaries or water users for a period of 1 to 2 years. Membership and services provided by the Boards are voluntary and to the community's benefit. The JAAS are in charge of all aspects related to water service provision, administration, operation, maintenance, commercialization, water treatment, and client service among others.

Water boards are also faced with a number of challenges, which have to do mainly with limited capacity and skills in the administration, operation and maintenance of water systems, the absence of studies and initiatives to improve or expand the systems and water quality, as well as the low service fees they charge making them financially unsustainable.

Water rights and permits

Based on discussions with representatives of the Municipality of Olanchito and Arenal including the Environmental Unit directors, no water permits are required for the use of surface water as these water sources are owned and managed by the municipalities as per the Municipal Plan for Taxes and Fees. Restrictions are in place regarding the use of natural resources in areas formally declared as part of water supply systems (such as buffer areas of various sizes) in accordance with requirements of the forestry law.

For groundwater sources, for the drilling of wells, the municipalities will grant appropriate permits and licenses for irrigation systems not exceeding a total of 10 ha as stipulated in Article 67 of General Water Law described in *Chapter 2*. In the case of irrigators who use infrastructure and irrigation volumes greater than 10 ha, Art.68 of the Water Law, stipulates that it is the national Water Authority that grants rights of use, through concession

[1] Municipal Plan of Taxes and Fees of Olanchito (2016). *Plan de Arbitrios Municipal de Olanchito.*

agreements based on the precepts of the Law on Concessions and applicable administrative laws (*Chapter 2*).

In the case of well drillings, the permit granting process is governed by Article 117 of the Municipal Plan of Taxes and Fees (*Plan de Arbitrios Municipal)* under which the municipality is responsible for granting the permits. The application is reviewed at the Municipal Corporation meeting after which a field investigation is conducted by the Environmental Unit (*Unidad de Medio Ambiente* or UMA) who is then responsible for approving or rejecting the application. For permits that are granted, the applicant is required to pay specific fees including the following: [1]

- Environmental fee of 400 Lempiras (17 USD) for domestic use.
- Well drilling fee of 2,000 Lempiras (83 USD)
- Well opening permit fee of 1,000 Lempiras (42 USD) for domestic use.
- Use of groundwater resources fee of 500 Lempiras (21 USD) paid to the municipality.

The non-compliance fine for the drilling of a well amounts to 5,000 Lempiras (208 USD) per well. However the SAGO reported that application of the law is limited in practice.

Irrigation networks

In the Project Area, surface water is commonly used for irrigation purposes, while the use of groundwater is marginal. Based on feedback obtained from the SAGO and CRELs, irrigation from surface water sources is mostly used in the rainy season. In contrast groundwater wells are used to a lesser extent and mainly during the dry season, in the form of shallow dug wells in locations that are near the river, or as drilled wells if located further away from the river. As such, although a few irrigation systems are present in the area (mostly from surface water sources), the lack of irrigation in the dry season remains a major issue and the primary cause of the reduction in the production of forage crops and milk. Additional information is presented in *Section 5.2.7* and *Section 5.2.8*.

Note that the community water supply outlets for domestic and potable use are located upstream of irrigation outlets and of the agricultural production area.

Electricity

Access to electricity at the national level is predominant in urban areas with 99% of coverage in 2013, although electricity cuts are frequent.[2] In rural areas electricity coverage is of 75% combined with 16% of alternative energy sources including candles, gas lamps, and fuel wood. In Arenal specifically, electricity

[1] [1] Municipal Plan of Taxes and Fees of Olanchito (2016). *Plan de Arbitrios Municipal de Olanchito.*

[2] INE (2013). "*XLIV Encuesta Permanente de Hogares de Propósitos Múltiples",* May 2013.

coverage is of 77.2% according to the Strategic Development Plan for 2013. No specific data was available for Olanchito.

Waste

Based on the Municipal Taxation Plans for the municipalities of Olanchito and Arenal, waste collection and disposal services are present in both municipalities and cover domestic users and non-domestic users including commercial and industrial.[1] Waste collected is taken to the municipal landfill where it is burned. The collection and disposal of toxic or contaminated waste from hospitals, chemical plants, or similar is excluded from this service. As such, industries that generate hazardous wastes are responsible for establishing their own system of hazardous waste disposal with approval from the municipality.

Note however that the service mostly covers the urban area of Olanchito with limited coverage in rural areas. In fact, according to an Emergency Prevention and Response Plan for Olanchito, 35% of the neighbourhoods in the urban area did not have access to the waste collection service in 2007.[2] In the rural area coverage is even more limited or non-existent. In the absence of a dedicated landfill or waste disposal location, residents either berry or burn their waste themselves.

Road transport

In the last 10 years, Honduras has managed to establish a paved road network with reasonable levels of service. However, the distribution throughout the territory is not uniform, particularly in the rural area, where improvement of the road network is most needed. The state of the rural network becomes critical during the rainy season, in particular in June and September which are the months with the heaviest rainfall reducing accessibility, limiting the development of productive activities or access to basic social services, and increasing transport costs and travel times.

The road leading to Olanchito from the port of San Pedro Sula where the kits will be delivered is approximately 320 km long and is mostly composed of national roads and primary roads connecting the municipalities together. The first portion of the road from San Pedro Sula to El Progreso is part of the national road network and is paved and well-maintained. The remaining section to Olanchito through the municipalities of Yoro and Jocon are municipal roads which includes both paved and unpaved roads. The road infrastructure in the western portion of the Project Area up to the hamlet of San Juan is less developed and is mainly unpaved dirt roads, while the middle and eastern portion of the Project Area from San Jeronimo up to Olanchito is more developed and roads are mostly paved and relatively well maintained.

[1] Plan de Arbitrios Municipal de Olanchito (2016). Plan de Arbitrios Municipal de Arenal (2016-2018).

[2] CODEM (2007), *Plan de Prevención y Respuesta Casco Urbano Municipio de Olanchito, Yoro.*

Figure 5.81 National road network from San Pedro Sula to El Progreso

Note: Toll along National Road CA13 between San Pedro Sula and El Progreso, outside the Project Area.
Source: Google Earth, April 2017.

Figure 5.82 Municipal roads from Yoro to Olanchito

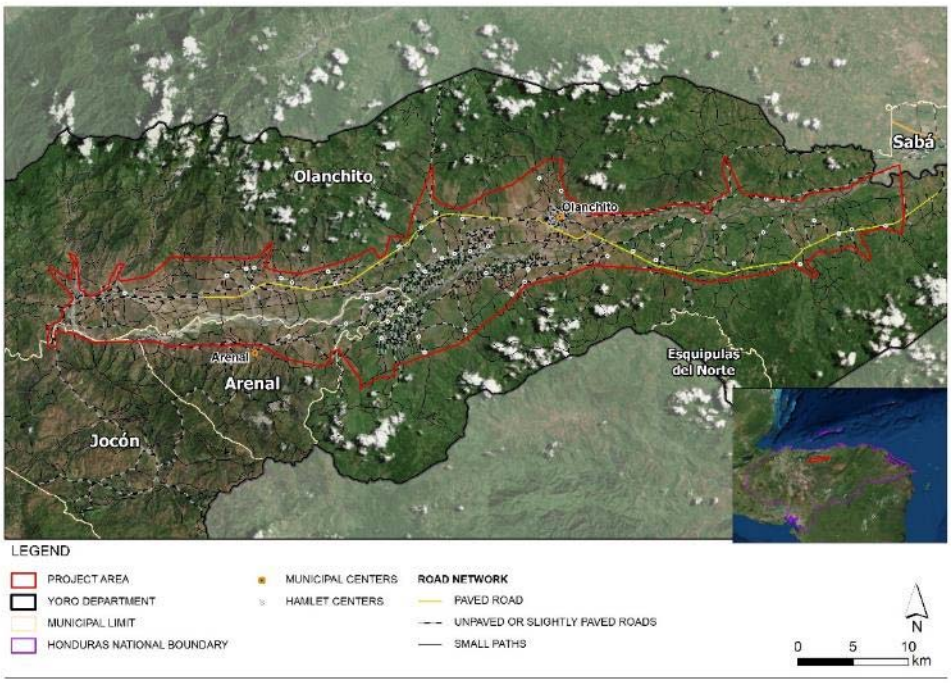
Note: Top pictures: unpaved road and river crossing near the hamlet of Las Delicias in the most eastern portion of the Project Area. Bottom picture: paved road near Palo Verde hamlet in the middle / eastern portion of the Project Area.
Source: Google Earth, January 2014 and August 2017.

As highlighted in the municipal development plans of Olanchito and Arenal, internal access roads and dirt roads tend to lack proper maintenance and appropriate paving and present deficiencies in terms of signage, landslides, and potholes. The road network in the area is also susceptible to flooding in the rainy season especially in the valley along the river.

Based on feedback from the municipality of Olanchito collected during the June 2018 field survey, improvements to the road network are planned, including the section between Yoro and Olanchito of the road leading to San Pedro Sula, as well as some sections of the road between Olanchito and Tegucigalpa.

The road network in the Project Area is presented in *Figure 5.83* below.

Figure 5.83 Road and transport infrastructure in the Project Area



Source: Prepared by ERM based on ICF, 2013

Access to healthcare

The most important centre is the area's public hospital located in Olanchito's urban centre, which provides health services to other municipalities in the department of Yoro, including Arenal. Olanchito and Arenal municipalities also count with additional health centres of the following categories:

- Dental Medical Centre (*Centros de Salud Médico Odontológico* or CESAMO)
- Rural Health Centre (*Centros de Salud Rural* or CESAR)
- Health centres with a permanent doctor
- Health centres only staffed with medical assistants

Table 5.42 below presents the health centres in Olanchito by category as of 2004.

Table 5.42 Health centres in Olanchito by category

CESAMO	**Health Centers with Permanent Doctors**
• CESAMO Olanchito • CESAMO El Carril (does not has an odontology service currently)	• *Juncal* • *Tepusteca*
CESAR	**Health Center with assistants only**
• *San Lorenzo* • *San José* • *Trojas Aldea* • *El Ocote* • *Amenia* • *Carbajales* • *24 de Mayor (City Center)*	• *La HIcaca* • *El Nace* • *Santa Bábara* • *El Terrero* • *San Francisco*

Source: Olanchito plan de desarrollo 2004-2020

In addition, according to a 2005 Institutional and Financial Diagnostic Report for Olanchito, seven (7) permanent doctors were present in the urban and rural areas of the municipality.[1] Considering a total population of 84,725 as per the 2001 census, this translates into a very low doctor per capita ratio of 0.083 out of 1,000.

More recent information collected during the field survey in June 2018 indicates that there are about 12 Rural Health Centres (CESAR) in total in the municipality of Olanchito located in hamlets with a population over 2,000 inhabitants. Private clinics are also present in Olanchito and provide general healthcare services.

As for Arenal, in line with information presented in the 2013 Municipal Development Plan, field survey interviews have confirmed that the municipality has two (2) CESARs and one (1) CESAMO.[2] The population of Arenal also has access to the Hospital located in Olanchito urban centre. One of the health centre is located in the urban centre of Arenal while the remaining two are in the rural areas.

Access to education

Based on data obtained through the official Education Statistics System online (*Sistema de Estadística Educativa)* Olanchito and Arenal have approximately 300 and 40 education establishments respectively. These centres are summarized in *Table 5.43* below.

[1] Institutional and Financial Diagnostic of the Municipality of Olanchito, 2005.

[2] Arenal Municipality Strategic Development Plan, July 2013.

Table 5.43 Education facilities per Municipality (2017)

Education Centres	Olanchito	Arenal
Pre-basic	146	9
Básic	50	4
Secondary (*Medio)*	18	1
Pre-basic Community Education Centers (*Centros Comunitarios de Educación Pre-Basica* or CCEPREB)	83	25
Superior (*Adulto)*	1	1
University	1	0
TOTAL	299	40

Source: Education Statistics System (*Sistema de Estadística Educativa*). 2017

The Regional University Centre of the Aguan Valley (*Centro Universitario Regional del Valle de Aguán* or CURVA) belonging to the Autonomous University of Honduras is also located in Olanchito's urban centre. CURVA specialises in agroindustry, dairy processing and livestock production, and microfinance.

5.5.13 Gender, security and human rights

This section describes the gender, security and Human Rights context in the Study Area. The Human Rights context in relation to working conditions and labour rights including child labour and forced labour are discussed in *Section 5.5.8*. Conflicts and Human Rights abuses related to land rights are also addressed in *Section 5.5.7*.

Gender context

According to the Law on Equal Opportunities adopted in 2000 by the Government of Honduras, the representation of women in elected positions should be of at least 30%. In the context of this Law, the SAG has implemented the Gender Equality Policy (*Politica de Equidad de Género*) in the agricultural sector. Awareness and institutional capacity building campaigns were carried out to disseminate gender policies among the different management and technical levels of the SAG and to coordinate the issue with civil society stakeholders.[1] In addition, based on CINSA & PAA Project Finance's preliminary assessment of 2017, The SAG has implemented productive development programmes and services for households in rural areas across the country that that are engaged in agriculture, with special emphasis on the participation of women who are household heads.

Despite these efforts, the participation of women in decision-making and their representation in elected positions remains low. In fact, in Olanchito, women

[1] SAG website. Accessed at: http://sag.gob.hn/acerca-de-la-sag/politicas/

only represent 25% of Water Boards members in 2016 which is still below the 30%.[1] Similarly, women's representation in the CRELs is reportedly around 10%. Women's representation in the livestock breeding and milk production sector is slightly higher with 15% of potential beneficiaries being women (see *Section 5.5.3*).

In the Project Area, the role of women as highlighted in the focus group discussion with small producers, is still mainly limited to the household. Some women are also employed in the large-scale banana plantations where they are involved in seeding and in packaging activities. No women are reportedly employed as farm labour.

Security context

Honduras together with El Salvador and Guatemala present the highest crime and violence rates in Latin America. The main causes that lie behind the violence in the region are drug trafficking, youth violence, gangs and the availability of firearms and weak justice institutions.[2] The rate of homicides in Honduras increased by 55.8 points from 30.7 out of 100,000 inhabitants in 2004 to 86.5 out of 100,000 in 2011.[3]

Homicide rates in the Study Area for 2016 are shown in the *Table 5.44* below.

Table 5.44 Homicide rates per 100,000 in Olanchito and Arenal as of December 2016

	Cases	Homicide Rate
Olanchito municipality	64	58
Arenal municipality	4	66.9
Olachito and Arenal (combined)	68	62
Department (Yoro)	420	70.5
National Total	5,150	59.1

Source: National Bolletin of the Violence Observatory (*Observatorio de la Violencia)*, National Autonomous University of Honduras, (December 2016). Modified by ERM (2018).

Although, homicide rates for Olanchito and Arenal are below the department rate, compared to the national level, the average rate of 62 per 100,000 for both municipalities is higher than the national rate.

In terms of security arrangements, security is managed by the police forces based out of six police stations with a total of 25 agents and 3 patrol vehicles. Citizen Security Committees (*Comités de Seguridad Ciudadana)* have been created at the community levels to support the police posts in patrolling and maintaining public order.[4]

[1] CONASA (2016), *Diagnóstico y Análisis del Sector Agua y Saneamiento Rural*, Municipio de Olanchito.

[2] Crime and Violence in Central America. A Challenge for Development. 2011. World Bank. LAC. Accessed at: http://siteresources.worldbank.org/INTLAC/Resources

[3] Bulletin of the Observatory of Violence UNAH. January to December 2011

[44] *Diagnostico Institucional y Financiero, Municipalidad de Olanchito*, Septiembre 2005.

Based on feedback collected from potential beneficiaries and the SAGO during the field survey in June 2018, farmers and livestock breeders do not employ any security for their farms, and no cases of abuse by law enforcement were reported in the Study Area. In addition, as stated in *Chapter 3*, no arrangement between the Project and police forces or security providers is planned.

5.5.14 Archaeological and cultural heritage

Based on the preliminary assessment conducted by CINSA and PAA Project Finance in 2017, the national Forestry Conservation Institute (*Instituto de Conservación y Desarrollo Forestal* or ICF) did not report the existence of any archaeological protected sites in the Project Area. Nevertheless, considering the high potential of the area, a high level archaeological and cultural heritage baseline overview has been included in this baseline chapter. Note that no cultural heritage specific data was collected during the field survey. Most of the information presented in this section is based on "The archaeology of the Mosquitia" by Chris Begley.[1]

Honduras dating periods

- *Period I (up to 8000 BC):* The earliest period with traces of human activity known from Central America. Only the site of Cueva del Gigante has yielded dates from this period.
- *Period II (8000-4000 BC):* This period, the equivalent to the Mesoamerican early and middle Archaic, is when the Cueva del Gigante shows plant remains that include squashes and beans.
- *Period III (4000-1000 BC):* Pollen cores from the Copan Valley and Lake Yojoa suggest the landscape changed due to the cultivation of maize for the first time. At Copan, Los Naranjos, and Puerto Escondido, the earliest remains of villages known in Honduras have been documented.
- *Early Period IV (1000-300 BC):* This period sees villages emerge across Honduras along with a distinctive material culture. Figurines in the 'Playa de los Muertos' style emerge in the lower Ulua valley, while burial shrines in caves are found in the Copan, Cuyamel and Aguan valleys. There are clear connections with the Olmec culture on the Mexican Gulf Coast suggesting long distance trading connections. The earliest form of monumental architecture is seen in the form of tall broad earthen platforms (as seen at Los Naranjos and Yarumela).
- *Late Period IV (300 BC- AD 500):* Corresponding to the Maya Late Preclassic and Early Classic, Usulutan resist pottery decoration emerges concentrated in western Honduras and El Salvador. Many settlement sites from this period are found under later period sites demonstrating continuous occupation. In places earthen platforms were also built but smaller than before(Rio Pelo). Towards the end of

[1] www.archaeomosquitia.wordpress.com

this period, Copan developed its distinctive style of public architecture and monuments.

- *Period V (AD 500-1000):* Corresponding to the Maya Middle Classic, Late Classic, and Terminal Classic, this is when most houses were built on raised stone platforms. Ballcourts are found in sites from Copan (to the west) to Mosquitia to the east. The people made and used a variety of painted polychrome pots, including Chamelecon Polychrome, Ulua Polychrome, Sulaco Polychrome, Cancique Polychrome, and more. In the lower Ulua Valley, Ulua Marble Vases were produced from local marble sources, transported to Uaxactun in the north and Costa Rica in the south. In Salitron Viejo in the Sulaco Valley, local production of jade took place, traded into Yucatan and down to Costa Rica. The period is when Copan's rulers reached its height of power. In each area where extensive settlement pattern studies have taken place, one site seems to be larger and tries to exercise more power in the last part of this period: La Sierra in the Naco Valley; Cerro Palenque in the lower Ulua Valley; Tenampua in the Comayagua Valley; and Salitron Viejo in the Sulaco Valley.
- *Period VI (AD 1000-1550):* This corresponds to the Myan Postclassic period. At the beginning many existing sites decline in size or are abandoned. Newly establishes sites are harder to identify. In eastern Honduras, this is the period when new incised kinds of pottery, the Cocal style, is found throughout. Sites are easily identified based on this new pottery. In western Honduras, people stopped using polychrome painted pottery for everyday use, so two new polychrome styles – Las Vegas Polychrome and Bay Islands Polychrome– are rare finds, usually seen in tombs or caches. Unslipped and red-slipped everyday pottery looks a lot like that used in earlier periods. New technology (copper metal working) and imported ceramics (Tohil Plumbate, from Mexico-Guatemala) are seen from this period. Towards the end of the fourteenth century, new painted pottery, red on white slipped or red and black on white slipped, is found in a few sites that were still occupied when the first Spanish arrived in Honduras. Spanish colonial control begins to be exerted in the 1520s, and by the 1550s has changed conditions across much of the country.

Overview of the archaeology of Eastern Honduras

Human occupation in eastern Honduras can be traced back 3,000 years, when linguistic evidence suggests Macro-Chibchan speakers from Lower Central America or northern South America migrated northward (Hasemann 1991: 50). The oldest known human remains in eastern Honduras come from burial sites within caves.

Some of the earliest evidence of human occupation in Honduras comes from the Aguan Valley, such as the Cuyamel Caves, which are located in the hills that separate Trujillo from the Aguan River, towards the eastern end of the Aguan Valley (outside the Project Area). The Cuyamel caves in the Aguan Valley have been dated to 1000-300 BC (Period IV), while the Talgua Cave,

near Catacamas, have been dated to 980-800 BC (Brady et al. 1995: 39). These may represent the remains of the first humans who migrated into the area. Recent research suggests these initial populations subsisted in root-cropping rather than maize (Brady et al. 1995).

Pottery recovered from the Cuyamel Caves, show decorative motifs suggestive of contact with the Olmec, (Healy 1974, 1984a). The Cuyamel and Talgua Caves may represent two distinct populations. No open-air sites dating to the same period have been identified.

The first settlements date to around AD 300 (Period IV), from the Selin Farm site (Healy 1984a: 136). The emergence of many open-air settlement sites may indicate a substantial increase in population. These early sites appear to be residential with no civic-ceremonial architecture (Begley).

The earliest evidence of complex societies occurs between AD 250 – 600, as is evidenced from sites at Altas de Subirana and Wankybila on the Patuca river. Pottery types, vertical strap handles and manatee lugs, are common at the enormous sites of Dos Quebradas and San Marcos near Catacamas, which reportedly contain mounds over 10 meters in height.

The earliest evidence of complexity shows some element of contact with Mesoamerica, evident in the formal, orthogonal site plans and in imported materials (obsidian). This early interaction with northern groups focuses on elite paraphernalia and symbols (jade, obsidian) and templates for public buildings (Begley).

Maize first appears around AD 600 to 900, dated through association with ceramics found from a cave near the Talgua Village. It is unsure as to what extant this changed the local diet. Stable isotope analysis from an individual from a Period V (AD 500-1000) context in the Talgua cave showed little maize in the diet (Brady et al. 1998).

At the start of Period VI a change appears in the archaeological record, which may be related to the Maya 'collapse'. The eastern Honduras cultures began to show less connections to the north, and began to resemble those from the south. Large public constructions were organized in ways not seen elsewhere. It has been suggested that this period represents the height of civilisation for Eastern Honduras. Most large sites such as Rio Claro are primarily Period VI but areas of eastern Honduras, (such as the lower Paulaya drainage) remain temporally undefined.

Many of the large sites in eastern Honduras are associated with an elaborate stone carving tradition which includes large, intricately-carved metates (grinding stones for maize). Several sites in eastern Honduras with large quantities of metates have a Period V component and some, like the Upper Group of Marañones, have no Period VI component. The tradition of elaborate stoneworking continued in eastern Honduras after its decline in the south at the end of Period V (AD 800-1000 – Epstein, 1957 and Healy 1983, 1984a).

There appears to have been a widespread demographic collapse of the population in Honduras during Period VI, affecting western and central Honduras (Healy 1984a; Hirth 1989; Messenger 1991). Eastern Honduran populations do not show this collapse, however. Many of the larger sites appear to have been abandoned by the time the Spanish arrived. However early Spanish chroniclers reported large communities that declined in less than 100 years.

No archaeological site has yet been identified with these large villages described by the Spanish, although there have been suggestions that the site of Rio Claro in the Aguan Valley may be the village of Chapagua, the centre of one recorded civilisation (Healy 1984a: 153).

One possible reason for the lack of late Period VI sites may involve a change in architectural style. It is possible construction of platform mounds declined. Sites in the vicinity of Olanchito may be late Period VI (AD 1000-1550) but contain little visible architecture, despite large artifact scatters (Begley). A non-mounded site near Trujillo may be one of the large settlements mentioned by conquistador Cortes (Begley).

Architecture

Eastern Honduras sites typically consist of rectangular plazas, rectangular structures, and ball courts. This is similar to sites in Mesoamerica. Further south, towards south-eastern Nicaragua and into Costa Rica, rectangular mounds are replaced by round ones, and the orthogonal, Mesoamerican planning is not found. The architecture of Eastern Honduras is distinctive. Most mounds are either cobble covered or have no stone at all. Some have vertical retaining walls, but always of unmodified cobbles (almost always river cobbles). Preservation is very good, until forest cover is cleared and agriculture quickly erode the features (Begley).

As stated above, known sites in the wider area of Eastern Honduras include the Cuyamel caves (where evidence for the earliest humans in Honduras has been found) and Rio Claro to the east.

Many archaeological sites in eastern Honduras are currently inhabited. It is common to find stone sculptures in modern villages, often incorporated into the architecture.

Archaeological sites within the Project Area

The Project Area contains a number of known archaeological sites, such as Puerto Escondido, located south of Olanchito town. It was occupied from 900BC to 1000AD and the buildings found appear to have been large farmsteads rather than substantial public buildings. In fact, many early sites are under or beside existing settlements, such as at Olanchito as described previously.

As such, the area can be regarded as having a high archaeological potential. Archaeological work in Eastern Honduras has shown that sites (houses rather than towns) and artefacts (pottery, carved stone) are often found in abundance. In addition, as farming, particularly of Maize, goes back to AD600, the fields would have seen human interventions since then.

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6 IMPACT ASSESSMENT METHODOLOGY

6.1 INTRODUCTION

This chapter presents the methodology for assessing potential environmental, social and health impacts that may result from both routine and non-routine (unplanned events) Project activities throughout its lifecycle (pre-operation phase, operation phase and abandonment phase).

6.2 IMPACT ASSESSMENT METHODOLOGY

The methodology employed in the environmental, social and health impact assessment was prepared in accordance with the *ERM Impact Assessment Standard v1.1* (2012). *Box 6.1* presents the ERM Impact Assessment Approach which is aligned with international best practices.

Box 6.1 ERM Impact Assessment Approach

A project can have potential significant impacts on a wide range of environmental, social and health receptors. The importance or significance of these impacts depends upon a number of factors, principally the level of magnitude of the impact and secondly the sensitivity of a receptor to be affected by the impact. It is therefore important to:

- Identify those processes or actions which will lead to an impact (i.e., a change in the environment) and evaluate the magnitude of this change; and,
- Identify any environmental receptors upon which the impacts may act and evaluate their sensitivity.

The significance of the impact is determined by comparing, wherever possible, against accepted company, national or international standards. If no standards are available then it is necessary to develop project-specific limits, based on guidance or experience, as necessary. Such standards or limits are referred to as the significance threshold. Wherever possible the significance thresholds are based on a measurable value and compared with a legal, policy or guideline value.

If the size and type of the impact is greater than the significance threshold, this is then termed a significant impact, which is further defined as high, moderate or low. A significant impact may be broadly defined as one which should be brought to the attention of those involved in the decision-making process and therefore any significant impacts identified must be reported in the ESIA Report and, wherever possible, avoided or mitigated to reduce them to an acceptable level.

6.2.1 *Identification and characterisation of impacts*

The first step in impact identification is to identify the various activities associated with the project, as well as the environmental, social and health resources and receptors. The relevant project activities and baseline information have been collated and are presented in *Chapter* ***¡Error! No se***

encuentra el origen de la referencia.and *Chapter* ***¡Error! No se encuentra el origen de la referencia.*** respectively.

The following exercise serves to screen potential impacts. An 'impact identification' matrix identifies and scopes the predicted interactions between project activities, environmental and socioeconomic resources, and receptors. The identification matrix is presented in *Section 6.3* below.

Once the screening exercise is complete and the potential preliminary impacts have been identified, the next step in the impact assessment is to define the characteristics of each impact. ERM's impact assessment uses a set of standards that are detailed in *Table 6.1*.

Table 6.1 Impact Definitions

Characteristics	Definition	Designation
Type	A descriptor indicating the relationship of the impact to the project (in terms of cause and effect)	Direct/Indirect/Induced
Extent	The "reach" of the impact (e.g., confined to a small area around the project, or projected for several kilometres)	Local/Regional/International
Duration	The time period over which a resource or receptor will be affected	Temporary/Short-term/ Long-term/Permanent
Frequency	A measure of the constancy or periodicity of the impact	(no fixed designations; intended to be a numerical value)

The following criteria are used in the current assessment in order to assign a consequence/magnitude to potential impacts.

Table 6.2 Criteria for magnitude of impacts

Magnitude	Description of Adverse Consequence	Description of Beneficial Consequence
Large	Loss of resource and/or quality and integrity; severe damage to key characteristics, features or elements.	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality.
Medium	Significant impact on the resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Small	Some measurable change in quality or vulnerability; minor loss of, or alteration to, one or more key characteristics, features or elements.	Minor benefit to, or addition of, one or more key characteristics, features or elements; some beneficial impact on an attribute or a reduced risk of negative impact occurring.
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements	Very minor benefit to or positive addition of one or more characteristics, features or elements

6.2.2 *Receptor sensitivity characterisation*

Sensitive receptors can be defined as:

- elements of the environment that are of value to the functioning of natural or human systems (i.e., areas or elements of ecological, landscape or heritage value, soil and sediment, air and water bodies);
- human receptors, such as people (i.e., users of dwellings, places of recreation or worship, places of employment and community facilities), and human systems (e.g., the employment market).

The environmental value (or sensitivity) of the receptors identified is defined using the criteria in *Table 6.3*.

Table 6.3 Sensitivity Value of Receptors

Value / Sensitivity	Description of Value
International/ High Sensitivity	Highly important and rare on an international scale with limited potential for substitution (e.g., international fresh water aquifer).
National/ Medium sensitivity	Highly important and rare on a national scale with limited potential for substitution (e.g., residential receptor).
Local/ Low sensitivity	Low or medium importance and rarity, local scale.

6.2.3 *Impact significance assessment*

Once the magnitude of impact and the sensitivity of the resource/receptor have been characterised, significance is assigned for each impact.

The current assessment uses a matrix to determine the significance of an impact which is presented in **¡Error! No se encuentra el origen de la referencia.**. Significance is therefore a function of the value or sensitivity of the receptor being considered, as defined in *Table 6.3* and in *Table 6.2*.

As mentioned in *Chapter 4*, since 2016, various meetings and field survey activities have been undertaken in the Project Area in order to identify and anticipate potential effects on the environmental and social receptors as a result of the planned Project activities. The observations and results of these meetings and field survey activities have been summarised throughout *Chapter 4 and Chapter 5*.

Furthermore, impact prediction and evaluation have taken into account any embedded controls (i.e., physical or procedural controls that are already planned as part of the Project design, regardless of the results of the impact assessment process). An example of an embedded control is for example the inclusion of water meters in the irrigation system to ensure water extraction can be monitored.

Figure 6.1 *Impact significance matrix*

		Sensitivity / Vulnerability / Importance of Resource/ Receptor		
		Low	**Medium**	**High**
Magnitude of Impact	**Negligible**	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

6.2.4 *Unplanned events significance assessment*

Impacts resulting from unplanned events are different to impacts that would reasonably be predicted to occur in the normal course of venting and decommissioning activities.

The methodology for evaluating impacts resulting from unplanned events is slightly different and the impact magnitude includes the likelihood of the event occurring. The impacts / risks will be assessed as follows:

1. *Identification of potential risks*: The identification of risks will be based on potential Source-Pathway-Receptor (S-P-R) linkages.
2. *Estimation of probability of the risk being realised (or event happening)*: Likelihood is determined based on professional judgement, as well as quantitative information (statistical frequency) where available.
3. *Identification of consequences*.
4. *Estimation of the impact risk significance*.

Table 6.4 *Probability scale for an unplanned events*

Likelihood	Descriptor	Comment/clarification
High	Repeated occurrences expected	Very likely to occur in the short term and almost certain to occur over the long term. Repeated occurrences expected based on experience in comparable industries. Where no comparable industry experience is available, a cautious approach will typically be adopted to allow for uncertainty.
Medium	Can be expected to occur several times per year	An event is possible, but not inevitable, in the short term, and likely over the long term.
Low	Infrequent occurrence	An occurrence is by no means certain in the long term and less likely in the shorter term. May have been reported in the past in other similar industries.
Very low	Rarely encountered, never reported, or highly unlikely	It is improbable that an event would occur even in the long term. Very few, if any, industry examples are available.

Table 6.5 Consequence scale for an unplanned event

Consequence	Descriptor	Comment/clarifications
High	A major environmental incident resulting in significant damage to the environment and/or harm to human health.	Irreversible adverse change to an ecological receptor. Short term (acute) risk to human health likely to result in "significant harm".
Medium	Moderate, localised effect on people and/or the environment in the vicinity of the incident.	Moderate effect on a sensitive water resource characterised by a breach in a regulatory standard. A significant effect on an ecological receptor or ecosystem.
Low	Minor environmental effect that may breach a regulatory standard but is confined to the point of release with no significant impact on the environment or human health.	No effect on a highly sensitive receptor (for example a groundwater source).
Very low	Slight environmental effect that does not exceed a regulatory standard.	No detectable effect on human health or the environment.

Figure 6.1 Impact risk significance matrix

Probability					
	High	Very Low	Medium	High	High
	Medium	Very Low	Medium	Medium	High
	Low	Very Low	Low	Medium	Medium
	Very Low	Very Low	Low	Low	Medium
		Very Low	Low	Medium	High
		Consequence			

Table 6.6 Description of impact risk significance and required action for unplanned events

Risk magnitude	Description/action
High	There is a high to medium probability that a pathway exists through which the source may reach the receptor and result in significant adverse effect to a sensitive receptor, or evidence exists of a significant adverse effect on the receptor. Additional mitigation is a priority and may include further investigation to understand and, if appropriate, reassess the significance of the risk.
Medium	Risks must be acted upon, but only if measures are not sufficient to reduce risks as to be ALARP (As Low as Reasonable Practical) as they do not pose such an immediate threat. The project can therefore continue while risk response measures are integrated and/or performed. Additional mitigation may be required that may include further investigation to understand and, if appropriate, reassess the significance of the risk.
Low	Risks may not require an additional response – it may be enough simply to monitor the risk to ensure that it does not arise during the project.
Very Low	Usually scoped out of the assessment in earlier phases.

Given the nature of the Project activities, unplanned -events will be limited to accidental spills or leaks of fuels or wastes due to the operation of the Project irrigation equipment, drilling vehicles and/or due to an inappropriate handling or storage of pollutant materials.

6.2.5 *Identification of Mitigation and Enhancement Measures*

A key objective of the ESIA is to identify mitigation measures for all significant negative impacts on the environmental, socioeconomic, and health resources and receptors, and determine the potential residual impact after their implementation.

Recommended mitigation measures have been identified and follow a mitigation hierarchy as shown in *Figure 6.2*. Mitigation is clearly described for all significant environmental and social impacts to a level appropriate for the stage of project development.

Figure 6.2 *Mitigation Hierarchy*

- **Avoid at Source; Reduce at Source:** avoiding or reducing at source through the design of the Project (e.g., avoiding by siting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity).
- **Abate on Site:** add something to the design to abate the impact (e.g., pollution control equipment, traffic controls, perimeter screening and landscaping).
- **Abate at Receptor:** if an impact cannot be abated on-site then control measures can be implemented off-site (e.g., noise barriers to reduce noise impact at a nearby residence or fencing to prevent animals straying onto the site).
- **Repair or Remedy**: some impacts involve unavoidable damage to a resource (e.g. agricultural land and forestry due to creating access, work camps or materials storage areas) and these impacts can be addressed through repair, restoration or reinstatement measures.
- **Compensate in Kind; Compensate Through Other Means:** where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g., planting to replace damaged vegetation, financial compensation for damaged crops or providing community facilities for loss of fisheries access, recreation and amenity space).

6.3 *IMPACT IDENTIFICATION MATRIX*

The impact identification matrix identifies the predicted interactions between project activities and environmental/socioeconomic resources and receptors. The impact identification matrix is presented in *Figure 6.3,* below.

Each marked cell on the impact matrix represents a potential interaction between a project activity and an environmental or social receptor or resource (i.e., potential impact).

Shaded cells in the matrix indicate no primary effect or an absence of the resources in the general area. These interactions have not been included in the detailed impact assessment (*Chapter 7*), as their impact is considered non-existent or negligible (i.e., they are not expected to lead to a significant impact). A detailed justification for scoping out of impacts is provided in *Table 6.7* below.

Figure 6.3 Impact Matrix Identification

	RECEPTORS														
	Physical							Biological Environment		Social					
	Climate	Air Quality	Noise	Topography and Geology	Soils	Surface Water Sources	Groundwater Sources	Biodiversity (habitats, flora and fauna)	Protected areas	Economy and Employment	Land and Livelihoods	Labour Rights and Workers' Health and Safety	Community Health, and Safety	Infrastructure and Services	Community Cohesion
Routine activities															
Pre-operation phase															
Delivery of the Project irrigation equipment and accessories (transport and associated logistics) and storage of the Project irrigation equipment												OHS1			
Selection of beneficiaries, signing of contracts, payment of fee										EE2	LL2				
Training delivery to SAG technicians and/or personnel designated by the SAG and to Project beneficiaires										EE1					
Operation phase															
Collection and transport of Project irrigation equipment to beneficiary land															
Beneficiary procurement of submerssible water pumps and water tanks										EE2					
Conditioning of beneficiary land (drilling of water well / construction of artesian well, and additional works related to the proper installation of Project equipment such as buried irrigation network)										EE3		OHS2			
Irrigation equipment operation and maintenance	CA1	CA1	N1		S1	SW1, SW2, SW3	GW1, GW2, GW3	B1, B2, B3	PA1	EE4, EE5	LL1, LL3, LL4	OHS3, OHS4	CHS1, CHS2	CHS3	CC1
Abandonment phase															
Irrigation equipment abandonment, water well abandonment and/or irrgated land abandonment															
Non-routine events															
Non-routine events related to accidental spills or leaks of fuels or wastes							Acc.1								

Source: ERM, 2018

Table 6.7 Justification of non-existent and non-significant impacts

Interactions between Project activity and receptors		Justification of non-significant impact
Project activity	**Receptor**	
Delivery of the Project irrigation equipment and accessories (transport and associated logistics during pre-operation phase)	Climate change and air quality	• The transport of the Project irrigation equipment will be undertaken progressively, during an overall and non-continuous period of approximately 15 months. • The transport by truck of the containers, containing the Project irrigation equipment once delivered to Honduras, will be equivalent to other vehicles movement in the Project Area, such as vehicles and agricultural machinery. • Emissions of air pollutants and GHGs due to the transport required for the delivery of equipment will not add a significant emission in comparison with the existing sources of air pollutants and GHGs in the Project Area. • Considering the existing vehicle movement and the progressive and non-continuous transport of equipment, the potential effects of the pre-operation phase in the climate and air quality are considered not significant.
	Acoustic environment	• As for the previous receptor (climate change and air quality), the transport of the Project irrigation equipment will be equivalent to other vehicles movement in the Project Area, such as vehicles and agricultural machinery. • Emission of noise due to the transport required for the delivery of equipment will not add a significant emission in comparison with the existing sources of noise in the Project Area. • Considering the existing vehicle movement and the progressive and non-continuous transport of equipment, the potential effects of the pre-operation phase in the acoustic environment are considered not significant.
	Economy and Employment	• Considering that the delivery and transport of the equipment to the SAGO warehouse in Olanchito will be gradual and non-continuous over a period of approximately 15 months, the number of workers to employ is negligible since the same individuals can perform the activity repeated times. • Note however that the number of batches for equipment delivery and the number of transports is unknown.
	Road infrastructure and traffic	• Reception and transport of equipment to the SAGO warehouse in Olanchito will be progressive and will occur over a 15-month period in a non-continuous manner. • As such, potential impacts on road infrastructure and road traffic is not considered significant and is therefore scoped out.
Collection and transport of Project irrigation equipment to beneficiary land. **Conditioning of beneficiary land** **Irrigation equipment operation and maintenance**	Road infrastructure and traffic	• The assignation and retrieval of the kits will take place progressively over a period of 15 to 20 months. • It is assumed that no more than one vehicle per kit is required. • As such, the potential on the road infrastructure and traffic from equipment pick-up and transport to the beneficiaries' land is not significant and is therefore scoped out.

Interactions between Project activity and receptors		Justification of non-significant impact
Project activity	**Receptor**	
	Topography and geology	• Project activities limited to, where applicable, the conditioning water source supply and the installation and operation of the Project irrigation system. These activities are standard ones within the irrigation projects, which are a common practice in the agriculture sector worldwide. • Absence of any earth movement activities. • Main project interaction results from the drilling of groundwater wells on the land of the beneficiaries that require it. However, standard drilling activities at shallow depths (no deeper than 80 m) for the installation of groundwater wells do not represent any impact to the substrate (geology). • Considering that no earth movement activities will be necessary and that the drilling of groundwater wells where necessary will not impact the substrate, potential effects on the topography and geology are considered not existent.
	Groundwater resources downstream of Project Area	• The annual decrease in groundwater calculated for the Project Area in the worst-case scenario assuming a stationary aquifer is of 0.5 meters, which is minimal. • In the area downstream of the Project Area, precipitation levels are higher which implies higher recharge levels and therefore a negligible decrease. • As potential impacts on groundwater levels downstream of the Project Area are insignificant, related impacts on farmers and producers and indigenous land of the Garífuna tribe located downstream are also expected to be insignificant and therefore scoped out.

Interactions between Project activity and receptors		Justification of non-significant impact
Project activity	**Receptor**	
Irrigation equipment abandonment, groundwater well abandonment and/or irrigated land abandonment	Groundwater resources	• The abandonment phase includes the abandonment of the irrigation system, which may involve as well the abandonment of the irrigated land and the abandonment of the groundwater well in case this was the water source of the beneficiary during operations. • Past the 10 years of operation, once the life expectancy of the irrigation equipment is achieved, the beneficiary can either continue with the operation through a change of equipment or abandon the irrigation equipment. This abandonment is considered unlikely in the short term, due to the expected economic benefits of the irrigation system. • Similarly, groundwater wells are beneficial to land owners, their abandonment in the event the beneficiary decides to abandon the Project irrigation equipment is considered even more unlikely. • Shall the abandonment of the irrigation system occur, it following convenient procedures, in particular regarding the closure of the groundwater well, in order to avoid any potential affection to the groundwater from potential contamination sources located in the surface, near the groundwater well would be an efficient mitigation. For that purpose the Project's design involves the delivery of trainings to the beneficiaries including training on good environmental practices. • The SAG will be responsible for monitoring of the correct implementation and management of environmental measures related to the abandonment activities. • Considering the previous points potential effects of the abandonment activities are considered not significant.
	Economy and Employment	• As stated above, the abandonment is considered unlikely in the short term, due to the expected economic benefits of the irrigation system. • The abandonment phase includes the abandonment of the irrigation system, which may imply a return to baseline conditions in terms of irrigation during the dry season, including with respect to the labour needed during the dry season. The number of permanent farm workers may therefore be decreased to pre-Project levels and temporary labour increased during the rainy season. • The Project's design involves the delivery of trainings to the beneficiaries including training on good social practices aimed to ensure that beneficiaries implement these throughout the Project's lifetime. • The SAG will be responsible for monitoring the correct implementation and management of environmental and social measures related to the abandonment activities, including proper employment termination measures such as prior notice, etc. • Considering that the likelihood of abandonment is low, and that the beneficiaries will have received training applicable to abandonment activities and that the correct abandonment of activities and related labour changes will be monitored, potential effects of the abandonment activities on employment are considered not significant.

Source: ERM, 2018

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7 ASSESSMENT OF ENVIRONMENTAL AND SOCIAL IMPACTS

7.1 INTRODUCTION

This section identifies and assesses the environmental and socioeconomic impacts and risks of the Project as well as detailing of any proposed mitigation measures. The assessment has been undertaken as per the method presented in *Chapter 6*.

The residual impacts and risks are assessed taking into account the implementation of the mitigation measures. These are either embedded in the Project Design, i.e., the delivery of a training programme for the beneficiaries, or are additionally identified as a result of the assessment. The latter measures will need to be detailed and implemented in the final Project design and/or Environmental and Social procedures and plans.

Potentially relevant sources of impacts and risks have been screened[1] and identified in the previous sections of this ESIA, in particular *Chapters 3, 4, and 5* as well as *Chapter 6*. These chapters have established:

- the technical, spatial and temporal scope assessed in the ESIA;
- the relevant interactions between Project activities and the receiving environments (physical, biological, and social); and
- the impact identification matrix of anticipated regular, cumulative, and unplanned impacts associated with the Project.

The temporal scope of the ESIA covers the three main phases of the Project:

- Pre-operation
- Operation
- Abandonment

The duration of the activities within each of these three phases is described in *Chapter 3 - Project Description and Alternatives* and each has its own environmental and socioeconomic impacts, and risk potential.

As previously established, impacts in the following sections are described and assessed according to the receptor they affect (see *Chapter 5 - Baseline Description* for details on the potential receptors, their importance, and values and sensitivities towards Project activities).

The Project Area is described in *Section 3.2*. It covers the Alto Aguan River Valley, representing a total surface area of 60,000 ha. The ESIA corresponds spatially to the Study Area, defined as the area where direct or indirect impacts might occur due to the Project activities. It is considered that for most

[1] A detailed account of scoped-out impacts including justification is presented in *Table 6.7* in *Section 6.3*. This is the result of a careful scoping assessment process.

receptors the area of influence will correspond to the Project Area. However, in some cases, the area of influence might vary. The specifics of these cases are also included.

Risks and impacts resulting from accidental events and their mitigation are assessed in *Section 7.14*. Cumulative impacts arising from the combination of activities associated with the Aguan Irrigation Project, together with other third party developments or projects in the same area of influence, are assessed in *Section 7.15*.

Each impact assessment discussion is presented in a systematic manner detailing the following:

- *Likely impacts* – describing the magnitudes of the impacts;
- *Foreseen mitigation* - the key mitigation measures adopted as well as a discussion of the various mitigation alternatives considered; and
- *Evaluation of the significance of residual impacts* – an indication as to the significance of the residual impacts and whether this will be minor, moderate, major, or critical.

7.2 CLIMATE AND AIR QUALITY

7.2.1 Overview

This section assesses the potential impacts on climate and air quality as a result of the Project activities. *Box 7.1* presents the key sources of impacts, potentially impacted receptors, baseline, and factors influencing the project.

Box 7.1 Key Considerations for Assessment - Air Quality and Climate change

Sources of Impact

- Operation and maintenance of irrigation equipment

Potentially Impacted Receptors

- Climate change
- Air quality
- Other receptors potentially impacted by effects on climate and air quality are flora and fauna (see *Section 7.6*) and Community Health (see *Section 7.13*).

Particular Baseline Conditions that Potentially Influence Impacts

- Low contribution of Honduras to global climate change.
- High sensitivity of Honduras to global climate change.
- GHG emissions in Honduras are 3,749.83 Gg CO_2 equivalent (data from UN website, 2010).
- Scarce information on air quality in Honduras.
- Overall, poor air quality conditions in urban areas, due to emissions from urban transport, dust in the streets (unpaved streets), and lime and brick plants operating in urban surroundings.
- Rural areas also face air quality problems, due to forest fires and agricultural burning, which produce emissions of suspended particles.

Project Factors that Potentially Influence Impacts

- The Project will provide irrigation to about 3,110 ha within the Project Area which covers a total surface of about 60,000 ha.
- Emissions of exhaust gases into the atmosphere from motor pumps&generators will be temporary only: irrigation will only be required during 3.5 months in the dry season (from January to April), and probably for 3-4 days / week, rather than on daily basis.
- 311 Motor pumps/generators are expected to be distributed
- Each motor pump will consume approximately 3.8 l/h of diesel.
- The life expectancy of a motor pump is about 10,000 h.
- The operations phase is estimated to be 10 years.
- Considering the motor pumps expected to be distributed and a maximum irrigation rate of 20 h/day for 3.5 months per year, the maximum fuel consumption is approximately 2,500 m^3/year.

References

- Chapter 3 Project Description and Alternatives – specifically *Section 3.1*, *Section 3.5*, *Section 3.6.1* and *Section 3.6.2*.
- Chapter 5 Baseline Description – specifically *Section 5.2.1* and *Section 5.2.2*.

Source: ERM, 2018

Table 7.1 presents the key impacts of the Project on air quality and climate change.

Table 7.1 Key Potential Impacts –Air Quality and Climate change

Pre-operation phase	Operation phase	Abandonment phase
None	• CA1 – Emissions of air pollutants and GHGs potentially affecting air quality and climate change	None

Source: ERM, 2018

7.2.2 Operation phase

Potential impacts

CA1 – Emissions of air pollutants and GHGs potentially affecting air quality and climate change

The operation and maintenance of the irrigation equipment involves the consumption of fuel (diesel) by the motor pumps/generators distributing the water from the water source to the irrigation network at 10 l/s and a pressure of 8 bars.

See *Box 7.1* for key considerations on baseline conditions and project factors that can potentially influence the impact.

The combustion of fuel (diesel)[1] results mostly in carbon dioxide (CO_2) and water vapour (H_2O). However, due to inefficiencies in the fuel (diesel) combustion process within the engine, some other chemical products are emitted in minor proportions: carbon monoxide (CO), unburned hydrocarbons (HC), nitrogen oxides (NO_x), volatile organic compounds (VOCs), and particulate matter (PM).

Some of these chemical products (CO, HC, NOx, VOCs, and PM) are pollutants, which can potentially affect the air quality. Additionally, CO_2, although not a pollutant, is a GHG. Therefore, the CO_2 emitted due to the combustion of fuel (diesel) can potentially affect climate change, due to its GHG properties.

In terms of air quality, the emissions will be an immediate effect of the operation of the irrigation equipment, affecting the Project Area throughout the operation phase, which is estimated to be 10 years taking into account the life expectancy of the equipment.

[1] https://www.dieselnet.com/standards/eu/fuel_reference.php

However, it must be considered that the motor pumps/generators will not be functioning continuously. They will only operate when the irrigation system is required, which will be limited to 3.5 months in the dry season (from January to April). No further emissions will occur outside the dry season, when due to the typical rainfall pattern, the farmer is not expected to operate the irrigation system. In addition to this, it is unlikely that the irrigation will be required every day during the dry season. A scenario where the irrigation is applied on 3-4 days / week is considered more realistic.

In addition, the Training Programme embedded into the Project design will provide technical training on the adequate use and maintenance of the irrigation equipment. This will contribute to minimizing the use of the motor pumps as much as feasible, and consequently, their emissions of air pollutants.

The motor pumps/generators have an engine power limited to 42 HP. This is small if compared with the engine of a small car (e.g., 90 HP) or the engine of a truck (e.g., 300 HP)[1]. Therefore, the consumption and emissions of each motor pump are smaller than those produced by a standard vehicle.

The Project Area covers a surface area of about 60,000 ha. Considering the number of motor pumps/generators to be distributed within the Project Area is 311, the average distribution will be approximately one pump/generator for every 10 ha in the Project Area. In addition to this, since the aim of the Project is to distribute as many irrigation systems to as many farmers possible, the resulting distribution is expected to be spread throughout the Project Area, avoiding a concentration of motor pumps and, consequently, a concentration of air emission sources in any particular location within the Project Area.

In general, the motor pumps/generators to be distributed by the Project are no different from other sources of air pollutants already existing in the Project Area (e.g., vehicles). Other air emissions, besides standard vehicles, include other motor pumps already used in the Project Area for groundwater wells, generators, and so on.

With regard to air pollutant emissions, considering the aspects mentioned above, the air quality impact is considered to be small in magnitude: some measurable change in quality or vulnerability, minor loss, or alteration to one or more key characteristics, features, or elements. Considering the fact that the irrigation activities will be undertaken in rural areas, away from sensitive receptors (residential areas), a medium sensitivity level of air quality has been assumed in the Project Area.

The main GHG resulting from the combustion of diesel is CO_2. According to the emissions factors proposed by the Oil Industry International Exploration & Production Forum (1994)[2], the combustion of 1 ton of diesel results in the

[1] Data provided are approximate only. Range of engines power in vehicles is very variable.
[2] This forum later became the OGP (International Association of Oil and Gas Producers).

emission of 3.2 tonnes of CO_2. Applying this factor and taking into account the density of the diesel (832 kg/m^3)[1], the combustion of 2,500 m^3 of diesel in one year would result in the emission of 6,400 tonnes of CO_2 per year.

The estimated GHG emissions for Honduras (data from year 2010 – according to the UN website) are 3,749.83 Gg CO_2 equivalent. Therefore, the estimated emission of CO_2 during the operation phase in one year will be limited to 0.17% of the total emissions in Honduras in one year (as per specific data of 2010).

Considering the estimated low contribution of the Project activities to GHG emissions, the impact on climate change is considered to be of negligible magnitude: very minor loss or detrimental alteration to one or more characteristics, features, or elements.

As a country that is vulnerable to the incidence of extreme weather conditions, such as hurricanes and prolonged periods of drought, Honduras is raising awareness of adaptation to climate change. At a local level, the main economic activity of the Olanchito and Arenal municipalities is livestock rearing and agriculture (mostly focused on the livestock), and, consequently, periods of drought affect production. The Project will contribute to improving the adaptive capacity of the farmers in the Project Area to climate change, reducing their vulnerability to drought.

According to Secaira, E. (2013), global climate change in Honduras could have the following consequences: increased temperatures (0.5–1.5 ^oC by 2050, and 2.0-3.5^o by 2080); decreased rainfall (3-7% by 2050, and 12-17% by 2080), mostly during the dry season; and increased climate variability because of the *El Niño* climate event. These changes would indirectly affect a number of receptors, including the biodiversity, population, and economy, confirming the importance of climate in the country. However, it is also worth noting that the climate vulnerability is low, since only very high magnitude impacts could produce a noticeable effect. Because of this, the overall sensitivity of the climate is considered to be medium.

Mitigation measures

The Project Design includes the following embedded measure:

- Training Programme including technical training on the adequate use and maintenance of the irrigation equipment. This will contribute to minimizing the use of the motor pumps/generators as much as feasible and, consequently, their emissions of air pollutants and GHGs.
- Beneficiaries will acquire a series of responsibilities linked to the irrigation system such as the maintenance of the equipment and its components and accessories, as recommended by the manufacturer or supplier. Equipment maintenance will contribute to minimizing air

[1] https://www.dieselnet.com/standards/eu/fuel_reference.php

pollutant and GHG emissions, since well-maintained equipment produces fewer emissions as a result of more efficient combustion.

In addition, the following recommendation measure is provided, considered as good management practice:

- The SAG will require beneficiaries to implement a logbook with records of fuel used. .

Residual impacts

Taking into account the impact magnitude and receptor sensitivity discussed above, it can be concluded that the impact significance on air quality and climate change due to air pollutant and GHG emissions as a result of the operation and maintenance of the irrigation equipment is ***Negligible***.

Table 7.2 summarises the impacts on air quality and climate change as a result of the Project activities during the operation phase.

Table 7.2 Summary of impact assessment on air quality and climate change during the operation phase

Impact / Risk	Measures to address the impact / risk	Residual Impact
CA1 - Emissions of air pollutants and GHGs potentially affecting air quality and climate change	*Embedded measures:* • Training Programme • Beneficiary responsibilities acquired linked to the irrigation system such as the maintenance of the equipment, which will contribute to minimizing air pollutant and GHG emissions. • Implementation of logbook with records of fuel used recommended as good practice.	**Negligible** • The motor pumps/generators are no different from other sources of air pollutants in the Project Area. Their expected level of emissions is actually lower than a standard vehicle, for example, one of the main air pollutant sources in the Project Area. • Yearly CO_2 emissions will be limited to 0.17% of the total yearly emissions in Honduras. • Irrigation limited to 5% of the total surface are in the Project Area. • Irrigation limited to 3.5 months a year.

Source: ERM, 2018

7.3 ACOUSTIC ENVIRONMENT

7.3.1 Overview

This section assesses the potential impacts on the acoustic environment as a result of Project activities. *Box 7.2* presents the key sources of impacts, potentially impacted receptors, the baseline, and factors influencing the project.

Box 7.2 Key Considerations for Assessment – Acoustic Environment

Sources of Impact

- Operation and maintenance of irrigation equipment

Potentially Impacted Receptors

- Acoustic environment.
- Other receptors potentially impacted by effects on the acoustic environment are fauna (see *Section 7.6*) and community health or labour rights and workers (see *Section 7.12*).

Particular Baseline Conditions that Potentially Influence Impacts

- Scarce information on noise background levels in Honduras.
- High noise levels expected in urban areas.
- Rural areas, such as the Project Area, are characterized by relatively low ambient noise levels.
- Although no noise background levels in the Project Area are available, average noise levels ranging between 50 and 60 dBA (daytime) are considered reasonable.

Project Factors that Potentially Influence Impacts

- The Project will provide irrigation to about 3,110 within the Project Area, which covers a total surface area of about 60,000 ha.
- Operating motor pumps/generatorsare a source of noise, typically ranging between 60 and 70 dBA (at 10 m distance) (Defra, 2005)[1].
- Noise emissions from motor pumps will be temporary only: irrigation will only be required during 3.5 months in the dry season (from January to April), probably on 3-4 days / week, rather than on daily basis.
- 311 Motor pumps/generators are expected to be distributed
- The life expectancy of a motor pump is about 10,000 h.
- The time of operation is estimated to be about 10 years.
- Natural attenuation of noise levels with distance.

References

- Chapter 3 Project Description and Alternatives – specifically *Section 3.1, Section 3.5, Section 3.6.1* and *Section 3.6.2.*
- Chapter 5 Baseline Description – specifically *Section 5.2.3.*

Source: ERM, 2018

[1] Update on noise database for prediction of noise in construction and open sites.

Table 7.3 presents the key impacts of the Project on the acoustic environment.

Table 7.3 Key Potential Impacts – Acoustic Environment

Pre-operation phase	Operation phase	Abandonment phase
None	N1 – Potential disturbance to workers and/or fauna	None

Source: ERM, 2018

7.3.2 Operation phase

Potential impacts

N1 – Potential disturbance to workers and/or fauna due to noise levels

See *Box 7.2*for key considerations on baseline conditions and project factors that can potentially influence the impact.

The noise levels produced by the motor pumps are similar to other noise sources existing in the Project Area. For example, the noise generated by a vehicle (standard car) at 45 km/h is about 62 dBA (at 15 m distance), whilst the noise generated by a medium-sized truck at the same speed is about 73 dBA (at 15 m distance) (Cowan, Environmental Acoustics)[1].

There is a correlation between the noise level and the distance receptor - noise source: sound levels decay 6 dB when the distance between the receptor and the noise source is doubled at open space (L. Beranek & McGraw-Hill, 1954[2]; Moore D.R., 2010[3]). Therefore, the noise level produced by the motor pumps will be reduced to 54 - 64 dBA at 20 m, 48 – 58 dBA at 40 m, 42 – 52 dBA at 80 m, and so on.

The expected distribution of motor pumps/generators in the Project Area will be very spread out (one motor pump for every 10 ha in the Project Area), avoiding any concentration of the pumps and, consequently, a concentration of noise sources in a specific location of the Project Area.

In addition, the Training Programme embedded into the Project design will provide technical training on the adequate use and maintenance of the irrigation equipment. This will contribute to minimizing the use of the motor pumps as much as feasible, and consequently, their noise emissions.

Considering the aspects mentioned above, the magnitude of the impact on the acoustic environment is considered to be small.

[1] https://www.nonoise.org/resource/trans/highway/spnoise.htm#top
[2] Acoustics, L. Beranek, McGraw-Hill, 1954.
[3] The Oxford Handbook of Auditory Science: Hearing. David R. Moore, 2010.

The motor pumps will be located next to the fields to be irrigated. In most cases, the agricultural fields and pastures that are the subject of the irrigation project are located in unpopulated areas. Because of this, the presence of receptors of the noise generated by the motor pumps is likely to be limited to farm workers, and only while the motor pump is operating, whenever the workers are in the proximity of the motor pump. Some fauna could occasionally be disturbed too. The natural attenuation of noise levels with distance will avoid any effect on nearby populated areas.

Although there is no specific information on the existing noise levels in the Project Area, it is very likely the acoustic environment is similar to other rural areas, where noise levels are described to be between of around 30dBA (daytime) except in urban centers (50-60 dBA). Considering the fact that the irrigation activities will be undertaken in rural areas, away from sensitive receptors (residential areas) and that receptors will likely be limited to farm workers and the fauna present near-by the sensitivity of the acoustic environment in the Project Area is considered to be low.

Mitigation measures

The Project Design includes the following embedded measures:

- The Training Programme will include a topic on the adequate use and maintenance of the irrigation equipment. This will contribute to minimizing the use of the motor pumps/generators as much as feasible, and consequently, their emissions of noise.
- Beneficiaries will acquire a series of responsibilities linked to the irrigation system, including carrying out the maintenance of equipment, its components, and accessories, as recommended by the manufacturer or supplier. Equipment maintenance will also contribute to minimizing the emissions of noise, as well-maintained equipment is quieter.

Residual impacts

Table 7.4 summarises the impacts on the acoustic environment as a result of the Project activities during the operation phase.

Table 7.4 Summary of the impact assessment on the acoustic environment during the operation phase

Impact / Risk	Measures to address the impact / risk	Residual Impact
N1 - Potential disturbance to workers and/or fauna due to noise levels	*Embedded measures:* • Training Programme. • Beneficiary responsibilities acquired linked to the irrigation system, such as the maintenance of the equipment, which will contribute to minimizing noise emissions.	**Negligible** • The noise levels produced by the motor pumps/generator (60 - 70 dBA – at 10 m distance) are similar to other noise sources existing in the Project Area. • The presence of receptors of the noise generated by the motor pumps is likely to be limited to farm workers and, occasionally, fauna. • Natural attenuation of noise levels with distance. Irrigation limited to 5% of the total surface area in the Project Area. • Irrigation limited to 3.5 months a year.

Source: ERM, 2018

7.4 SOILS

7.4.1 Overview

This section assesses the potential impacts on the soils as a result of the Project activities. *Box 7.3* presents the key sources of impacts, potentially impacted receptors, the baseline, and factors influencing the project.

Box 7.3 Key Considerations for Assessment – Soils

Sources of Impact

- Operation and maintenance of irrigation equipment.

Potentially Impacted Receptors

- Soils.
- Other receptors potentially impacted by effects on the soil are surface water resources and groundwater resources (see *Section 7.5*) and flora and fauna (see *Section 7.6*).

Particular Baseline Conditions that Potentially Influence Impacts

- The main types of soils found in the Project Area are alluvial soils and two types of lithosols (Jacaleapa and Yaruca).
- Although chemical products (herbicides, pesticides, and fertilizers) are commonly employed on the farms in the Project Area, only small quantities are used.
- Soil quality conditions in the Project Area are expected to be good, in the absence of evidence of erroneous use of use of chemical products.

Project Factors that Potentially Influence Impacts

- The Project will provide irrigation to about 3,110 ha within the Project Area, which covers a total surface area of about 60,000 ha.
- Waste generation will be limited to lubricants used in the maintenance of the irrigation equipment.

References

- Chapter 3 Project Description and Alternatives – specifically *Section 3.1*, *Section 3.5*, *Section 3.6.1* and *Section 3.6.2*.
- Chapter 5 Baseline Description – specifically *Section 5.2.6.*

Source: ERM, 2018

Table 7.5 presents the key impacts of the Project on the soils.

Table 7.5 Key Potential Impacts – Soils

Pre-operation phase	Operation phase	Abandonment phase
None	S1 – Loss of soil properties and soil disturbance	None

Source: ERM, 2018

7.4.2 Operation phase

Potential impacts

S1 – Potential loss of soil properties due to excessive irrigation and soil disturbance

The irrigation of agricultural fields and pastures has the potential to affect the soil properties. Two main causes of soil property affection are described below:

- Excessive irrigation can lead to the accumulation of salts, which can damage the soil structure. This occurs particularly in clay soils due to the presence of sodium, and in soils that already have a naturally high content of sodium (salinity soil). Damage to the soil structure would result in less stability, and greater vulnerability to a structural decline.
- Excessive irrigation can also lead to increased erosion. Two typical erosion processes are:
    - Gully erosion: characterized by the removal of the top soil and the formation of channels or gullies that become wider and deeper as a result of being preferential paths for water in heavy rain events.
    - Sheet erosion: characterized by the loss of a thin layer of topsoil from sloping land.
- Some soil disturbance near the surface may occur routinely because of machinery use and tilling, water drops and irrigation, water flow, and livestock activities. Soil disturbance at depth (e.g., compaction) is not expected because deep tilling and the passage of heavy machinery are not habitual in the type of crops expected in the Project Area.

Soil impact will only occur as a result of poor irrigation practices (accumulation of salts and erosion), and will only affect the soils where the irrigation system will be implemented in the Project Area (maximum 4,240 ha). This may last longer than the operation phase itself, since recovering soil properties and quality can be a long process, both in the case of natural recovery and soil improvement or remediation projects.

In addition, the Training Programme embedded into the Project design will provide technical training on the adequate use and maintenance of the irrigation equipment. This will contribute to minimizing the amount of water used as much as feasible, and consequently, reduce the risk of salinization and / or erosion events.

Moreover, it must be taken into account that an excessive irrigation would require a financial effort from the farmer. This is not realistic taking into account that irrigating in excess agricultural fields and pastures does not lead to a higher production.

The soil conditions in the Project Area are expected to be good. Information gathered during the field survey conducted in June 2018 confirmed that chemical products (fertilizers, herbicides, and pesticides) were used correctly in the agricultural practices: they are commonly employed, but only in small quantities. Good soil quality is related to a high level of vulnerability. In addition to this, the most important economic sector in the Project Area is livestock, which depends on pasture and forage crops to provide food for the cattle. The soil condition is a key factor in the development of both pasture and forage crops. Because of this, the importance of the soil is high too. To sum up, taking into account its high vulnerability and its high importance, the sensitivity of the soil in the Project Area is considered to be high.

Mitigation measures

The Project Design includes the following embedded measure:

- Training Programme including technical training on the adequate use and maintenance of the irrigation equipment. This will contribute to minimizing the amount of water used as much as feasible, and consequently, reduce the risk of salinization and / or erosion events.
- Training will also impart good irrigation practices, aligned with the FAO guidelines:
    - Guidelines for Water Management and Irrigation Development.
    - Guidelines for Planning Irrigation and Drainage Investment Projects.
- Planned monitoring of irrigation equipment use and maintenance for a period of no less than 10 years, including the beneficiaries' water consumption (water meters are included in the irrigation system). This embedded measure will enable some of the mitigation measures described below to be monitored.

- Beneficiaries will acquire a series of responsibilities linked to the irrigation system. These will include compliance with the mitigation measures described below.

The following mitigation measures will be implemented in order to minimize the loss of soil properties as a result of inadequate irrigation:

- The SAG will require beneficiaries to follow irrigation plans and schedules as per FAO's guidelines when using the irrigation equipment.

In addition, the following recommendation measure is provided, considered as good management practice:

- The SAG will require the beneficiaries to implement a logbook with records of the water pumped (or hours of pumping), and share this with the CRELES.

Residual impacts

Table 7.6 summarises the soil impacts as a result of the Project activities during the operation phase. The embedded measures considered in the Project Design and the mitigation measures defined during the impact assessment result in a Residual Impact assessed as minor.

Table 7.6 Summary of impact assessment on the soils during the operation phase

Impact / Risk	Measures to address the impact / risk	Residual Impact
SI - Potential loss of soil properties due to excessive irrigation and soil disturbance	*Embedded measures:* • Implementation of the Project's Training Programme including technical training on the adequate use and maintenance of the irrigation equipment. This will contribute to minimizing the amount of water used as much as feasible, and consequently, reduce the risk of salinization and / or erosion events. • Training Programme including good irrigation practices (aligned with FAO guidelines). • Monitoring of the irrigation equipment for a period of no less than 10 years including the beneficiaries' water consumption (water meters are included in the irrigation system). • Beneficiaries required to comply with the mitigation measures proposed. *Mitigation measures:*	**Minor** • Effect on soil properties is limited to an indirect effect resulting from excess of irrigation. • Irrigation limited to up to 5% of the total surface area in the Project Area. • Irrigation limited to 3.5 months a year (105 days).

Impact / Risk	Measures to address the impact / risk	Residual Impact
	• Follow irrigation plans and schedules as per FAO's guidelines. • Implementation of logbook with records of water pumped (or hours of pumping), and share this with the CRELs.	

Source: ERM, 2018

7.5 WATER RESOURCES

7.5.1 Overview

This section assesses the potential impacts on the surface and groundwater resources as a result of the Project activities. *Box 7.4* presents the key sources of impacts, potentially impacted receptors, the baseline, and factors influencing the project.

Box 7.4 Key Considerations for Assessment –Water Resources

Sources of Impact

- Operation and maintenance of irrigation equipment

Potentially Impacted Receptors

- Surface water resources.
- Ground water resources.
- Other receptors potentially impacted by effects on the water resources are biodiversity (see *Section 7.6*), land user livelihoods and incomes (see Section 7.11) and Community Health (see *Section 7.13*)

Particular Baseline Conditions that Potentially Influence Impacts

Surface water resources:

- Project Area located in the Aguan River basin.
- Aguan River characterized by a very active dynamic. Water flow of the Aguan River fluctuates between the dry season (January – April) and the rainy season (rest of the year).
- Average water flow in Sabana Larga: 9.62 m^3/s (dry season) and 23.22 m^3/s (rainy season).
- Average water flow in Olanchito: 20.95 m^3/s (dry season) and 32.00 m^3/s (rainy season).
- Connection between the Aguan River and the Alluvial Aquifer.
- Surface water features in the Project Area are used for irrigating agricultural fields and providing water for the cattle. Tributaries of the Aguan River also used as a water supply for the communities (human consumption).Lack of information on surface water quality from chemical analysis.

Groundwater resources:

- Most of the Project Area is located on the Alluvial Aquifer of the Aguan River, which is described as a highly productive and extensive aquifer.
- Water flows ranging between 4 and 67 l/s.
- Transmissivity is 470 m^2/day.
- Most of the Project Area is characterized by groundwater levels at depths of < 10 m to 40 m.
- There is no official register of groundwater wells, so there is no accurate information available on the exact number of these in the Project Area.
- The use of groundwater is minor in comparison with the use of surface water. Groundwater wells are mostly utilized for farming activities (cleaning and water for cattle), but in a few cases they are also used as a water supply for the communities (human consumption).

Project Factors that Potentially Influence Impacts

- The Project will provide irrigation to about 3,110 ha within the Project Area, which covers a total surface area of about 60,000 ha.
- Irrigation water requirement will be 32 l/m^2 per week and the irrigation activities will be limited to 3.5 months / year (rounded to 105 days).
- The total water consumption is estimated to be 14,93 Hm^3/year, when the irrigated surface reaches the maximum of 3,110 ha. This last volume is approximately a 3,89% of the minimum available reserve in worst scenario. If the 870.000.000 m^3 of the average reserves are considered, the maximum water consumption would mean a 1,7 % of the average reserves of the Alto Aguan Valley.
- Two water source options are proposed: surface water (option 1) and groundwater (option 2).
- Time of operation is estimated to be about 10 years.

References

- Chapter 3 Project Description and Alternatives – specifically *Section 3.1*, *Section 3.5*, *Section 3.6.1* and *Section 3.6.2*.
- Chapter 5 Baseline Description – specifically *Section 5.2.7* and *Section 5.2.8*.

Source: ERM, 2018

Table 7.7 presents the key impacts of the Project on the water resources.

Table 7.7 Key Potential Impacts –Water Resources

Pre-operation phase	Operation phase	Abandonment phase
None	• W1 - Loss of surface and groundwater quality. • W2 – Eutrophication of surface water. • W3 – Effects on river flow. • W4 - Increase of organic matter in the groundwater. • W5 – Effect on groundwater level.	None

Source: ERM, 2018

7.5.2 Operation phase

Potential impacts

W1 – Loss of surface and groundwater quality

An indirect consequence of the Project might be the increased use of chemical products (herbicides, pesticides, and fertilizers).

Herbicides and pesticides include toxic chemical compounds in their composition, which affect the biological integrity of the elements they are meant to eliminate (weeds in the crops, different types of insects, or other types of pests).

These toxic chemical compounds can contribute to water pollution, if they are not used appropriately, for example through excessive doses or an excessively high frequency of use.

Although water pollution would affect surface water in the first instance, it could also affect the groundwater by the chemical compounds filtering through the subsoil, especially where groundwater levels are shallow. In the case of the Project Area, the groundwater level ranges between depths of <10 and 40 m in most cases. Two wells have been identified in the Project Area where the groundwater level was reported to be < 4 m: the well on farm 108 (visited in June 2018), where the water level is 3.6 m; and the "Palo Verde A" well (identified in 2017), where the water level is 3.05 m.

Another condition that must be met for surface water pollution to reach the groundwater is suitable subsoil lithology. In cases of impermeable materials (for example, clays) the filtration would be very slow and might not even reach the groundwater level. As described in *Section 5.2.6*, the soils in the

Project Area are alluvial (sandy and silty soils) and lithosols (Jacaleapa and Yaruca – described as soils with a high stone content or thin soils on rock).

Therefore, neither the alluvial soils nor the lithosols can be considered impermeable, and, consequently, filtration through the subsoil could occur. In addition to this, since the groundwater level in the Project Area is not very deep, if herbicides and / or pesticides were not used appropriately, they could affect the groundwater quality through filtration.

Loss of water quality, in both surface and groundwater, will occur only as a result of bad practices in the use of herbicides and pesticides on the irrigated land (maximum 3,110 ha) located within the Project Area, potentially affecting water resources limited to the Project Area, throughout the duration of the irrigation activities. In the case of groundwater resources, although recovery of groundwater quality can be a long process, in the case of the Project Area this is unlikely to be the case considering the connection between the Aguan River and the Alluvial Aquifer.

However, taking into account the feedback received during the June 2018 field survey, there is limited use of pesticides and herbicides in the Project Area, reducing the likelihood of inappropriate use in the future:

- Herbicides are used 1 – 2 times / year and in quantities below 1.5 l / ha.
- The use of pesticides is very low. These are only employed regularly in the banana plantations; however, the Project will not be implemented in these areas.
- Farmers are advised by SENASA[1] to consider alternatives to pesticides, such as IPC (integrated pest control) management and the use of standard detergents (non-hazardous for the environment).

In addition, the Training Programme embedded in the Project design will provide technical training on the adequate use of pesticides and herbicides, focusing on minimizing their use as much as possible and selecting low toxicity pesticides and herbicides.

With regard to the surface water bodies in the Project Area, it has to be taken into account that:

- The Aguan River has a high surface water flow. The western section of the Project Area maintains an average water flow of 9.62 m^3/s during the dry season (data corresponding to *Sabana Larga*). In the case of Olanchito, located in the centre of the Project Area, the average water flow is 20.95 m^3/s during the dry season. There is, therefore, a significant contribution of water from tributaries across the Project Area.

[1] National Service of Health and Agro-food Safety – *Servicio Nacional de Sanidad e Inocuidad Agroalimentaria*

This data shows that even in the dry season, when the water flows are lower, the Aguan River and its tributaries have very high capacity for diluting any potential herbicide or pesticide that may reach the rivers as a result of an inadequate use. For example, in the case of herbicides, it was described that about 1.5 l/ha is applied 1 – 2 times/year on the farms; this represents a maximum quantity of 3 l/ha, which would in turn be a maximum quantity of 9,330 l (assuming a maximum of 3,110 ha of irrigated fields as a result of the Project).

This volume is similar to the amount of water in the Aguan River in the area of Sabana Larga in just one second (9,620 l) during the dry season, and almost only half of the amount of water in the Aguan River in Olanchito (20,950 l) in one second. Because of this, it is considered that even if, due to inadequate use of pesticides or herbicides, some quantities reached the rivers in the Project Area (mostly from the groundwater flowing towards the Aguan River and its tributaries), their dilution capacity, based on their water flow, would avoid significant effects on the surface water quality of the rivers.

The small surface water bodies in the Project Area, not connected to the Aguan River and / or its tributaries, such as ponds and reservoirs, would be more vulnerable to the loss of water quality, if they were located near irrigated fields where there was bad management of pesticides and herbicides.

As described in *Section 5.2.7*, no surface water quality analysis are available. However, observations during the field survey included fish in several river locations (tributaries of the Aguan River) and the occasional presence of caiman (*Caiman cocodrilus*) was reported. This is evidence of good surface water quality. However, there is a risk of loss of quality through organic contamination as a result of poor wastewater management in the communities near the Aguan River or its tributaries. This expected good quality, together with the potential risk of organic contamination, results in a high level of vulnerability. In addition, surface water is used by the local population: mostly for irrigation and to provide water for the cattle (in the case of the Aguan River), but also as a potable water source (in the case of the upper areas of the Aguan River tributaries).

Considering the aspects mentioned above, the magnitude of the impact on surface water is considered to be small: some measurable change in quality or vulnerability, minor loss, or alteration to one or more key characteristics, features or elements.

Other future and potential uses and services provided by the Aguan River and its tributaries are future hydropower stations (Arenal Etapa I-II Hydroelectric project, Aguan Energy Complex), the Irrigation

Project Austria II (all three projects evaluated in *Section 7.15 Cumulative impact assessment*) and potential local, low-intensity fishing (for self-consumption only). As a result of the uses described, the importance of the surface water sources is also high. In summary, taking into account its high vulnerability and high importance, the sensitivity of the surface water resources (Aguan River, its tributaries, and any other surface water sources such as ponds or small lakes) is considered to be high.

With regard to the groundwater in the Project Area, it has to be taken into account that:

- The Alluvial Aquifer and the Aguan River are connected, therefore any persistent chemicals will migrate through the groundwater to the river.

- As described in *Section 5.2.8*, the groundwater resources of the Olanchito municipality are adequate for irrigation purposes. However, the groundwater samples were collected in 1997, and since then no more recent samples have been available. The feedback received during the field survey stated that the groundwater wells used for human consumption were initially analysed, the results being favourable, but once again no further information on the current water quality has been provided. For this reason, there is a reasonable level of uncertainty about the current groundwater quality.

  In addition to this, due to the poor wastewater management procedures in the communities in the Project Area (the most common management system in the small communities scattered across the Project Area involves latrines that filter into the subsoil), there is a risk of organic contamination in the groundwater. Because of this, the vulnerability of the groundwater is considered to be medium.

  Groundwater use is minor in comparison with the surface water use. However, the implementation of the irrigation project will increase the use of groundwater. Because of this, the importance of the groundwater resources is considered to be medium (currently) to high (after the implementation of the Project). To sum up, taking into account its medium vulnerability and its medium to high importance, the sensitivity of the groundwater is considered to be medium.

W2 – Surface water eutrophication

As described in Impact W1, an indirect consequence of the improvement of the agricultural / livestock sector in the Project Area is the increased of use of chemical products (herbicides, pesticide, and fertilizers).

Fertilizers provide additional amounts of key chemical elements for the growth of crops, including nutrients such as nitrogen (N), phosphorus (P), and

potassium (K). Fertilizers can be organic (e.g., manure from livestock) or inorganic (e.g., commercial fertilizers).

If not used appropriately, these chemical elements can contribute to water eutrophication, for example by excessive dosing and frequency of use. A summary of the eutrophication process is included below:

- Additional nutrients (e.g., erroneous of fertilizers) in a water body produce an increase in aquatic plants and phytoplankton.
- This increase in aquatic plants and phytoplankton produces: (1) depleted oxygen levels due to the increase in aerobic metabolism; and (2) blocks sunlight which cannot reach the deeper levels of the water.
- Depletion of oxygen and lack of sunlight contribute to the death of aerobic and photosynthetic organisms. Their degradation results in an additional depletion of oxygen.
- This provokes a change from an aerobic environment to an anaerobic environment, which has a significant effect on the overall aquatic life in the water body. For example, most fish species will die when dissolved oxygen levels are dramatically reduced.
- This process is more significant in static waters (e.g., reservoirs and lakes), since in mobile waters, the continual contribution upstream water compensates for the eutrophication process by adding oxygen-rich water into the system.

Surface water eutrophication would only occur as a result of bad practices in the use of fertilizers on irrigated land (maximum 4,240 ha) located within the Project Area, potentially affecting water resources limited to the Project Area, for the duration of the irrigation activities.

However, the same considerations as for surface water in Impact W1 have to be taken into account: the potential surface to be irrigated (3,110ha which only represents 5% of the total Project Area); the current use of fertilizers in the Project Area is limited; the Project includes an embedded Training Programme that will contribute to the adequate use of fertilizers. In addition, as the Aguan River and its tributaries have a high dilution capacity, it is considered that even if there were inadequate use of fertilizers resulting in some quantities reaching the rivers in the Project Area (mostly from the groundwater flowing towards the Aguan River and its tributaries), eutrophication would be avoided as a result of dilution process. Taking into account these aspects, the magnitude of the impact is considered to be small: some measurable change in quality or vulnerability, minor loss, or alteration to one or more key characteristics, features, or elements.

As described in Impact W1, the sensitivity of the surface water resources (Aguan River, its tributaries and any other surface water sources such as ponds or small lakes) is considered to be high. Small surface water features in the Project Area, not connected to the Aguan River and / or its tributaries, such as ponds and reservoirs, will be more vulnerable to eutrophication

processes if they are located near irrigated fields where there is bad management of fertilizers.

W3 – Effect on river flow

As described in *Section 3.5*, the irrigation system designed considers two water resource options:

- Option 1 - groundwater, extracted via a drilled groundwater well on the beneficiary's land.
- Option 2 - surface water, through the construction of a dug well / pit on the beneficiary's land, next to the nearest surface water body.

The Alluvial Aquifer is one of the sources of water flow in the Aguan River. Because of this connection, abstraction of water by the Project might produce a depletion of the water, as follows:

- Direct depletion of the groundwater level (assessed in Impact W5), in the case of option 1.
- Direct depletion of the surface water level, in the case of option 2.
- Indirect depletion of the surface water level, in the case of option 1.

The effect on river flow will be direct or indirect, based on the water abstraction option considered, potentially affecting surface water resources limited to the Project Area, for the duration of the irrigation activities.

A complete Water Resource Balance was developed by PAA Project Finance and Integra Ingeniería in 2017. *Annex 8* provides a summary of this. The main conclusion was that the Alto Aguan Valley has a hydric excess of 384 Hm^3/year.

As described in *Section 3.6.2*, the irrigation water requirement will be 32 l/m^2 over 3.5 months each year. Thus, maximum water consumption will be approximately 14,93 Hm^3/year, when considering the maximum irrigation surface (311 ha) and a 100% of use of irrigation systems.

This water consumption is 3,89% of the calculated hydric excess in the Alto Aguan Valley (384 Hm^3/year), meaning the planned water abstraction by the Project is sustainable and renewable.

Sustainable and renewable water abstraction would avoid a depletion of the surface water levels in the Aguan River and / or its tributaries, which will contribute to maintaining the biodiversity associated with the fluvial ecosystems and the use by the local communities: as a water source; for fishing; hydropower; and so on. This would also avoid any effect downstream of the Project Area.

In addition, sustainable and renewable water abstraction contributes to maintaining the chemical dilution capacity of the Aguan River and its tributaries, as discussed in Impacts W1 and W2. A changing hydrological

regime and a depletion of water flow can alter the capacity of the rivers to assimilate water-soluble chemicals (e.g., those from pesticides, herbicides, and fertilizers).

In any case, no direct abstraction from the river courses is assumed by the Project activities and therefore a reduction of the streamflow of the river would be caused only by a temporary reduction of the groundwater flow discharge into the river stream. This groundwater discharge depends on geological conditions and the difference of level between groundwater table and the river surface. In the Project Area, the groundwater level is clearly above the river surface level which leads to groundwater to move into the river stream (gaining stream). According to the Water Resource Balance, the total pumping proposed will result in an estimated theoretical depletion of less than 0.5 m in the groundwater levels. It is a negligible change in the groundwater level and thus it will not affect the fact that the river stream is a gaining stream.

Taking into account the sustainable and renewable water abstraction considered in the Project Design, the fact the potential surface area to be irrigated (3,110ha) only represents 5% of the total Project Area, and the embedded Training Programme that will include a topic on the adequate use and maintenance of the irrigation equipment which will contribute to minimizing the amount of water used as much as feasible, and consequently, reduce the risk of affecting the river water flow, the magnitude of the impact is considered to be small: some measurable change in quality or vulnerability, minor loss, or alteration to one or more key characteristics, features, or elements.

As described in Impacts W1 and W2, the sensitivity of the surface water sources (the Aguan River, its tributaries, and any other surface water sources such as ponds or small lakes) is considered to be high.

W4 – Increase of organic matter in groundwater resources

Fertilizers provide additional amounts of key chemical elements for the growth of the crops, including nutrients such as nitrogen (N), phosphorus (P), and potassium (K). Fertilizers can be organic (e.g., manure from livestock) or inorganic (commercial fertilizers).

In the case of surface water, these chemical elements can contribute to water eutrophication, as described in Impact W2. In the case of groundwater resources, the fertilizers may increase the levels of nitrates in the groundwater, if fertilizers are not used appropriately, for example, they are excessively dosed or applied too frequently.

High levels of nitrates in the groundwater can produce health problems (methaemoglobinaemia) as a result of the reduction of nitrates into nitrites. Because of this, the WHO (World Health Organization) provides guideline

values for nitrate and nitrite concentrations in water for human consumption: 100 mg/l and 3 mg/l, respectively (WHO, 2011)[1].

Any increase of organic matter in groundwater resources will be indirect, only occurring as a result of bad practices in the use of fertilizers, potentially affecting groundwater resources limited to the Project Area, for the duration of the irrigation activities.

However, as for previous impacts, it should be noted that the potential surface to be irrigated (3,110 ha) is relatively reduced, there is limited current use of fertilizers in the Project Area, and the Training Programme embedded into the Project will contribute to the adequate use of fertilizers. In addition, as described in Impact W1, the connection between the Alluvial Aquifer and the Aguan River would result in a potential migration of persistent chemicals to the river.

Considering all these aspects, the magnitude of the impact is considered to be small: some measurable change in quality or vulnerability, minor loss, or alteration to one or more key characteristics, features, or elements.

As described in W1, taking into account its medium vulnerability and its medium to high importance, the groundwater sensitivity is considered to be medium.

W5 – Effect on groundwater level

As described in *Section 3.5* and Impact W3, the irrigation system designed considers two water source options: groundwater and surface water.

The Alluvial Aquifer is one of the sources of water flow in the Aguan River. Because of this connection, the abstraction of water by the Project might produce a depletion of the water, as follows:

- Direct depletion of the groundwater level, in the case of option 1.
- Direct depletion of the surface water level, in the case of option 2.
- Indirect depletion of the surface water level, in the case of option 1.

The effect on the groundwater level will be direct, as a result of groundwater abstraction (option 1), potentially affecting groundwater resources limited to the Project Area, for the duration of the irrigation activities

As described in Impact W3, the planned water abstraction by the Project is sustainable and renewable. A sustainable and renewable water abstraction would avoid depletion of groundwater levels, and help maintain the use of groundwater by the local communities. A general depletion of the groundwater levels is not expected. The Water Resource Balance estimated a

[1] Nitrate and Nitrite in Drinking-water. Background document for development of WHO Guidelines for Drinking-water Quality. WHO, 2011.

theoretical depletion of the water table for a low porosity substrate of 4% of less than 0.5 m with a extraction of 14,93 Hm^3/year without considering any recharge in the aquifer during the dry period; which is not real and therefore these estimations are very conservative. Recharge from rainfall, for example, would compensate for this theoretical depletion (see further details in *Annex 8*) [1]. This aquifer depletion of the water resource is not relevant in terms of water balance based on the calculated hydric excess in the Alto Aguan Valley (384 Hm^3/year). Likewise, it is not expected to significantly change in the river flow due to this small depletion in the aquifer's reserve; which is temporary and not cumulative, since it is offset by the rains that also occur in the dry season and within the annual hydrological cycle by the excess of contribution during the wet period.

It is unlikely that groundwater wells installed by the Project will be located near other groundwater wells. First of all, because the use of groundwater was reported to be minor in the Project Area, suggesting there are few groundwater wells in the Project Area. Secondly, because the land where the irrigation systems will be installed only represents 5% of the Project Area. Because of this, effects on other groundwater users are not expected.

The drawdown in the wells is considered as minor and can be estimated using the Thiem method of well hydraulics and assuming a transmissivity of 470 m^2/day, a flow of 10 l/seg. a 10" well diameter and a radius of influence of 400 m in 2.4 m or 2 m when a radius of influence of 100 m is assumed.

In addition, the Training Programme will include a topic on the adequate use of the irrigation equipment. This will contribute to minimizing the amount of water used as much as feasible and, consequently, reduce the risk of affecting the groundwater level.

Taking into account the aspects mentioned above, the magnitude of the impact is considered to be small.

As described in Impacts W1 and W4, the sensitivity of the groundwater is considered to be medium.

Mitigation measures

The Project Design includes the following embedded measure:

- A Training Programme including a topic on the adequate use of the irrigation equipment. This will contribute to minimizing the amount of water used as much as feasible and, consequently, reduce the risk of affecting the river water flow. As described in *Section 1.3*, a reduction of water use up to 40% occurs when training on efficient water irrigation, water use optimization, and good agricultural practices is conducted.

[1] According to rainfall maps the Project area has about 14 l/m^2/week of rain during the dry period.

- The Training Programme will also impart good irrigation practices, aligned with following FAO guidelines:
    - Guidelines for Water Management and Irrigation Development.
    - Guidelines for Planning Irrigation and Drainage Investment Projects.
- The Training Programme will include a topic on the adequate use of chemical products (pesticides, herbicides, and fertilizers) focused on minimizing their use as much as possible and selecting low toxicity pesticides and herbicides. This will contribute to reducing the risk of affecting the water quality and the risk of eutrophication.
- Planned monitoring of the irrigation equipment use and maintenance for a period of no less than 10 years, including the beneficiaries' water consumption (water meters are included in the irrigation system). This embedded measure will enable some of the mitigation measures described below to be monitored.
- Beneficiaries will acquire a series of responsibilities linked to the irrigation system. These will include compliance with the mitigation measures described below.
- The location of the water abstraction source will be selected making sure that it is situated away from other water sources (e.g. other existing groundwater wells) and away from potential contamination sources.

The following mitigation measures will be implemented in order to minimize the loss of surface and groundwater quality, surface water eutrophication, and any increase of organic matter in the groundwater as a result of the inadequate use of pesticides, herbicides, and fertilizers:

- A Pesticides, Herbicides, and Fertilizer Management Plan will be prepared and implemented by the SAG.
- The SAG will ensure that the monitoring of the use of pesticides, herbicides, and fertilizers is undertaken by SENASA.
- The SAG will ensure that the monitoring of the pesticides, herbicides, and fertilizers sold in Olanchito by consultation in distribution shops is undertaken by SENASA.
- The SAG will ensure that SENASA monitors that only products recommended by SENASA are used.
- The SAG will ensure that the monitoring of the nitrate and nitrite levels in the groundwater wells installed as a result of the Project activities is undertaken by SENASA.

Note: considering the low risk for contamination from pesticides and the high costs of analysing pesticides, monitoring of the levels of pesticides in irrigation has been deemed unnecessary. The mitigation measures in place to prevent contamination are considered sufficient.

Moreover, the following recommendation measure is provided, considered as good management practice:

- The SAG will require beneficiaries to implement a logbook to record any pesticides and/or herbicides used.

The following mitigation measures will be implemented in order to minimize the effect on river flow and groundwater levels as a result of inappropriate irrigation:

- The SAG will ensure beneficiaries follow irrigation plans and schedules when using the irrigation equipment.
- The beneficiaries will share and discuss water consumption in the CRELES, in order to improve the management of irrigation water.
- A Water Management Plan will be prepared and implemented by the SAG. Aspects to be covered by the plan include: an assessment of water use and monitoring data; coordination with other water users and management response as needed; participation of the local administration; and control of the groundwater wells installed.
- The SAG will ensure that the monitoring of the Aguan River flow upstream and downstream of the Project Area is undertaken by UMA. Two monitoring events will be conducted during the year: in the dry and rainy season. This monitoring will be extended to the main tributaries of the Aguan River within the Project Area, limited to one location only, in the proximity of their union with the Aguan River.
- The SAG will ensure that the monitoring of the groundwater levels in the wells installed for the Project activities, as well as in any other potential existing well located within an approximate ratio of 100 m from the installed groundwater wells, is undertaken by UMA.

In addition, the following recommendation measure is provided, considered as good management practice:

- The SAG will require that beneficiaries implement a logbook to record the water pumped (or hours of pumping).

Residual impacts

Table 7.8 summarises the impacts on the water resources as a result of the Project activities during the operation phase. The embedded measures considered in the Project Design and the mitigation measures defined during the impact assessment result in the Residual Impacts being assessed as Minor.

Table 7.8 Summary of impact assessment on the water resources during the operation phase

Impact / Risk	Measures to address the impact / risk	Residual Impact
W1 - Loss of surface and groundwater quality	*Embedded measures:* • Implementation of the Project's Training Programme including a topic on the adequate use of the irrigation equipment. This will contribute to minimizing the amount of water used as much as feasible and, consequently, reduce the risk of affecting the river water flow. • Training Programme including good irrigation practices (aligned with FAO guidelines). • Implementation of the Project's Training Programme including a topic on the adequate use of chemical products (pesticides, herbicides, and fertilizers) focused on minimizing their use as much as possible and selecting low toxicity pesticides and herbicides. This will contribute to reducing the risk of affecting the water quality and the risk of eutrophication. • Monitoring of the irrigation equipment for a period of no less than 10 years including the beneficiaries' water consumption (water meters are included in the irrigation system). • The location of the water abstraction source will be selected making sure that it is situated away from other water sources (e.g. other existing groundwater wells) and away from potential contamination sources. • Beneficiaries required to comply with mitigation measures proposed.	**Minor** • Surface water resources in the Project Area of high sensitivity. • Loss of surface water quality is limited to an indirect effect resulting from bad practices in the use of herbicides and pesticides. • Irrigation limited to 5% of the total surface area in the Project Area. • Irrigation limited to 3.5 months a year (105 days). • Limited use of pesticides and herbicides in the Project Area. Dilution capacity of the rivers in the Project Area.
	Mitigation measures: • Development and implementation of a Pesticides and Herbicides Management Plan. • Monitoring of pesticides and herbicides used. • Monitoring of pesticides and herbicides sold in Olanchito. • Monitor that only products recommended by SENASA are used. • Monitoring of the nitrate and nitrite levels in the groundwater wells installed as a result of the Project activities. Implementation of logbook with records of pesticides and herbicides used recommended as good practice.	**Negligible** • Groundwater resources in the Project Area of medium sensitivity. • Loss of groundwater quality is limited to an indirect effect resulting from bad practices in the use of herbicides and pesticides. • Irrigation limited to 5% of the total surface area in the Project Area. • Irrigation limited to 3.5 months a year.

Impact / Risk	Measures to address the impact / risk	Residual Impact
		• Limited use of pesticides and herbicides in the Project Area. Connection between the Alluvial Aquifer and the Aguan River enables the migration of persistent chemicals through the groundwater to the river.

Impact / Risk	Measures to address the impact / risk	Residual Impact
Impact / Risk	**Measures to address the impact / risk**	**Residual Impact**
• W2 – Eutrophication of surface water.	Same embedded measures as W1. *Mitigation measures:* • Development and implementation of a Fertilizer Management Plan. • Monitoring of fertilizers used. • Monitoring of fertilizers sold in Olanchito. • Monitoring of the nitrate and nitrite levels in the groundwater wells installed as a result of the Project activities. • Implementation of logbook with records of fertilizers used recommended as good practice.	**Minor** • Surface water resources in the Project Area of high sensitivity. • Loss of surface water quality is limited to an indirect effect resulting from bad practices in the use of fertilizers. • Irrigation limited to 5% of the total surface area in the Project Area. • Irrigation limited to 3.5 months a year (105 days). • Limited use of fertilizers in the Project Area. • Dilution capacity of the rivers in the Project Area.
• W3 – Effect on river flow.	Same embedded measures as W1. Mitigation measures: • Follow irrigation plans and schedules as per FAO's guidelines. • Development and implementation of a Water Management Plan. Aspects to be covered by the plan include: an assessment of water use and monitoring data; coordination with other water users and management response as needed; participation of the local administration; and control of the groundwater wells installed. • Water flow monitoring in Aguan River and main tributaries (upstream and downstream). Two monitoring events will be conducted during the year: in the dry and rainy season. This monitoring will be extended to the main tributaries of the Aguan River within the Project Area, limited to one location only, in the proximity of their union with the Aguan River. • Implementation of logbook with records of water pumped recommended as good practice.	**Minor** • Surface water resources in the Project Area of high sensitivity. • Irrigation limited to 5% of the total surface area in the Project Area. • Irrigation limited to 3.5 months a year (105 days). • Water abstraction by the Project activities will be sustainable and renewable, according to the Water Resource Balance developed by PAA Project Finance and Integra Ingeniería in 2017.
Impact / Risk	**Measures to address the impact / risk**	**Residual Impact**

Impact / Risk	Measures to address the impact / risk	Residual Impact
• W4 - Increase of organic matter in the groundwater.	Same embedded measures as W1. Mitigation measures: • Development and implementation of a Fertilizer Management Plan. • Monitoring of fertilizers used. • Monitoring of fertilizers sold in Olanchito. • Monitoring of the nitrate and nitrite levels in the groundwater wells installed as a result of the Project activities. • Implementation of logbook with records of fertilizers used recommended as good practice.	**Negligible** • Groundwater resources in the Project Area of medium sensitivity. • Loss of groundwater quality is limited to an indirect effect resulting from bad practices in the use of fertilizers. • Irrigation limited to 5% of the total surface area in the Project Area. • Irrigation limited to 3.5 months a year (105 days). • Limited use of fertilizers in the Project Area. • Connection between the Alluvial Aquifer and the Aguan River enables the migration of persistent chemicals through the groundwater to the river.
• W5 – Effect on groundwater level.	Same embedded measures as W1. *Mitigation measures:* • Follow irrigation plans and schedules as per FAO's guidelines. • Development and implementation of a Water Management Plan. Aspects to be covered by the plan include: an assessment of water use and monitoring data; coordination with other water users and management response as needed; participation of the local administration; and control of the groundwater wells installed. • Groundwater level monitoring in the wells installed for the Project activities, as well as in any other potential existing well located within an approximate ratio of 100 m from the installed groundwater wells. • Implementation of logbook with records of water pumped recommended	**Negligible** • Irrigation limited to 5% of the total surface area in the Project Area. • Irrigation limited to 3.5 months a year (105 days). • Water abstraction by the Project activities will be sustainable and renewable, according to the Water Resource Balance developed by PAA Project Finance and Integra Ingeniería in 2017. • It is unlikely that groundwater wells installed by the Project are located near other groundwater wells.

Source: ERM, 2018

7.6 *BIODIVERSITY*

7.6.1 *Overview*

This section assesses the potential impacts on the biodiversity (habitats, flora, and fauna) as a result of the Project activities. *Box 7.5* presents the key sources

of impacts, potentially impacted receptors, the baseline, and factors influencing the project.

This section is complemented by the Critical Habitat Assessment included in *Annex 9*. Critical habitats are characterised by high biodiversity values, which are determined by species, ecosystems and ecological processes. This assessment is a requirement of IFC PS6[1] for managing risks as well as avoiding, mitigating, and offsetting impacts to areas with high biodiversity values (see *Section 2.2*, for further references). The IFC's PSs are the most internationally accepted guidance for projects on how to achieve this.

Box 7.5 Key Considerations for Assessment – Biodiversity

Sources of Impact

- Operation and maintenance of irrigation equipment

Potentially Impacted Receptors

- Flora, fauna, and habitats.
- Other receptors potentially impacted by effects on biodiversity are the protected areas (see *Section 7.7*)

Particular Baseline Conditions that Potentially Influence Impacts

- The main habitats in the Project Area are agricultural fields and pastures, grassland, aquatic systems, inhabited urban and rural areas, and shrubland and forest.
- Very dry tropical forest is a habitat of high biodiversity value, since it only occurs in two locations in Central America and has a high level of endemism.
- Flora: 306 species identified in the Project Area. 10 endemic species; six species classified as VU by IUCN; two species classified as EN by IUCN; three species classified as CR by IUCN; 26 species included in the Appendices of CITES; and one species classified as a Species of Special Concern in Honduras.
- Fauna – Fish: 33 species potentially present in the Project Area. No endemic species; one species classified as VU by IUCN; and two species classified as Species of Special Concern in Honduras.
- Fauna – Amphibians: 15 species identified in the Project Area. No endemic species.
- Fauna – Reptiles: 40 species identified in the Project Area. Two endemic species; one species classified as CR by IUCN; and two species included in the Appendices of CITES.
- Fauna – Birds: 189 species identified in the Project Area. One endemic species; one species classified as EN by IUCN; 34 species included in the Appendices of CITES and seven species included in the Appendix II of the CMS.
- Fauna – Mammals: 40 species identified in the Project Area. No endemic species; one species classified as VU by IUCN; and five species included in the Appendices of CITES.

Project Factors that Potentially Influence Impacts

- The Project will provide irrigation to about 3,110 ha within the Project Area, which covers a total surface area of about 60,000 ha.
- Emissions of exhaust gases into the atmosphere and noise emissions from motor pumps will be temporary only: irrigation will only be required over 3.5 months in

1 IFC (2012) Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.

the dry season (from January to April) and probably for 3-4 days / week, rather than on a daily basis.

- 311 motor pumps/generators are expected to be distributed.
- Time of operation is estimated to be about 10 years.
- Waste generation will be limited to lubricants used in the maintenance of the irrigation equipment.
- Accidental spills of fuel (diesel) used by the motor pumps.
- The irrigation equipment will not be used in natural or critical habitats as it will be limited to agricultural land for irrigation.

References

- Chapter 3 Project Description and Alternatives – specifically *Section 3.1*, *Section 3.4.1*, *Section 3.5*, *Section 3.6.1* and *Section 3.6.2*.
- Chapter 5 Baseline Description – specifically *Section 5.3.1, Section 5.3.2 and Section 5.3.3.*

Source: ERM, 2018

Table 7.9 presents the key impacts of the Project on the biodiversity.

Table 7.9 Key Potential Impacts – Biodiversity

Pre-operation phase	Operation phase	Abandonment phase
None	• B1– Disturbance to fauna. • B2 – Disturbance to flora. • B3 – Loss of natural habitats and subsequent loss of flora and fauna.	None

Source: ERM, 2018

7.6.2 Operation phase

Potential impacts

B1- Disturbance to fauna

The operation and maintenance of the irrigation equipment will produce:

- Emissions of pollutants (CO, HC, NOx, VOCs and PM) to the atmosphere. As described in Impact CA1 (*Section 7.2*), the maximum estimated diesel consumption is less than 2,500 m^3/year.
- Noise emissions. As described in Impact N1 (*Section 7.3*), the motor pumps are a source of noise, typically ranging between 60 and 70 dBA.
- Accidental spills of fuel (diesel) or wastes (lubricants), as described in *Section 7.16 Non-routine events*.
- Increased of use of chemical products (herbicides, pesticides, and fertilizers), as an indirect consequence of the improvement of the agricultural / livestock sector in the Project Area.

All these factors have the potential to disturb the fauna in the proximity of the irrigated fields.

In the case of air pollutants and noise, the disturbance would be limited to a temporary displacement of fauna, which would probably move away from the areas where these factors are present. Disturbance can also affect breeding and foraging activities in fauna.

Accidental spills of fuel (diesel) or wastes (lubricants or bentonite-based muds), and an increase in the use of chemical products (herbicides, pesticides and fertilizers), would result in different effects.

Fuel (diesel), waste (lubricants or bentonite-based muds), herbicides and pesticides, can include in their composition toxic chemical compounds, which would affect the fauna if ingested.

It should be noted that not all pesticides and herbicides lead to serious consequences for the fauna. The most likely scenario involves ingestion of plants containing traces of herbicides and / or pesticides, which can be found within the crop field or the field borders. The consequences to the fauna will vary depending on the toxicity of the herbicides / pesticides and the quantity ingested; these can include:

- Loss of individuals.
- Pesticides may affect the fauna indirectly when part of its habitat or food supply is modified. Pesticides may diminish insect populations that are fed on by bird or fish species; insect pollinators may be reduced too, thereby affecting plant pollination.
- Herbicides may reduce food, cover, and nesting sites needed by insect, bird, and mammal populations.

Ingestion of fuel (diesel) or waste (lubricants) is not likely, but disturbance can occur due to dermal contact, if, for example, a spill occurs that is not removed promptly.

In the case of fertilizers, as described in Impact W2, the eutrophication process can have negative consequences for the aquatic life of a water body due to the transformation from an aerobic environment to an anaerobic environment. Most fish species are, for example, very sensitive to the levels of dissolved oxygen in the water and loss of individuals can occur in an anaerobic environment.

This impact on the fauna can be characterised as follows:

- Direct impact as an immediate effect of the Project activities, in the case of disturbance by air pollutants and noise.
- Indirect impact, only occurring as a result of bad practices in the use of herbicides, pesticides, and / or fertilizers and through accidental spills of fuel (diesel) or waste (lubricants or bentonite-based muds).

- Local extent only, limited to the Project Area. No disturbance to fauna is expected outside the Project Area.
- Duration limited to the operation phase, estimated to be about 10 years, taking into account the life expectancy of the equipment. In addition, over this period, the impact would occur intermittently: only during the irrigation period, comprising 3.5 months in the dry season (from January to April), and probably 3-4 days/week, rather than daily.

It should be taken into account that:

- The residual impact of Impact CA1 was assessed as negligible (*Section 7.2*). The same assessment applies for the disturbance to fauna due to air pollutant emissions: the motor pumps/generators will not function continuously; the Project Design involves an embedded Training Programme that includes technical training on the adequate use and maintenance of the irrigation equipment (minimizing its use as much as possible); the emissions from the motor pumps/generators are expected to be lower than those produced by other air pollutant sources in the Project Area (e.g., vehicles); and there will be a scattered distribution of motor pumps/generators in the Project Area (one every 140 ha).
- The residual impact of Impact N1 was assessed as negligible (see *Section 7.3*). The same assessment applies in the case of the disturbance to fauna due to noise levels, for the same reasons described above for the air pollutant emissions.
- With regard to disturbance to fauna due to exposure to toxic chemical compounds present in fuel (diesel), waste (lubricants), herbicides and pesticides, it should be noted that:
    - The potential surface to be irrigated only represents 5% of the total surface area of the Project Area. Therefore, any potential exposure would only occur in a very small part of the Project Area.
    - Exposure to fuel (diesel) and waste (lubricants or bentonite-based muds) would only occur as a result of an accidental spill.
    - Exposure to pesticides and herbicides would only occur as a result of their inappropriate use. However, they are only used in a limited way in the Project Area and the Training Programme will include a topic on their adequate use, focused on minimizing their use as much as possible and selecting low toxicity pesticides and herbicides.

- With regard to the disturbance of fauna due to eutrophication, it should be noted that:
    - The potential surface to be irrigated only represents 5 % of the total surface area of the Project Area. Therefore, eutrophication processes could only occur in a very small part of the Project Area.

- An eutrophication process would only occur as a result of the inappropriate use of fertilizers. However, these are used in a limited way in the Project area and the Training Plan will include a topic on their adequate use.
- Even in the case that some quantities of fertilizers reached the rivers in the Project Area, eutrophication would be avoided as a result of dilution thanks to the high dilution capacity of the Aguan River and its tributaries. Only small surface water bodies not connected to the Aguan River and / or its tributaries, such as ponds and reservoirs, would be vulnerable to eutrophication.

- The Project will provide irrigation equipment to be installed in areas already used for agricultural or pasture purposes. No irrigation equipment will be installed in natural habitats. The risk of disturbance to fauna in agricultural fields and pastures is low since this habitat has a continuous level of disturbance due to on-going agricultural and livestock activities. Because of this, if any disturbance occurs, it is likely to only affect species used to human presence (frequent in agricultural fields and livestock pastures).

Considering the aspects mentioned above, the magnitude of the impact is considered to be negligible. The sensitivity of the fauna depends on the particular species, as described in *Section 5.3.3.*, as different species have different levels of sensitivity.

B2- Disturbance to flora

The following factors related to the operation and maintenance of the irrigation equipment (see Impact B1 for further details) have the potential to disturb the flora present in the proximity of irrigated fields:

- Emissions of air pollutants to the atmosphere.
- Accidental spills of fuel (diesel) or waste (lubricants or bentonite-based muds).
- Increased of use of chemical products (herbicides and pesticides).

Air pollutants can affect plants, for example: PM emissions can affect photosynthesis by reducing the exposure of leaves to the sunlight; and NOx can produce leaf damage, result in reduced growth, and increase susceptibility to diseases.

Accidental spills of fuel (diesel) or wastes (lubricants or bentonite-based muds), and an increase in the use of chemical products (herbicides, pesticides and fertilizers), would result in different effects.

Herbicides are products designed to eliminate plant species that can interfere in normal crop development. They have different mechanism of action, such

as inhibiting photosynthesis or mitosis. When herbicides are applied by spray, they can hit non-target vegetation.

Fuel (diesel), waste (lubricants), and pesticides can include in their composition toxic chemical compounds, which can also affect the flora, in the case of contact, both through the surface of the plant tissues or root absorption.

This impact on the flora can be characterised as follows:

- Direct impact as an immediate effect of the Project activities, in the case disturbance by air pollutants.
- Indirect impact, only occurring as a result of bad practices in the use of herbicides and / or pesticides and by accidental spills of fuel (diesel) or wastes (lubricants or bentonite-based muds).
- Local extent only, limited to the Project Area. No disturbance on flora is expected outside the Project Area.
- Duration limited to the operation phase, estimated to be about 10 years, taking into account the life expectancy of the equipment. In addition, over this period, the impact would occur intermittently: only during the irrigation period, comprising 3.5 months in the dry season (from January to April), and probably 3-4 days/week, rather than daily.

The magnitude of the impact is considered to be negligible due to the following considerations:

- The residual impact of Impact CA1 was assessed as negligible (see *Section 7.2*). The same assessment applies for the disturbance to flora due to air pollutant emissions: the motor pumps will not function continuously; the Project Design involves an embedded Training Programme that includes technical training on the adequate use and maintenance of the irrigation equipment (minimizing its use as much as possible); the emissions from the motor pumps are expected to be lower than those produced by other air pollutant sources in the Project Area (e.g., vehicles); and there will be a scattered distribution of motor pumps in the Project Area (one every 140 ha).

- With regard to disturbance to flora due to exposure to toxic chemical compounds present in fuel (diesel), waste (lubricants), herbicides and pesticides, it should be noted that:
    - The potential surface to be irrigated represents only 5% of the total surface area of the Project Area. Therefore, any potential exposure would only occur in a very small part of the Project Area.
    - Exposure to fuel (diesel) and waste (lubricants or bentonite-based muds) would only occur as a result of an accidental spill.
    - Exposure to pesticides would only occur as a result of their inappropriate use. However, these are used in a limited way in

the Project area and the Training Plan will include a topic on their adequate use, focused on minimizing their use as much as possible and selecting low toxicity pesticides and herbicides.

- The Project will provide irrigation equipment to be installed in areas already used as agricultural fields or pastures. No irrigation equipment will be installed in natural habitats. These habitats – agricultural fields and pastures – are not characterized by a rich flora. Therefore, the risk of disturbance to flora is low and mostly limited to the action of pesticides, when used, which generally involves widely distributed species that affect the normal growth of crop species. Such widely distributed species are not likely to have significant conservation or protection concerns (for example, ruderal species).

Considering the aspects mentioned above, the magnitude of the impact is considered to be negligible. The sensitivity of the flora described in *Section 5.3.2* depends on the particular plant species, as different species have different levels of sensitivity.

B3- Loss of natural habitats and subsequent loss of flora and fauna

An irrigation plan has the potential to modify the habitats where it is implemented, since irrigation could produce a change in the environment. There are two potential effects of the operation and maintenance of the irrigation equipment in the Project Area:

- Direct effect, produced by the potential changes of habitat
- Indirect effect, produced by new land potentially being transformed into irrigated land, to increase agriculture and livestock efficiency.

In both cases, in addition to the effect on habitats, there is an additional effect on the flora and fauna, which could also be affected as result of a change or loss of habitat, assessed already in previous sections

In the first case, the irrigation equipment will be used in existing agricultural fields and pastures, in order to improve their productivity during the dry season. The land to be irrigated will already be a modified habitat which could be modified slightly further by being artificially maintained in a condition of higher humidity than "natural" conditions. On the other hand, if the run off from irrigated areas, due to topographical conditions, could enter forested areas, the maintenance of higher humidity than "natural" conditions in those habitats, adapted to summer dry conditions could result in minor habitat change.

With regard to indirect effects, it is reasonable to think that an efficient irrigation project will increase farm productivity. With increased productivity, farmers could consider the option of expanding their areas of production, meaning natural habitats being transformed into new productive areas (agricultural fields and pastures). This issue was the subject of a detailed

assessment conducted during the June 2018 field survey. The main key findings noted during the field survey are listed below:

- There are several criteria that must be met in order to obtain the irrigation equipment. One of these criteria aims specifically to avoid any effect on natural habitats: in principle, beneficiaries with land within the protected areas will not be eligible for irrigation equipment, although this could be considered on a case-by-case basis, depending on where the land to be irrigated would be located with relation to the remaining well-preserved critical habitat.

- Most of the surface area in the Project Area is already agricultural fields and pastures (approximately of 50.5%). As described in *Section 5.3,* the area of agricultural fields and pastures has increased over recent decades, so that the remaining surface occupied by natural habitats is smaller and, in most cases, is already part of the protected areas (RVSCEH, see *Section 7.7*).

- The transformation of a natural habitat into an agricultural field or pasture would require a financial effort from the farmer (e.g., additional workers hired for chopping activities). This is not realistic when there is already an excess of available agricultural fields and pastures where irrigation equipment could be installed without the need for further financial investment.

  The limiting factor in the economy of the activity is not land but water availability in the dry season. Overall, the density of cattle on the farms observed during the field survey is not high. For example, during a meeting held with small producers, it was reported that an approximate average of cattle per farm is 40 animals. It was considered that small producers were those with farms between 11 and 39 ha. If considering an average surface of 25 ha, the resulting density of cattle would be 1.6 animals/ha. Although this is not the exact average of cattle per hectare in the Project Area, it is a good estimate of the cattle density in the context of the Project Area. For example, there are areas in the EU where the density of cattle is higher than 7.5 animals/ha (Eurostat, 2017)[1].

  Moreover, it is likely that the average of cattle in the Project Area is lower than 1.6 animals/ha, since only the feedback from small producers was used in this estimation. It is very likely that larger producers have lower densities (although more cattle). Therefore, it is considered that there is sufficient room to increase the amount of cattle, without the need to increase the surface area dedicated to agricultural fields and pastures. There would be a change in the livestock production system, from an extensive pattern to an

[1] http://ec.europa.eu/eurostat/statistics-explained/index.php/Agri-environmental_indicator_-_livestock_patterns

intermediate pattern, where cattle would be kept using the same extensive management during the rainy season, but would be intensively managed during the dry season, being housed and fed with silage.

- One of the current reasons for the loss of natural habitats in the Aguan Valley is the search for new grazing areas for the cattle during the dry season. During the rainy season, the cattle is kept at the bottom of the valley, where there is enough food for them. However during the dry season, food is not as abundant, and farmers may take the cattle to upper areas of the hills. Here they chop down trees in forested areas to create new grazing land and keep the cattle fed. The immediate consequence of implementing the irrigation project would be that the cattle would not need to move to higher areas during the dry season. They could be kept near the farms, at the bottom of the valley, in fields already devoted to agriculture and pasture, and be fed with silage produced as a result of the improved crop management made possible by the irrigation system.

The Project could in fact benefit the conservation of the natural habitats in the Protected Area, such as the very dry tropical forest, and, consequently, the key species within the habitat, such as the Honduran emerald hummingbird (*Amazilia luciae*) and the black-chested spiny-tailed iguana (*Ctenosaura melanosterna*).

The impact on the habitats can therefore be characterised as follows:

- Direct impact, as an immediate effect of the Project activities.
- Indirect impact, only occurring due to the potential transformation of natural land for agriculture and livestock activity.
- In both cases, the impact would be of local extent only, limited to the Project Area. No effect on habitats, flora, or fauna is expected outside the Project Area.
- The duration is limited to the operation phase, estimated to be about 10 years, taking into account the life expectancy of the equipment.

Based in the rationale provided above, the magnitude of this impact is as follows:

- Negligible, with regard to the direct change of habitats as any habitat modification would be limited to modification of the existing agricultural fields and pastures which are considered to have a low sensitivity, due to their continuous exposure to human activities (agriculture and livestock).

- Minor or negligible, depending on the actual location of the plots to be irrigated, in the case of the potential run off from irrigated plot towards forested areas.

- Medium with a positive/beneficial consequence, with regard to the indirect change of habitat, as the transformation of natural land to increase agriculture and livestock activity is not expected due to the reasons described above: the selection criteria of beneficiaries, the financial limiting factors and the fact that the irrigation system during the dry season will keep the cattle in fields already devoted to agriculture and pasture. In addition, based on the feedback received from local environmental experts, ASIDE and ICF, it is expected that the diversification resulting from the Project will contribute to the conservation of the remaining natural habitats in the Project Area.

Mitigation measures

The Project design includes the following embedded measures:

- Development of a Biodiversity Management Plan prepared and implemented by the SAG. This will contribute to increasing awareness of the importance of the biodiversity and how to sustainably manage farms with regard to biodiversity.
- Potential beneficiaries whose land is partially within or adjacent to protected areas and/or natural habitats (such as shrubland or forest), will be selected on a case-by-case basis by the PIU-SAG, with the contractual condition that these protected areas are not within the irrigated plot, and the natural habitats are maintained as they are, including prevention of irrigation or its run-off entering the natural habitat, if these beneficiaries are ultimately provided with Project irrigation equipment.
- The travelling reels/micro-sprinklers hold a hose or PVC connection of 125 ms maximum length, which have a maximum irrigation distance of 25 ms from each hose, from irrigation hydrant/micro-sprinklers locations. In this way it is easy to locate the hydrantmicro-sprinkler location nearest the natural habitat (if relevant) at a sufficient distance as to irrigate the plot without irrigating the natural habitat
- Embedded mitigation measures described in Impact CA1 (see *Section 7.2*), regarding the disturbance of fauna (Impact B1) and flora (Impact B2) as a result of the emissions of pollutants to the atmosphere.
- Embedded mitigation measures described in Impact N1 (see *Section 7.3*), regarding the disturbance of fauna (Impact B1) as a result of the emission of noise.
- Embedded mitigation measures described in *Section 7.14 Non-routine events*), regarding the disturbance of fauna (Impact B1) and flora (Impact B2) as a result of accidental spills of fuel (diesel) or waste (lubricants or bentonite-based muds).
- Embedded mitigation measures described in the impacts on surface water and groundwater resources (see *Section 7.5*), regarding the disturbance of fauna (Impact B1) and flora (Impact B2) as a result of the increased use of chemical products (herbicides, pesticides, and fertilizers).

In addition to these embedded mitigation measures, it should be noted that the mitigation measures to be adopted in Impact S1 (see *Section 7.4*), Impacts W1,W2, and W4 (see *Section 7.5*) will also be beneficial for minimizing and avoiding any disturbance to the fauna (Impact B1) and flora (Impact B2).

Residual impacts

Table 7.10 summarises the impacts on biodiversity as a result of the Project activities during the operation phase. The embedded measures considered in the Project Design result in the Residual Impacts being assessed as Negligible and Positive.

Table 7.10 Summary of impact assessment on the biodiversity during the operation phase

Impact / Risk	Measures to address the impact / risk	Residual Impact
B1– Disturbance to fauna.	*Embedded measures:* • Development and implementation of a Biodiversity Management Plan. • Case-by-case selection of potential beneficiaries whose plot is partially within or adjacent to protected areas and/or natural habitats, such as shrubland and forest, with the contractual condition, with the contractual condition that these protected areas are not within the irrigated plot, and the natural habitats are maintained as they are, including prevention of irrigation or its run-off entering the natural habitat if ultimately provided with Project irrigation equipment. • The selection will include a site visit the beneficiary plots to confirm that no sensitive resources will be affected. • Embedded mitigation measures as described in: o Impact CA1, o Impact N1, o Impact S1, o Impact W1, o Impact W2, o Impact W4. Embedded mitigation measures as described in: non-routine events (Acc1) (see Section 7.14), *Mitigation measures:* • Mitigation measures as described in: o Impact CA1, o Impact N1, o Impact S1, o Impact W1, o Impact W2, o Impact W4.	**Negligible** • Impact CA1 and Impact N1 were assessed as Negligible. • Exposure to toxic chemical compounds only occurring as the result of an accidental spill. • Irrigation equipment to be installed in areas already used as agricultural fields or pastures, where presence of fauna is lower than in natural habitats. • Irrigation limited to up to 5% of the total surface area in the Project Area. • Irrigation limited to 3.5 months a year. • Only agricultural fields and pasture to be irrigated; no irrigation systems installed in natural habitats
B2 – Disturbance to flora.		**Negligible** • Impact CA1 assessed as Negligible. • Exposure to toxic chemical compounds only occurring as the result of an accidental spill. • Irrigation equipment to be installed in areas already used as agricultural fields or pastures, where presence of fauna is lower than in natural habitats. • Irrigation limited to up to 5% of the total surface area in the Project Area. • Irrigation limited to 3.5 months a year. • Only agricultural fields and pasture to be irrigated; no irrigation systems installed in natural habitats

Impact / Risk	Measures to address the impact / risk	Residual Impact
B3 – Loss of natural habitats and subsequent loss of flora and fauna.		**Negligible** • Direct impact – change of habitat • Only agricultural fields and pasture to be irrigated; no irrigation systems installed in natural habitats
		Positive – Medium • • The expectation of local environmental experts, ASIDE and ICF is that the irrigation will benefit the conservation of natural habitats and will not contribute to its transformation.

Source: ERM, 2018

7.7 *PROTECTED AREAS/ CRITICAL HABITATS*

7.7.1 *Overview*

This section assesses the potential impacts on protected areas and critical habitats as a result of the Project activities. *Box 7.6* presents the key sources of impacts, potentially impacted receptors, the baseline, and factors influencing the project.

Box 7.6 Key Considerations for Assessment – Protected Areas

Sources of Impact

- Operation and maintenance of irrigation equipment

Potentially Impacted Receptors

- Protected Areas: Honduran Emerald Hummingbird Wildlife Refuge (RVSCEH).
- The other receptor potentially impacted by effects on the protected areas is biodiversity/ critical habitats (see *Section 7.6 and Annex 9*).
- **Particular Baseline Conditions that Potentially Influence Impacts**
- Main ecological features in the RVSCEH and adjacent Critical Habitats are: (1) fauna – Honduran emerald hummingbird and black-chested spiny-tailed iguana, both endemic; (2) up to 10 species of endemic flora; (3) very dry tropical forest habitat.

Project Factors that Potentially Influence Impacts

- The Project will provide irrigation to about 4,240 ha within the Project Area, which covers a total surface of about 60,000 ha.
- The irrigation equipment will not be used in natural or critical habitats within the limits of any protected area.

References

- Chapter 3 Project Description and Alternatives – specifically *Section 3.1*, *Section 3.4.1*, *Section 3.5*, *Section 3.6.1* and *Section 3.6.2*.
- Chapter 5 Baseline Description – specifically *Sections 5.3.4& 5.3.5*
- *Annex 9*

Source: ERM, 2018

Table 7.11 presents the key impacts of the Project on the protected areas.

Table 7.11 Key Potential Impacts – Protected Areas & Critical Habitats

Pre-operation phase	Operation phase	Abandonment phase
None	PA1 – Effect on habitats, flora, and fauna in the Protected Area/ Critical Habitats during operation	None

Source: ERM, 2018

Operation phase

Potential impacts

PA1 – Effect on habitats, flora and fauna in the Protected Area/Critical Habitats

This has already been assessed under Impacts B1, B2 and B3. As any impact on the protected area (PA1) and other potential Critical Habitats outside Protected Areas (possible but of relatively infrequent occurrence and limited footprint, as explained in *Section 5.4.5* of the Baseline) would occur as a result of the effects on habitats within the protected area, or any species of fauna and / or flora considered a main ecological feature in the Protected Area, the conclusions of those impacts are the same as for this impact. In particular and with respect to Critical Habitats, as explained in previous sections and Annex 9, with the application of the mentioned mitigation measures, the project itself could result in a Net Gain for the Critical Habitats within the project footprint.

Mitigation measures

The embedded measures and mitigation measures described and referred to in *Section 7.6*also apply to Impact PA1.

Although the significance was assessed as Negligible, with regard to the potential disturbance of fauna and flora in the RVSCEH and direct changes of habitat in this protected area, the following two mitigation measures will be included, taking into account the high sensitivity of the RVSCEH:

- The Pesticides and Herbicides Management Plan will have specific considerations regarding the use of pesticides and herbicides in the proximity of the protected area.

- The Fertilizers Management Plan will have specific considerations regarding the use of fertilizers in the proximity of the protected area.

Residual impacts

Table 7.12 summarises the impacts on the protected areas as a result of Project activities during the operation phase. The embedded measures considered in the Project Design result in the Residual Impacts being assessed as Negligible and Positive.

Table 7.12 Summary of impact assessment on the protected areas/critical habitats during the operation phase

Impact / Risk	Measures to address the impact / risk	Residual Impact
PA1 – Effect on habitats, flora, and fauna in the Protected Area	*Embedded measures:* Same embedded measures as B1, B2 and B3. *Mitigation measures:* Same mitigation measures as B1, B2 and B3. In addition to this: • The Pesticides and Herbicides Management Plan will have specific considerations regarding the use of pesticides and herbicides in the proximity of the protected area. • The Fertilizers Management Plan will have specific considerations regarding the use of fertilizers in the proximity of the protected area.	**Negligible** • Aligned with Impacts B1 and B2 regarding effect on flora and fauna in the RVSCEH. • Aligned with Impact B3 regarding direct effects on habitats in the RVSCEH. **Positive - Medium** • Indirect impact - change of habitat occurring due to the transformation of natural land to increase agriculture and livestock activity • ASIDE and ICF, co-managers of the RVSCEH, expect that the diversification resulting from the Project will contribute to the conservation of the remaining natural (including critical) habitats in the Project Area and will therefore benefit the protected area.

Source: ERM, 2018

7.8 ECONOMY AND EMPLOYMENT

7.8.1 Overview

This section assesses the potential economic and employment impacts associated with the Aguan Irrigation Project. The assessment is divided into pre-operation and operation. The abandonment phase has been scoped out

(see Chapter 6) and is not treated in this Section. A summary of the key considerations for the assessment of economic and employment impacts is presented in *Box 7.7* below.

Box 7.7 Key Considerations for Assessment – Economy and Employment

Sources of Impact

- SAG beneficiary fee and beneficiary procurement of goods and services.
- Training of SAG technicians and/or designated personnel to train and support beneficiaries.
- Conditioning of beneficiary land and drilling of water wells and additional works related to the proper installation of Project equipment.
- Operation and management of the irrigation equipment

Potentially impacted receptors

- Project beneficiaries (between 260 and 300 stockbreedermilk producers and farmers in the Study Area representing 75 % of the total producers in the Project Area).
- Unemployed or underemployed local labour force in the agriculture, livestock and milk production sector
- Unemployed or underemployed local labour force employed in the machinery installation sector (for the installation of irrigation kits)

Project Factors that are Potentially Influencing Impacts

- The SAG will use the fee paid by beneficiaries to sustain the operation phase including beneficiary capacitation building and ad-hoc.
- SAG technicians and/or SAG-designated personnel will receive training by PAA Project Finance on installation, use and maintenance of Project equipment.
- Project beneficiaries receive training from the SAG trained technicians and/or designated personnel on appropriate installation, operation, and maintenance of the equipment as well as sustainable agriculture and irrigation practice.
- 311 irrigation kits will be delivered and installed and may require temporary employment equivalent to 310-550 man days to support with installation.
- Project beneficiaries requiring an underground water source (approx. 70% of potential beneficiaries) are responsible for drilling the wells.
- Duration of the pre-operation is approximately 15 to 20 months.
- Duration of operation phase is approximately 10 years.

Particular Baseline Conditions that are Potentially Influencing Impacts

- Approximate number of potential beneficiaries (i.e. total livestock breeders and milk producers in the Project Area) is estimated between 350 and 400. Based on preliminary assessments (CINSA&PAA 2017), 75% of potential beneficiaries are expected to meet the selection criteria. The Project is therefore expected to benefit 260 – 300 producers, which represents 75% of total producers. These Producers occupy approximately 16,000 ha which correspond to 70% of the total cultivated and pasture land in the Area.
- The majority (48%) of potential beneficiaries are small producers with less than 40 ha of land. 14% have less than 10 ha.
- Income and employment: the main income and employment-generating sector for households in the Project Area is agriculture and livestock breeding (48% in Olanchito and 57% in Arenal). While the milk-processing sector only employs 0.22% of the population in Olanchito and Arenal and 0.11% at the department level, it still represents an important economic contribution at the regional and national level.
- Annual milk production per year in Olanchito is of 18,000,000 Litres.
- *Skill level*: in the formal employment sector, the machinery installation and mechanics sector employ about 9-14% of the labour force in Olanchito and Arenal i.e. 2,700 individuals (overall 17% in Yoro). Agricultural skills are widely available.
- *Availability of goods for procurement*: the machinery and mechanics sector employ about 17% of the labour force in the department of Yoro. It is assumed therefore that most pumps and water tanks can be sourced locally or at the regional level.
- *High importance to local stakeholders*: high underemployment, mostly low skilled jobs in agriculture / livestock sector (23-30% of employment in Olachito and Arenal i.e. 6,400 individuals).

- Number of employees on the farms tend to increase by 50% to 100% in the rainy season through the hiring of temporary labour.

Vulnerable Groups

- Indigenous individuals reside in the Project Area among non-indigenous communities and are reportedly well integrated into the labour market in the Study Area. Some individuals of indigenous descent are also reportedly employed on potential beneficiary farms and benefit from the same conditions as non-indigenous workers.
- High levels of underemployment in the area. One third of the occupied population in Honduras is underemployed with higher numbers in rural areas.

References

- Chapter 1 Introduction – specifically *Section 1.3*.
- Chapter 3 Project Description and Alternatives – specifically *Section 3.4*, *Section 3.5*, and *Section 3.6*.
- Chapter 5 Baseline Description – specifically *Section 5.5.3, Section 5.5.5, Section 5.5.6, Section 5.5.8,* and *Section 5.5.9*.

Source: ERM, 2018

Potential economic impacts relating to local livelihoods are covered separately under Land and Livelihoods in *Section 7.9*. *Table 7.13* presents the key impacts of the Project on the economy and employment during the three phases of pre-operation, operation, and abandonment.

Table 7.13 Key Potential Impacts – Economy and Employment

Pre-operation phase	Operation phase	Abandonment phase
EE1 - Long-term benefits of capacity enhancement for SAG technicians and beneficiaries *Note: this impact also extends to the operation phase.*	EE2- Temporary economic impacts from beneficiary fee payment to the SAG and beneficiary procurement. EE3 – Temporary direct employment of labour for installation of the irrigation equipment. EE4 – Long-term economic growth from production increase and improvements in the agriculture, milk production sector and related sectors. EE5 - Long-term direct and indirect employment in the agriculture, livestock breeding and milk production sector and related sectors.	None

Source: ERM, 2018

7.8.2 Pre-Operation and Operation Phase

Potential impacts

EE1 – Long-term benefits of capacity enhancement for SAG technicians and beneficiaries

As part of the Project pre-operation phase, PAA Project Finance, with support from the SAG, will be responsible for training SAG technicians and/or SAG-designated personnel on the correct installation, operation, and maintenance of the irrigation equipment and use of drilling vehicles. Training of SAG and designated technicians will also include capacity building on proper agricultural consulting in order to support beneficiaries as needed throughout the installation and operation of the equipment.

The SAG technicians training programme will contribute to the capacity building and long-term skill acquisition of the technicians, which in turn will also increase the SAG's capacity to implement similar irrigation projects in other areas in the future and to support local producers through the provision of adequate technical advice on agricultural practices and proper equipment and groundwater well maintenance.

Since the beneficiaries themselves are responsible for the installation of the equipment and not the SAG, the SAG formed technicians will train project beneficiaries from the agriculture, livestock breeding and milk production sectors on proper installation, use and maintenance of irrigation equipment, as well as on sustainable agriculture and irrigation techniques and environmental and social good practice. The training received and the operation of the irrigation equipment will result in increased skills and capacity building for producers in the agriculture, livestock breeding and milk production sectors through the introduction of innovation into the local production process.

In summary, capacity building is expected to benefit SAG technicians on the one hand, as well as the SAG itself for the implementation of similar projects. The number of SAG technicians and designated staff is unknown at this stage.As for the beneficiaries, the Project is expected to benefit 75% of potential beneficiaries in the area (i.e. 260-300 producers). Therefore 75% of the producers are expected to benefit from the acquisition of new skills which will improve their productivity throughout the 10-year operation phase.

Enhancement Measures

The project design already includes the following embedded measures:

- PAA Project Finance, with support from the SAG, is responsible for implementing the Project's Training Programme which includes training SAG technicians and/or personnel designated by the SAG on the correct installation and use of the irrigation equipment and drilling vehicles. The technical training also includes capacity building on agricultural consulting.
- As part of the embedded Training Programme, the SAG will in turn provide training to the beneficiaries on the installation, use, and maintenance of equipment as well as on agricultural and irrigation good practice and environmental and social measures.

In order to enhance the positive impacts to the local economy from capacity building in the irrigation and agriculture sector, the following enhancement measures will apply:

- In addition to the embedded Training Programme by PAA Project Finance, the SAG will develop in partnership with local organisations a training programme to provide ongoing technical support and agricultural/irrigation advice to Project beneficiaries during the operation phase.
- As part of the training program, the SAG will develop and implement ad-hoc additional training on relevant aspects as required.

Residual Impacts

Table 7.14 summarises the impacts of SAG financing and procurement and capacity enhancement as a result of the Project activities during both the pre-operation and operation phase. The embedded measures considered in the Project Design and the enhancement measures defined during the impact assessment further enhance the Positive impact.

Table 7.14 Summary of impact assessment of SAG financing, procurement, and capacity building and enhancement measures during pre-operation and operation

Impact / Risk	Measures to address the impact / risk	Residual Impact
EE1 – Long-term benefits of capacity enhancement for SAG technicians and Project beneficiaries	*Embedded measures* • PAA Project Finance, with support from the SAG, will implement the Project's Training Programme including training of SAG technicians and designated personnel on the correct installation and use of the irrigation equipment and drilling vehicles. The technical training also includes capacity building on agricultural consulting. • The SAG will in turn provide training to the beneficiaries on the installation, use, and maintenance of equipment as well as on agricultural and irrigation good practice and environmental and social measures. *Enhancement measures:* • In addition to the embedded Training Programme by PAA Project Finance, the SAG will develop in partnership with local organisations a training programme to provide ongoing technical support and agricultural/irrigation advice to Project beneficiaries during the operation phase. • As part of the training program, the SAG will develop and implement ad-hoc additional training on relevant aspects as required.	**Positive - Moderate** • Capacity building is expected to benefit 75% of producers in the Project Area. • Productivity gains from capacity building will extend throughout the 10-year operation phase. • Capacity building of SAG technicians and the SAG will extend beyond the operation phase. • The number of SAG technicians to train is unknown. • The enhancement measures will further enhance the benefits of capacity building through the provision of continuous ad-hoc support.

Source: ERM, 2018

7.8.3 Operation Phase

Potential impacts

EE2 – Temporary economic impacts from beneficiary fee payment to the SAG and beneficiary procurement

During the pre-operation phase, the selected beneficiaries will be required to pay a fee to the SAG in return of the irrigation equipment. The fee amount has not yet been specified, but is expected to only covering a small portion of the equipment cost and intended to support the long-term sustainability of the Project during the Operation phase. The fee is expected to be set at 2,000 USD based on a similar fee used for a similar irrigation project in the area. As such, the fees paid will be used as funds for the SAG to finance additional training and capacity building as well as supervision, ad-hoc support and monitoring of Project implementation during the Operation phase. Specifically, this will

contribute to financing the technical Training Programme (included in Project Design) and additional capacity building programmes such as those recommended in the present ESIA including annual crop production and irrigation good practices, sustainable use of water, use of pesticides and fertilizers, waste management, etc. Considering the importance of the agriculture, livestock breeding and milk production sectors in the Study Area, additional investments in the sector to build capacity and increase productivity will reach about 48% and 57% of the population in Olanchito and Arenal employed in this sector at the local level. The impacts are expected to extend throughout the 10-year operation phase, and potentially beyond, depending on the amount of funds available and their reinvestment. The economic impact of the Project on this sector is assessed in more detail in Impact EE4 (*Section 7.8.3)*

In terms of procurement, PAA Project Finance will provide the irrigation equipment, which will be imported from outside Honduras. Beneficiaries will need to have available or acquire themselves is limited to an underground well to place the submersible pumps provided by the project. This only applies to beneficiaries who require underground water supply, which represents the majority (approx. 70%) of potential beneficiaries, i.e. 210 potential beneficiaries. Considering that the machinery and mechanics sector employs between 9 and 14% of local labour force in Olanchito and Arenal and about 17% in the department of Yoro, it is assumed that most drilling works can be sourced by companies locally or at the regional level. The economic benefits will therefore primarily occur at the local and regional levels and will be spread out over the first two years of the operation phase in a punctual manner (non-continuous).

EE3 –Temporary direct employment of labour for installation of the irrigation equipment

The execution of the drilling of water wells, the placement of the collection pipe and the installation of the pump is the responsibility of the beneficiaries who will be trained by SAG technicians and/or designated personnel. Nevertheless, it is expected that beneficiaries may require additional support and hire temporary labour in addition to the existing farm labour to help them with the installation (i.e. digging and installing the buried pipe network, covering up the pipes and connecting the different components, etc.). Assuming installation of a total of 311 irrigation kits, one support worker per kit and average installation of one to two days per kit depending on each spot, it can be concluded that the labour required for the installation will be around 310-550man days. [(1)] Since 9-14% of the population in the Study Area are employed in the machinery installation and mechanics sector, the labour will be hired locally and contribute to temporary employment in this sector. Employment duration will be very short-term.

[1] Man-days refer to the number of man-hours in a day of work and is used as a measure of how much work or labor is required or consumed to perform some task. Work calculated in man-days does not correspond to full time employment as the work may be distributed over a more flexible timeframe.

As for the drilling of underground water wells, these activities will be performed by specialist local or regional companies for beneficiaries that do not have access to surface water sources for irrigation (approx. 70% of beneficiaries). It is estimated that 182 to 210 underground water wells will be drilled [(1)] over a 2-year period. As such different companies can conduct multiple installations one after the other on a business as usual mode resulting in a negligible number of jobs.

To summarise, the potential employment creation related to installation and drilling is expected to be limited with a small number of very short-term and punctual employment opportunities at the local level.

EE4 – Long-term economic growth from production increase and improvements in the agriculture, milk production sector and the related sectors

Based on Project objectives, irrigation technology is expected to prolong the production cycle and even-out production during the rainy and dry seasons resulting in an increase in agricultural output and associated milk production. According to the SAGO, the increase in agricultural output is expected to reach up to 40% per year depending on the crops (see *Section 1.3*), which is expected to translate into a similar increase in annual milk production. Similarly, based on feedback collected through interviews with the SAGO and CRELs it is projected that milk production will increase by 40-50% during Project implementation. However, it was noted that these projections rely primarily on assumptions made by the SAGO and the CRELs which are based on the fact that production in the rainy season increases by up to 150% and that the annual production would increase by about 40%-50% if production is made constant throughout the year and if productivity gains are achieved. No formal economic feasibility study was conducted and therefore these projections require further confirmation.

Based on more conservative calculations, the annual milk production increase would be of approximately 17% assuming a constant production rate equal to that of the rainy season throughout the year.[2] This production increase is expected to translate into increased economic activity in the milk production sector and related sectors such as milk processing and artisanal cheese production. Increased economic activity in the milk production sector is also expected to contribute to employment (*Impact EE5*) and potentially higher disposable incomes for Project beneficiaries and their households (*Impact LL1*).

[1] The estimation of underground water wells to be drilled is based on the fact that approximately 75% of potential beneficiaries are expected to meet the selection criteria based on preliminary findings of CINSA&PAA's assessment in 2017. Considering that the total number of potential beneficiaries is estimated between 350 and 400, the number of eligible potential beneficiaries is estimated between 260-300 (see *Section 5.5.3*). Since 70% of potential beneficiaries require underground water wells, then the estimated number of wells is between 182 and 210.

[2] Considering an annual production of milk of 18,000,000 liters, and assuming that production in the rainy season (9 months) increases by up to 150% from the dry season (3 months), the milk production value in the dry season was calculated using the following equation: 9*(150%*X+X) + 3 X = 18,000,000. Monthly production rate in the dry season is therefore 705,882 and 1,764,706 in the rainy season. Assuming constant production during the 12 months of production at the rainy season rate, total production per year increases to 21,176,471 which corresponds to a 17.65% increase.

Milk production and access to market

An important increase in milk production could potentially lead to a drop in the price of milk if the demand does not match the increased supply. Since a formal supply-and-demand market study for the milk production and milk processing sectors was not conducted, the potential risks and opportunities related to the increased supply cannot be fully assessed. However, according to a national newspaper article from June 2017, milk processing industries do not have the capacity to process all the milk produced during the rainy season, when milk production sometimes increases by up to 150% and results in overproduction and losses in the milk production sector.[1] That being said, it has been reported during the 2018 field survey that national milk processing companies such as LEYDE have been asking CRELs and producers to improve reliability and stability of the supply throughout the year. Also, desk-based research of available online sources also show that in-spite of the annual increase in milk production, milk production is reportedly not sufficient to meet the growing domestic demand.[2] In addition, the Municipality of Olanchito has also planned improvements to the road network (independent from the Project), which are expected to facilitate increased access to milk processing centers and markets for the sale of dairy products, such as San Pedro Sula in the department of Cortés. Overall, this supports the existence of a market for an increased production as long as the supply remains stable and peaks are reduced. However overproduction remains a potential risk if not properly managed.

Production diversification and related sectors

Based on data collected during the 2018 field survey, the Project is also seen as an opportunity to diversify the type of cattle feed and increase the production of forage species and crops that can be collected in the rainy season and then stored in silos to feed the cattle throughout the year. This includes corn, sorghum, and other forage species. The increased and more reliable supply of cattle feed will be the key to improving productivity in the milk production sector and to stabilize the production during the whole year. The Project also presents an opportunity to diversify agricultural output of non-cattle feed crops such as citric, vegetables and grains in order to adjust more easily to market variations, thus positively influencing the creation or establishment of agro-food industries and related job opportunities in the agriculture sector at the local level over the 10-year operation phase.

At the local level, a more stable milk production throughout the year will also benefit local artisanal cheese producers whose milk input decreases significantly during the dry season, when most milk producers sell their milk

[1] "Sector Ganadero Afronta Sobreproducción de Leche". La Prensa, June 2017. Accessed at: http://www.laprensa.hn/economia/1080703-410/leche-sobreproduccion-hector_ferreira-camara_leche-ganadero

[2] Dairy value chain in Honduras and Nicaragua: Background proposals for the CGIAR Research Program on Livestock and Fish. Accessed at: https://cgspace.cgiar.org/bitstream/handle/10568/16971/LivestockFish_DairyVCHondNicarag.pdf?sequence=1

to the higher-paying milk processing industries (10 to 11 lempiras per litre ie. 0.42 to 0.46 USD). Artisanal cheese producers usually get to buy the production surplus during the rainy season at a lower price (7 to 8 lempiras per litre – i.e. 0.29 to 0.33 USD). However, with an increased and more stable production as a result of the Project, cheese producers can also stabilise their production throughout the year and increase their revenues over the 10-year operation phase.

In addition, improvements in the industrial milk production sector in the Study Area are also expected to translate into increased economic activity and growth for the milk-processing and dairy product industries located outside the Study Area, and outside the department of Yoro, mainly in the department of Olancho and in San Pedro Sula (department of Cortés). In the rainy season when the supply of milk more than doubles, milk processing industries do not always have the capacity to absorb all the production, resulting in lost milk production and losses for milk producers who are not able to sell their milk.[1] An increased and more stable milk production throughout the year, will allow these industries to better adjust their processing capacity and increase their production and revenues. Milk processing industries are also important at the national level as they strongly contribute to the national commercial balance.

Increased disposable income and spending

As discussed above, higher milk production volumes and increased economic activity in the milk production sector and agricultural sector will result in higher revenues for Project beneficiaries. Beneficiaries in turn will have more disposable income to spend, which is expected to contribute to the local economy during the 10-year period. Revenue gains and higher incomes are also expected to create more opportunities for investing in more efficient technology contributing to further improvements of the sector beyond the operation phase.

EE5 – Long-term direct and indirect employment for workers in the agriculture, livestock and milk production sector and related agriculture and milk processing sectors

As discussed previously in *Impact EE4*, milk production is estimated to increase by 17% per year although the SAGO and CRELs report expectations of a greater increase. This in turn is expected to generate additional employment opportunities for farm labour, especially permanent workers, as well as increased income stability during the 10-year operations phase.

The average number of permanent employees is reportedly 2-4 for small producers, 6-8 for medium producers and 10-12 for large producers. The numbers usually tend to increase by 50% in the rainy season through the hiring of temporary labour, and up to 100% in the first two months of the rainy season. With a stable production throughout the year the number of

[1] http://www.laprensa.hn/economia/1080703-410/leche-sobreproduccion-hector_ferreira-camara_leche-ganadero

permanent workers is therefore expected to increase compared to seasonal workers, which offers a more stable source of livelihoods (see *Section 7.9)*.

Based on a similar irrigation project undertaken by the SAG in various departments including Yoro in 2015, job creation per hectare of irrigated land for the main forage species (*pasto*) and crops in the Project Area (ie. corn, beans, and sorghum) was approximately 0.55 jobs (see *Section 5.5.10*).[1] Considering that the Project Area will irrigate an area of 3,110 ha, this translates into approximately 1,700 jobs.

According to estimates provided by SAGO and CRELs representatives each farm on average employs approximately six (6) permanent workers. Since the project is expected to benefit up to 300 producers, the number of permanent workers currently employed in beneficiary farms is estimated at 1,800. Furthermore, since the 300 beneficiaries cultivate a total of approximately 16,000 ha, job creation per hectare of land pre-irrigation is estimated at 0.11 jobs.

Considering that out of the 16,000 ha owned by beneficiaries, 3,110 are irrigated by the Project and the remaining 12,000 are not, labor estimates are the following:

- The required labour for the approximate 12,000 ha of land not irrigated by the Project is 1,320.
- The required labour for the 3,110 ha of land irrigated by the Project is 1,700

Therefore the total number of permanent labour (all year round) required to cultivate the 16,000 ha of land is 3,020 which represents a 51% increase, and corresponds to the reported labour increase during the rainy season. Since employment increase is not linear, a more conservative estimate between 30%-51% would be more adequate.

Overall, since 23% and 30% of the active population in Olanchito and Arenal respectively (i.e. approximately 6,000 and 400 people respectively) are employed as low-skilled farm labour, assuming a 30% employment increase the number of new jobs created is estimated to be 1,920.[2] Considering the high levels of underemployment in the area, jobs are expected to be filled locally, providing additional and more stable jobs in the sector for the local population, especially in the dry season when employment opportunities tend to decrease.
This estimated increase in low-skilled job opportunities it is expected to also benefit individuals of indigenous descent working in the Study Area, as it is the case for a number of indigenous individuals who reportedly reside in the area and are employed in some potential beneficiary farms.

[1] Bauer, Irrigation Project for High Value Crops (*"Cultivos de Alto Valor Bajo Riego por Aspersión")*. October 2015.

[2] The calculation is the following: 6400 x 1.3 = 8,320 and 8,320 – 6400 = 1,920.

With respect to the milk processing sector, a milk production increase of 17% would also imply more milk to process in total per year, however production would be spread out more evenly between the rainy season and the dry season, which might not require additional milk processing jobs to cover the additional supply. The impact on the milk-processing sector in terms of indirect employment opportunities is therefore not expected to be very significant.

Enhancement Measures

The project design already includes the following embedded measures:

- In addition to the technical training provided to beneficiaries during the pre-operation phase, other relevant trainings for beneficiaries will be implemented by the SAG as part of the Project's Training Programme to ensure the application of environmental and social good practice, such as annual crop production and irrigation good practices, sustainable use of water recommendations, use of pesticides and fertilizers, waste management. These trainings will be delivered by technicians from the SAG-DICTA (Directorate of Agricultural Science and Technology) and from other local organizations such as ASIDE, SENASA, Health Secretary / Coordination of Environmental Health Program of the Municipality of Olanchito to the selected beneficiaries.

In addition to the existing measures, and in order to enhance positive impacts to the local economy from beneficiary fee payment to the SAG and procurement the following enhancement measures will apply:

- The SAG will conduct an assessment of local content potential for the procurement of submersible water pumps and water tanks for Project beneficiaries, including:
    - identifying the local suppliers in the study area and in nearby municipalities that meet the required quality standards and assess their ability to meet the expected demand;
    - as required, providing appropriate capacity-building and technical or financial information support to ensure adequate supply over the 10 years installation period; and
    - providing beneficiaries with a list of approved water pump and water tanks suppliers, first at the local level in the Study Area, and then at the Department level in order to promote local procurement.

In order to enhance positive impacts from employment creation for installation workers who may be hired by the beneficiaries, the following enhancement measures will apply:

- The SAG will ensure that beneficiaries employ workers from the local labour force prioritizing workers from the Project Area followed by

workers from Olanchito and Arenal more broadly and neighbouring municipalities as needed.
- The SAG will ensure that beneficiaries rely on the CRELs and the municipality employment department to advertise their employment needs with a clear application procedure and ensure equal opportunities for all and transparent hiring practices.

For Project impact on economic growth and improvements in the agriculture, livestock and milk production and related milk processing sector, the following enhancement measures apply:

- The SAG will conduct a detailed economic feasibility study and supply-and-demand market study for the agriculture, milk production and milk-processing sectors to assess risks and opportunities related to an increased milk and agriculture production.

As for employment opportunities for workers in the agriculture, livestock and milk production sector, the following applies:

- The SAG will consider as part of the beneficiary selection criteria the potential beneficiary's financial solvency to cultivate the minimum 10 ha of irrigated land and to generate additional employment in order to increase their agriculture or milk production output.
- The SAG will require potential beneficiaries to present an investment plan showing how they plan to cultivate the land irrigated by the Project including the number of permanent jobs expected.
- The SAG will agree with selected Project beneficiaries on the expected level of yearly employment and will ensure that best efforts are made to employ workers from within the Project Area including individuals of indigenous descent, while guaranteeing equal pay and working conditions. Additional labour requirement with respect to employment conditions and labour rights will also be agreed jointly with the Project beneficiaries. These specific requirements are discussed in *Section 7.12*.
- The SAG through relevant technical departments will monitor compliance with labour related commitments both during the rainy and dry season.

Residual Impacts

Table 7.15 summarises the impacts on economic growth and employment as a result of the Project activities during the operation phase. The enhancement measures defined during the impact assessment results in Positive Residual Impacts of Minor to Major significance.

Table 7.15 Summary of impact assessment on economic growth and employment during the operation phase

Impact / Risk	Measures to address the impact / risk	Residual Impact

EE2 – Temporary economic impacts from beneficiary fee payment to the SAG and procurement	*Embedded measures*
	• As part of the Project's Training Programme, the SAG to ensure that relevant technical departments and partner organizations (ASIDE, SENASA, Health Secretary, etc.) implement relevant trainings for beneficiaries to ensure application of environmental and social good practice, such as annual crop production and irrigation good practices, sustainable use of water, use of pesticides and fertilizers, and waste management.
	
	Enhancement measures
	• SAG to conduct an assessment of local procurement potential including:
	  • identification of local suppliers that meet required quality standards and ability to meet the demand;
	  • capacity building and support to identified suppliers to ensure continuous supply; and
	  • promotion of local procurement by beneficiaries by providing a list of local and regional suppliers.
		Positive - Moderate
		• The beneficiary fee amount is not known at this stage however the estimated number of beneficiaries is 260 to 300.
		• Productivity gains from reinvestments of the fees will reach between 48% and 57% of the population in the Study Area over a 10-year period and potentially beyond.
		• The procurement of 190 pumps will benefit 9 to 14% of the local labour spread out over a 2 year period, non-continuous.

EE3 – Temporary direct employment of labour for installation of irrigation equipment	• SAG to ensure that beneficiaries employ workers from the local labour force prioritizing workers from the Project Area followed by workers from Olanchito and Arenal more broadly and neighbouring municipalities as needed. • The SAG will ensure that beneficiaries rely on the CRELs and the municipality employment department to advertise their employment needs with a clear application procedure to and ensure equal opportunities for all and transparent hiring practices.	**Positive – Negligible to Minor** • Employment of support workers for the installation will be very short term and temporary (1 to 2 days over 20 months). • A limited number of temporary jobs will be required over this period (approximately more than 400). • Enhancement measures will ensure that employment opportunities benefit the local labour force.

Impact / Risk	Measures to address the impact / risk	Residual Impact
EE4 – Long-term economic growth from production increase and improvements in the milk production sector and related sectors	• The SAG will conduct a detailed supply-and-demand market study for the agriculture, milk production and milk-processing sectors to assess risks and opportunities related to an increased milk production.	**Positive – Moderate / Major** • Impacts are distributed across multiple sectors (milk production, agriculture, artisanal cheese production, milk processing industries, etc.) at the local, regional, and national levels. • The operation phase will last 10-years with impacts potentially extending beyond this period in the case of technological improvements and capacity-building in the different sectors. • Development of a supply and demand market study will ensure that opportunities are maximized and that risks are managed adequately.
EE5 - Long-term direct and indirect employment in the agriculture, livestock breeding and milk production sector and related sectors.	• SAG to consider as criteria the potential beneficiary's financial solvency to generate additional employment in order to cultivate the irrigated land. • SAG to require potential beneficiaries to present an investment plan including the number of permanent jobs expected to be created. • SAG to agree with selected Project beneficiaries on the expected level of yearly employment and ensure best efforts to employ workers from within the Project Area including individuals of indigenous descent, while guaranteeing equal pay and working conditions. • SAG technical relevant technical departments to monitor compliance with labour related commitments both during the rainy and dry season.	**Positive – Moderate / Major** • The Project is expected to increase the number of permanent employees by 50% throughout the 10-year operation phase. • The local labour force will benefit from more stable employment opportunities over a 10-year period. • The implementation of enhancement measures will ensure that employment opportunities will be maximized, in particular for low-skilled farm labour.

Source: ERM, 2018

7.9 *LIVELIHOODS AND INCOME*

7.9.1 *Overview*

This section assesses the potential impacts to existing livelihoods as a result of the Aguan Irrigation Project. The assessment focuses on the operations phase when all potential livelihood impacts are expected. In addition to embedded measures in the Project Design, a series of mitigation measures have been designed to ensure that the level of impacts to socioeconomic receptors is avoided, minimized or reduced. *Box 7.7* below shows the key sources of

impacts, potential impacted receptors, as well as baseline and Project influencing factors related to Project impact on land and livelihoods.

Box 7.8 Key Considerations for Assessment –Livelihoods and Income

Sources of Impact

- Conditioning of beneficiary land (drilling of water well and additional works related to the proper installation of Project equipment)
- Operation and management of the irrigation equipment

Potentially impacted receptors

- Project beneficiaries
- Non-beneficiary land users and other groundwater and surface water users

Project Factors that are Potentially Influencing Impacts

- Project beneficiaries receive training from the SAG trained technicians and/or designated personnel on appropriate installation, operation, and maintenance of the equipment as well as sustainable agriculture and irrigation practice.
- Duration of operation phase is approximately 10 years.
- The Project is expected to irrigate 3,110 ha of land (i.e. 12% of cultivated and pasture land in the Project Area).

Particular Baseline Conditions that are Potentially Influencing Impacts

- Agriculture, livestock and milk production is the main livelihood activity in the Study Area, followed by employment in large scale production companies, and agriculture. In Olanchito and Arenal 48% and 57% of the population respectively is employed in the agriculture and livestock sector, including 23% and 30% as low-skilled farm workers.
- Approximately 10% of potential beneficiaries currently cultivate additional crops not destined for livestock feed such as beans, watermelon and sugar-cane.
- Average income of small producers is currently estimated between 20,000 and 40,000 lempiras (834 – 1,665 USD) in the rainy season compared to 10,000 and 20,000 (416 – 834 USD) in the dry season with an overall average of 30,000 lempiras (1,249 USD) per month.
- Farm workers reportedly receive monthly salaries between 4000-6000 (167 – 250 USD) for milking activities and 3000-4000 (125 – 167 USD) for cleaning.
- The official minimum wage for the agricultural sector established by the Secretary of Labour and Social Security in 2018 is set at 6,000 lempiras (250 USD)per month for enterprises of up to 10 employees.
- Use of chemical products (herbicides, pesticides and fertilizers) is common in the farms in the Project Area, but only in small quantities and once or twice a year.
- Water balance assessment shows that water consumption from the Project (14,93Hm^3/year) represents about 4 % of the calculated hydric excess in the Alto Aguan Valley.
- Use of groundwater for irrigation and human consumption is minor in comparison to surface water.

Vulnerable Groups

- Some individuals of indigenous descent residing in the Project Area reportedly employed on potential beneficiary farms and benefit from the same conditions as non-indigenous workers.
- Small producers (with less than 40 ha of land) are more vulnerable to overhead costs as they have smaller economies of scale than the larger farms and therefore higher operating costs. Small producers represent approx. 48% of potential beneficiaries, including 14% of producers with less than 10 ha of land.
- Small-scale crop farmers with limited access to land and who cultivate crops for self-consumption and/or supplemental income generation. These farmers reportedly tend to engage in other income-generating activities.

References

- Chapter 3 Project Description and Alternatives – specifically *Section 3.6.*
- Chapter 5 Baseline Description – specifically *Section 5.5.5, Section 5.5.7, Section 5.5.7, Section 5.5.8,* and *Section 5.5.9.*
- Chapter 7 Impact Assessment - specifically *Section 7.5.*

Source: ERM, 2018

Table 7.13 presents the key impacts of the Project on land and livelihoods during the three phases of pre-operation, operation, and abandonment.

Table 7.16 Key Potential Impacts – Livelihoods and Income

Pre-operation phase	Operation phase	Abandonment phase
None	LL1 –Improved livelihoods and food security for Project beneficiaries and farm labour. LL2 – Risk of livelihood losses for beneficiaries due to increased financial pressure on beneficiaries LL3 – Risk of livelihood losses for beneficiaries and other land users due to loss of soil fertility LL4 – Risk of livelihood and losses for non-project beneficiaries due to decreased availability of water	None

Source: ERM, 2018

7.9.2 Operation Phase

Potential impacts

LL1 – Improved livelihoods and food security for Project beneficiaries and farm labour

The Aguan irrigation Project is expected to improve agriculture and milk production stability in the dry season and increase the total volume of milk produced (by at least 50% according to the SAGO). As discussed in Impacts EE4 and EE5 (*Section 7.8.3*), this will lead to increased economic activity in the milk production sector including the creation of additional jobs, and higher disposable incomes for Project beneficiaries and the farm workers they employ. [1]

Increased revenues and disposable incomes

Specifically, it is assumed that a stable or semi-stable production (with increased quantities and quality of preserved forage for the dry season)

[1] As stated in Impact EE4, the 50% production increase and associated increase in revenues is an assumption based on estimations and feedback collected by the SAG, SAGO, and interested parties and is not based on any formal sector and market analysis.

throughout the year will allow farmers to replicate production levels in the dry season as well as related revenues assuming a stable demand. Considering that 48% of potential beneficiaries are small producers with less than 40 ha including 14% with less than 10 ha, the project is expected to impact mostly small producers. As such, small producers who generate on average 20,000 to 40,000 Lempiras (832 – 1,664 USD) per month in the rainy season would be able to generate similar amounts in the dry season and nearly double their revenue yearly average to 60,000 Lempiras (2,497 USD) per month. [1] This would translate into an approximate 50% increase in revenues throughout a 10-year period.

Some of the potential beneficiaries interviewed in June 2018 mentioned that they would use the additional revenue to further improve their production process. As such, assuming that a portion of the generated income will be spent on fixed costs for operation of the irrigation equipment such as fuel, labour and maintenance, and that another portion will be reinvested in technology improvements, labour, additional inputs, etc. the remaining portion will be used as disposable income and contribute to increasing standards of living for the beneficiaries and their households.

With respect to farm workers, a more stable production throughout the year will lead to increased employment of permanent workers compared to seasonal workers, which will contribute to increased income stability for workers and improvement in their standards of living, including for indigenous workers living in the Study Area. As discussed in Impact EE5 above (*Section 7.8.3*), employment of farm labour is expected to increase by 20% to 40%. Increased employment opportunities may also potentially lead to an increase in the salaries of workers as they will be dealing with larger production volumes throughout the year. Currently, workers' monthly salaries on average are below the 6,000 Lempiras minimum wage established for the sector in 2018. Considering current levels of employment of the population as low-skilled farm labour (23% and 30% in Olanchito and Arenal respectively), relatively higher incomes and improved income stability will impact over 25% of the population in the Study Area over an extended period of 10-years.

Diversified sources of income and increased food security

In addition to increased incomes from milk production, the Project will also create opportunities to diversify the sources of income and increase food security. The use of a more reliable irrigation process and more sustainable irrigation and cultivation practices will allow a greater number of beneficiaries to diversify into additional crops and to generate complementary income by better adjusting for market fluctuations. Some of the potential beneficiaries interviewed have also mentioned the possibility to purchase additional cattle

[1] Note: monthly income averages are only estimates calculated based on June 2018 field survey findings and data from the sample of 301 beneficiaries (CINSA & PAA 2017).

heads for the same amount of land and diversify into the meat production sector, and generate additional income.

Beneficiaries will also be able to better address their consumption needs by growing specific crops for self-consumption (such as corn, sugar cane, watermelon, beans, etc.), thereby improving food security throughout the year. Currently approximately 10% of potential beneficiaries cultivate additional corps that are not intended as animal feed. With the Project implementation, more beneficiaries may decide to grow additional crops for self-consumption and for small trade, improving their food security and the general food security at the community level which would also benefit lower-income residents.

Overall the impact is expected to last over a long-term period (10-years) and will benefit 75% of the producers in the area, of which 48% are small producers, and are therefore more sensitive to revenue increases and diversification. Similarly, low-skilled farm workers who present almost one third of the occupied population will also benefit from improvements in their standards of living. As such magnitude is expected to be medium and receptor sensitivity is considered medium to high.

LL2 – Risk of livelihood losses for beneficiaries due to increased financial pressure on beneficiaries

Small producers and beneficiaries with low financial solvency will be faced with increased financial pressure due to the required initial investment and additional fixed costs. As explained in *Section 3.4.2* of the Project Description, selected beneficiaries will incur the following initial investment costs:

- One-time fee payment to the SAG.
- Relevant permit fees (including well drilling permit and municipality fee).
- Transport costs and drilling materials.
- Cost of well drilling activities (underground or hand-dug).
- Cost of submersible water pump and water container (for beneficiaries with no access to surface water sources – ie. 70% of potential beneficiaries).
- Any labour cost to support with equipment installation.

Additional fixed operation costs will include:

- Increased labour costs.
- Diesel for the motor pump/generators.
- Maintenance of well and irrigation equipment.

Note that the fee amount has not yet been decided. It is expected to guarantee that the equipment is properly maintained and to ensure long-term sustainability of the Project during the Operation phase. Underground drilling activities will be undertaken by local or regionalspecialized drilling

companies. Also, the motor pump/generator included in the kit consumes less than 3.8l /h.

Nevertheless, despite these embedded measures to reduce costs, overall costs might still be too cumbersome for beneficiaries with lower solvency. Small producers are also generally more vulnerable to overhead costs due to the limited economies of scale they experience compared to larger farms who use their equipment and structures more intensively. In addition, beneficiaries may be encouraged to seek credits to boost production further, for example by increasing livestock population for the same amount of land, which would allow them to achieve higher economies of scale and reduce their production costs. This however may expose them to higher risks of solvency and inability to pay back their loans if the demand does not match the supply for milk.

That said, although purchasing additional cattle has been mentioned in some cases during the field survey, increasing the cattle population is not considered necessary to increasing production in the dry season given the efficiency gains from the irrigation itself. As for the demand for milk, as discussed in Impact EE4, milk processing companies have been asking for a more constant production of milk throughout the year, which indicates the existence of a market for a more stable production. Road infrastructure is also being updated at the municipality and inter-municipality level, which will improve connection between Olanchito and other areas that present potentially interesting markets milk processing and dairy products. However, market opportunities and risks cannot be fully assessed without a formal supply-and-demand study and supply chain analysis.

In terms of solvency and capacity to manage and repay loans, farmers and producers are reportedly used to requesting credit and to managing it properly, although some have reported bad experiences with cases of mismanagement. Credits are mainly taken from banks, as institutional support in the form of farmer associations (*cooperativas*) and rural funding organizations and savings banks (*cajas rurales),* is more focused on the agricultural sector rather than on the agriculture, livestock and milk production sector. As such, beneficiaries may not be fully equipped to make informed decision in terms of investment or to manage their loans adequately. This increases the risk of over indebtedness and associated loss of livelihoods over the long-term. Since 48% of potential beneficiaries are small producers with less than 40 ha, and 14% with less than 10 ha, and considering the weak financial support structure available, the sensitivity of the receptor is considered high.

LL3 – Risk of livelihood losses for beneficiaries and other land users due to loss of soil fertility

Poor irrigation management and excessive use of pesticides, herbicides and fertilizers may potentially lead to loss of soil fertility and result in long-term livelihood losses for Project beneficiaries. As described in *Impact SI* on the soil (*Section 7.5*), the impact on soil quality is expected to be localized and should

not affect non-beneficiary land. The impact assessment therefore focuses on the potential impact on beneficiaries.

As described in *Impact S1* loss of soil fertility may occur only as a result of bad irrigation practices (accumulation of salts and erosion) and by accidental spills. This would only affect beneficiary land, which represents 5% of the total Project Area and up to 12% of the total cultivated and pasture land in the Project Area. This would also affect approximately 60% of the agriculture, livestock breeders and milk producers in the area. Soil quality is of high importance to the livestock and agriculture sector which represent the main economic sectors of the area. Receptor sensitivity is therefore medium.

This being said, information gathered during the field survey conducted in June 2018 has indicated that the use of chemical products is considered appropriate as these products are used only in small quantities and a few times a year. In addition, to enhance appropriate use, the Project's embedded Training Programme will address adequate use of the irrigation equipment and sustainable irrigation approach, which includes minimizing use of chemical products as much as possible. Sustainable irrigation also involves increasing water use efficiency in order to minimize water usage, which would subsequently reduce the risk of salinization and / or erosion events. Considering the embedded mitigation measures, the magnitude of the impact is therefore considered medium.

LI4 – Risk of livelihood losses for non-project beneficiaries due to decreased availability of groundwater and surface water

The potential decrease in the groundwater table due to ground water extraction for the Project implies a potential reduction in the availability of both groundwater and surface water resource, which could adversely affect existing water users, especially at dry times of the year. This in turn would lead to reductions in agricultural production and related livelihood losses for non-beneficiaries in the Project Area. Note that farmers and producers located downstream of the Project Area should not be impacted by groundwater and surface water reductions, and have been scoped out from this assessment. A more detailed justification is presented in *Table 6.7* of the Impact Assessment Methodology chapter.

As discussed in Impact W5 (*Section 7.5*), the water balance assessment shows that water consumption from the Project (14,93 Hm^3/year) represents about 4% of the calculated hydric excess in the Alto Aguan Valley, and therefore, the planned water abstraction by the Project is considered sustainable. However, although a general depletion of the groundwater level is not expected, the local behavior of the groundwater flows can be very variable and therefore localized groundwater depletions cannot be discarded.

This being said, it is very unlikely that groundwater wells installed by the Project are located near other groundwater wells. Firstly, because the use of groundwater was reported to be minor in the Project Area, secondly, because

the Project irrigated-land will be spread out over a large area of 60,000 ha. As such, local groundwater level depletion events and affection to other groundwater users is not expected. Impact magnitude is therefore considered small.

Nevertheless, considering that local farmers and livestock and milk producers rely mostly on surface water for irrigation but that the groundwater level also affects indirectly the surface water levels, the sensitivity of these producers to the reduction in groundwater levels is considered high, in particular for small-scale crop farmers in the area who are more vulnerable to livelihood losses and income drops.

Mitigation and Enhancement Measures

Mitigation measures already embedded in the Project Design include the following:

- The SAG will implement measures to reduce initial investment costs for beneficiaries including fee minimization, efficient motor pump/generator with low diesel consumption (3.8l/h),.
- The SAG and relevant technical departments will implement the Training Programme including training on appropriate use of irrigation equipment and sustainable irrigation and agricultural practices, training on adequate use of chemical pesticides, herbicides and fertilizers, and minimizing water usage for irrigation.
- The SAG will ensure that beneficiaries allow monitoring of the irrigation equipment for a period of no less than 10 years. This embedded measure will enable to monitor some of the mitigation measures described below.

In order to enhance the impact of improved livelihoods for beneficiaries and farm labour and to mitigate potential losses from increased financial pressure the following enhancement and mitigation measures will apply:

- The SAG will conduct a detailed sector and market study for agriculture or milk production to provide official estimates of production increases from the Project and related revenue increases for beneficiaries including a supply-and-demand market assessment. This study will allow the SAG and beneficiaries as well as actors in the dairy production sector to plan their operations and investments accordingly in order to maximize opportunities and manage risks including risks of over indebtedness.
- As part of the beneficiary selection process, the SAG will require proof of financial solvency to minimize the risk of over indebtedness and financial pressure on beneficiaries, especially small producers.
- The SAG, in collaboration with the SAGO and CRELs will support the creation and capacity building of rural funding organizations (*Cajas Rurales)* for the agriculture, livestock breeding and milk production sectors specifically.

- The SAG, in collaboration with the rural funding organizations, will provide project management support and financial literacy trainings to beneficiaries to allow them to prepare long-term business plans for their operations including for the reinvestment of revenues in additional technology.

Measures to mitigate the potential livelihood losses due to the loss of soil properties as a result of an inadequate irrigation and use of chemical products are presented in *Impact S1* (*Section 7.4.2****¡Error! No se encuentra el origen de la referencia.***), and mitigation measures for potential livelihood losses related to groundwater and surface water availability are addressed in *Impact W5* (*Section 7.5*) With respect to livelihood losses related to groundwater and surface water availability specifically, additional measures include the following:

- As part of the Stakeholder Engagement Plan, the SAG will disclose and implement the grievance mechanism to the wider community, including in particular farmers associations or cooperatives to ensure that small-scale crop framers in the area are able to voice any grievances or complaints related to the Project and seek proper remedy.

Residual Impacts

Table 7.17 summarises the impacts on livelihoods and incomes as a result of the Project activities during the operation phase. The embedded mitigation measures along with additional enhancement and mitigation measures The embedded measures considered in the Project Design defined as part of the impact assessment result in Positive impacts and impacts of Minor significance.

Table 7.17 Summary of impact assessment on livelihoods and income during the operation phase

Impact / Risk	Measures to address the impact / risk	Residual Impact
LL1 - Improved livelihoods and food security for Project beneficiaries and farm labour.	• SAG to undertake a sector and market study for agriculture, milk production including a supply-and-demand market assessment. • SAG and relevant technical departments to provide project management support and financial literacy trainings.	**Positive –Major** • Revenues generated in the rainy season are expected to be replicated in the dry season increasing yearly revenues by 50%. • Impacted beneficiaries are mostly (48%) small beneficiaries including 14% with less than 10 ha. • Beneficiaries will also improve their food security through crop diversification. • Farm labour including indigenous individuals will benefit from increased employment stability and potentially higher incomes resulting in higher standards of living. • Impact is long-term (10-years). • The development of a formal market study will allow beneficiaries to plan their operations and investments in order to maximize opportunities and manage risks.

Impact / Risk	Measures to address the impact / risk	Residual Impact
LL2 – Risk of livelihood losses for beneficiaries due to increased financial pressure on beneficiaries	*Embedded measures:* • The SAG will implement measures to reduce initial investment costs for beneficiaries including fee minimization, efficient motor pump with low diesel consumption (3.8l/h), and minimized groundwater well drilling costs through hiring of a specialized NGO. *Mitigation measures:* • As part of the beneficiary selection process, the SAG will require proof of financial solvency to minimize the risk of over indebtedness and financial pressure on beneficiaries, especially small producers. • The SAG, in collaboration with the SAGO and CRELs will support the creation and capacity building of rural funding organizations (*Cajas Rurales)* for the agriculture and milk production sectors specifically. • The SAG, in collaboration with the rural funding organizations, will provide project management support and financial literacy trainings to beneficiaries to allow them to prepare long-term business plans for their operations.	**Minor** • Small producers (48% of potential beneficiaries) are more exposed to solvency risks and therefore highly sensitive to increased financial pressure. • Institutional support for the agriculture, livestock and milk production sector is not sufficiently developed. • The impact is long-term (10 years). • Implementation of the mitigation measures will allow beneficiaries to improve their ability to manage farm operations and funding adequately and minimize risks of over indebtedness. These measures will also improve the institutional financial support available to producers reducing the residual impact to a Minor significance.
LL3 – Risk of livelihood losses for beneficiaries and other land users due to loss of soil fertility	*Embedded measures:* • The SAG and relevant technical departments will implement the Training Programme including training on appropriate use of irrigation equipment and sustainable irrigation and agricultural practices, training on adequate use of chemical products and minimizing water usage for irrigation. • The SAG will ensure that beneficiaries allow monitoring of the irrigation equipment for a period of no less than 10 years. *Mitigation measures:* • Same Mitigation measures as S1 (*Section 7.4.2*).	**Minor** • Affection to soil properties may only result from bad irrigation practices. • Irrigation is limited to 17% of the total cultivated and pasture land. • Irrigation is limited to the dry season (3.5 months per year or 105 days). • Impact significance is reduced to Minor through implementation of the mitigation measures described in Impact S1.

Impact / Risk	Measures to address the impact / risk	Residual Impact
LL4 – Risk of livelihood and losses for non-project beneficiaries due to decreased availability of water	*Embedded measures:* • Same embedded mitigation measures as W5 (*Section 7.5.2*). *Mitigation measures:* • Same mitigation measures as W5 (*Section 7.5.2*). *Additional mitigation measures:* • As part of the Stakeholder Engagement Plan, the SAG will disclose and implement the grievance mechanism to the wider community, including in particular farmers associations or cooperatives to ensure that small-scale crop framers in the area are able to voice any grievances or complaints related to the Project and seek proper remedy.	**Minor** • Irrigation is limited to 12% of cultivated and pasture land in the Project Area. • Irrigation is limited to 3.5 months a year. • Water abstraction by the Project activities will be sustainable and renewable, according to the Water Resource Balance developed by PAA and Integra Ingeniería in 2017. • It is very unlikely that groundwater wells installed by the Project are located near other groundwater wells. • Impact significance is reduced to Minor through implementation of the mitigation measures described in Impact W5.

Source: ERM, 2018

7.10 OCCUPATIONAL HEALTH AND SAFETY AND LABOUR RIGHTS

7.10.1 Overview

This section assesses potential impacts to workers directly employed by the SAG or by its contractors/partners and by the beneficiaries themselves as a result of the Aguan Irrigation Project. This assessment addresses occupational health and safety and labour rights including working hours, fair remuneration and working conditions in the pre-operation and operation phase of the Project. A series of mitigation measures have been designed to ensure that the level of impacts to workers is avoided, minimized or reduced.

Box 7.9 ***¡Error! No se encuentra el origen de la referencia.*** below shows the key sources of impacts, potential impacted receptors, as well as baseline and Project influencing factors related to Project impact on workers' health and safety and labour rights.

Box 7.9 ***Key Considerations for Assessment –Occupational Health and Safety and Labour Rights***

Sources of Impact

- Transport of irrigation equipment to the SAGO warehouse
- Conditioning of beneficiary land (drilling of water well and additional works related to the proper installation of Project equipment)
- Operation and maintenance of the irrigation equipment

Potentially impacted receptors

- Workers directly employed by the SAG or by SAG contractors or partners
- Workers employed by beneficiaries including farm labour and workers to support with installation of the irrigation equipment and to work on the farms.

Project Factors that are Potentially Influencing Impacts

- Project beneficiaries receive training from the SAG trained technicians and/or designated personnel on appropriate installation, operation, and maintenance of the equipment as well as sustainable agriculture and irrigation practice.
- 311 irrigation kits will be delivered and installed and may require temporary employment of more than 300 workers to support with installation.
- Transportation of equipment to the SAGO warehouse will take during an overall and non-continuous period of approximately 15-month.
- Duration of operation phase is approximately 10 years.

Particular Baseline Conditions that are Potentially Influencing Impacts

- National Labour Laws exist in Honduras exist, however practice in terms of hiring and working practices may fall short of international standards.
- The National Labour Code does not require written contracts for labour employed in agricultural and livestock farms that are not industrial or commercial, nor for temporary labour of up to 60 days and punctual tasks.
- Results of the 2018 field survey have shown that farm workers do not have formal contracts. Their average salary is below the minimum wage of 6,000 lempiras per month established for enterprises employing up to 10 workers in the agricultural and livestock sector.
- Based on feedback collected during the field survey, a work day on the farm is of 6 to 8 hours, specifically 6am to 12pm for general tasks and 4am to 12pm for milking.
- National minimum working age is 14 for children who continue to attend school and otherwise 16, whereas ILO standards set the general minimum working age at 15 and 18 for hazardous work (16 under strict conditions).
- In practice, child labour in Honduras is prevalent with 14.7% of children between 5 and 14 who work, of which 57.5% are employed in the agriculture sector (sugarcane, coffee, etc.).
- It has been reported during the field survey that children under 14 help out at the farm on their free time outside of school, including children of the farm owner.
- Secondary sources highlight cases of forced over-time and low pay in in the agricultural sector in Honduras, focusing mainly on crop cultivation. No specific reports were found with respect to over time in the livestock and milk production sector.
- Vector born disease such as malaria and dengue are present in the Study Area.
- The road network is susceptible to flooding and landslides during the rainy season.

Vulnerable Groups

- Children under 14 employed as farm labour.
- Farm workers living on the farms and who have been assigned land to cultivate for self-consumption.

References

- Chapter 3 Project Description and Alternatives – specifically *Section 3.6.*
- Chapter 5 Baseline Description – specifically *Section 5.5.8, Section 5.5.9, Section 5.5.10, Section 5.5.12.*

Source: ERM, 2018

Table 7.18 presents the key impacts of the Project on occupational health and safety and labour rights during the three phases of pre-operation, operation, and abandonment.

Table 7.18 Key Potential Impacts – Occupational Health and Safety and Labour Rights

Pre-operation phase	Operation phase	Abandonment phase
OHS1 – Occupational health and safety and labour rights related to road transport.	OHS2 – Occupational health and safety and labour rights related to ground-water well drilling and equipment installation. OHS3 – Occupational health and safety and labour rights related to farm labour including the risk of child labour and forced overtime. OHS4 - Labour rights for farm labour including the risk of child labour and forced overtime	None

Source: ERM, 2018

7.10.2 Pre-Operation Phase

Potential impacts

Anticipated Impact OHS1 – Occupational health and safety related to road transport of irrigation kits to the SAGO warehouse

Activities related to the transport of the irrigation kits to the SAGO warehouse can potentially reinforce below standard working conditions and health and safety conditions for the workers loading and transporting the kits.

The transport of the equipment from the Port of San Pedro Sula to the SAGO warehouse will be undertaken by drivers designated by the SAG. Transport activities are expected to be undertaken progressively, during an overall and non-continuous period of approximately 15 months. The number of drivers needed to undertake the transport is not known at this stage however considering that delivery will be spread out and not continuous, the number is expected to be very small.

Health and Safety

Considering that the equipment transportation will occur over a 15-month period, it is assumed that trips may also occur during the rainy season when the roads in the Study Area are more susceptible to flooding and landslides, limiting access to certain areas. The roads in the Project Area may also lack proper maintenance. Despite the planned improvements to the road network by the municipality, the risk posed by heavy rains during the rainy season, especially in the month of June and September, may still translate into road accidents leading to workers injury or fatality if not properly prevented. This

risk is highest along unpaved roads, tunnels and bridges in the western portion of the Project Area where the road network is less developed, and less so along the middle and eastern portion of the main road leading to Olanchito. In addition, given the distance from the Port of San Pedro Sula to Olanchito (approx. 300 km and a 5-6 hours drive), drivers are also exposed to road accidents due to long hours of continuous driving if not properly trained on safe driving practices. Loading and offloading the kits onto the transport vehicles also present health and safety risks for the workers related to heavy lifting, which requires adequate training and good physical condition. Individuals with back problems will be more susceptible to potential injuries.

Labour rights

The hiring of labour for the project will be carried out within the framework of the Honduran Labour Code, and the laws and statutes in force in Honduras, including provisions for overtime pay, minimum working age, and the rights of children and adolescents. However, in practice working conditions and labour rights in Honduras may fall short of ILO standards in terms of overtime work and minimum age. Also certain provisions of the Labour Code such as the requirement of a written contract do not apply to temporary labour employed for less than 60 days. In the case of the drivers, since the transport of equipment is not continuous, they may not be employed on the basis of a written contract. However, considering the punctual nature of the work, the impact is considered negligible.

Overall, assuming that Project transport will follow the main municipal road which is relatively well maintained, and considering the short-term and temporary nature of the work, the impact magnitude is considered small for both health and safety and labour rights. Receptor sensitivity is high considering the risk of serious injury and death.

Mitigation Measures

The project design already includes the following embedded measures:

- The SAG will employ labour for the project within the framework of the Honduran Labour Code, and the laws and statutes in force in Honduras, including provisions for overtime pay, minimum working age, and the rights of children and adolescents.

Mitigation measures to ensure improved health and safety for workers during pre-operation:

- The SAG will develop and implement a Traffic Management Plan indicating the route to follow especially during the rainy season when smaller roads in the Study Area are less accessible due to flooding and landslides. The plan will include measures such as stopping the car in case of heavy rains, not crossing rivers and creeks during floods, hours of driving and rest periods, etc.

- The SAG through relevant technical departments or partner organizations will provide training on traffic safety to selected drivers.
- As part of the hiring process, the SAG will request medical approval for loading and offloading heavy packages and provide adequate training to selected drivers on good loading and offloading techniques.

Mitigation measures to ensure respect for workers' rights while keeping in mind the national context:

- As part of the Project's Stakeholder Engagement Plan, the SAG will develop and disclose a grievance mechanism for all Project stakeholder including workers to ensure that a stakeholder can voice concerns with respect to the Project and have access to a fair and transparent resolution mechanism. The grievance mechanisms and disclosure process is described in detail in *Annex 1* of the present ESIA.
- The SAG through relevant technical departments will conduct regular monitoring of labour issues through following up on the grievances raised.

Residual Impacts

Table 7.19 summarises the impacts on workers' health and safety and labour rights as a result of the Project activities during the pre-operation phase. The embedded measures considered in the Project Design and the mitigation measures defined during the impact assessment reduce the residual impact significance to Minor.

Table 7.19 Summary of impact assessment of occupational health and safety and labour rights during the pre-operation phase

Impact / Risk	Measures to address the impact / risk	Residual Impact
OHS1 – Health and safety and labour rights related to road transport of irrigation kits to the SAGO warehouse.	*Embedded measures* • The SAG will employ labour within the framework of the Honduran Labour Code, and the laws and statutes in force including provisions for overtime pay, minimum working age, and the rights of children and adolescents. *Mitigation measures* • The SAG will develop and implement a Traffic Management Plan indicating the route to follow especially during the rainy season. Measures will include stopping the car in case of heavy rains, not crossing rivers and creeks during floods, hours of driving and rest periods, etc. • The SAG through relevant technical departments or partner organizations will provide training on traffic safety to selected drivers. • As part of hiring process, the SAG will request medical approval for loading and offloading heavy packages and provide adequate training to selected drivers on safe loading and offloading techniques. • As part of the Stakeholder Engagement Plan, the SAG will disclose and implement a grievance mechanism for all Project stakeholder including workers.	**Negligible** • Transport will be progressive and non-continuous over a 15-month period. • The number of drivers is expected to be very small. • Transport may occur during the rainy season however it is assumed that it will follow the main road which is relatively well maintained. • Risk of transport accidents and injuries related to loading/offloading the kits will be significantly reduced through implementation of the mitigation measures. • The grievance mechanism will also ensure that potential abuses are reported and addressed.

Source: ERM, 2018

7.10.3 Operation Phase

Potential impacts

OHS2 – Occupational health and safety and labour rights related to ground-water well drilling and installation

Activities related to the drilling of groundwater wells and installation of irrigation equipment can potentially reinforce below standard working conditions and health and safety for workers employed in the machinery installation sector.

Health and safety

As discussed in *Impact EE3* (*Section 7.8.3*), beneficiaries may seek to hire temporary labour to support them in installing the irrigation equipment. The workers involved in the installation will be exposed to potential health and safety risks primarily related to weather conditions such as high temperatures that may cause sunstroke, heat stroke and burns for installation workers. Assuming one workers per installation kit, it is estimated that more than 300 workers may be hired on a temporary basis and for a very short-term of one or two days, which limits exposure of workers to health and safety risks. Also, as an embedded measure in Project design, the beneficiaries will receive training on adequate equipment installation, use and maintenance. Assuming that beneficiaries in turn train the workers they hire, this should contribute to reducing the risks of potential accidents and injuries related to equipment installation, resulting in an impact of small magnitude

As for the specialized local or regional drilling companies' workers conducting the groundwater wells drilling activities, in addition to heat related risk, other hazardous conditions specifically related to groundwater well drilling include the risk of injury associated with a drilling rig and its ancillary equipment (moving parts, heat, noise, falls, crushing) as well as the storage and use of hazardous materials (such as fuels, lubricants, cement, grouts, etc.) on site.[1] Assuming that two three employees per vehicle are employed, the magnitude of the impact is considered negligible.

Labour rights

As stated in *Impact OHS1* above (*Section 7.10.2*), verbal contracts are not required by law for activities of temporary nature of up to 60 days or for punctual activities priced at 200 Lempiras or less, which increases the precariousness of working conditions for the workers and increases the risk of labour abuses such as unpaid overtime. This applies to the NGO workers performing the well-drilling activities since the activity may last between one and 10 days depending on the characteristics of the well. Similarly, labour that may be hired by the beneficiaries to support with the installation will also be employed on the basis of verbal contracts, increasing the risk of potential labour abuses as mentioned above. However, considering the short-term and punctual nature of the work performed and the limited number of workers required, the impact is considered of small magnitude.

Overall, the impact magnitude is considered small although receptor sensitivity is medium considering the risks of injuries if appropriate measures are not in place.

OHS3 – Occupational health and safety of farm labour

The operation and maintenance of the irrigation equipment could potentially reinforce below standard health and safety conditions for farm workers

[1] UK Environment Agency (2006). Guidance on the Design and Installation of Groundwater Quality Monitoring Points. Accessed at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/290727/scho0106bkct-e-e.pdf

employed by beneficiaries, mainly exposure to vector-borne disease and noise from the motor pump.

Vector-borne disease

As part of the operation of the irrigation equipment, water will be extracted from the groundwater or hand-dug wells and stored in water tanks before being pumped into the irrigation system and redistributed across the fields. This process will imply the creation of stagnant water sources some intended (ie. well and container) and other unintended such as small puddles or patches of water due to possible leaks. These piles of stagnant water constitute breeding grounds for mosquitos carrying vector-borne diseases and increase the risk of transmission of diseases such as malaria and dengue fever. In fact, dengue has been reported to occur in the Study Area with 10.4% of the population of Arenal affected in 2011. Malaria is also reportedly present in Olanchito, especially during the rainy season when the risk is highest. This being said dengue and malaria occurrences have reportedly been very limited in recent years in the Study Area.

Farm workers working on the fields on a daily basis will be most exposed to these mosquitos gathering near the stagnant water piles. The risk of transmission is even higher given that workers reportedly start working in the early morning between 4am or 6am when malaria-carrying mosquitos are most active. Also, some farms do not have access to basic services such as wastewater management systems, which may also contribute to spreading vector-borne diseases. Workers and poor families, especially children, are considered most vulnerable to these diseases as they may lack the capacity or awareness necessary to prevent infection.

Considering the expected increase in production as a result of the Project, the number of permanent labour is also expected to increase, which may imply more workers and their families living on the farms. Considering that about 23% of the occupied population of the Project Area is employed as low-skilled farm labour, and that this number is expected to increase as a result of Project-induced hiring, the population exposed to an increased risk of transmission of vector-borne disease would represent over 25% of the population in the Project Area.

This being said, it is expected that the irrigation system will be used during the dry season, which reduces the risk considerably. In addition, vector-borne disease occurrences are reportedly very limited in the Area. As such, the impact magnitude is considered small with highly sensitive receptors.

Noise from the pumps/generators

Farm workers will also be exposed to the noise from the motor pumps/generators. As described in *Impact N1* on the Acoustic Environment (*Section 7.3*), the impact is expected to be negligible considering that the noise levels produced by the pumps/generators are similar to other existing noises in the Project Area. Also, the pump/generator will only be operating 3 months

a year during the dry season and 3-4 days a week. As an embedded measure, the Project will include training to beneficiaries on adequate use of the irrigation equipment which involves minimizing the use of the pump/generator as much as possible.

OHS4 – Labour rights of farm labour including child labour and forced overtime

Field survey findings show that workers in the farms of potential beneficiaries do not have written employment contracts as formal employment contracts are not required for farm workers under the national Labour Code. Similarly, the law does not state minimum salary requirements for labour not employed in companies. The field survey has also highlighted the absence of medical coverage or insurance, clear remuneration criteria or working hours.

However, it has been noted that despite the absence of formal contracts, most of the time, the producer covers medical costs for worker hospitalization, who usually also benefits from a paid medical leave. Workers also reportedly receive a fixed monthly salary depending on the task they perform and have more or less specific working hours. In the case of workers who live on the farms with their families, it has been reported, that some of them receive a portion of land for cultivation for personal consumption.

Despite the reported conditions, the lack of a formal contract leaves room to potential labour abuses including low pay and forced overtime, and makes workers vulnerable to changes in the employers' disposition for covering medical expenses and other benefits such as access to land for self-cultivation. Specifically, workers who have been informally assigned a plot of land to cultivate face the risk that the employer reassigns the plot to use it for cultivation of additional cattle feed, leading to a loss of livelihood for the worker if he is not assigned alternative land to cultivate on. Considering workers' vulnerable economic situation and their reliance on subsistence farming, workers may be highly sensitive to loss of access to land and to the absence of a formal contract protecting their rights.

Child labour

According to the Labour code, children are allowed to start work at 14, which is below the minimum age set out by ILO as 15 for general work and 18 for hazardous work.
No child labour has been observed during the June 2018 field survey on visited farms of potential beneficiaries. However it has been reported that in most cases, children under 14 help-out at the farm on their free time outside of school. Nevertheless, in case of shortage of workforce in the area there is a risks that children under 14 could be required to work.

Forced labour

Based on secondary sources, cases of forced over-time and low pay in the agricultural sector in Honduras are reportedly common and are mainly due to the lack of specific legal sanctions, and mostly, to the culture of tolerance of

labour rights violations encouraged by the economic crisis, unemployment and low salaries. Based on feedback collected during the June 2018 field survey, a work day is of 6 to 8 hours with average monthly salaries between 3,000 and 6,000 Lempiras which is below the industry minimum. Although no over time has been reported, the absence of written contracts including working hours, salaries, and other employment considerations, workers are more vulnerable to potential abuses such as forced overtime work.

Considering the cultural and economic context, the vulnerability of low skilled laborers and the expected increase demand for farm labour, the risk of compulsory overtime could increase.

Mitigation Measures

The project design already includes the following embedded measures:

- The SAG will be responsible for providing a technical training to the beneficiaries on adequate equipment installation, use and maintenance.
- As an embedded measure, the SAG will include training to beneficiaries on adequate use of the irrigation equipment which involves minimizing the use of the pump as much as possible.

Mitigation measures to reduce health and safety risks related to well-drilling and installation activities:

- As part of the technical training to beneficiaries, the SAG will include health and safety prevention measures for equipment installation adapted to high temperature weather conditions (clothing, water intake, shade, change of work schedule, etc.) and thunderstorms, etc.
- The SAG trained staff will monitor installation and well-drilling activities and provide support as needed to beneficiaries to ensure that beneficiaries and the workers hired for drilling and installation follow the training provided and the manufacturer's instructions for handling of the equipment.
- The SAG will require the specialized local or regional drilling companies for well-drilling to develop Health and Safety Plans to ensure that well-drilling staff is well-trained on safe drilling practices and health and safety prevention measures.

Mitigation measures to reduce health and safety related to exposure to vector-borne diseases for farm workers:

- The SAG through relevant departments and institutional partners will conduct awareness and capacity building training to beneficiaries, beneficiary farm workers, and broader community on exposure to vector-borne diseases such as malaria and adequate prevention measures.
- The SAG through relevant department and institutional partners will train beneficiaries and farm workers on proper management of piles of stagnant water including the following:

- Preventing that water stays stagnant for more than 10 to 12 days as water renewal prevents mosquito larvae from competing their growth cycle.
- Placing a protection mesh on top of water tanks to protect the water.
- Using biological / organic products (bacteria) to destroy the larvae in the water.

Mitigation measures to ensure improved working conditions and labour rights for farm workers:

- As part of the Project's Stakeholder Engagement Plan, the SAG will develop and disclose a grievance mechanism for all Project stakeholder including workers to ensure that a stakeholder can voice concerns with respect to the Project and have access to a fair and transparent resolution mechanism.
- The SAG through relevant technical departments will conduct regular monitoring of labour issues through following up on the grievances raised.
- The SAG will monitor farm labour working conditions on beneficiary farms to ensure that worker's rights are respected, including minimum age requirements and overtime work.
- The SAG will conduct a preliminary identification of the number of farm workers who have been assigned land for self-cultivation on beneficiary land and will require that beneficiaries commit to ensuring that these workers continue having access to the land in question or to alternative parcels of equal or higher quality.

Residual Impacts

Table 7.20 summarises the impacts on occupational health and safety and labour rights as a result of the Project activities during the operation phase. The embedded measures considered in the Project Design and the mitigation measures defined during the impact assessment reduce the residual impact significance to Negligible to Minor.

Table 7.20 Summary of impact assessment of workers' health and safety and labour rights during the operation phase

Impact / Risk	Measures to address the impact / risk	Residual Impact
OHS2 – Occupational health and safety and labour rights related to installation and well drilling.	*Embedded measures* • The SAG will be responsible for providing a technical training to the beneficiaries on adequate equipment installation, use and maintenance. *Mitigation measures:* • As part of the technical training to beneficiaries, the SAG will include health and safety prevention measures for equipment installation adapted to high temperature weather conditions (clothing, water intake, shade, change of work schedule, etc.) and thunderstorms, etc. • The SAG trained staff will monitor installation and well-drilling activities and provide support as needed. • The SAG will require the specialised local or regional drilling companies for well-drilling to develop Health and Safety Plans to ensure that well-drilling staff is well-trained on safe drilling practices and health and safety prevention measures. • As part of the Project's Stakeholder Engagement Plan, the SAG will disclose and implement the grievance mechanism for all Project stakeholder including workers. • The SAG will conduct regular monitoring of labour issues by following up on the grievances raised.	**Negligible to Minor** • Very short term and punctual work (one to two days for installation and up to 10 days for wells). • Limited exposure to OHS risk and labour abuse considering adequate mitigation measures will be implemented. • Workers sensitivity remains high since accidents can lead to injuries and even death.

Impact / Risk	Measures to address the impact / risk	Residual Impact
OHS3 – Occupational health and safety of farm labour	*Embedded measures* • The SAG will include training to beneficiaries on adequate use of the irrigation equipment which involves minimizing the use of the pump as much as possible. *Mitigation measures* • The SAG through relevant departments and institutional partners will conduct awareness and capacity building training to beneficiaries, beneficiary farm workers, and the broader community on exposure to vector-borne diseases such as malaria and adequate prevention measures. • The SAG through relevant department and institutional partners will train beneficiaries and farm workers on proper management of piles of stagnant water.	**Minor** • Presence of dengue and malaria in the Study Area. • Workers and poor families, especially children are most vulnerable. • The irrigation system will be used during the dry season when the risk of vector-borne disease is significantly lower. • The motor pump will only operate 3 months a year. • The implementation of awareness raising programmes, proper management of piles of water, and appropriate use of the motor pump will further reduce impact significance.
OHS4 - Labour rights for farm labour including the risk of child labour and forced overtime	*Mitigation measures* • As part of the Project's Stakeholder Engagement Plan, the SAG will develop and disclose a grievance mechanism for all Project stakeholder including workers to ensure that a stakeholder can voice concerns and have access to a fair and transparent resolution mechanism. • The SAG through relevant technical departments will conduct regular monitoring of labour issues through following up on the grievances raised. • The SAG will monitor farm labour working conditions on beneficiary farms to ensure that worker's rights are respected, including minimum age requirements and overtime work. • The SAG will conduct a preliminary identification of the number of farm workers who have been assigned land for self-cultivation on beneficiary land and will require beneficiaries to commit to ensuring that these workers continue having access to the land in question or to alternative parcels of equal or higher quality. The SAG will conduct regular monitoring during the operation phase to ensure that workers have not lost access to land.	**Negligible to Minor** • Important shortcomings of the labour law (no contract or salary requirements for farm labour) • Approximately 25% of the occupied population is employed as farm labour. • Farm workers are considered highly vulnerable in particular those who risk losing the land they have been assigned for self-cultivation. • Child labour (under 14) and overtime work are common in the sector. • The impact is long-term (10-years). • The measures in place will contribute to minimizing the impact to moderate or minor.

Source: ERM, 2018

7.11 COMMUNITY HEALTH AND SAFETY

7.11.1 Overview

Project implementation during the operation phase could affect the health and safety of the beneficiaries as a result of exposure to a potential increase in vector-borne and water-borne diseases in relation to the use of the irrigation equipment. Any beneficiary and non-beneficiary concerns or perceptions with regard to reduced health also need to be addressed.

Box 7.10 below shows the key sources of impacts, potential impacted receptors, as well as baseline and Project influencing factors related to Project impact on community health and safety.

Box 7.10 Key Considerations for Assessment – Community Health and Safety

Sources of Impact

- Operation and maintenance of the irrigation equipment

Potentially impacted receptors

- Beneficiaries and their families
- Non-beneficiaries in the Project Area
- Primary health care facilities in the Project Area.

Project Factors that are Potentially Influencing Impacts

- Project beneficiaries receive training from the SAG trained technicians and/or designated personnel on appropriate installation, operation, and maintenance of the equipment as well as sustainable agriculture and irrigation practice.
- Duration of operation phase is approximately 10 years.

Particular Baseline Conditions that are Potentially Influencing Impacts

- Vector-borne diseases such as malaria and dengue are present in the Study Area.
- Limited access to health care especially in rural areas, with health centres located in hamlets of 2,000 inhabitants or more.
- Limited number of doctors (0.083 per 1,000 population).
- Limited sanitation coverage and poor waste wastewater management in rural settlements..

Vulnerable Groups

- Children under 14 who are most vulnerable to vector-borne and water-borne diseases.
- Water-borne infections are the most common causes of intestinal infections and diarrheas for which 18% of all reported cases in Olanchito occurred among children under 5 years of age and 20% among children between 5 and 14.
- 21% of children between 1 and 4 years old in Honduras die of diarrhea.

References

- Chapter 3 Project Description and Alternatives – specifically *Section 3.6.*
- Chapter 5 Baseline Description – specifically *Section 5.5.10 and Section 5.5.12.*
- Chapter 7 Impact Assessment - specifically *Section 7.5.*

Source: ERM, 2018

Table 7.21 presents the key impacts of the Project on community health and safety during the three phases of pre-operation, operation, and abandonment.

Table 7.21 Key Potential Impacts – Community Health and Safety

Pre-operation phase	Operation phase	Abandonment phase
None	CHS1 – Increased risk of water-borne diseases due to poor drinking water quality CHS2 – Increased transmission of vector-borne diseases CH3 – Increased tension on healthcare infrastructure and access to healthcare	None

Source: ERM, 2018

7.11.2 Operation Phase

Potential impacts

CHS1 –Increased risk of water-borne diseases due to poor drinking water quality

The use of fertilisation and pest control and the handling of hazardous substances such as fuel in the areas irrigated by the Project could reach surface water sources if not properly managed. The risk of contamination of water sources poses a threat to the health of local communities who rely on surface water for drinking purposes. Health issues related to poor quality of drinking water already exist in the Project Area due to poor waste water management and lack of potabilisation. Most cases were reported among young children, who are particularly sensitive to water-borne diseases.

As described in *Impact W1* (*Section 7.5*), the loss of water quality, both surface and groundwater, will occur only as a result of bad practices in the use of herbicides and pesticides on the irrigated land located inside the Project Area and will be primarily limited to water resources inside the Project Area. Taking into account field survey findings, the use of chemical products in the Study Area is considered appropriate as these products are used only in small quantities and a few times a year. In any case, in the event of agricultural runoff, surface water flow data shows that the Aguan River and its tributaries have a very good capacity to dilute potential herbicide or pesticide that may reach the rivers, even during the dry season when the surface water flows are lower (*Impact W1*). Nevertheless, small surface water features in the Project Area, not connected to the Aguan River and / or its tributaries, such as ponds and reservoirs, would be more vulnerable to the loss of water quality.

As an embedded measure, the Project's Training Programme will include minimizing the use of chemical products as much as possible and favouring chemical products with low toxicity levels, which contributes to reducing further the potential impact magnitude. Farmers also receive advice from SENASA to consider alternative options to pesticides.

Finally, potable water sources for human consumption are located in upper areas of the tributaries of the Aguan River upstream of the Project Area, which makes potential contamination by the Project unlikely. As such, potential contamination of surface drinking waters in the Project Area is more likely to occur due to existing conditions such as poor wastewater management and organic contamination in settlements near the Aguan River or its tributaries.

Given the vulnerability of children to water-borne diseases, receptors are considered highly sensitive to any potential decrease in drinking water quality.

CHS2 - Increased transmission of vector-borne diseases

As discussed previously in *Impact OHS3* (*Section 7.10.3*), the operation of the irrigation equipment is expected to generate stagnant water piles which increases the risk of transmission of vector-borne diseases on beneficiary farms and surrounding areas if not properly contained. Since both dengue and malaria are reportedly present in the Study Area, although occurrences are low, Project implementation may further increase the risk of transmission, which was raised as a concern by the municipal organism in charge of monitoring vector-borne disease in Olanchito during the field survey.

This being said, the irrigation system will be used primarily during the dry season, when the risk of vector-born disease transmission is significantly lower. The magnitude is therefore considered small. Low-income beneficiaries (small producers), especially children, are considered most vulnerable to diseases transmission as they may lack the awareness or knowledge necessary to prevent infection. Since 14% of beneficiaries are small producers with less than 10 ha of land, receptor sensitivity is therefore considered medium.

CHS3 - Increased pressure on health infrastructure and access to health care

As described in previously in *Impact OHS2 (Section 7.10.3*) Project implementation increases the exposure to potential accidents and injuries related to well-drilling activities and equipment installation if appropriate preventive measures are not taken. The operation of the irrigation system will also potentially increase the risk of transmission of vector-borne (*Impact CHS2*) and water-borne (*Impact CHS1*) disease during the 10-year operation phase. Since access to healthcare services is limited in rural areas as health centres are mostly located in hamlets of 2,000 or more inhabitants and given the low doctor to population ratio in the area (0.1 per 1000), the increased risk of injuries and diseases may result in increased pressure on health infrastructure and healthcare services if these risks are not properly managed and if healthcare offering in the Study Area is not improved.

With respect to the installation of irrigation equipment and well-drilling activities *Impact OHS2 (Section 7.10.3),* the nature of the work is temporary and very punctual (one to two days for installation and up to 10 days for well-drilling) and will be spread out over a 2-year period which reduces the likelihood of overlap of installations activities. Despite the limited access to

healthcare in rural areas and the low doctor to population ratio in the Study Area, pressure on health infrastructure and healthcare services as a result of these activities is therefore not expected, and as such the related potential impact is considered insignificant or negligible.

As for water-borne disease (*Impact CHS1*) and vector-borne disease *(Impact CHS2)*, the impact magnitude is rated as small since irrigation will occur only 3.5 months a year during the dry season and considering a number of other factors, such as the appropriate use of chemical substances observed in the Area, the hydrological features of the Aguan River, and the Training Programme in place. Nevertheless focusing irrigation during 3.5 months implies that the occurrence of Project-related diseases will also be focused over a 3.5 months period. If not prevented, this can lead to an increase in cases that the existing healthcare infrastructure might not be able to absorb efficiently, which would translate into longer waiting times and worse health outcomes. Children and poor households are most vulnerable to these diseases and are considered highly sensitive to the potential increased pressure on healthcare.

Mitigation Measures

The Project design already includes the following embedded measures:

- The SAG and relevant technical departments will implement the Training Programme including training on appropriate use of irrigation equipment and sustainable irrigation and agricultural practices, training on adequate use of chemical pesticides, herbicides and fertilizers, and minimizing water usage for irrigation.

Measures to mitigate the potential impacts on community health due to the potential decrease in drinking water quality are presented in *Impact W1* (*Section 7.5*). With respect to the increased exposure to vector-borne diseases the mitigation measures listed for *Impact OHS3* in *Section 7.10.3* apply. Additional measures include the following:

- The SAG will partner with the relevant institutional and organizational partners to develop and implement a Community Health and Safety Plan including awareness raising and capacity building programmes for settlements in the Project Area on the prevention of vector-borne and water-borne diseases.

In order to mitigate the increased pressure on health infrastructure and healthcare services the following measures will apply:

- The SAG will partner with the relevant institutional and organizational partners to develop and implement a Community Health and Safety Plan including community awareness programmes in order to prevent potential disease occurrence and therefore reduce the risk of increased pressure on the healthcare system in the Study Area during the 3.5 months of irrigation.

- As part of the Community Health and Safety Plan, the SAG and relevant partners will promote any developments to the healthcare sector in the Study Area, including the delivery of capacity building on the prevention and treatment of vector-borne and water-borne diseases.

Residual Impacts

Table 7.22 summarises the impacts on community health and safety as a result of the Project activities during the operation phase.

Table 7.22 Summary of impact assessment of workers' health and safety and labour rights during the operation phase

Impact / Risk	Measures to address the impact / risk	Residual Impact
CHS1 – Increased risk of water-borne disease due to poor drinking water quality	*Embedded measures* • SAG and relevant technical departments to implement the Training Programme including training on adequate use of chemical pesticides, herbicides and fertilizers. *Mitigation measures:* • Same mitigation measures as Impact W1 *(Section 7.5)* • SAG to partner with the relevant institutional and organizational partners to develop and implement a Community Health and Safety Plan including awareness raising and capacity building programmes for settlements in the Project Area on the prevention of vector-borne and water-borne diseases.	**Minor** • Irrigation is limited to 5% of the Project Area and to 3.5 months a year. • Limited use of pesticides and herbicides in the Project Area. • Good dilution capacity in the rivers in the Project Area and no impacts expected on water resources outside the Area. • Drinking water outlets are located in upper areas of the tributaries. • Communities, especially children under 14 are highly sensitive to degradation of water quality. • The implementation of the mitigation measures reduces the impact significance to Minor.

Impact / Risk	Measures to address the impact / risk	Residual Impact
CHS2 – Increased transmission of vector-borne diseases	*Embedded measures* • SAG to include training to beneficiaries on adequate use of the irrigation equipment which involves minimizing the use of the pump as much as possible. *Mitigation measures* • Same mitigation measures as Impact OHS3 *(Section 7.10.3)* • SAG to partner with the relevant institutional and organizational partners to develop and implement a Community Health and Safety Plan including awareness raising and capacity building programmes for settlements in the Project Area on the prevention of vector-borne and water-borne diseases. • SAG through relevant department and institutional partners to train beneficiaries and farm workers on proper management of piles of stagnant water.	**Minor** • Presence of dengue and malaria in the Study Area. • Children are most vulnerable. • The irrigation system will be used during the dry season when the risk of vector-borne disease is significantly lower. • The implementation of awareness raising programmes, and proper management of piles of water will reduce impact significance to Minor.
CHS3- Increased pressure on health infrastructure care and access to health care	*Mitigation measures:* • SAG will partner with the relevant institutional and organizational partners to develop and implement a Community Health and Safety Plan including community awareness programmes in order to prevent potential disease occurrence and therefore reduce the risk of increased pressure on the healthcare system in the Study Area during the 3.5 months of irrigation. • As part of the Community Health and Safety Plan, the SAG and relevant partners will promote any developments to the healthcare sector in the Study Area, including the delivery of capacity building on the prevention and treatment of vector-borne and water-borne diseases.	**Minor** • Increased risk of exposure to diseases concentrated over 3.5 months a year. • Limited access to healthcare services in rural areas and low capacity of healthcare providers (0.1 doctors for 1,000 people). • Limited ability of the healthcare system to absorb an increase in disease occurrence over a concentrated period of time. • Children are highly sensitive to poor healthcare delivery. • Impact magnitude for the increase in vector-borne and water-borne disease occurrence is considered small. • Implementation of mitigation measures to prevent disease occurrence and to improve healthcare service delivery will reduce the impact to a significance of minor.

Source: ERM, 2018

7.12 COMMUNITY COHESION

7.12.1 Overview

This section assesses the potential impacts on community cohesion as a result of the Aguan Irrigation Project. In addition to embedded measures in the Project Design, a series of mitigation measures have been designed to ensure that the level of impacts to socioeconomic receptors is avoided, minimized or reduced. *Box 7.11* below shows the key sources of impacts, potential impacted receptors, as well as baseline and Project influencing factors related to Project impact on community cohesion.

Box 7.11 Key Considerations for Assessment – Community Cohesion

Sources of Impact

- Operation and management of the irrigation equipment

Potentially impacted receptors

- Project beneficiaries
- Non-beneficiary land users and water users for irrigation, drinking and domestic purposes.

Project Factors that are Potentially Influencing Impacts

- Duration of operation phase is approximately 10 years.
- The Project is expected to irrigate 3,110 ha of land (i.e. 5) of the total Project Area).
- The Project beneficiary selection require that beneficiaries have ownership of the land and that the plot in question is not located on indigenous land.

Particular Baseline Conditions that are Potentially Influencing Impacts

- Water balance assessment shows that water consumption from the Project (14,93Hm3/year) represents about 4% of the calculated hydric excess in the Alto Aguan Valley.
- Use of groundwater for irrigation and human consumption is minor in comparison to surface water.
- Violent land conflicts between local farmers and large land owners has been ongoing for over a decade in the Lower Aguan River, downstream of the Project Area.

Vulnerable Groups

- Children under 14 who are most vulnerable to water-borne diseases related to poor water quality.
- Indigenous individuals from the Tolupan communities who may potentially have contested ancestral land claims in the Project Area.

References

- Chapter 3 Project Description and Alternatives – specifically *Section 3.4.*
- Chapter 5 Baseline Description – specifically *Section 5.5.5, Section 5.5.7,* and *Section 5.5.9.*
- Chapter 7 Impact Assessment - specifically *Section 7.5.*

Source: ERM, 2018

Table 7.23 presents the key impacts of the Project on community cohesion during the three phases of pre-operation, operation, and abandonment.

Table 7.23 Key Potential Impacts – Community Cohesion

Pre-operation phase	Operation phase	Abandonment phase
None	CC1 – Increased tensions between communities, producers, and beneficiaries over land ownership and water availability in the dry season	None

Source: ERM, 2018

7.12.2 Operation Phase

Potential impacts

CC1 – Increased tensions between communities, producers, and beneficiaries over land ownership and water availability in the dry season

Project implementation may lead to increased tensions in the communities around the use of water and land ownership if these issues are not foreseen and properly managed.

Specifically, groundwater extraction for irrigation by the Project could potentially lead to increased tensions and risk of conflict around both groundwater and surface water availability between competing water users for irrigation, drinking and domestic purposes, especially during the dry period.

As discussed in *Impact LL4 (Section 7.9.2*) and *Impact W5 (Section 7.5),* depletion of groundwater resources and the interaction between groundwater wells is not likely to occur (water balance assessment shows only a very low % of the hydric excess will be abstracted). It is also unlikely that groundwater wells installed by the Project are located near other groundwater wells which should prevent interaction between wells. However, potential localized decrease in water table cannot be discarded and the potential risk must be analysed at each well opening. As for drinking water sources, as discussed in *Impact CHS1 (Section 7.11.2*), the community drinking water supply outlets are located upstream of the agricultural production area, and as such, irrigation activity is not expected to interfere on the quantity or quality of the water delivered to the communities for drinking or domestic purposes. Also, as embedded measures in Project design, the location of the water abstraction source will be selected making sure that it is away from other water sources such as existing groundwater wells and from potential contamination sources.

As such, the risk of tensions between water users is considered low and the magnitude of the impacts is therefore small to medium. However the sensitivity of water users for irrigation and drinking water is considered high given the importance of water availability for irrigation and the vulnerability of the community to poor water quality (see *Impact CHS1*).

With respect to land-related tensions, it is noted that beneficiaries are not allowed to sell the irrigation equipment and are required to return the equipment to the SAG in the event of a land sale (Chapter 3). As such, the attractiveness of the land for potential buyers disappears in the absence of the irrigation equipment, which makes major land acquisitions by large land owners due to the Project very unlikely. Similarly, as part of the beneficiary selection criteria, the Project requires that selected beneficiaries have ownership of the land to be irrigated and that the plot in question is not located on indigenous land. Nevertheless, contested land claims may still exist in the Project Area, such as the one identified in the hamlet of Agalteca. As such, the possibility of other claims in the Project Area cannot be discarded, which may lead to tensions if not addressed adequately. Since most ancestral lands of the Tolupan community are located in the mountainous areas of Olanchito outside the Project Area, the impact magnitude is considered small however the sensitivity of indigenous communities is high.

Overall, good relationships have been reported in the Project Area along with a strong social conscience among the communities, especially since Hurricane Mitch in 1998, which strengthened community cohesion and engagement in collaborative initiatives such as the creation of CRELs. Indigenous individuals residing in the area are also reportedly well integrated with cases of inter-marriage with non-indigenous communities.

Considering the above, the overall impact magnitude is considered small to medium while receptor sensitivity is considered high for water users and for indigenous people with potential land claims.

Mitigation measures

The Project design includes the following embedded measures:

- The Project has planned monitoring of the irrigation equipment use and maintenance for a period of no less than 10 years, including the beneficiaries' water consumption (water meters are included in the irrigation system).
- The location of the water abstraction source will be selected making sure that it is situated away from other water sources (e.g. other existing groundwater wells) and away from potential contamination sources.
- Land beneficiaries are not allowed to sell the irrigation equipment and are required to return the equipment to the SAG in the event of a land sale.
- As part of the beneficiary selection criteria, the Project requires that selected beneficiaries have ownership of the land to be irrigated and that the plot in question is not located on indigenous land.

To mitigate potential impacts on community cohesion due to the potential decrease in water availability in the dry season, the mitigation measure presented in *Impact W5 (Section 7.5*) apply, in particular the following:

- A Water Management Plan will be prepared and implemented by the SAG. Aspects to be covered by the plan include: an assessment of water use and monitoring data; coordination with other water users and management response as needed; participation of the local administration; and control of the groundwater wells installed.
- The SAG will ensure beneficiaries follow irrigation plans and schedules when using the irrigation equipment.
- The beneficiaries will share and discuss water consumption in the CRELs, in order to improve the management of irrigation water.
- The SAG will ensure that the monitoring of the Aguan River flow upstream and downstream of the Project Area is undertaken by UMA. Two monitoring events will be conducted during the year: in the dry and rainy season.
- The SAG will ensure that the monitoring of the groundwater levels in the wells installed for the Project activities, as well as in any other potential existing well wells located within an approximate ratio of 100 m from the installed groundwater wells, is undertaken by UMA.
- The SAG will require that beneficiaries implement a logbook to record the water pumped (or hours of pumping).

Additional mitigation measures to mitigate potential impacts on community cohesion related to land ownership include:

- During the beneficiary selection process, the SAG will investigate the existence of potential ancestral land claims and exclude beneficiaries whose land ownership is contested regardless of their ownership title.
- As part of the Stakeholder Engagement Plan, the SAG will disclose and implement the grievance mechanism to the wider community, to ensure that all potential grievances or concerns are raised and addressed in order to address issues on time and reduce the risk of tensions.

Residual Impacts

Table 7.24 summarises the impacts on community cohesion as a result of the Project activities during the operation phase. The embedded measures considered in the Project Design and the mitigation measures defined during the impact assessment reduce the residual impact significance to Minor.

Table 7.24 Summary of impact assessment on community cohesion during the operation phase

Impact / Risk	Measures to address the impact / risk	Residual Impact
CC1 – Increased tensions between communities, producers, and beneficiaries over land ownership and water availability in the dry season	*Embedded measures:* • The Project has planned monitoring of the irrigation equipment use and maintenance for a period of no less than 10 years, including the beneficiaries' water consumption. • The location of the water abstraction source will be situated away from other water sources and away from potential contamination sources. • Land beneficiaries are not allowed to sell the irrigation equipment and are required to return the equipment to the SAG in the event of a land sale. • The Project requires that selected beneficiaries have ownership of the land to be irrigated and that the plot in question is not located on indigenous land. *Mitigation measures:* • A Water Management Plan will be prepared and implemented by the SAG. • The SAG will ensure beneficiaries follow irrigation plans and schedules when using the irrigation equipment. • The beneficiaries will share and discuss water consumption in the CRELs, in order to improve the management of irrigation water. • The SAG will ensure that the monitoring of the Aguan River flow upstream and downstream of the Project Area is undertaken by UMA. • The SAG will ensure that the monitoring of the groundwater levels in the wells installed for the Project activities, as well as in any other potential existing well located within an approximate ratio of 100 m from the installed groundwater wells, is undertaken by UMA. • The SAG will require that beneficiaries implement a logbook to record the water pumped (or hours of pumping). • During the beneficiary selection process, the SAG will investigate the existence of potential ancestral land claims and exclude beneficiaries whose land ownership is contested regardless of their ownership title. • As part of the Stakeholder Engagement Plan, the SAG will disclose and implement the grievance mechanism to the wider community, to ensure that all potential grievances or concerns are raised and addressed in order to address issues on time and reduce the risk of tensions.	**Minor** • Irrigation limited to 3.5 months a year (105 days). • Water abstraction by the Project activities will be sustainable and renewable, based on the Water Resource Balance. • It is unlikely that groundwater wells installed by the Project are located near other groundwater wells. • Drinking water outlets are located in upper areas of the tributaries. • Communities, especially children under 14 are highly sensitive to the availability and quality of water. • Land sales due to the Project are highly unlikely. • Most ancestral lands of the Tolupan group are located outside the Project Area but contested land claims may still exist. • Implementation of mitigation measures will reduce the impact to a significance of minor.

Source: ERM, 2018

7.13 ARCHAEOLOGICAL AND CULTURAL HERITAGE

7.13.1 Overview

This section presents an assessment of potential impacts, specific mitigation measures, and anticipated residual impacts associated with the archaeological and cultural heritage environment. *Box 7.12* below shows the key sources of impacts, potential impacted receptors, as well as baseline and Project influencing factors related to Project impact on archaeological and cultural heritage.

Box 7.12 Key Considerations for Assessment – Archaeological and Cultural Heritage

Sources of Impact

- Conditioning of beneficiary land in particular ground-disturbing activities (drilling of groundwater wells)

Potentially impacted receptors

- Archaeological sites, Monuments, and Sites with cultural heritage value.

Project Factors that are Potentially Influencing Impacts

- The National Forestry Institute has not reported the existence of any archaeological protected sites in the Project Area. No further cultural heritage assessment was undertaken.
- Approximately 70% of potential beneficiaries require a groundwater source, ie. 210 potential beneficiaries. This implies that approximately 210 underground wells will be drilled and distributed over 3,110 ha of cultivated land.

Particular Baseline Conditions that are Potentially Influencing Impacts

- The region of Eastern Honduras presents a high archaeological and cultural heritage potential and the Project Area can be regarded as having high archaeological potential.
- Some of the earliest evidence of human occupation in Honduras comes from the Aguan Valley, such as the Cuyamel Caves, located outside the Project Area towards the eastern end of the Aguan Valley.
- The Project Area contains a number of known archaeological sites, such as Puerto Escondido, located south of Olanchito town.
- Many early sites may be located under or beside existing settlements, such as at Olanchito.
- As farming, particularly of Maize, goes back to AD600, the agricultural fields in the Project Area would have seen human interventions since then.

References

- Chapter 5 Baseline Description – specifically *Section 5.5.14.*

Source: ERM, 2018

Table 7.13 presents the key impacts of the Project on archaeological and cultural heritage during the three phases of pre-operation, operation, and abandonment.

Table 7.13 Key Potential Impacts – Archaeological and Cultural Heritage

Pre-operation phase	Operation phase	Abandonment phase
None	CH 1 – Potential damage to archaeological or cultural heritage elements in the Project Area	None

Source: ERM, 2018

7.13.2 Operation Phase

Potential impacts

CH 1 – Potential damage to archaeological or cultural heritage elements in the Project Area

Direct physical disturbance of; or damage to, cultural heritage sites will result in the loss of scientific, historic, or cultural value. Ground-disturbing activities, such as the planned groundwater drilling activities, are key sources of impacts, as these activities have the potential to destroy archaeological resources.

Considering that approximately 70% of beneficiaries will require a groundwater source and that the depth of each well will vary between 6 and 80 m deep (depending on geology of the site), that the Project Area contains a number of known archaeological sites and that it can be regarded as having a high archaeological potential, direct physical disturbance on unknown archaeological or cultural heritage sites during the groundwater well drilling activities is likely to exist.

The sensitivity of the impact depends of the value of the cultural heritage resource. Considering that some of the earliest evidence of human occupation in Honduras comes from the Aguan Valley, although outside of the Project Area, it is considered that the sensitivity of the cultural heritage resource is high.

Mitigation Measures

In order to mitigate direct physical disturbance to archaeological or cultural heritage sites, the following measures will apply:

- The SAG through relevant technical departments or partner organizations will prepare and develop a Cultural Heritage Management and Monitoring Plan.
- The SAG through relevant technical departments or partner organizations will map locations of known archaeological sites within the Project Area.
- The SAG through relevant technical departments or partner organizations will undertake a site survey of the beneficiary land plot and selected groundwater well locations.
- The SAG through relevant technical departments or partner organizations will ensure that groundwater well locations are avoided

if there are indications that archaeological material will be encountered;
- The SAG through relevant technical departments or partner organizations will undertake archaeological monitoring during the drilling of the wells in locations where archaeology may be encountered. A Chance Find Procedure will be implemented during these monitoring activities.

Residual Impacts

Table 7.19 summarises the impacts on archaeological or cultural heritage elements as a result of the Project activities during the operation phase. The mitigation measures defined during the impact assessment reduce the residual impact significance to Minor

Table 7.25 Summary of impact assessment of archaeological or cultural heritage elements in the Project Area during the operation phase

Impact / Risk	Measures to address the impact / risk	Residual Impact
CH1- Potential damage to archaeological or cultural heritage elements in the Project Area	*Mitigation measures* • The SAG will prepare and develop a Cultural Heritage Management and Monitoring Plan. • The SAG will map locations of known archaeological sites within the Project Area. • The SAG will undertake a site survey of the beneficiary land plot and selected groundwater well locations. • The SAG will ensure that groundwater well locations are avoided if there are indications that archaeological material will be encountered; • The SAG will undertake archaeological monitoring during the drilling of the wells in locations where archaeology may be encountered. A Chance Find Procedure will be implemented during these monitoring activities.	**Minor** • High sensitivity of cultural heritage resources. • Potentially unknown archaeological or cultural heritage sites located in the Project Area • Limited duration of drilling activities (non-continuous and spread out over 2 years).

Source: ERM, 2018

7.14 NON-ROUTINE EVENTS

7.14.1 Overview

This section assesses the potential impacts derived from non-routine events as a result of the Project activities, these refer to accidental spills of fuel (diesel) and / or wastes (such as lubricants or bentonite-based muds).

Box 7.13 presents the key sources of impacts, potentially impacted receptors, baseline and project influencing factors.

Box 7.13 Key Considerations for Assessment – Non-routine events

Sources of Impact

- Drilling vehicles operation and maintenance
- Irrigation equipment operation and maintenance

Potentially Impacted Receptors

- Soil
- Water resources

Particular Baseline Conditions that are Potentially Influencing Impacts

- Soil quality conditions in the Project Area are expected to be good, in absence of evidences of a wrong use of use of chemical products.
- Connection between the Aguan River and the Alluvial Aquifer.
- Most of the Project Area is located on the Alluvial Aquifer of the Aguan River, which is described as a highly productive and extensive aquifer.

Project Factors that are Potentially Influencing Impacts

- Accidental spills of fuel (diesel) or wastes (lubricants and bentonite-based muds) used by the motor pumps and drilling vehicles.

References

- Chapter 3 Project Description and Alternatives – specifically *Section 3.1*, *Section 3.5*, *Section 3.6.1* and *Section 3.6.2*.
- Chapter 5 Baseline Description – specifically *Section 5.2.7* and *Section 5.2.8*.

Source: ERM, 2018

Table 7.26 presents the key impacts derived from non-routine events.

Table 7.26 Key Potential Impacts – Non-routine events

Pre-operation phase	Operation phase	Abandonment phase
None	Acc1 - Affection to the soil quality and groundwater quality due to accidental spills of fuel (diesel) and/or wastes (lubricants, bentonite-based muds).	None

Source: ERM, 2018

7.14.2 Operation phase

Potential impacts during operation phase

Acc1 – Impact on soil and water quality due to non-routine events

During the operation and maintenance of the drilling vehicles and Project irrigation equipment, accidental spills and discharges of pollutant materials can occur which have the potential to result in soil and water resource contamination including, the shallow aquifers beneath the spill site and the nearby surface water in event that the discharge reaches a river stream.

Pollutant materials derived from the operation of the drilling vehicles and of the Project irrigation equipment include fuel (diesel) and/or wastes (used lubricants or bentonite-based muds for drilling activities).

Non-routine impacts from accidental spills/leaks may occur during the operation phase, at the beneficiaries' plot:

- During the drilling of the groundwater wells, that will be undertaken only at the beginning of the operation phase for a limited period of time and only on the plots that require a groundwater source;
- During the operation of the Project irrigation equipment, during the 3,5 months per year it will be used; or/and
- Due to an inappropriate handling, storage or management of pollutant materials.

It should be taken into account that:

- The Project will include a Training Programme, meant to be provided to the beneficiaries receiving the irrigation system. This Training Programme will include a topic of adequate use and maintenance of the irrigation equipment and management of pollutant materials.
- The drilling of the groundwater wells at the beneficiary's plot that require it will be undertaken by specialised local or regional drilling companies which will be screened by the SAG-PIU.
- Wastes generated by the project are limited to lubricants used in the maintenance of the irrigation equipment. As described in *Section 3.6.2*, the beneficiary will be responsible for the management of the used lubricants. In addition to this, it should be noted that use of lubricants will not be a new activity, since they are used frequently in the farms (e.g. maintenance activities for farm machinery or vehicles).
- As described in *Section 3.6.2*, specific groundwater construction wells drilling fluids will be used, bentonite-based preferably for the drilling of groundwater wells for the beneficiaries that require one. Any chemical additive used will be biodegradable.

The accidental event can be therefore characterised as follows:

- *Probability:* These events, even if unplanned and unwanted, can occasionally happen. The probability of a single event at a single location can be considered medium to high, however, the probability of more than one event and of happening simultaneously is considered low. The combined probability is thus medium.
- *Consequence:* The consequence is dependent on the nature of the product accidentally spilled and the quantity. The soil of the Project Area is considered of good quality and the groundwater table ranges from less than 10 m and up to more than 40 m. Considering that the operation will be conducted in a small plot, that the potential quantity of pollutant material with a risk of being spilled (fuel, lubricants or bentonite-based muds) used by each beneficiary individually for the

operation of the Project irrigation equipment or by the drilling vehicles will be small, and it is not expected that such a small shallow spill can reach the groundwater table or a near-by river stream, the consequence is be considered low.

Taking into account the medium probability and the low consequence, the overall risks from spills and/or leaks are considered *low*.

Mitigation measures

The Project design includes the following embedded measures:

- Training Programme including a topic of adequate use and maintenance of the irrigation equipment. This will contribute to avoid the risk of an inadequate management of wastes resulting from the maintenance of the irrigation equipment (used lubricants for the start-up of the equipment and used spill absorbent materials) subsequently the risk of affecting soil and groundwater quality and indirectly fauna and flora species and protected areas.
- The drilling of the groundwater wells at the beneficiary's plot that require it will be undertaken by specialised local drilling companies which will be screened by the SAG-PIU.
- This will contribute to avoid the risk of an inadequate management of wastes (used drilling fluids).
- The provision of the irrigation equipment will include the requirement to the beneficiary of the irrigation equipment of allowing the monitoring of the irrigation equipment for a period of no less than 10 years. This embedded measure will enable to monitor some of the mitigation measures described below.
- The provision of the irrigation equipment will include the requirement to the beneficiary of acquiring a series of responsibilities linked to the irrigation system such as carrying out the maintenance of equipment and its components, accessories, as recommended by the manufacturer or supplier. These will include the compliance with the mitigation measures described below.

The following mitigation measures will be implemented in order to minimize the affection to soil and groundwater quality due to accidental spills of pollutants (fuel (diesel) or wastes (lubricants)):

- Motor pumpswill to be installed on impermeable surfaces, so that if a spill of fuel (diesel) or wastes (lubricants) occurs, it does not lay on the ground directly.
- Absorbing materials will be available in the proximity of the motor pumps/generators, so that if a spill of fuel (diesel) or wastes (lubricants) occurs, it can be cleaned promptly.
- Fuel (diesel) and lubricants will be stored in certified and specific storages for such products.

In addition, the following recommendation measure is provided, considered as good management practices:

- Implementation of logbook with records of fuel (diesel) used, spills occurred (if any)

Residual impacts

Table 7.27 summarises the impacts derived from non-routine events. The embedded measures considered in the Project Design and the mitigation measures defined during the impact assessment results in a Residual Impact assessed as *very low*.

Table 7.27 Summary of non-routine events

Impact / Risk	Measures to address the impact / risk	Residual Impact
Operation and maintenance of drilling vehicles and Project irrigation equipment: • Affection to the soil quality and water resource quality due to accidental spills of fuel (diesel) and/or wastes (lubricants, bentonite-based muds).	*Embedded measures:* • Implementation of the Project's Training Programme • Drilling of the groundwater wells at the beneficiary's plot that required it will be undertaken The drilling of the groundwater wells at the beneficiary's plot that require it will be undertaken by specialised local or regional drilling companies which will be screened by the SAG-PIU. • . This will contribute to avoid the risk of an inadequate management of wastes. • Monitoring of the irrigation equipment for a period of no less than 10 years. • Beneficiary responsibilities acquired linked to the irrigation system such as the maintenance of the equipment. *Mitigation measures:* • Motor pumps will be installed on impermeable surfaces. • Absorbing materials will be available in the proximity of the motor pumps. • Fuel (diesel) will be stored in certified and specific storages for such products. • Implementation of logbook recording for fuel used, spills occurred recommended as good practice.	**Low** • Residual risks of accidental events are impossible to eliminate. The embedded measures of the Project Design and the implementation of the mitigation measures will however keep this risk as low as reasonably practicable (ALARP).

Source: ERM, 2018

7.15 CUMULATIVE IMPACTS

7.15.1 Overview

Cumulative impacts may be broadly defined as impacts that result from the accumulation of a number of individual impacts (European Commission DG XI (1999) *Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions*, OOPEC, May 1999, *p iii* and *Section 2.1*). They may result from various types of interaction, including:

- Impacts that arise from the accumulation of different impacts at a specific location (e.g. impacts of irrigation activities affecting the same receptor such as soils – individually these may not be significant, but the accumulation of different impacts may give rise to an overall significant impact) – these impacts were identified in the relevant thematic topic assessment earlier in this Chapter (e.g. Soil in *Section 7.4*).*;* and
- The accumulation of impacts of the same type at different locations (e.g. non-significant individual groundwater level impacts at different sites collectively may give rise to an overall significant impact in the overall Project Area) – these impacts have been identified in the relevant thematic topic assessment earlier in this Chapter (e.g. Groundwater in *Section 7.5*).
- Impacts which are the result of the combination of activities associated with the Alto Aguan Project (i.e. irrigation activities and water use) together with other similar ongoing or foreseen activities expected to take place in the near-by area. These potential impacts are assessed in this section

The mentioned other similar ongoing or foreseen activities expected to take place in the near-by area have been identified and summarised in the following *Table 7.28***.**

Table 7.28 Potential cumulative impacts from the interaction between the Alto Aguan Project and other projects

Project	Description of the ongoing or planned projects and potential interaction with the Alto Aguan Project
Aguan Energy Complex	The Aguan Energy Complex[1] consists of the development of the first Energy Complex of Honduras comprised of hydroelectric, biomass and photovoltaic plants, managed by the ENEE (Empresa Nacional de Energía Eléctrica). The Complex is planned to be consolidated in the Aguan Basin and it will occupy an area of 11.005 km². It is planned to generate 220 MW. The hydroelectric component will use three different water sources following three consecutive steps: the basin of the Aguan river (planned to generate 64 MW), the basin of the river Mame (tributary of the Aguan river planned to generate 36.46 MW) and the basin of the Yaguala river (tributary of the Aguan river planned to the generate 71.39 MW). The disruption to water flows is possible on the Aguan river, the river Mame and the river Yaguala as a result of the construction and operation of the planned hydroelectric dams. These effects on the river flow could be perceived by the irrigation activities of the Alto Aguan Irrigation Project. Providing there is a limited amount of information available on the Aguan Energy Complex, specifically on the planned project design of its hydroelectric component, the potential interaction and subsequent cumulative environmental impacts of the hydroelectric' s construction and operation cannot be assessed. The Stakeholder Engagement Plan (SEP) (see *Chapter 4* and *Annex 1*) developed for the Alto Aguan Irrigation Project will be implemented throughout the Project's phases. One aspect raised in the SEP by the SAG is that future projects such as the Aguan Energy Complex will be undertaken in cooperation with the Alto Aguan Irrigation Project to guarantee the sustainable use of resources, in particular water resources.

[1] http://enee.hn/pdfs/Aguan.pdf

Project	Description of the ongoing or planned projects and potential interaction with the Alto Aguan Project
Arenal Etapa I-II Hydroelectric project	The Arenal Etapa I-II Hydroelectric project[1] (hereafter, Arenal I-II) consists of a 61.04 MW hydropower station over the Yaguala river, one of the Aguan river's tributaries, located in the municipalities of El Arenal and Olanchito. The project generation layout consists of a 93m high regulation dam and water storage, a 4.6 Km conduction tunnel, a 130 m penstock, and two vertical-axis Francis turbines located in the powerhouse, which will connect with the National Interconnection System of the ENEE (Empresa Nacional de Energía Eléctrica). The net power production provided to the national grid is expected to be approximately 229.72 GWh per year. The hydroelectric project is under construction at the moment (September 2018) and its operation are planned to start in 2020. Detailed information on the potential impact of this planned dam on the Yaguala river and consequently potentially to the Aguan river (as the tributary flows towards the Aguan river) is not available. It is expected that the new dam will be supplied with the hydric excess of the wet season and will maintain a basic flow during the dry season. The potential impact would be related to the current flow of the Yaguala river, not to the alluvial aquifer which is the main water source of the Aguan Irrigation Project. As for the previously mentioned project, the Stakeholder Engagement Plan (SEP) raises that future projects such as the Arenal Etapa I-II Hyroelectric project will be undertaken in cooperation with the Alto Aguan Irrigation Project to guarantee the sustainable use of resources, in particular water resources.
Irriation Project Austria II	The Austria II Project[2], in operation since 2015, consists of the provision of 190 sprinkler irrigation equipment distributed in various departments of Honduras for high value crop production. Twenty one irrigation equipment were distributed in the Yoro Department. The selected beneficiaries comply with the criteria of having at least 5 ha of land with an abundant surface water source located at less than 300 meters from the land to be irrigated. It can be assumed that the selected beneficiaries of the Yoro department are located in the Alto Agua River Valley and that they are using as water source the Aguan river. Considering that the water balance of the Aguan Irrigation Project takes into account all current water abstraction and that the beneficiaries of the Project will use a groundwater source in the majority of the cases, it is considered that the potential interaction between the two irrigation projects is compatible. Based on the mitigation measures to be implanted for the potential Impact W3, which are described in *Section 7.5.2, i*t is expected that that the potential interactions result in non-significant cumulative environmental impacts.

Source: ERM, 2018

Mitigation measures

The mitigation measures required to prevent impacts to river water flow (Impact W3) are described in *Section 7.5.2*.

Through the Stakeholder Engagement Plan (SEP) (*Chapter 4* and *Annex 1*) the SAG raises that future projects such as Aguan Energy Complex and the

[1] https://www.bnamericas.com/project-profile/es/planta-hidroelectrica-arenal-etapa-i-ii-planta-hidroelectrica-arenal-etapa-i-ii

[2] http://www.laprensa.hn/honduras/832112-410/invertir%C3%A1n-352-millones-para-riego-de-23000-hect%C3%A1reas-de-cultivos

Arenal Etapa I-II Hydroelectric project or current projects such as the Austria II project will be undertaken in cooperation with the Alto Aguan Irrigation Project to guarantee the sustainable use of resources and to ensure that the potential interactions related to the water resources do not result in significant environmental impacts.

Residual impacts

River flow related impacts would be associated with the construction and operation of other planned or foreseen projects such as the Austria II project, Aguan Energy Complex and the Arenal Etapa I-II Hydroelectric project. All three projects pose the use of surface water in two tributaries of the river Aguan as well as in the river Aguan and do not include direct actions on the underground water from the alluvial aquifer of the river Aguan. In addition; the application of the planned stakeholder engagement activities will allow the cooperation of these projects with the Aguan Irrigation Project in order to make sure that potential interactions between the projects do not result in significant environmental impacts.

On the basis that the mitigation measures are implemented, the overall magnitude of the residual cumulative impact would be expected to be not significant.

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LIST OF TABLES

8 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

8.1 OVERVIEW

This section sets out the approach to the management and monitoring of environmental and socioeconomic issues related to the pre-operation, operation and abandonment phases of the Alto Aguan Irrigation Project.

The main objective of the Environmental and Social Management Plan (ESMP) is to provide a framework for the implementation of the measures identified in the impact assessment (*Chapter 7*) to avoid, mitigate or offset adverse impacts and to minimise and manage risks on the physical, biological and social environments from Project activities.

The broad purpose of the ESMP is to:

- Ensure that good industry practice with regards to environmental and socioeconomic management is adopted during all phases of the Project (pre-operation, operation and abandonment);
- Define strategies and methods and control approaches to ensure implementation of measures to effectively mitigate potentially adverse environmental or socioeconomic impacts;
- Provide a framework for compliance monitoring (auditing and inspection) by which the identified responsible parties will assure that the environmental and socioeconomic performance commitments of the Project are being met.

Following the objective of the ESMP, the chapter is structured as follows:

- *Section* ***¡Error! No se encuentra el origen de la referencia.***: list of the potential environmental and social impacts and identified mitigation measures per Project phase;
- *Section 8.3*: definition and commitments of the proposed specific environmental and social management plans;
- *Section 8.3.12:* definition of the proposed monitoring plan including the roles and responsibilities of the involved stakeholders to ensure a fully effective implementation of the ESMP.

8.2 ENVIRONMENTAL AND SOCIAL MANAGEMENT IMPLEMENTATION AND MONITORING PLAN

Table 8.1, Table 8.2, *Table 8.3* and *Table 8.4* present the Environmental and Social Management Plan for the Project summarizing the mitigation measures identified in *Chapter 7* along with implementation timelines and milestones, responsible party, monitoring and reporting requirements.

Table 8.1 Environmental and social management plan - pre-operation phase

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
Economy and employment	EE1 – Long-term benefits of capacity enhancement for SAG technicians and Project beneficiaries *Note: this impact also extends to the operation phase.*	*Embedded measures* • Implementation of the Project's Training Programme including training of SAG technicians and designated personnel on the correct installation and use of the irrigation equipment. The technical training also includes capacity building on agricultural consulting. • Provide training to the beneficiaries on the installation, use, and maintenance of equipment as well as on agricultural and irrigation good practice and environmental and social measures. *Enhancement measures* • Development in partnership with local organisations a training programme to provide ongoing technical support and agricultural/irrigation advice to Project beneficiaries during the operation phase. • As part of the training program, development and implementation of ad-hoc additional training on relevant aspects as required.	During pre-operation phase	• PAA Project Finance (training of SAG technicians) • The SAG

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
Occupational health and safety and labour rights	OHS1 – Health and safety and labour rights related to road transport of irrigation kits to the SAGO warehouse	*Embedded measures* • Employment of labour within the framework of the Honduran Labour Code, and the laws and statutes in force including provisions for overtime pay, minimum working age, and the rights of children and adolescents. *Mitigation measures* • Development and implementation of a Traffic Management Plan indicating the route to follow especially during the rainy season. Measures will include stopping the car in case of heavy rains, not crossing rivers and creeks during floods, hours of driving and rest periods, etc. • Provide training on traffic safety to selected drivers through relevant technical departments or partner organizations. • As part of hiring process, request medical approval for loading and offloading heavy packages and provide adequate training to selected drivers on safe loading and offloading techniques. • As part of the Stakeholder Engagement Plan, disclose and implement a grievance mechanism for all Project stakeholder including workers.	During pre-operation phase	• The SAG

Table 8.2 Environmental and social management plan – operation phase

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
Air Quality and Climate change	CA1 – Emissions of air pollutants and GHGs potentially affecting air quality and climate change	*Embedded measures:* • Implementation of the Project's Training Programme including technical training on the adequate use and maintenance of the irrigation equipment, which will contribute to minimizing the use of the motor pumps/generators as much as feasible and, consequently, their emissions of air pollutants and GHGs • Beneficiary responsibilities acquired linked to the irrigation system such as the maintenance of the equipment, which will contribute to minimizing air pollutant and GHG emissions. • Implementation of logbook with records of fuel used recommended as good practice.	During pre-operation phase (training). During operation phase (maintenance of the equipment and implementation of logbook)	• The SAG • Beneficiaries (maintenance of the equipment)
Acoustic Environment	N1 – Potential disturbance to workers and/or fauna	*Embedded measures:* • Implementation of the Project's Training Programme including a topic on the adequate use and maintenance of the irrigation equipment, which will contribute to minimizing the use of the motor pumps/generators as much as feasible, and consequently, their emissions of noise. • Beneficiary responsibilities acquired linked to the irrigation system, such as the maintenance of the equipment, which will contribute to minimizing noise emissions.	During pre-operation phase (training). During operation phase (maintenance of the equipment).	• The SAG • Beneficiaries (maintenance of the equipment)

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
Soils	S1 – Loss of soil properties and soil disturbance	*Embedded measures:* • Implementation of the Project's Training Programme including technical training on the adequate use and maintenance of the irrigation equipment. This will contribute to minimizing the amount of water used as much as feasible, and consequently, reduce the risk of salinization and / or erosion events. • Training Programme including good irrigation practices (aligned with FAO guidelines). • Monitoring of the irrigation equipment for a period of no less than 10 years including the beneficiaries' water consumption (water meters are included in the irrigation system). • Beneficiaries required to comply with the mitigation measures proposed. *Mitigation measures:* • Follow irrigation plans and schedules as per FAO's guidelines. • Implementation of logbook with records of water pumped (or hours of pumping), and share this with the CRELs.	During pre-operation phase (training). During operation phase (monitoring activities, irrigation plan and schedule and the implementation of logbooks).	• The SAG • The SAG with support of the CRELs (monitoring of water consumption) • Beneficiaries (comply with the mitigation measures)

Water Resources	• W1 - Loss of surface and groundwater quality.	*Embedded measures:* • Implementation of the Project's Training Programme including a topic on the adequate use of the irrigation equipment. This will contribute to minimizing the amount of water used as much as feasible and, consequently, reduce the risk of affecting the river water flow. • Training Programme including good irrigation practices (aligned with FAO guidelines). • Implementation of the Project's Training Programme including a topic on the adequate use of chemical products (pesticides, herbicides, and fertilizers) focused on minimizing their use as much as possible and selecting low toxicity pesticides and herbicides. This will contribute to reducing the risk of affecting the water quality and the risk of eutrophication. • Monitoring of the irrigation equipment for a period of no less than 10 years including the beneficiaries' water consumption (water meters are included in the irrigation system). • The location of the water abstraction source will be selected making sure that it is situated away from other water sources (e.g. other existing groundwater wells) and away from potential contamination sources. • Beneficiaries required to comply with mitigation measures proposed. *Mitigation measures:*	During pre-operation phase (training and development of management plans). During operation phase (construction of water abstraction source, monitoring activities and implementation of logbook).	• The SAG • The SAG with the support of SENASA (monitoring of pesticides, herbicides, fertilizers used/sold) • The SAG with support of the CRELs (monitoring of water consumption) • The SAG with the support of UMA (monitoring of Aguan River and tributaries upstream and downstream) • The SAG with the support of UMA (monitoring of groundwater levels in wells) • Beneficiaries (comply with the mitigation measures)

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
		• Development and implementation of a Pesticides and Herbicides Management Plan. • Monitoring of pesticides and herbicides used. • Monitoring of pesticides and herbicides sold in Olanchito. • Monitor that only products recommended by SENASA are used. • Monitoring of the nitrate and nitrite levels in the groundwater wells installed as a result of the Project activities. • Implementation of logbook with records of pesticides and herbicides used recommended as good practice.		
	• W2 – Eutrophication of surface water.	*Embedded measures:* Same embedded measures as W1. *Mitigation measures:* • Development and implementation of a Fertilizer Management Plan. • Monitoring of fertilizers used. • Monitoring of fertilizers sold in Olanchito. • Monitoring of the nitrate and nitrite levels in the groundwater wells installed as a result of the Project activities. • Implementation of logbook with records of fertilizers used recommended as good practice.		

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
	• W3 – Effects on river flow.	*Embedded measures:* Same embedded measures as W1. *Mitigation measures:* • Follow irrigation plans and schedules as per FAO's guidelines. • Development and implementation of a Water Management Plan. Aspects to be covered by the plan include: an assessment of water use and monitoring data; coordination with other water users and management response as needed; participation of the local administration; and control of the groundwater wells installed. • Water flow monitoring in Aguan River and main tributaries (upstream and downstream). Two monitoring events will be conducted during the year: in the dry and rainy season. This monitoring will be extended to the main tributaries of the Aguan River within the Project Area, limited to one location only, in the proximity of their union with the Aguan River. • Implementation of logbook with records of water pumped recommended as good practice.		

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
	• W4 - Increase of organic matter in the groundwater.	*Embedded measures:* Same embedded measures as W1. *Mitigation measures:* • Development and implementation of a Fertilizer Management Plan. • Monitoring of fertilizers used. • Monitoring of fertilizers sold in Olanchito. • Monitoring of the nitrate and nitrite levels in the groundwater wells installed as a result of the Project activities. • Implementation of logbook with records of fertilizers used recommended as good practice.		

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
	• W5 – Effect on groundwater level.	*Embedded measures:* Same embedded measures as W1. *Mitigation measures:* • Follow irrigation plans and schedules as per FAO's guidelines. • Development and implementation of a Water Management Plan. Aspects to be covered by the plan include: an assessment of water use and monitoring data; coordination with other water users and management response as needed; participation of the local administration; and control of the groundwater wells installed. • Groundwater level monitoring in the wells installed for the Project activities, as well as in any other potential existing well located within an approximate ratio of 100 m from the installed groundwater wells. • Implementation of logbook with records of water pumped recommended		
Biodiversity	• B1– Disturbance to fauna.	*Embedded measures:* • Development and implementation of a Biodiversity Management Plan. • Case-by-case selection of potential beneficiaries whose plot is partially within or adjacent to protected areas and/or natural habitats, such as shrubland and		• The SAG • The SAG – PIU (selection of beneficiaries) • The SAG with support of ASIDE and ICF (case-by-case selection of potential beneficiaries whose plot

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
	• B2 – Disturbance to flora.	forest, with the contractual condition that these protected areas are not within the irrigated plot, and the natural habitats are maintained as they are, including prevention of irrigation or its run-off entering the natural habitat, if these beneficiaries are ultimately provided with		is partially within or adjacent to protected areas and/or natural habitats) • Monitor of irrigation/run-off into natural habitats by SAG with

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
	• B3 – Loss of natural habitats and subsequent loss of flora and fauna.	Project irrigation equipment. The selection will include a site visit to the beneficiary plots to confirm that no sensitive resources will be affected. • Monitor beneficiaries to prevent irrigation and/or run-off outside plot borders into natural habitats • Embedded mitigation measures as described in: o Impact CA1, o Impact N1, o Impact S1, o Impact W1, o Impact W2, o Impact W4. • Embedded mitigation measures as described in: non-routine events (Acc1) (See *Table 8.3*) *Mitigation measures:* • Mitigation measures as described in: o Impact CA1, o Impact N1, o Impact S1, o Impact W1, o Impact W2, o Impact W4.	During pre-operation phase (development of management plans, selection of beneficiaries) See implementation timing of Impact CA1, Impact N1, Impact S1, Impact W1, Impact W2, Impact W4	potential support from ASIDE and ICF • See responsible parties of Impact CA1, Impact N1, Impact S1, Impact W1, Impact W2, Impact W4

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
Protected Areas/Critical Habitats	PA1 – Effect on habitats, flora, and fauna in the Protected Area/Critical Habitats/during operation	*Embedded measures:* Same embedded measures as B1, B2 and B3. *Mitigation measures:* Same mitigation measures as B1, B2 and B3. In addition to this: • The Pesticides and Herbicides Management Plan will have specific considerations regarding the use of pesticides and herbicides in the proximity of the protected area. • The Fertilizers Management Plan will have specific considerations regarding the use of fertilizers in the proximity of the protected area.	During pre-operation phase (development of management plans, selection of beneficiaries) See implementation timing of Impact CA1, Impact N1, Impact S1, Impact W1, Impact W2, Impact W4	• The SAG • The SAG – PIU (selection of beneficiaries) • The SAG with support of ASIDE and ICF (case-by-case selection of potential beneficiaries whose plot is partially within or adjacent to protected areas and/or natural habitats) • See responsible parties of Impact CA1, Impact N1, Impact S1, Impact W1, Impact W2, Impact W4

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
Economy and Employment	EE2- Temporary economic impacts from beneficiary fee payment to the SAG and beneficiary procurement.	*Embedded measures* • Implementation of the Project's Training Programme including relevant trainings for beneficiaries to ensure application of environmental and social good practice, such as annual crop production and irrigation good practices, sustainable use of water, use of pesticides and fertilizers, and waste management. Trainings to be delivered with support of technical departments and partner organizations (ASIDE, SENASA, Health Secretary, etc.) *Enhancement measures:* • Conduct an assessment of local procurement potential including: o identification of local suppliers that meet required quality standards and ability to meet the demand; o capacity building and support to identified suppliers to ensure continuous supply; and o promotion of local procurement by beneficiaries by providing a list of local and regional suppliers.	During pre- operation phase (trainings, assessment of local procurement, well-drilling companies screening). During operation phase (rest of measures)	• The SAG • The SAG with support of technical departments and partner organizations (ASIDE, SENASA, Health Secretary, etc.)

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
	EE3 – Temporary direct employment of labour for installation of the irrigation equipment.	*Enhancement measures:* • Ensure that the beneficiaries employ workers from the local labour force prioritizing workers from the Project Area followed by workers from Olanchito and Arenal more broadly and neighbouring municipalities as needed. • Ensure that beneficiaries rely on the CRELs and the municipality employment department to advertise their employment needs with a clear application procedure to and ensure equal opportunities for all and transparent hiring practices		
	EE4 – Long-term economic growth from production increase and improvements in the agriculture and milk production sectors and related sectors.	*Enhancement measures:* • Conduct a detailed supply-and-demand market study for the agriculture, milk production and milk-processing sectors to assess risks and opportunities related to an increased production.		

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
	EE5 - Long-term direct and indirect employment in the agriculture, livestock breeding and milk production sector and related sectors.	*Enhancement measures:* • Consider as criteria the potential beneficiary's financial solvency to generate additional employment in order to cultivate the irrigated land. • Require potential beneficiaries to present an investment plan including the number of permanent jobs expected to be created. • Agree with selected Project beneficiaries on the expected level of yearly employment and ensure best efforts to employ workers from within the Project Area including individuals of indigenous descent, while guaranteeing equal pay and working conditions. • Monitor compliance with labour related commitments both during the rainy and dry season through technical and relevant technical departments		

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
Livelihoods and Income	LL1 –Improved livelihoods and food security for Project beneficiaries and farm labour.	*Mitigation measures:* • Undertake a sector and market study for production including a supply-and-demand market assessment. • Provide project management support and financial literacy trainings through relevant technical departments.	During pre-operation phase (sector and market study, selection of beneficiaries, trainings and capacity building, and development of management plans).	• The SAG • The SAG-PIU (selection of beneficiaries) • The SAG with support of SAGO and CRELs (creation and capacity building) • The SAG with support of rural funding organizations (project management support and financial literacy trainings) • The SAG with the support of UMA (monitoring of surface water flow and groundwater levels) • The SAG with support of the CRELs (monitoring of water consumption)

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
	LL2 – Risk of livelihood losses for beneficiaries due to increased financial pressure on beneficiaries	*Embedded measures:* • Implement measures to reduce initial investment costs for beneficiaries including fee minimization, efficient motor pump with low diesel consumption (3.8l/h) *Mitigation measures:* • As part of the beneficiary selection process, require proof of financial solvency to minimize the risk of over indebtedness and financial pressure on beneficiaries, especially small producers. • Support the creation and capacity building of rural funding organizations (*Cajas Rurales)* for the agriculture and milk production sectors specifically, in collaboration with the SAGO and CRELs • Provide project management support and financial literacy trainings to beneficiaries to allow them to prepare long-term business plans for their operations, in collaboration with the SAGO and CRELs		

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
	LL3 – Risk of livelihood losses for beneficiaries and other land users due to loss of soil fertility	*Embedded measures:* • Implementation of the Project's Training Programme including training on appropriate use of irrigation equipment and sustainable irrigation and agricultural practices, training on adequate use of chemical products and minimizing water usage for irrigation. • Monitoring of the irrigation equipment for a period of no less than 10 years *Mitigation measures:* • Same Mitigation measures as S1.		

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
	LL4 – Risk of livelihood and losses for non-project beneficiaries due to decreased availability of water	*Embedded measures:* • Same embedded mitigation measures as W5. *Mitigation measures:* • Same mitigation measures as W5. *Additional mitigation measures:* • As part of the Stakeholder Engagement Plan, disclose and implement the grievance mechanism to the wider community, including in particular farmers associations or cooperatives to ensure that small-scale crop framers in the area are able to voice any grievances or complaints related to the Project and seek proper remedy.		

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
Occupational Health and Safety and Labour Rights	OHS2 – Occupational health and safety and labour rights related to groundwater well drilling and equipment installation.	*Embedded measures* • Implementation of the Project's Training Programme including technical training on the adequate use and maintenance of the irrigation equipment. *Mitigation measures:* • As part of the technical training to beneficiaries, include health and safety prevention measures for equipment installation adapted to high temperature weather conditions (clothing, water intake, shade, change of work schedule, etc.) and thunderstorms, etc. • Monitor installation and well-drilling activities and provide support as needed. • Require the local drilling companies for well drilling to develop Health and Safety Plans to ensure that well-drilling staff is well trained on safe drilling practices and health and safety prevention measures. • As part of the Project's Stakeholder Engagement Plan, disclose and implement the grievance mechanism for all Project stakeholder including workers. • Conduct regular monitoring of labour issues by following up on the grievances raised.	During pre-operation phase (trainings). During operation phase (rest of measures).	• The SAG

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
	OHS3 – Occupational health and safety and labour rights related to farm labour including the risk of child labour and forced overtime.	*Embedded measures:* • Same embedded measures as OHS2. *Mitigation measures:* • Conduct awareness and capacity building training to beneficiaries, beneficiary farm workers, and the broader community on exposure to vector-borne diseases such as malaria and adequate prevention measures, through relevant departments and institutional partners. • Train beneficiaries and farm workers on proper management of piles of stagnant water, through relevant departments and institutional partners.		

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
	OHS4 - Labour rights for farm labour including the risk of child labour and forced overtime	*Mitigation measures:* • As part of the Project's Stakeholder Engagement Plan, develop and disclose a grievance mechanism for all Project stakeholder including workers to ensure that a stakeholder can voice concerns and have access to a fair and transparent resolution mechanism. • Conduct regular monitoring of labour issues through following up on the grievances raised, through relevant technical departments. • Monitor farm labour working conditions on beneficiary farms to ensure that worker's rights are respected, including minimum age requirements and overtime work. • Conduct a preliminary identification of the number of farm workers who have been assigned land for self-cultivation on beneficiary land and will require beneficiaries to commit to ensuring that these workers continue having access to the land in question or to alternative parcels of equal or higher quality. • Conduct regular monitoring during the operation phase to ensure that workers have not lost access to land.		

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
Community Health and Safety	CHS1 – Increased risk of water-borne diseases due to poor drinking water quality	*Embedded measures:* • Implementation of the Project's Training Programme including a topic on the adequate use of chemical products (pesticides, herbicides, and fertilizers) *Mitigation measures:* • Same mitigation measures as W1. *Additional mitigation measures:* • Develop and implement a Community Health and Safety Plan including awareness raising and capacity building programmes for settlements in the Project Area on the prevention of vector-borne and water-borne diseases, partnering with the relevant institutional and organizational partners.	During pre-operation phase (development of management plans and trainings). During operation (rest of measures).	• The SAG

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
	CHS2 – Increased transmission of vector-borne diseases	*Embedded measures* • Implementation of the Project's Training Programme including a topic on the adequate use of the irrigation equipment. *Mitigation measures:* • Same mitigation measures as OHS3. *Additional mitigation measures:* • Develop and implement a Community Health and Safety Plan including awareness raising and capacity building programmes for settlements in the Project Area on the prevention of vector-borne and water-borne diseases, partnering with the relevant institutional and organizational partners. • Train beneficiaries and farm workers on proper management of piles of stagnant water through relevant department and institutional partners.		

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
	CH3 – Increased tension on healthcare infrastructure and access to healthcare	*Mitigation measures:* • Develop and implement a Community Health and Safety Plan including community awareness programmes in order to prevent potential disease occurrence and therefore reduce the risk of increased pressure on the healthcare system in the Study Area during the 3.5 months of irrigation, through relevant departments and institutional partners. • As part of the Community Health and Safety Plan, promote any developments to the healthcare sector in the Study Area, including the delivery of capacity building on the prevention and treatment of vector-borne and water-borne diseases.		

Community Cohesion	CC1 – Increased tensions between communities, producers, and beneficiaries over land ownership and water availability in the dry season	*Embedded measures:* • Monitoring of the irrigation equipment for a period of no less than 10 years including the beneficiaries' water consumption (water meters are included in the irrigation system). • The location of the water abstraction source will be selected making sure that it is situated away from other water sources (e.g. other existing groundwater wells) and away from potential contamination sources. • Land beneficiaries are not allowed to sell the irrigation equipment and are required to return the equipment to the SAG in the event of a land sale. • The Project requires that selected beneficiaries have ownership of the land to be irrigated and that the plot in question is not located on indigenous land. *Mitigation measures :* • Development and implementation of a Water Management Plan. • Follow irrigation plans and schedules as per FAO's guidelines. • Implementation of logbook with records of water pumped (or hours of pumping), and share this with the CRELs. • Water flow monitoring in Aguan River and main tributaries (upstream and downstream). Two monitoring events will be conducted during the year: in the dry and rainy season. • Groundwater level monitoring in the wells installed for the Project activities, as well as in	During pre-operation phase (management plans and selection of beneficiaries). During operation phase (rest of measures).	• The SAG • The SAG-PIU (selection of beneficiaries) • The SAG with the support of UMA (monitoring of surface water flow and groundwater levels • The SAG with support of the CRELs (monitoring of water consumption))

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
		any other potential existing well located within an approximate ratio of 100 m from the installed groundwater wells. • During the beneficiary selection process, the SAG will investigate the existence of potential ancestral land claims and exclude beneficiaries whose land ownership is contested regardless of their ownership title. • As part of the Stakeholder Engagement Plan, disclose and implement the grievance mechanism to the wider community, to ensure that all potential grievances or concerns are raised and addressed in order to address issues on time and reduce the risk of tensions.		
Archaeological and Cultural Heritage	CH 1 – Potential damage to archaeological or cultural heritage elements in the Project Area	*Mitigation measures:* • Development and implementation of a Cultural Heritage Management and Monitoring Plan. • Map locations of known archaeological sites within the Project Area. • Undertake a site survey of the beneficiary land plot and selected groundwater well locations. • Ensure that groundwater well locations are avoided if there are indications that archaeological material will be encountered; • Undertake archaeological monitoring during the drilling of the wells in locations where archaeology may be encountered. A Chance Find Procedure will be implemented during these monitoring activities.	During pre-operational phase (management plans and procedures, mapping). During operational phase (rest of measures).	• The SAG • The SAG through relevant technical departments or partner organizations

Table 8.3 Environmental and social management plan – non routine events

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
Non-routine events	Acc1 - Affection to the soil quality and groundwater quality due to accidental spills of fuel (diesel) and/or wastes (lubricants, bentonite-based muds).	*Embedded measures:* • Implementation of the Project's Training Programme • Drilling of the groundwater wells at the beneficiary's plot that required itwill be undertaken by specialised local drilling companies.. This will contribute to avoid the risk of an inadequate management of wastes. • Monitoring of the irrigation equipment for a period of no less than 10 years. • Beneficiary responsibilities acquired linked to the irrigation system such as the maintenance of the equipment. *Mitigation measures:* • Motor pumps will be installed on impermeable surfaces. • Absorbing materials will be available in the proximity of the motor pumps. • Fuel (diesel) will be stored in certified and specific storages for such products. • Implementation of logbook recording for fuel used, spills occurred recommended as good practice.	During Pre-operation phase (trainings) During operational phase (rest of measures).	• The SAG

Table 8.4 Environmental and social management plan – cumulative impacts

Receptor	*Impact/Risk*	*Mitigation Measures*	*Implementation Timeline / Milestone*	*Responsible party*
Current of future projects	The disruption to surface water flow	*Mitigation measures:* • Same Mitigation measures as Impact W3. *Additional mitigation measure:* • Through the Stakeholder Engagement Plan, it is raised that future projects such as Aguan Energy Complex and the Arenal Etapa I-II Hydroelectric project or current projects such as the Austria II project will be undertaken in cooperation with the Alto Aguan Irrigation Project to guarantee the sustainable use of resources and to ensure that the potential interactions related to the water resources do not result in significant environmental impacts.	During pre-operation phase (management plans and irrigation plans and schedules) During operation phase (rest of measures).	• The SAG • The SAG with support of the CRELs (monitoring of water consumption)) • The SAG with the support of UMA (monitoring of Aguan River and tributaries upstream and downstream) • The SAG with the support of UMA (monitoring of groundwater levels in wells)

8.3 SPECIFIC MANAGEMENT PLANS

8.3.1 Introduction

The above proposed mitigation measures as well as the embedded measures of the Project design make reference to a number of specific management plans that will need to be developed to address in detail key areas of potential environmental and socioeconomic impacts and risks.

Additional management plans may be introduced as the Project progresses to aid in the management of any newly identified impacts or sensitive receptors or changes that may occur in the course of Project implementation.

These plans are regarded as 'live' documents and will need to be updated periodically as the implementation of the Project evolves.

This section provides a brief presentation of plans and programs foreseen for the Project in the context of the mitigation and embedded measures proposed based on the outcomes of the impact assessment as well as the Project design. It should be noted that the management plans presented below are not comprehensive independent plans, but represent the basis for the development of these plans.

8.3.2 Permitting Action Plan

The aim of the Permitting Action Plan is to identify the required permits and approvals that have to be processed by the beneficiaries as well as the administrative departments and resources that will be implicated in the process.

This Plan shall include information on:

- The required permits to be acquired by the beneficiaries and the administrative departments where permits need to be applied for;
- Approximate permitting time necessary to obtain the permits, administrative resources to manage applications and consultations that may arise during the permitting process;
- Follow up actions on the beneficiaries' permitting process.

8.3.3 Water Management Plan

The overall objective of the Water Management Plan (WMP) is to protect water resources and minimize potential environmental and social impacts that Project activities may cause through the definition of an appropriate Water Management Strategy to be implemented by the SAG throughout the Project lifetime.

The Water Management Plan will have the following objectives:

- Ensure compliance with legislation/permitting regulations, relevant IFC requirements and industry best standards.

- Monitor water use: the Plan will set procedures for estimating water used by the project, identifying the indicators of the monitoring programme, as well as activities that use this resource and following a reporting procedure for registering used volumes of water.
- Minimize water use: the Plan will provide a series of measures to be considered for minimising the use of water.
- Document water sources and extraction locations: water sources to be used will be agreed previously with the relevant local authorities and, potentially, with other water users. Sources of water will be identified and registered in the Plan, together with the GPS coordinates and the maximum water volumes allowed from the source.
- Define training needs in water management.
- Define the responsible parties required to ensure the achievement of each objective.

8.3.4 Biodiversity Management Plan

The Biodiversity Management Plan (BMP) will seek to limit adverse impacts to habitats, flora and fauna species to the extent practical, and to avoid adverse impacts to populations of any endangered, sensitive and protected species.

The BMP will be developed in coordination with ASIDE and ICF, co-managers of the RVSCEH and implemented by the SAG with support from these organisations. It aims at:

- Protecting habitats, flora and fauna species.
- Limiting disturbances to the natural habitat resulting from Project activities.
- Addressing the protection of endangered, sensitive and protected species.
- Developing sustainable management practices for biodiversity.
- Defining monitoring tasks, indicators, frequency and reporting requirements.
- Defining training needs in biodiversity management.
- Defining the responsible parties required to ensure the achievement of each objective.

The BMP will provide a comprehensive plan for the Project to address issues of biodiversity protection. In addition, the BMP will address specific requirements related to Critical Habitat as specified in the IFC Performance Standards regarding how net gain is to be achieved for the key species and habitats of concern.

8.3.5 Good Practice Irrigation Guideline

According to the FAO, good agricultural practices are practices that address environmental, economic and social sustainability for on-farm processes and result in safe and quality food.

The aim of the Good Practice Irrigation Guideline will be to provide a practical framework to ensure that the Project's irrigation is performed sustainably according to the local context requirements.

For the elaboration of this document, FAO's irrigation guidelines as well as other technical and scientific based documents (e.g. World Bank technical reports) will be assessed to provide technically sound and practical information coherent with the local agricultural context (e.g. environmental and geographic setting).

The guideline shall address at least the following issues:

- Analysis of local/regional knowledge and local practices.
- Environmental implications of irrigation systems (e.g. water quality and pollution, water availability, etc.).
- Water quality requirements for irrigation.
- Required frequency of irrigations considering local context and crops to ensure a sustained production based on the crops needs.
- Methodology for selection of crops suitable for irrigation.
- Training needs in good irrigation practices.
- Aspects of food security and local preparedness for natural hazards and disasters in both drought and floods.

8.3.6 Pesticides, Herbicides and Fertilizer Management Plan

The Pesticides, Herbicides and Fertilizer Management Plan shall be a guidance document for the prevention, evaluation and mitigation of occurrences of pesticides or herbicides products in groundwater and surface waters of the Project Area.

The Pesticides and Herbicides Management Plan will have the following objectives:

- Ensure compliance with legislation/permitting regulations, relevant IFC requirements and industry best standards.
- Monitor pesticides, herbicides and fertilizers use: the Plan will set procedures for estimating pesticides, herbicides and fertilizers used by the Project, identifying the indicators of the monitoring programme, identifying activities that use this resource and following a reporting procedure for registering used pesticides, herbicides and fertilizers.
- Minimize pesticides, herbicides and fertilizers use, providing a series of measures to be considered for this.

- Define training needs in pesticides, herbicides and fertilizers management.
- Define the responsible parties required to ensure the achievement of each objective.

8.3.7 Waste Management Plan

The Waste Management Plan shall be developed to manage solid and liquid wastes and to avoid any discharges into the soil or water. It establishes procedures for the storage, collection and disposal of waste, including liquid and solid waste and hazardous and non-hazardous waste.

The overall objective of the Waste Management Plan (WMP) is to minimise impact of waste generated during Project activities through the following:

- Ensure generated wastes are properly managed and disposed of in accordance with local regulations.
- Maximise the amount of waste that is recovered for recycling.

The WMP will aim at:

- Defining produced waste characteristics, existing collection and treatment systems.
- Defining monitoring tasks, indicators, frequency and reporting requirements.
- Defining training needs in waste management.
- Defining the responsible parties required to ensure the achievement of each objective.

8.3.8 Cultural Heritage Management and Monitoring Plan

The Cultural Heritage Management and Monitoring Plan (CHMMP) will have the objective of avoiding potential damages to cultural resources.

The Plan will include:

- Summary of applicable legislation, International legislation and the ESIA commitments.
- Assessment of the known cultural heritage in the Project Area.
- Definition of the Chance Find Procedure.
- Verification and monitoring, including procedures for the identification of additional resources not initially identified.
- Define training needs in cultural heritage management.
- Define the responsible parties required to ensure the achievement of each objective, including details on the communication lines between the beneficiaries, the SAG and local and national conservation bodies.

Avoidance of cultural heritage resources is the preferred mitigation method. Marking and protection of cultural heritage sites with temporary barriers such

as a bright coloured plastic or mesh wire fence with highly visible flagging is recommended.

8.3.9 Occupational Health and Safety Guidance

In order to avoid or mitigate potential adverse Occupational Health and Safety (OH&S) risks that may arise from implementation of the Project activities (road transport during pre-operation phase and working conditions, vector born disease during operation phase), an OH&S Management Plan will be developed.

This OH&S Plan will have the following objectives:

- Avoid or minimize risks to and impacts on the health and safety of beneficiaries and workers employed by the beneficiaries (farm workers and hired workers for the drilling and installation activities).
- Define health and safety prevention measures to beneficiaries and workers employed by the beneficiaries (farm workers and hired workers for the drilling and installation activities).
- Ensuring compliance with national legislation and international good practices.
- Define monitoring tasks, indicators, frequency and reporting requirements.
- Define training needs in health and safety guidance.
- Define the responsible parties required to ensure the achievement of each objective.

8.3.10 Community Health Management Plan

The Community Health Management Plan (Community Health MP) will be developed to avoid or minimise the risks and adverse impacts to community health (including safety and security) that may arise from Project activities (poor water quality, vector born disease, pressure on health care infrastructure and access to it) to ensure safe operations that protect communities. This plan will be developed in collaboration with the local health institutions in Olanchito.

The objectives of the Community Health MP are to:

- Avoid or minimize risks to and impacts on the health and safety of the community (including vector and water born disease).
- Define health and safety prevention measures to beneficiaries and workers employed by the community.
- Ensuring compliance with national legislation and international good practices.
- Define monitoring tasks, indicators, frequency and reporting requirements.
- Define training needs in community health guidance.
- Define the responsible parties required to ensure the achievement of each objective.

8.3.11 Training Management Plan

Once the management plans are developed, it is essential that all stakeholders implicated in the Aguan Irrigation Project are properly trained as to ensure that they are efficiently implemented.

As so, the Training Plan aims at disseminating information, increasing awareness and building capacity of all those who have a shared responsibility to support the Project in achieving high environment, health and safety standards.

The Training Plan will include the training defined as part of the Project Design (described in *Section 3.6.1* of *Chapter 3*) as well as the training needs identified in the environmental and social impact assessment (*Chapter 7*).

The objectives of the Training Plan are to:

- Define training topics based on those embedded in the Project Design and those identified in the environmental and social impact assessment.
- Define the responsible parties in charge of preparing the training material and imparting each training.
- Define the stakeholders that have to attend to the training.

The training topics either defined as part of the Project Design or identified in the environmental and social impact assessment are summarized in *Table 8.5*.

Table 8.5 Training topics

Training topic	Responsible party
Installation of the irrigation equipment and its accessories and use of the equipment Maintenance and upkeep of the irrigation equipment Guidelines for groundwater well abandonment	PAA Project Finance
Guidelines for Water Management and Irrigation Development Guidelines for Planning Irrigation and Drainage Investment Projects Use and management of pesticides, herbicides and fertilizers Waste management Cultural heritage management including chance-find procedure Health and safety Traffic safety Biodiversity management Project management support and financial literacy	SAG-DICTA (Directorate of Agricultural Science and Technology) and from other local organizations such as ASIDE, SENASA, Health Secretary / Coordination of Environmental Health Program of the Municipality of Olanchito

Application of Chance Find Procedure Grievance mechanism

Source: ERM, 2018

8.3.12 Monitoring Plan

The purpose of the Monitoring Plan is to describe the activities required to follow up the Project implementation to ensure that it is done accordingly with the defined management plans.

The objectives of the Monitoring Plan are to:

- Define the monitoring task and indicator that will enable to assess the Project's implementation performance based on the mitigation and embedded measures identified in the environmental and social impact assessment.
- Define the frequency of monitoring task and responsible parties in charge of undertaking the monitoring and of reporting the data.

The Monitoring Plan shall include the following elements among others (not exhaustive list):

- Number of active contracts or agreements for the Project irrigation equipment
- Irrigation drilling and installation activities as per good practice guidelines
- Irrigation plans and schedules as per good practice guidelines
- Groundwater well drilling related indicators:
    - Location.
    - Water level.
    - Nitrates and nitrites levels.
    - Access and quality of water
- Water use and management related indicators:
    - Water consumption.
    - Flow of the Aguan River and of main tributaries of the Aguan River within the Project Area.
    - Irrigation outside plot borders.
- Pesticides, herbicides and fertilizers related indicators:
    - Pesticides, herbicides and fertilizers consumption
- Biodiversity indicators as determined by Aside / Emerald Hummingbird
- Grievances received
- Stakeholder engagement
- Social and economic related indicators:
    - Labour compliance and rights
    - Employment creation (Number of hired workers by beneficiaries)
    - Production (rates, price variations)

    - Beneficiary satisfaction
- Health related indicators:
    - Vector-borne diseases
- Occupational Health and Safety (OHS)
- Status of equipment (damaged and stolen)
- Training and capacity building
- Cultural heritage

8.4 ROLES AND RESPONSIBILITIES

As the Project owner, the SAG will have the responsibility of implementing the ESMP, which will include:

- Ongoing management of environmental and socioeconomic issues throughout the Project's lifetime.
- Monitoring of beneficiaries' performance and reporting procedures.
- Development of strategies / mechanisms for dealing with problems.
- Acting as a point of contact for consultation and feedback with lenders.
- Implementing the Stakeholder Engagement Plan and grievance mechanism.

In addition, the SAG will be responsible for ensuring compliance with:

- All relevant national legislation and international good practices.
- Environmental and socioeconomic controls and mitigation measures contained in the ESMP

The specific management plans will be developed by ERM on behalf of PAA Project and the SAG. ERM is expected to develop these over a four and a half month period, once the ESIA is approved.





Stakeholder Engagement Plan (SEP) for the Alto Aguan River Valley Irrigation Project in Honduras

Rev01

PAA Project Finance A/S

January 2018
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Stakeholder Engagement Plan (SEP) for the Alto Aguan River Valley Irrigation

PAA Project Finance A/S
Rev01

For ERM

Approved by: Maria Quintana

Title: Partner

Date: 15th January 2018

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ABBREVIATIONS

ACITMFM	Association of Indigenous Tolupan Communities of "La Montaña de la Flor"
AHJASA	*Representante municipal de la Asociación Hondureña de Juntas Administradoras de Sistemas de Agua* (Municipal Representative of the Hunduran Association of Water Systems Management Boards)
AJAASPIB	*Asociación de Juntas Administradoras de Sistemas de Agua del Sector Sur del Parque Nacional Pico Bonito* (Water System Management Boards Association of the South Sector of the Pico Bonito National Park)
ASIDE	Co-manager of the Emerald Hummingbird Wildlife Refuge in Honduras
ALFALIT	Literacy, community development, food safety
CBOs	Community-Based Organisations
CINSA	Consultores en Ingeniería, S.A (Honduran Engineering Consulting Company)
COMAS	Municipal Water and Sanitation Commission
CONASA	National Council of Potable Water and Sanitation
CREL(ES)	*Centro de Recolección de Leche* (Milk Collection Centre)
CURLA	Regional University Center of Aguan Valley
DECA	*Dirección General de Evaluación y Control Ambiental de la MiAmbiente* (General Directorate of Environmental Assessment and Control of MIAMBIENTE)
ESIA	Environmental and Social Impact Assessment
FENAGH	*Federación Nacional de a Agricultores y Ganaderos de Honduras* (National Farmers' and Stockbreeders' Federation of Honduras)
FETRIXY	Federation of Xicaque of Yoro
FGD	Focus Groups Discussions

FUPNAPIB	Protection, Conservation and Responsible Use of Natural Resources Present in Pico Bonito National Park
ICF	*Instituto de Conservación Forestal* (Institute of Forest Conservation)
IFC-PS	International Finance Corporation Performance Standards
IHAH	*Instituto Hondureño de Antropología e Historia* (Honduran Institute of Anthropology and History)
INA	*Instituto Nacional Agrario* (Agrarian National Institute)
INE	*Instituto Nacional de Estadísticas* (National Institute of Statistics)
INFOP	National Institute for Professional Training
IUCN	The International Union for Conservation of Nature
MiAmbiente	*Secretaría del Estado en el Despacho de Energía, Recursos Naturales, Ambiente y Minas* (Secretariat of State in the Office of Energy, Natural Resources, the Environment and Mining)
NGO	Non-Governmental Organisation
OXFAM	Oxford Committee for Famine Relief
PIU	Project Implementing Unit (*Unidad Ejecutora del Proyecto - UEP*)
SAG	*Secretaría de Agricultura y Ganadería* (Secretary of Agriculture and Livestock)
SAG-DICTA	*Dirección de Ciencia y Tecnología Agropecuaria* (Directorate of Agricultural Science and Technology)
SAGO	*Sociedad de Agricultores y Ganaderos de Olanchito* (Olanchito Farmers' and Stockbreeders Society)
SEDINAFROH	*Secretaría de Estado de Pueblo Indígenas y Afrohondureños* (State Secretariat for Indigenous and Afrohonduran People)
SENASA	*Servicio Nacional de Sanidad e Inocuidad Agroalimentaria* (National Service for Agrifood Health and Safety)
SEP	Stakeholder Engagement Plan
SERNA	*Secretaría de Integración Económica Centroamericana* (Ministry of Central American Economic Integration)

SEFIN	*Secretaría de Finanzas* (Finances Secretary)
SIECA	*Secretaría de Integración Económica Centroamericana* (Ministry of Central American Economic Integration)
UMA	*Unidad Municipal de Ambiente* (Environmental Municipal Unit)
UNAH	Honduras National Autonomous University
WWF	World Wildlife Fund

1 INTRODUCTION

1.1 BACKGROUND

PAA Project Finance A/S, hereafter referred to as "PAA Project Finance", have appointed Environmental Resources Management (ERM) to act as independent environmental and social consultants to undertake the Stakeholder Engagement Plan (SEP) for the Alto Aguan River Valley Irrigation Project in the Municipalities of Olanchito and Arenal in central Honduras hereafter known as "The Project". The Project is an initiative of the Secretary of Agriculture and Livestock of Honduras (*Secretaría de Agricultura y Ganadería* or SAG) ascribed to the Government of Honduras.

The Project, by the implementation of individual irrigation systems across the municipalities of Olanchito and Arenal, aims to support the policies and strategies of the Government of Honduras to reach poverty alleviation, creation of job opportunities and agricultural and livestock production output improvement.

The Government of Honduras, through the SAG, has awarded PAA Project Finance the contract for delivering irrigation sets and accessories, in addition to training SAG technicians/trainers in their use and maintenance. In order to conduct this Irrigation System Project, the SAG will designate a Project Implementation Unit – PIU (*Unidad Ejecutora del Proyecto* or UEP), in charge of managing the project throughout its lifetime. The PAA Finance Project will collaborate with the SAG-PIU in the provision and delivery of the irrigation equipment and its accessories, as well as training in its use and appropriate maintenance. Additionally, PAA Project Finance will provide one off financial support for the establishment of the PIU. PAA Project Finance assumes no responsibility for the subsequent operation, use of the systems and decommissioning of the irrigation system.

The Government of Honduras is receiving financing from ING Bank, and EKF, Denmark's Export Credit Agency, to transform the Alto Aguan river valley and is expected to conduct the activities in line with the World Bank Group Standards: IFC Performance Standards and IFC/World Bank Environmental, Health and Safety (EHS) General Guidelines.

According to local regulations, the Project does not require the development of an Environmental and Social Impact Assessment (ESIA), as the activities that will be carried out, namely the supply of equipment such as portable pumps and irrigation units, are not subject to a specific environmental licence. However, in 2017, PAA Project started developing an Environmental and Social Impact Assessment (ESIA) to comply with lender requirements. Currently, PAA Project Finance has commissioned ERM to update and finalize the draft 2017 ESIA, according to the gaps in this ESIA identified by lenders.

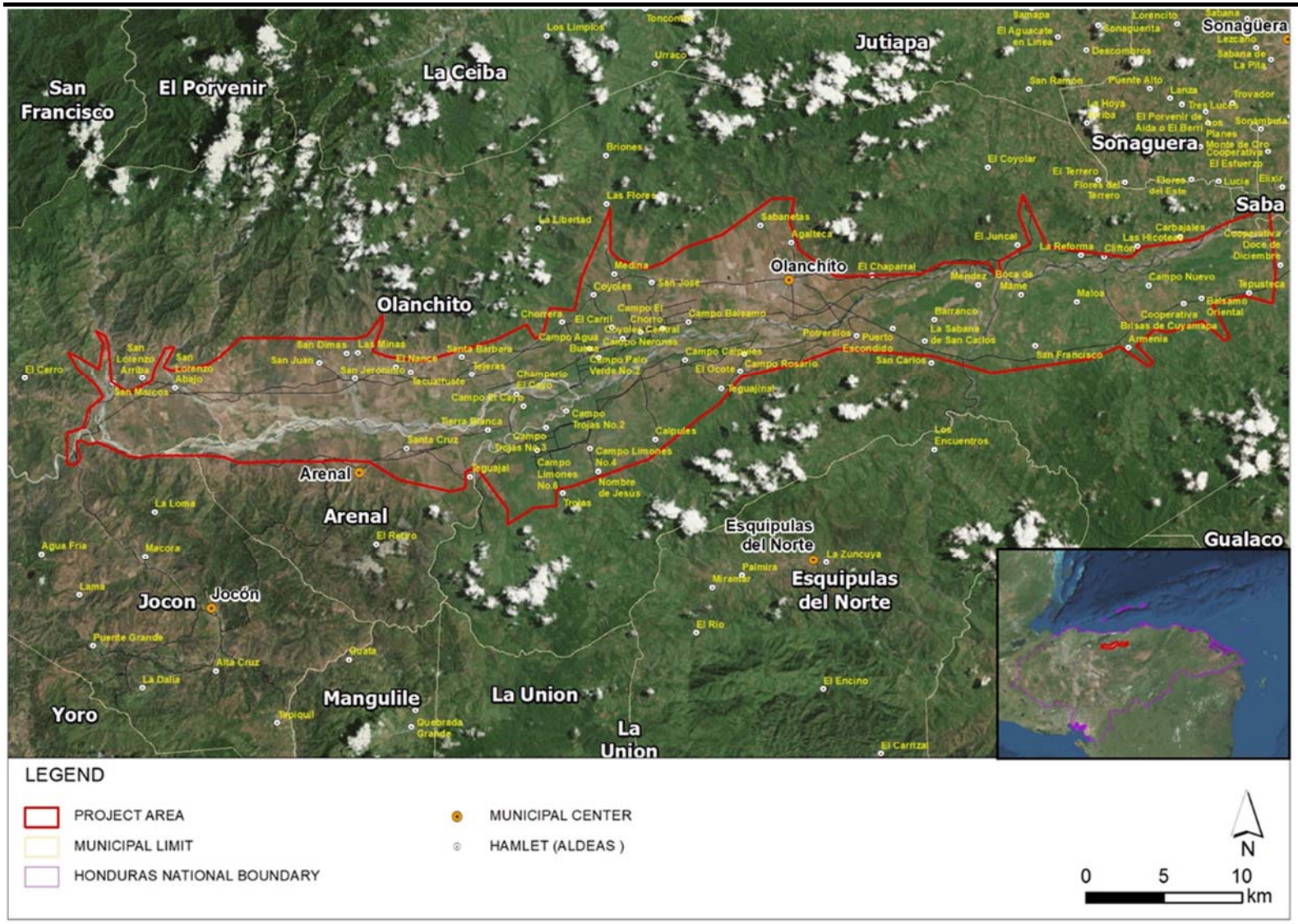
1.2 PROJECT LOCATION

The Project is located within the Yoro department, within the Olanchito and El Arenal municipalities. A small portion of the potential areas to be irrigated touch the Jocón and Sabá municipalities.

The 3,110 ha to be irrigated are distributed over an area of 60,000 ha which coincides with the Alto Aguan River Valley area, and represents approximately 6.7% of the total area of the Alto Aguan River Valley. The specific locations of the plots to be irrigated will be defined only once the beneficiaries have been selected; the overall perimeter of the 60,000 ha that encompasses the maximum total area where the irrigation system may be implementation has been assumed as the Project Area (see *Section* ***¡Error! No se encuentra el origen de la referencia.*** for details on the beneficiary selection process).

Figure 1.1 shows the location of the Project Area

Figure 1.1 Location of the Project Area



Source: ERM, 2018

1.3 PROJECT OVERVIEW

1.3.1 Project Overview and Organisation

The Project consists in the establishment of an irrigation system for approximately 3,110 hectares of agricultural land located in the Alto Aguan Valley.

Through the establishment of an irrigation system, the Project, designed by the Engineering Company Integra Ingeniería and managed by PAA Project Finance, aims to support the SAG, owner of the Project, to improve the socioeconomic status of the population in the Aguan Valley. This objective is sought through the efficient and sustainable use of soil and water resources for the existing agricultural and livestock production of the Valleys, by supplying irrigation equipment to pre-selected beneficiaries among the milk producers and farmers in the area. The SAG will establish a Project Implementation Unit - PIU (*Unidad Ejecutora del Proyecto* or UEP), formed by members of the SAG, and whose role will be to manage the Project throughout its lifetime.

It is estimated that the number of milk producers in the Project Area, and thus potential beneficiaries, is between 350 and 400. The majority[1] of the producers in the Project Area are members of a CREL, a common interest association. There are currently 16 CRELs in the Project Area. These will be able to apply to become beneficiaries provided they meet the criteria set by the SAG and PAA Project Finance.[2] All applications will be reviewed and the decision-making on the final beneficiaries of the irrigation system will be based on strict selection criteria. This selection process will be undertaken by the PIU of the SAG. It is envisaged that the project could benefit between 250-300 milk producers out of the approximately 400 in the area. These will be able to apply for a number of irrigation sets depending on land availability and resources. In addition to complying with the strict selection criteria set, beneficiaries will have to pay a fee (*canon*) to receive the irrigation equipment and accept the responsibilities that he/she acquires by converting himself/herself into a beneficiary of the Agua Irrigation Project The responsibilities that beneficiaries will acquire with regards to the Project are presented in detail in *Annex A* to this report.

The fee or *canon* will be established by the SAG based on socioeconomic criteria and a series of to-be-defined Project variables. To this date it has not been established by the SAG yet. Its purpose is the assurance of a long-term viability of the Project and the correct use of the equipment received. The fees

[1] Based on the field survey activities undertaken in 2017 and in 2018, it has been estimated that between 85% and 90% of the milk producers in the Project Area are members of a CREL.

[2] Land plots eligible for the Project should meet the following criteria: (a) Belong to the beneficiary; (b) Not to be located in protected areas; (c) Not to be under forested use; (d) Have water availability, either surface or underground water; (e) Not to be located in indigenous land.

collected will be used for the Project (e.g. for training purposes, for supervision activities).

The Project activities under PAA Project Finance include the delivery of an irrigation equipment and its accessories to thewharehouse defined by SAG, as well as training in its use, maintenance and other relevant training (this phase is designated as the pre-operation phase). It is noted that PAA Project Finance involvement will be limited to the initial phase of the Project when equipment will be delivered and train the trainers provided. After this phase the Project will be entirely managed by the SAG. The operation phase is expected to extend over a ten year period.

The activities and responsible parties of each phase are specified in the following sections and in more detail in Chapter 3 of the ESIA.

1.3.2 Project Activities

Project activities will take place in three different phases: pre-operation, operation, and abandonment, in which the responsible parties differ from one phase to another.

Pre-Operation phase (20 months approximately)

During the pre-operation phase, PAA Project Finance will be responsible for the delivery of irrigation equipment.

The irrigation equipment consists of a diesel surface motor pump or electrical underground pump with diesel surface electrical generator, two easy-to-handle travelling cannons, a set of aluminium pupe ducts and accessories for the farmer type irrigation systems; and consists of surface motorpump or underground electrical pump with surface electrical generator, PVC pipe ducts, microsprinklers and associated accessories for the agriculture type irrigation systems. Each irrigation system is designed to irrigate up to 10 ha of land.

The delivered irrigation equipment will be stored in warehouse defined by SAG until the beneficiaries are selected by the SAG-PIU.

In addition, PAA Project Finance, with the support of the SAG-PIU, will be responsible for preparing and delivering the necessary training to SAG technicians (in other words training the trainers) to ensure the correct use of the irrigation equipment. The technical training will address the following aspects:

- installation of the irrigation equipment, its accessories, and use of the equipment,
- maintenance and upkeep of the irrigation equipment, and

In addition, other relevant training will be prepared to ensure good practices, which will be defined in the corresponding Training Management Plan. Trainings will be provided by technicians from the SAG-DICTA (Directorate of Agricultural Science and Technology) and from other local organizations such as ASIDE, SENASA, Health Secretary / Coordination of Environmental Health Program of the Municipality of Olanchito (*Secretaría de Salud / Coordinación del Programa de Salud Ambiental del Municipio de Olanchito*) to the selected beneficiaries.

The pre-operation phase is estimated to take place during less than 20 months.

Operation phase (10 years)

This phase consists of the operation of the irrigation system. It also includes associated monitoring activities.

Once the beneficiary's application is accepted, training received, the conditions for the use of the equipment agreed to and the fee for the reception of the irrigation equipment paid, the beneficiary will be assigned an irrigation equipment set.

This equipment will be collected by the selected beneficiaries from the warehouse defined by SAG and transported to his/her land plot. Each beneficiary will be responsible for the conditioning of his/her water source supply (groundwater or surface water) the installation of the Project irrigation equipment and other necessary equipment and finally start irrigating.

As mentioned previously, along with the equipment, the beneficiary will acquire a series of responsibilities linked to the irrigation equipment as well as all usage rights of natural resources (see *Annex A).* In addition, the beneficiary shall be liable for certain environmental services costs such as those related to the use of water and of electricity. Beneficiaries will also be responsible for the safeguarding of the irrigation equipment[3] as well as the proper storage of the equipment when not in use during the rainy season.

Monitoring activities of the irrigation equipment will be managed by the SAG directly with the support of other organisations such as the CRELs and the SAGO. During these monitoring activities, the condition and correct operation of the irrigation equipment will be verified as well as the correct implementation and management of environmental and social measures (which will be defined in the corresponding Environmental and Social Impact Assessment).

[3] No additional security measures will be implemented during the operation phase. Once the Project irrigation equipment is appointed to the beneficiary, he/she is the responsible for the security of the equipment.

The operation phase is estimated to extend during the expected operational life of the irrigation equipment which corresponds to 10 years.

Abandonment Phase

The following abandonment activities have been considered:

- The abandonment of the irrigation equipment, i.e., assuming that the equipment is no longer used for the purpose initially planned by the Project.
- The abandonment of the water wells, i.e., assuming that the water wells are no longer used for extracting water for irrigation purposes, or assuming that no water can be extracted.
- The abandonment of the irrigated areas, i.e., assuming that the land is no longer irrigated and no longer used for agricultural or livestock purposes, as initially planned by the Project.

During this phase, the beneficiaries will be responsible for correctly abandoning the irrigation equipment and water wells. Abandoned Project irrigation equipment can be either managed and recycled by a specialist company or reused by the milk producer or farmer on other machinery, or for other purposes. In the event that the producer decides to no longer use it, the abandoned water wells will need to be decommissioned as appropriate, following good practice. As for the operation phase, the SAG will be responsible for monitoring of the correct implementation and management of environmental and social measures related to the abandonment activities.

1.4 SCOPE

This SEP describes how PAA Project Finance shall engage with the SAG and Project beneficiaries as well as with other stakeholders during pre-operation and operation phases. Decommissioning is also considered at a high level. This SEP provides the following:

- Description of regulatory, lender, company, and/or other requirements for consultation and disclosure;
- Identification and prioritisation of stakeholders;
- Strategy and timetable for sharing information and consulting with stakeholders;
- Resources and responsibilities for implementing stakeholder engagement activities; and
- Description of how stakeholder engagement activities will be incorporated into the PAA Project Finance's overall management system.

1.5 STAKEHOLDER ENGAGEMENT PRINCIPLES

PAA Project Finance understands that effective stakeholder engagement and public consultation is a cornerstone of successful Project development, and is committed to free, prior, and informed engagement with stakeholders throughout the Project lifecycle.

The key principles guiding PAA Project Finance's approach to stakeholder engagement on this Project are:

- To be open and transparent with stakeholders.
- To be accountable and willing to accept responsibility as a corporate citizen and to account for impacts associated with the Project activities.
- To have a relationship with stakeholders that is based on trust and a mutual commitment to acting in good faith.
- To respect stakeholders' interests, opinions and aspirations.
- To work collaboratively and cooperatively with stakeholders to find solutions that meet common interests.
- To be responsive and to coherently respond in good time to stakeholders.
- To be pro-active and to act in anticipation of the need for information or potential issues.
- To engage with stakeholders such that they feel they are treated fairly and their issues and concerns are afforded fair consideration.
- To be accessible and within reach of stakeholders so that they feel heard and to provide comprehensive information.
- To be inclusive and proactively anticipate, identify and include all stakeholders.

The SAG is the owner of the Irrigation System Project, where PAA Project Finance was contracted by the SAG in order to design the irrigation system, provide the equipment and collaborate with the SAG and the Project Implementation Unit (PIU) in the installation of the irrigation equipment in the selected plots.

1.6 OBJECTIVES

The main objectives of the development and implementation of the SEP for the Project are outlined in *Table 1.1* below.

Table 1.1 Objectives of the Project Stakeholder Engagement Plan

Objective	Rationale
Identify relevant stakeholders for this Project.	Identify and categorise individuals or organisations that may be affected by the Project or have an effect on how the Project is implemented, noting that this is an ongoing process which many change throughout the life of the Project.

Objective	Rationale
Distribute accurate Project information in an open and transparent manner.	Ensure that stakeholders, particularly those directly benefitted/affected by the proposed Project, have all relevant information available to them to enable them to make informed comments and plan for the future. This helps reduce levels of uncertainty and anxiety. Information should allow affected parties to develop an understanding of potential impacts, risks and benefits and an open and transparent approach is central to achieving this aim.
Form partnerships to promote constructive interaction between all parties.	Develop relationships of trust between the Project and stakeholders, in particular beneficiaries, to contribute to proactive interactions and avoid where possible, unnecessary conflicts based on rumour and misinformation. Identifying structures and processes to deal with conflicts and grievances allows the Project a better understanding of stakeholder concerns and expectations thereby providing opportunities to increase the Project's value to local stakeholders.
Record and address public concerns, issues and suggestions.	Document stakeholder issues, concerns and comments to allow the rationale for Project decisions to be traced and understood. Records also assist during review and audits of the Project, in identifying thematic issues, which may need a more holistic response, and during follow up engagements with the affected people. This approach also addresses potential concerns that stakeholder engagement is a token gesture by the developer that meets requirements but that it is not taken seriously in Project planning.
Manage stakeholders' expectations.	Expectations, both positive and negative, may not be aligned with the realities of the Project. Ensuring that expectations are kept at realistic levels (e.g. inclusion in the project, around job opportunities; provision of local infrastructure; social development; and disruption) limits disappointments and frustrations of directly affected parties at later stages of Project implementation, and therefore mitigates the potential for conflict with stakeholders.
Fulfil national and international requirements for consultation.	Ensuring compliance can avoid potential Project delays based on procedural issues rather than substantive ones, and save the PAA Project Finance from any additional costs from fines.

2 REGULATIONS AND REQUIREMENTS

2.1 PAA PROJECT FINANCE CSR STANDARDS

In 2007, The Aarsleff Group acquired PAA Project Finance (formerly called EAC Trading) as a fully owned subsidiary. PAA Project Finance services are rendered internally within the Aarsleff Group as well as to customers and partners in a global environment.

For this reason, PAA Project Finance policies and corporate social responsibility standards comply with those of the Aarsleff Group.

In addition, PAA Project Finance applies OHSAS 18001 – Occupational health and safety management standards, DS/ISO 9001 – Quality management standards, and DS/ISO 14001 – Environmental management standards whenever these are relevant to their services and customers.

The Aarsleff Group currently works on identifying the CSR matters that are most important to the Group and its stakeholders. The Group takes responsibility for its business activities and wants to ensure positive and clear coherence between the activities of the Group and a sustainable society.

The four main strategic areas of the Group are:

2.1.1 *Environment and climate*

The Aarsleff Group has incorporated a number of policies, principles and working methods to protect the environment on a short- and long-term basis. One of the relevant policies is the environmental policy, which describes the Group's awareness of their influence on the environment and how it works to protect it and prevent pollution.

The Aarsleff Group is committed to minimising their environmental impact through planning, design, and choice of method. The Group measures significant environmental parameters and seeks to minimise waste and excessive consumption of materials.

The environmental policy covers issues such as fuel efficiency, energy-saving measures, and purchasing products from environmentally friendly companies.

Furthermore, the Aarsleff Group's quality, environment and occupational health and safety management system (QE&OHS) provides guidelines for environmentally responsible actions and operating procedures.

2.1.2 Employees

The Aarsleff Group has been certified in occupational health and safety since 2009. To achieve its goals, it has developed a number of policies, principles and working methods all incorporated into everyday work routines.

The Group's occupational health and safety policy shows that it wants to offer attractive workplaces with a focus on occupational health and safety, job satisfaction, and lifelong development.

The Aarsleff Group has already incorporated OHS aspects in the design phase and method selection; prioritising order, tidiness, and a systematic fitting out of the workplaces; and the Group continuously improves its occupational health and safety measures.

Aarsleff's One Company approach and Code of Conduct are the cornerstones for its code of good management. The OHS policy states that the Group wants a sound and stimulating working environment that enhances job satisfaction.

2.1.3 Society

The Aarsleff Group wishes to contribute to a sound, democratic, and competitive development of society. The Group aspires to comply with applicable competition legislation and oppose all types of corruption, including blackmail and bribery.

It has developed a guideline for compliance with competition legislation providing information on the prohibition of agreements or the exchange of information that coordinates tenders or splits up markets or customers.

As stated in its policy on respect for human rights, the Aarsleff Group wishes to avoid negative impacts on human rights, and it actively manages any negative impacts it may have caused or contributed to. The Group's approach is based on the UN Guiding Principles for Business and Human Rights.

Actively entering into applicable collective agreements is a fundamental principle of the Aarsleff Group, and it does everything possible to counteract social dumping.

2.1.4 External business partners

As stated in the Aarsleff Group quality policy, it complies with legislation, rules and agreements entered into, and customer satisfaction is an important quality parameter. It is committed to engaging in professional collaboration, making customer satisfaction a high priority.

Planning and preparation are essential to the Group, and it continuously seeks to improve through systematic control. In addition it deliberately seeks to cultivate a culture of improvement that allows experience and creativity to be communicated and applied.

The Aarsleff Group has defined a set of principles applying to "Activities with customers and business partners" that provides specific rules concerning gifts, lunches, dinners, study trips, and training courses.

Actively creating collaborations and good stakeholder relations on projects is a fundamental principle of the Aarsleff Group, as this benefits project implementation and increases stakeholder satisfaction.

2.1.5 Equality

Aarsleff Group believes that equality helps generate better results, wiser decisions, increased innovation ability, an improved internal working environment, and make the Group an attractive employer.

2.2 HONDURAS REGULATIONS

With the aim of assuring the regulation compliance, an official letter request was sent to MiAmbiente, to receive confirmation of the environmental licensing requirements for the Project. In this regard, according the environmental regulation in Honduras (Ministerial Agreement 016-2015, published in the Gazette on 6.10.2015) the Project does not require undergoing Environmental and Social Impact Assessment (ESIA). The two main regulations relevant to the Project, which require stakeholder engagement, include the following:

Public Participation in the Environmental Assessment (Decree No. 800-2015)

Public participation in the environmental evaluation is regulated by Executive Decree nº008-2015, in force since September 14th, 2015 (Chapter VII: Elements of the Environmental Assessment and Control Process) which declares the following:

- Art. 58: MIAMBIENTE will promote the participation of the general public during the environmental evaluation process, in all its phases, for any projects, work, or activities considered significant from the environmental point of view, according to the Principles of Proportionality and Gradualness.
- Art. 59: The proponent of the project, work, or activity subject to environmental assessment, in accordance with the terms of reference established by MIAMBIENTE, must involve the neighbouring population of the project area at the earliest possible stage of the ESIA preparation process.

However, as the Project requires no environmental licensing, no public participation is required.

General Water Act (Decree nº181-2009)

The General Water Act states that:

- Art.3: Citizen participation will be effective in the planning of water management, use, protection, and conservation.

This Act is described in detail in the following subsection

Water Resource (Decree 181-2009)

Article 3 of the *General Water Act, Decree nº181-2009*, in force since December 14th, 2009, declares the principles and foundations of water management. These include the following:

- Water is an essential resource for life, as well as social and economic development. Its protection and conservation constitute a priority action of the State.
- Human consumption has a preferential and privileged relationship over other uses.
- Water is a social resource, and its access will be equitable.
- Citizen participation will be effective in the planning of its management, use, protection, and conservation.
- The comprehensive management of the resource, linked to the water cycle and the natural environment, will take place with the involvement and responsibility of all Government bodies, their organizations.
- Remuneration for services will be linked to the use, protection, and conservation of water.

2.3 LENDERS REQUIREMENTS

2.3.1 IFC Performance Standards

The International Finance Corporation Performance Standards (IFC PS) on Environmental and Social Sustainability are considered a benchmark for good practice for environmental and social risk management in private sector developments. The IFC PSs require that clients engage affected communities through disclosure of information, consultation, and informed participation, in a manner commensurate with the risks to and impacts of the Project on the affected communities.

The IFC PSs include specific guidance on conducting stakeholder engagement both during the planning phase and through the project lifecycle.

Stakeholder engagement requirements are outlined in PS1: Assessment and Management of Environmental and Social Risks and Impacts. The key requirements for consultation and disclosure through the life of the project are summarised in *Box 2.1.*

Box 2.1 Outline of IFC Performance Standard 1

Stakeholder Analysis and Engagement Planning

Stakeholder engagement is an on-going process that may involve, in varying degrees, the following elements: stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, grievance mechanism, and on-going reporting to Affected Stakeholders.

Disclosure of Relevant Project Information

Provide affected stakeholders with access to relevant information on: (i) the purpose, nature, and scale of the project; (ii) the duration of proposed project activities; (iii) any risks to and potential impacts on such stakeholders and relevant mitigation measures; (iv) the envisaged stakeholder engagement process; and (v) the grievance mechanism.

Consultation

Consultation will be in line with the degree of impact of the Project and should: i) begin early and continue through project, ii) be based on prior disclosure of relevant and easily accessible information on the project, iii) focus engagement on those who are directly affected, iv) be free of outside interference and external manipulation, v) enable meaningful participation, vi) be documented.

Informed Consultation and Participation

For projects with potentially significant adverse impacts on affected stakeholders, conduct an informed consultation and participation process. It should involve deep exchange of views and information, and an organized and iterative consultation, leading to the project incorporating into their decision-making process the views of the affected stakeholders on matters that affect them directly, such as the proposed mitigation measures, the sharing of development benefits and opportunities, and implementation issues. The process should be documented, in particular the measures taken to avoid or minimize risks to and adverse impacts on the affected stakeholders. The stakeholders should be informed about how their concerns have been considered.

External Communications

Implement and maintain a procedure for external communications that includes methods to (i) receive and register external communications from the public; (ii) screen and assess the issues raised and determine how to address them; (iii) provide, track, and document responses, if any; and (iv) adjust the management program, as appropriate. In addition, clients are encouraged to make publicly available periodic reports on their environmental and social sustainability.

Grievance Mechanism for Affected Stakeholders

Establish a grievance mechanism to receive and facilitate resolution of affected stakeholders' concerns and grievances about the client's environmental and social performance.

On-going Reporting to Affected Stakeholders

Provide periodic reports to the affected stakeholders that describe progress with implementation of the project Action Plans on issues that involve on-going risk to or impacts on affected stakeholders and on issues that the consultation process or grievance mechanism have identified as a concern to those stakeholders. The Performance Standards require that after completion of an environmental assessment the consultation and disclosure must continue throughout the life cycle (construction and operation phase) of the project.

Source: ERM 2018

The IFC PSs also have stakeholder engagement and consultation requirements to manage specific impacts as described in the following PSs and presented in more detail in *Table 2.1:*

- IFC PS2: Labour and Working Conditions;
- IFC PS3: Resource Efficiency and Pollution Prevention;
- IFC PS4: Community Health, Safety and Security;
- IFC PS6: Biodiversity Conservation and Sustainable Natural Resource Management; and
- IFC PS8: Cultural Heritage.

IFC PS 5 on Land Acquisition and Involuntary Resettlement requires prior, informed and inclusive engagement with affected persons. However, this Project does not require any land acquisition since irrigation equipment will be installed in agricultural plots property of the beneficiaries and no economic or physical displacement is envisaged. As such IFC PS5 was not triggered and engagement related to resettlement is not covered in this SEP. PS7 on Indigenous People also includes requirements for engagement where indigenous people are impacted by Projects. However, as indigenous people are not found within the Project area this is not considered in this SEP.

Table 2.1 Other Relevant IFC Performance Standards

Standard	Key Components
PS2: Labour and Working Conditions	Recognises that the pursuit of economic growth through employment creation and income generation should be balanced with the protection of basic rights for workers. Acknowledges that constructive worker-management relationship and safe and healthy working conditions may enhance the efficiency and productivity of operations. As such, requires engagement between projects and their workers including mechanisms for workers to report grievances.
PS3: Resource Efficiency and Pollution Prevention	Recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels
PS 4: Community Health, Safety & Security	Recognizes that project activities, equipment and infrastructure bring benefits to communities including employment, services and opportunities for economic development. However, the project can also increase the potential for community exposure to risks from development. Where project activities pose risks of adverse impacts on the health, safety and security of affected communities the developer is required to make available relevant information (including the details of an Action Plan), in an appropriate form, to affected parties and government authorities so that they can fully understand the nature and extent of the risks.

PS 6: Biodiversity Conservation and Sustainable Natural Resource Management	Recognises that protecting and conserving biodiversity in all its forms is fundamental to sustainable development. Where the project has potential impacts on legally protected or critical habitats consultation with relevant authorities, specialists and communities must be undertaken.
PS8: Cultural Heritage	Recognises the importance of cultural heritage for current and future generations and is consistent with the convention concerning the protection of the world's cultural and natural heritage. Where sites of cultural heritage are potentially impacted by the project the developer will consult with local communities as well as relevant national authorities responsible for the maintenance of such sites.

Source: ERM 2018

2.3.2 Good Practice

In addition to the requirements of the IFC PSs, the Project has adopted certain good practices such as accessibility to information (through the use of oral and visual methods), and respect of local traditions.

3 SUMMARY OF PREVIOUS STAKEHOLDER ENGAGEMENTS

3.1 INTRODUCTION

Stakeholder consultations for the Project began during Project planning phase in 2017 and has been continuous through the feasibility studies, Environmental and Social Impact Assessment (ESIA) update including field visit for new engagement with key stakeholders conducted in June 2018.

Engagement as part of the project development and ESIA process for lenders was conducted between 2016 and 2018. Initial consultations took place with the Government ministries and departments, the interested farmers, the Local Administration Authorities as well as social institutions in the area. Both public and private stakeholders were included in the engagement process, which was undertaken in 2017.

3.2 ENGAGEMENT ACTIVITIES DURING ESIA FOR LENDERS PREPARATION (2017)

Stakeholder engagement activities during ESIA preparation in 2017 consisted on the following:

- Continuous engagement with the Secretary of Agriculture and Livestock (SAG).
- Face to face meetings with the relevant Government Ministries and Institutions such as MiAmbiente (Secretariat of State in the Office of Energy, Natural Resources, the Environment and Mining), MiAmbiente-DECA (Directorate General of Environmental Assessment and Control of MiAmbiente); MiAmbiente Water Authority and, ICF (Institute of Forest Conservation).
- Discussions and social interaction with the Local Administration Authorities and Municipalities: Environmental Department of the Municipality of Olanchito and, UMA (Municipal Environmental Unit).
- Assembly-type meeting with representatives of livestock and milk producers: SAGO (Farmers' and Stockbreeders' Society of Olanchito), FENAGH (National Farmers' and Stockbreeders' Federation of Honduras) and, CREL (Milk Collection Centre).
- Discussions and visits to local farmers interested in becoming Project beneficiaries of the proposed irrigation Project. The assessment included a survey of potential interested farmers in becoming Project beneficiaries (see further details below).
- Meetings with Water Board Representatives: Association of Water Boards and Well Drilling technician
- Focus group discussions with community members and members of the general public in the Project Area of Influence.
- Meetings with local NGOs and key informants in particular ASIDE (*Asociación de Investigación para el Desarrollo Ecológico y Socioeconómico*).

In particular, a personalised communication approach was established with the key representatives of the CRELS, the leaders of the National Farmers' and Stockbreeders' Federation of Honduras (FENAGH) and the Olanchito Stockbreeders' Society (SAGO), and the Mayor of Olanchito and Arenal.

During the preliminary survey conducted by CINSA & PAA Project Finance in 2017, a sample of 301 out of approximately 350 SAGO livestock breeders and milk producers were visited and interviewed, which represents 86% of the current estimated population of livestock breeders and milk producers. The preliminary survey included 47 women, and 52 independent producers who do not belong to any CREL (of which 8 women). As such, the information collected through this process is considered representative of the total livestock and milk producer population in the area. Most producers are located in the municipality of Olanchito (91%) and a few are located in the municipalities of El Arenal (8%) and Jocon (1%). Irrigated land will be evenly distributed across the Project Area.[4]

Throughout the project promotion stage, the local press was called for a conference to explain the project benefits and selection criteria. This included a written booklet of the project benefits, the responsibilities, the selection criteria and the application procedure. These project promotion meetings were held at the SAGO.

Table 3.1 below outlines the exchange with the Honduras State Institutions as part of the ESIA process initiated in 2017:

Table 3.1 Stakeholder Consultation Summary (2017)

Stakeholder	Date	Discussion Topics
Exchange with the Honduras State Institutions		
MiAmbiente	27.11.2017	Project classification. Letter number: SAG.939-2017
MiAmbiente – Water Resources	16.11.2017	Water contract application
	21.11.2017	Registration of wells in Alto Aguan, progress with the formation of the water authority
ICF central offices	n/a	Protected areas
ICF office in Tocoa (Interview Karina Turcios)	10.11.2017	Prevention measures in the lands adjacent to the Honduran Emerald Hummingbird Wildlife Refuge
Socialisation of the Project with the Co-manager of the Wildlife Refuge		
ASIDE –Hummingbird Wildlife Refuge (Interview José Luis Ramos)		Presentation of the Project and receipt of comments
Socialisation with Municipalities		
Environment Department of the Municipality of Olanchito (Interview Ramón Rosa)	10.11.2017	Project classification
Socialisation with Water Board Representatives		
Association of Water Boards (Interview Ricardo Cruz)	8.11.2017	Water board activities and water availability
Well drilling technician (Braulio Pastor)	9.11.2017	Location of wells and their capacity
Socialisation with Milk Producers		

[4] A map showing the even distribution of irrigated land is presented in Chapter 3 of the ESIA.

Stakeholder	Date	Discussion Topics
National Farmers' and Stockbreeders' Federation of Honduras (FENAGH) / Farmers' and Stockbreeders' Society of Olanchito (SAGO) -	7.11.2017	Assembly-type meeting- Presentation of the irrigation Project, exchange of opinions
	8.11.2017	Visit to the following farms: Rogelio Cruz in Ocotes Altos; Rony Rogelio Núñez; Estuary of the Aguan River, Milton Puerto; Juan José Molina in Rancho Don Juan (before Villa Sara); Farm Santa Rosa, José Antonio Salas; Milton Munguía, Calpules; Hacienda La Flor – Santa Bárbara
CREL – Milk Collection Centre	7.11.2017	Discussion on equipment for the CREL
	8.11.2017	Visit to the following farms - Cruz Nuñez & Asociados; Leopoldo Durán Dueñas; Mejía Rodríguez Potrero; Bustillo – Martínez, Lijia Elizabeth Bustillo, Juan Bustillo

Source: PAA & CINSA 2017

See *Annex B.1* for more details and evidence of engagement activities in 2017.

3.3 ENGAGEMENT ACTIVITIES DURING ESIA UPDATE PREPARATION (2018)

In the field visit performed in June 2018 as part of the ESIA update process, additional engagement meetings have been conducted to fill data gaps and reconfirm assessment of impacts. The following activities were undertaken:

- Introduction to the project, review of field survey planning, definition of the selection criteria for potential beneficiaries and fees, technical aspects of the project, baseline conditions and training to beneficiaries with members of the core team: the SAG Subdirector and Engineer, SAG Olanchito, PAA Project Finance and Integra Ingeniería representatives, an environmental expert from CINSA and an ERM consultant.
- Meeting with SAG and SAGO representatives to confirm SAGO organization, requirements to join, profile of members, crops and production issues, working conditions, water management and land tenure.
- Discussions with CRELs and SAG regarding to management of a CREL, their organization and requirements to join.
- Consultation with Municipality of Olanchito and El Arenal with member of the core team about the project introduction to the members of the municipality, water and wastewater management in the municipality.
- Discussion between SENASA and the core team concerning the use and management of chemical products in the agriculture and livestock sector.
- Focus groups with small farmers and visit/interview to local farms for confirmation of farm/water management, land tenure, among others.
- Meeting with INA (Agrarian National Institute) to review the management of Cajas Rurales.
- General visit to the project arena for habitats observation.
- Meetings with Olanchito Hospital representatives to review health condition in the Project Area.
- Interview with Indigenous workers regarding location, socioeconomic profile, working conditions, conflict assessment, etc.

- Dialogue with AJAASPIB (Water Boards Management Systems Association of the South Sector of Pico Bonito National Park) with regard to water management.
- Discussion with ASIDE and ICF related to protected areas management.

See *Annex B.2* for more details of engagement activities in 2018.

4 PROJECT STAKEHOLDERS

4.1 STAKEHOLDER IDENTIFICATION

Stakeholder identification began at Project inception and planning and has continued through the various stages of the project development. Stakeholders identified to date represent the organisations and individuals who may be directly or indirectly (positively or negatively) affected by the Project or who may have an effect on how the Project is implemented.

Stakeholders identified for inclusion in engagement activities meet one of the following criteria:

- have an interest in the Project;
- would potentially be impacted by or have an influence on the Project (negatively or positively); and/or,
- could provide commentary on issues and concerns related to the Project.

Identified stakeholders can be summarized as follows:

- *Primary Stakeholders:* Those directly affected or benefitted by the Project such as milk and livestock producers, farm workers and nearby communities to beneficiary farms, including members of the public, vulnerable and various institutions.

- *Secondary Stakeholders:* Those indirectly affected by the Project but who will influence the Project implementation. These include the responsible agencies, National Government Agencies, Government ministries, National Associations and Federations, Regional Federations, National Regulatory bodies, Traditional Authorities / Local Government, technical departments, and Local administration.

Stakeholders were categorised, based on their various needs, interests, and potential influence on the Project.

Table 4.1 Stakeholder Category List

Stakeholder Category	Stakeholder Group	Connection to the Project	Stakeholders
Internal Stakeholders	• Project Owner • Equipment Provider • Consultants	Approves the design, provides resources, approves applications, delivers equipment, trains, and monitors; Commercial Agreement	***Project Owner/Leader***: • Secretary of Agriculture and Livestock of Honduras (*Secretaría de Agricultura y Ganadería* or SAG) ***Equipment Provider:*** - PAA Project Finance ***Engineers and Advisors:*** • Integra Ingeniería • CINSA en Ingeniería S.A. (Honduran Engineering Consulting Company) • Environmental Resource Management (ERM)
Implementing Partners	• National Government agencies	Collaboration agreements with other government bodies; Budget management; Surveillance and communication and engagement with local population; Reforestation Plan	• SAG Irrigation Department, Project Implementation Unit (PIU) (*Unidad Ejecutora del Proyecto – UEP*) - SAG Olanchito - Finances Secretary (*Secretaría de Finanzas – SEFIN*)
Financial Institution	• Lender	Loan agreement and funding	ING Bank, and EKF's Denmark Export Credit Agency
Project Partners (External)	• National associations and federations • Regional associations • University and research centers	Formal, legal and functional organizations with credibility in the area and experience in other project implementations. CRELs have been consulted and involved during the project design and diverse studies so far. Collaboration agreement.	- Honduran National Farmer's and Stockbreeders' Federation (*Federación Nacional de Agricultores y Ganadores de Honduras - FENAGH*) - Olanchito Farmers and Stockbreeders's Society (*Sociedad de Agricultores y Ganaderos de Olanchito - SAGO*) - National Agrarian Institute (*Instituto Nacional Agrario – INA*) - Fund for Agricultural Development *(Fondo Internacional de Desarrollo Agrícola - FIDA)* - Honduras Land Administration Program *(Programa de Administración de Tierras de Honduras – PATH* - Regional University Center of Aguan Valley (*Centro Universitario Regional del Valle Aguan - CURVA*) of the National Autonomous University of Honduras (*Universidad National Autonoma de Honduras - UNAH*) - Centers for the collection and cooling of milk (*Centro de Recoleccion y Enfríamiento de Leche - CREL*)
National Government	• National Regulatory bodies	National Government are of primary national political importance throughout all stages of the Project life cycle, in charge of licensing, granting permits/authorizations for the	- MiAmbiente – DECA General Directorate of Environmental Assessment and Control of MIAMBIENTE (Dirección General de Evaluación y Control Ambiental de la MiAmbiente-DECA) - MiAmbiente – Water Authority

Stakeholder Category	Stakeholder Group	Connection to the Project	Stakeholders
		Project; monitoring and enforcing compliance with Honduran Law. The ICF is the National Institute that ensures the forest cover and suitable forest management, declares protected natural areas and grants permits to cut down trees and issuing compensation measures.	- Institute for Forestry Conservation and Development *(Instituto de Conservación y Desarollo Forestal - ICF)* - Ministry of Health - Property Institute *(Instituto de la Propiedad – IP)* - Honduran Institute of Anthropology and History *(Instituto Hondureño de Antropología e Historia – IHAH)* - National Council of Potable Water and Sanitation *(Consejo Nacional de Agua Potable y Saneamiento - CONASA)* - State Secretariat for Indigenous and Afrohonduran Peoples *(Secretaría de Estado de Pueblo Indígenas y Afrohondureños – SEDINAFROH* - *Secretariat of Labour / Social Security Institution*
Municipal Government	• Municipal Authorities and Government bodies	Regional and local government are responsible for implementation of legislation, and development plans and policies at the Regional and Local levels. Municipal corporations are elected by residents and are also responsible for granting permits to the farms as well as water extraction permits. Municipal environmental units typically have low technical capacity level. They are involved in the monitoring of the fulfilment of the environmental control measures.	• Olanchito and El Arenal Municipal corporation headed by the Mayor *(Alcalde)* • Municipal Environmental Unit (*Unidades Municipales de Ambiente – UMA*) • Department of Human Resources (Employment) • Municipal Administration (*Administración municipal)* - Urban Areas: Boards of Trustees (*Consejos de Administración)* - Rural Areas (both *aldeas* and *caseríos*) governed by an Assistant Mayor *(Alcalde Auxiliar)* and Alternate selected in a communal assembly and appointed by the Municipal Administration - The Municipal Administration's Governance and Transparency Department (previously referred to as Community Development Department) • Municipal Water and Sanitation Commission (*Comisión Municipal de Agua Potable y Saneameinto* - COMAS) • Municipal representative of the Honduran Society of Administrative Boards of Water Systems (*Asociación Hondureña de Juntas Administradoras de Sistemas de Agua - AHJASA*) • Health Centers - In the Municipality of Olanchito 2 Health Centers with permanent doctor *(Centro de Salud con Médico Permanente - CESAMO)* - In the Municipality of Arenal: 1 CESAMO and 2 Health centers only with assistants (Centro de Salud con Auxiliares – CESAR)
Project Potential Beneficiaries	• Selected livestock and milk producers • Farm workers	Livestock and milk producer with no or up to extensive experience in irrigation. Interests and expectations lie in improving economic income, reducing vulnerability to drought and improving income stability. Getting benefits from the project.	- ***Potential Beneficiaries of the project:*** • 350-400 livestock and milk producers present in the Project Area members of SAGO (grouped into CRELs or independent) • There are 16 CRELs in the Project Area: Andino Munguía; Armín; Jerónimo Figueroa; Bustillo Martínez; Cárcamo Martínez; CRELCA; Cruz Nuñez; Fabricio Puerto; Heberto Chirinos Ponce; Leopoldo Duran Dueñas; Martinez Hernández; Martínez Lobo; Mejía

Stakeholder Category	Stakeholder Group	Connection to the Project	Stakeholders
		Connection to the Project established by the Conditional Grant and the agreement established between SAG and the beneficiary.	Rodríguez; Puerto Lozano; Salinas Gonzales; Salvador Figueroa; and Superación
Potentially affected stakeholders	• Landowners and farm workers in the area • Residents / other water users • Water boards (resident associations) • Downstream communities[5]	Users of water for human consumption and livestock and agriculture. No direct participation in decision-making. Representative participation via water boards, associations and municipal corporations.	• 61 Hamlets (*aldeas*) and 147 settlements (*caseríos*) in the Project Area • Hamlets ("Aldeas") located downstream of Project Area • Landowners and farm workers not selected as beneficiaries • Residents or other water users • Water Administration Boards *(Juntas Administradoras de Agua - JAAS)* in each hamlet (*aldea*)
Vulnerable and Indigenous Persons/Groups	Vulnerable groups within the Project Area	Vulnerable groups may be affected by the Project by virtue of their physical disability, social or economic standing, limited education, lack of employment or access to land. No indigenous communities are found within the Project Area, nonetheless indigenous individuals live among non-indigenous communities representing a small percentage of the population who are employed in farms of potential Project beneficiaries. These indigenous individuals are employed in livestock and milk production farms and/or reportedly intermarried. Furthermore, the Project Area is located downstream from indigenous settlements, with little interference to soil and water resources located upstream. Appropriate engagement practices and tools will be adopted to ensure adequate access to information and participation.	***Vulnerable people within the hamlets in the Project Area:*** [6] • Beneficiaries with limited financing capacity (low income and reduced access to savings or credit) • Very small producers (potential beneficiaries) • Small-scale subsistence farmers (non-beneficiaries) with lower incomes and reduced access to savings or credit • Potential female landowner beneficiaries (approximately 50 individuals) and female-headed households • Individuals or households where the household head is elderly or disabled • Individuals belonging to indigenous groups or of indigenous background • Unemployed youth • Elderly and orphans ***Representatives of Indigenous and Afro-descendant groups residing /working in the Project Area[7] as part of non-indigenous communities:*** • Federation of Xicaque Tribes of Yoro (*Federación del Tribu Xicaque de Yoro* - FETRIXY) • Association of Indigenous Tolupan Communities of La Montaña de la Flor *(Asociación de Comunidades Indígenas Tolúpanes de la Montaña de la Flor - Acitmfm)*

[5] The assessment of impacts presented in the ESIA have concluded that as potential impacts on groundwater levels downstream of the Project Area will be insignificant, related impacts on farmers and producers and indigenous land of the Garífuna tribe located downstream are also expected to be insignificant. As such these have been scoped out of the assessment. For further justification please refer to Chapters 6 and 7 in the ESIA.

[6] A detailed assessment and definition of vulnerable groups is presented in *Chapter 5- Baseline* of the ESIA.

[7] Some individuals of indigenous background live and work in the communities within the Project Area, however no ancestral land associated to indigenous communities have been identified. The individuals that live in the valley are intermarried and assimilated into the local society.

Stakeholder Category	Stakeholder Group	Connection to the Project	Stakeholders
			• Settlements where indigenous populations can be found in the Project Area includes the hamlets of Calderas located approximately 50 to 60 km West of Olanchito and in Agalteca neighbourhood 1km northeast of Olanchito town. Other settlements where indigenous households reside include El Aguacate, El Chorro, Carboneras, and El Aleman, with an average of 30 - 40 households composed of 3-4 members per community
Civil Society	• Community-Based Organisations (CBOs) • Local Associations • Research and Academic Institutions (national and local)	• Organisations with direct interest in the Project, and its social and environmental aspects and that are able to influence the Project directly or through public opinion. • Such organisations may also have useful data and insight and may potentially become partners to the Project in areas of common interest such as the implementation of training programs, etc.	• ASIDE co-manager of the Emerald Hummingbird Wildlife Refuge in Honduras (*Refugio de Vida Silvestre Colibrí Esmeralda*) • Alfalit in Honduras (literacy, community development, food safety) • CARE-PASOS • FUPNAPIB - Protection, Conservation and Responsible Use of Natural Resources Present in Pico Bonito National Park • CURVA University (see potential Project partners above) • National Institute for Professional Training *(Instituto Nacional de Formación Profesional - INFOP*) • SAGO (see potential Project partners above) • Milk Collection Centres (*Centros de Recolección de Leche* or CRELs) • Olanchito Red Cross
Non-Governmental Organizations (NGOs)	• International • National • Local	• NGOs with direct interest in the Project (social and environmental aspects) with the ability to directly influence the project or through public opinion. NGOs could potentially become partners to the Project in areas of common interest. • NGO projects are coordinated through the National Agrarian Institute, SAG, and the Public Prosecutor's Office. • International NGOs include organisations based within and outside Honduras with an interest in the Project. They include international NGOs, multilateral and bilateral organisations.	***National and international NGOs present in the area:*** • ASIDE (co-manager of the Emerald Hummingbird Wildlife Refuge in Honduras) • Alfalit in Honduras (literacy, community development, food safety) • FUPNAPIB • Other potential international NGOs and Pressure Groups: Human Rights Watch, World Vision, IUCN, OXFAM, WWF, Food and Agriculture Organization - FAO
Other interest groups:	• Media • Private sector / multinational companies • Law enforcement	Multinational companies are economic actors with strong economic and political influence. Although they have no direct participation in the Project they have an interest in ensuring that the Project does not generate sanitary issues and problems of access to water that may disrupt their operations. The Dairy production sector also has a vested interest in modernising and stabilising milk production and supply and reducing prices through the Project. Law enforcement is responsible for maintaining security in the area.	• Local and municipal media (radio, newspaper, TV) • Banana plantations (DOLE) located in the Project Area and downstream • Palm trees plantations located in the Project Area and downstream • Dairy product producers (micro and large enterprises) • Police and law enforcement in the area • National Processing Companies: LEYDE, SULA, LECHOSA, SANPILES, • Local artisanal cheese producers.

Stakeholder Category	Stakeholder Group	Connection to the Project	Stakeholders
Potential partners	• Contractors. • Suppliers and service providers. • Other businesses operating within the community • Local and international banks • Other	Organisations, businesses and individuals with direct interest in the Project e.g. running businesses or providing services and supplies to the Project. These may also include NGOs and CBOs listed above as potential partners for implementation of trainings, etc.	***Indirect beneficiaries of the project*** • Micro and small entrepreneurs • Workshop supplies

In order to clearly develop a systematic and effective means of engagement, stakeholders were mapped and their feedback analysed to understand their key issues, comments and concerns about the Project.

To support the analysis of stakeholders and help develop an appropriate approach for engagement, the following additional information was recorded:

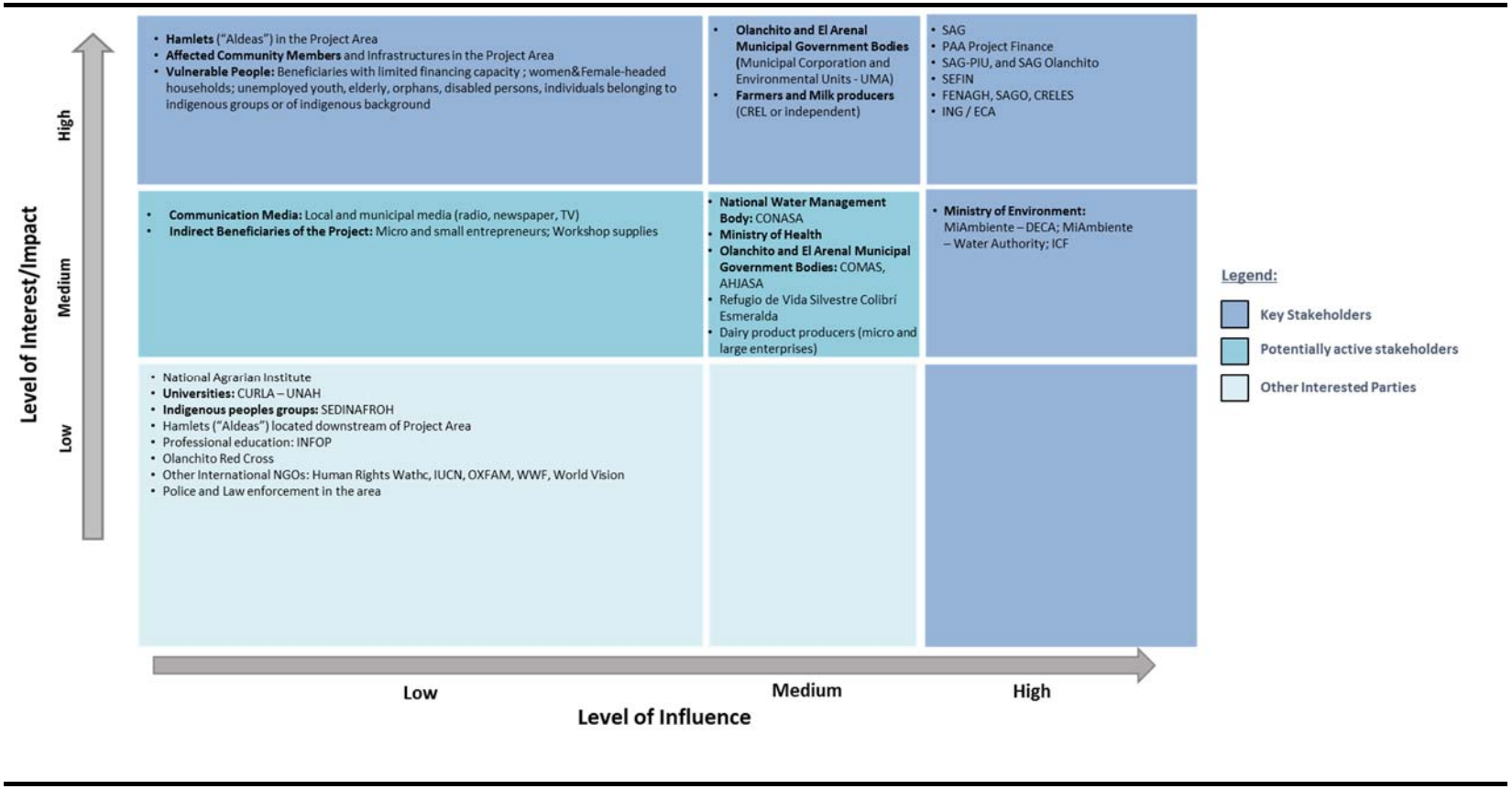
- influence on the Project (high, medium, low); and
- interest and impact in the Project (high, medium, low).

Influence refers to the power that the stakeholders have in relation to decisions either taken by, or affecting the Project. This power may be in the form of stakeholders that have formal control over the decision-making process or it can be informal in the sense of protesting against, blocking or allowing Project operations to continue.

It is also important to map those stakeholders whose interests determine them as stakeholders, i.e. may be directly involved with the Project or have something to either gain or lose because of Project implementation. Understanding stakeholder level of interest can help clarify the motivations of different actors and the ways in which they might be able to influence the Project. Impact refers to the consequences for the stakeholder of undertaking the Project in relation to their environment, socio-economic and cultural context. The level of impact also influences affected stakeholder's interest in the Project; the higher the level of impact, the higher the interest in the way impacts are being addressed. It should be noted that the positions of stakeholders may change over time as the Project progresses and that the stakeholder map should be reviewed and updated as appropriate. In addition, any new stakeholders identified should be added into the map.

Using the information, stakeholders have been mapped and graphically represented according to interest, influence and impact. *Figure 4.1* below illustrates the outcome of the stakeholder mapping.

Figure 4.1 Stakeholder Mapping



Source: ERM 2018

Different levels of engagements will be proposed for different categories of stakeholders. This is primarily based on experience with similar projects and the analysis of the stakeholder consultation and engagement process since the Project began. Less intensive forms of engagement such as disseminating information may be adequate to keeping stakeholders informed about Project progress. However, solving the more systemic and deep-rooted challenges or major changes in Project activities requires more collaborative engagement as it has been the case so far.

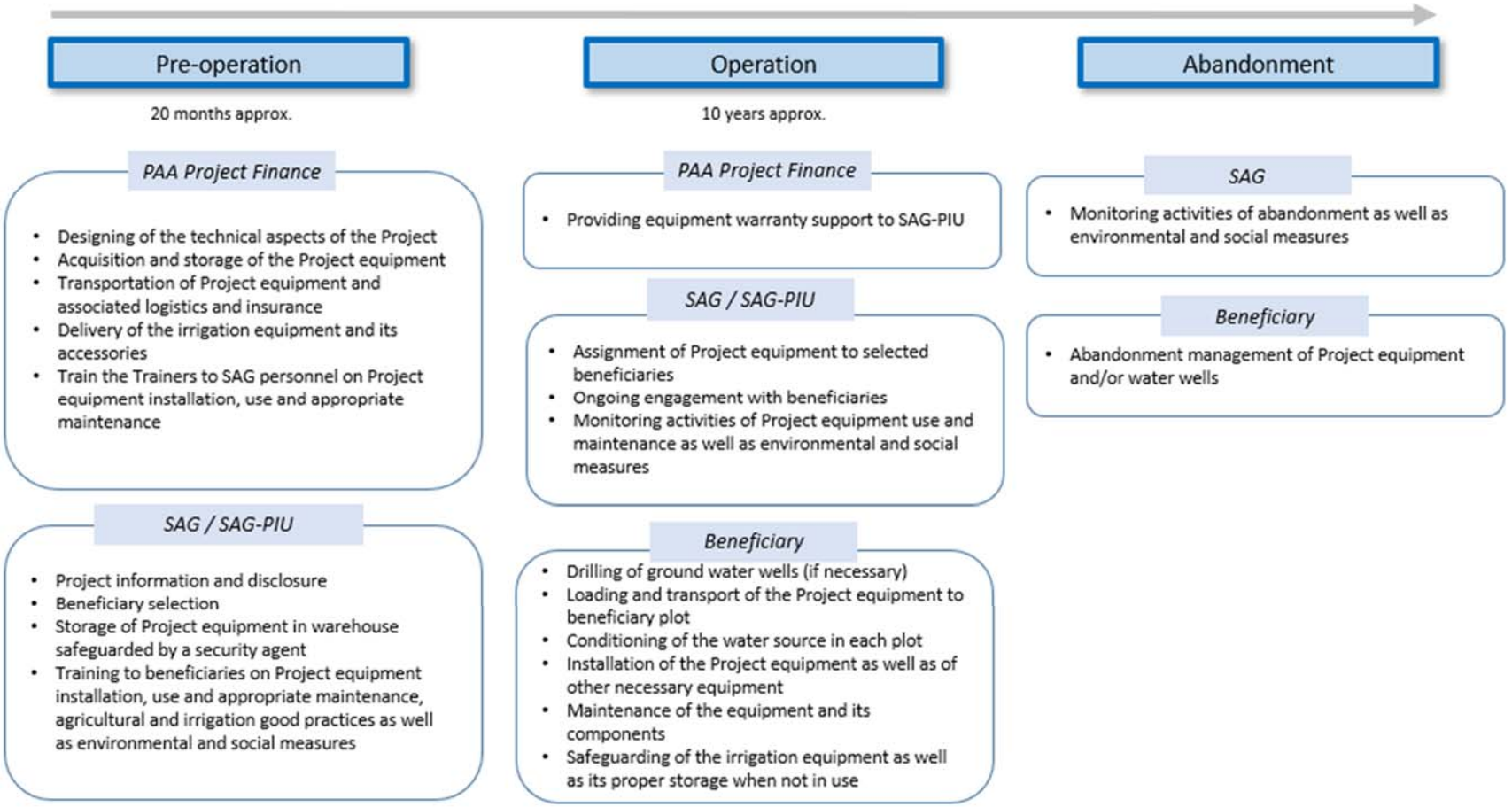
5 STAKEHOLDER ENGAGEMENT PROGRAMME

5.1 OVERVIEW

The stakeholder engagement programme is designed to cover all phases of the Project. However, PAA Project Finance will hand over the Project to the SAG once the irrigation equipment is installed and the training for beneficiaries has been completed. During the operation phase PAA Project Finance's responsibilities regarding the irrigation project will be limited to supplying spare parts. In this regard, all engagement activities during the operation will be managed and promoted by the Project Implementation Unit (PIU).

The general objectives of stakeholder engagement under this SEP are as outlined in ***¡Error! No se encuentra el origen de la referencia.*** below.

Figure 5.1 Stakeholder Engagement Objectives for Each Project Phase



Source: ERM 2018

Specific planning and engagement activities will be necessary at each Project phase; however, some activities will be ongoing throughout the entire Project cycle and therefore common to the different phases. Common activities include the following:

- Regular update and revision of the stakeholder register including stakeholder analysis and re-evaluation as necessary throughout the different Project phases.
- Addressing comments, questions, and grievances regularly and through appropriate channels, and issuing information to stakeholders. This includes regular refreshers to stakeholders about the Grievance Mechanism and related processes.
- Regular reporting to the different stakeholders as appropriate (see *Section 8.2).*
- Regular Project Monitoring reports.

The following sections detail the planned engagements at each Project phase.

5.2 PRE-OPERATION PHASE ENGAGEMENT

5.2.1 Approach and Objectives

Establishment of the Project Implementation Unit (PIU)

The SAG will establish a Project Implementation Unit (*PIU*), formed by members of the SAG, and whose role will be to manage the Project during pre-operation phase and part of the operation phase.

The PIU will be responsible to coordinate the beneficiary eligibility conditions approval programs, equipment delivery and user training for installation, user maintenance, environmental training and monitoring; using the existing technical and operational elements, in addition to delivering periodic reports on financial management. Usually formed by the following positions: Project Director, administrative manager, logistics manager, irrigation systems technician and agricultural consultant. SAG-PIU responsibilities are described in detail in *Section 7*.

The PIU will be established at the start of the pre-operation phase and located in the offices of the SAG in Olanchito. A cooperation agreement between PIU and SAGO (Olanchito Stockbreeders' Society, which provides technical support to the CRELs) shall be established to implement the irrigation project. In this way, SAGO and the CRELs, key stakeholders in the agriculture and livestock sector in the Project Area, will also be involved in the project implementation.

Re-Engagement

Stakeholder engagement activities have taken place during the Project design and ESIA development process since 2014 in order to consult relevant stakeholders at all levels and collect their feedback (see *Section 3.2*). Some follow-up engagement activities have also taken place during the ESIA update process (see *Section 3.3*).

To formalise these engagements, within the SEP framework, and ensure that all stakeholders have the same understanding (including selection criteria and socialisation of the grievance mechanism), a round of refresher engagement meetings will be undertaken during the pre-operation phase. The re-engagement activities are summarized in the next *Section 5.2.2*. It is noted that the re-engagement activities presented in the summary table should be led by the PIU with the support of PAA Project Finance.

BA booklet summarizing information will have information on Project development activities and shared with stakeholders during engagement activities.

Beneficiary Selection Process

The potential beneficiaries of the Aguan Irrigation Project have been estimated to be between 350-400 livestock and milk producers of the Alto Aguan River Valley, members of the SAGO; most of whom are also members of the 16 CRELs present in the Project Area. Once the Project starts, the milk producers will be able to reconfirm their interest to become potential beneficiaries. All applications will be then reviewed and the decision-making on the final beneficiaries of the irrigation system will be based on strict selection criteria. This selection process will be undertaken by the PIU of the SAG during the Pre-Operation phase. More details on the responsibilities and requirements of beneficiaries are included in *Annex A* to this report. It is envisaged that the SAG-PIU will regularly engage with potential beneficiaries to disseminate information and updates on the selection process.

Site Presence and Regular Engagement with Beneficiaries

PAA Project Finance will undertake the following engagement actions during the equipment installation with the objective of maintaining the social license to operate:

- PAA Project Finance will collaborate with the SAG-PIU to regular release information related to the equipment delivery and start-up, during the pre-operation phase. The irrigation system includes pumping units, water distribution and sprinkler systems, and accessories.
- PAA Project Finance will collaborate with the SAG-PIU to inform and disseminate the requirements/criteria for beneficiary selection and the grievance mechanism developed by the SAG to all the potential beneficiaries.

- PAA project Finance will collaborate with the SAG-PIU in the provision of information on potential Project benefits to non-beneficiary stakeholders including indigenous individuals living in settlements in the Project Area.
- Update stakeholders and beneficiaries in particular on installation progress and schedule.
- Address upon indication of the SAG-PIU any grievances in relation to installation of pumps, beneficiary selection and capacity building program.
- Training of SAG technicians ("train the trainers"), enabling them to carry out training for the beneficiaries of the project, on the following aspects:
  - Installation of irrigation equipment and its accessories, use of irrigation equipment.
  - Preservation and maintenance of irrigation equipment (motor pump, irrigation cannons, etc.).
  - Agricultural consulting.
  -

Establish and Maintain Grievance Procedure

In addition to the information indicated in Table 5.1, the following actions will be included but not limited to:

- PAA Project Finance through its local representative will collaborate with the PIU to inform and disseminate the grievance mechanism developed by the SAG.
- PAA Project Finance through its local representative will collaborate with the PIU to keep a complaint register on site. The register will contain the contact details of the complainant and information regarding to the complaint itself and any measures or agreements made in resolution to such complaint.
- PAA Project Finance will provide support to the PIU and SAG to install an adequate number of complaints/suggestion mailboxes at strategic points in Olanchito. For more detail related to grievance mechanism, please refer to *Section 6.*

5.2.2 Summary of Engagement Activities

The stakeholder engagement to be implemented during pre-operation phase is presented in *Table 5.1* below.

Table 5.1 Stakeholder engagement activities during Pre-Operations

Activity	Stakeholders	Purpose	Timeframe	Responsible
Disclosure of relevant Project information to key institutional stakeholders	• Honduras State Institutions, • Municipality representatives • Milk & livestock Producers (FENAGH, SAGO, CREL) • Water Board Representatives such as: AJAASPIB, association of water boards, among others	• Present the updated ESIA • Present the Stakeholder Engagement Plan • Updated Project schedule and activities • Familiarize new identified stakeholder with the project • Introduce Project´s Environmental and Social management procedures • Grievance mechanism	Early in the pre-operation phase	SAG-PIU supported by PAA Project Finance
Information update to key non-governmental stakeholders	• NGOs • Local associations • Community Based Organisations (CBOs) • Research and Academic Institutions (national and local) • Indigenous associations	• Foster understanding of the Project; • Allay fears and avoid miscommunication. • Obtain and maintain social licence to operate. • Maintain regular contact and communication interaction	Regular	SAG-PIU supported by PAA Project Finance
Provision of information to potential Project beneficiaries	• Interested stockbreeder's and milk producers affiliated to FENAGH, SAGO, CRELs	• Reminder of SAG and PAA Project's agreed requirements and criteria for beneficiary selection (Minimum requirements such as water sources availability/contract, making adequate use of the received material, complying with legal/environmental/social requirements and permits) • Confirmation of fees payment procedure (Benefit fee established by the SAG) • Presentation of grievance mechanism • Timeframe for beneficiary selection	Early in the pre-operation phase	SAG-PIU supported by PAA Project Finance
Provision of information to selected beneficiaries regarding irrigation equipment provision and training program (*regular updates*)	• Selected stockbreeder and milk producers beneficiaries	Information disclosure and participation process: • Criteria for beneficiary selection (Minimum requirements such as water sources availability/contract, making adequate use of the received material, complying with legal/environmental/social requirements and permits) • Fees payment procedure (Benefit fee established by the SAG)	Regular	PAA Project Finance supported by SAG-PIU

Activity	Stakeholders	Purpose	Timeframe	Responsible
		• Local radio broadcasts will be used by the PIU to provide Project updates and information related to enrolment dates for trainings.		
Provision of information regarding irrigation equipment installation *(regular updates)*	• Selected stockbreeder's beneficiaries	Update beneficiaries on installation progress and schedule through SAG webpage, notice board in SAG Olanchito	Regular	• PAA Project Finance collaborating with PIU for equipment installation • PAA Project Finance in-country representative in charge to ensure proper grievances management by PIU
PAA Project Finance train the trainers of SAG technicians, enabling them to carry out training for the beneficiaries of the project, on the following aspects: • Installation of irrigation equipment and its accessories, use of irrigation equipment • Preservation and maintenance of irrigation equipment (motor pump, irrigation cannons) • Agricultural consulting •	Selected stockbreeder's beneficiaries SAG-Technical Support	Meetings – Project Presentation; focus groups discussions Regarding training of beneficiaries conducted by the SAG-PIU: notice boards, webpage, project leaflets, radio broadcast		PAA Project Finance
External Communications - Implement and maintain a procedure for external communications	• NGOs / Co-manager of the Wildlife Refuge: ASIDE, Alfalit, CARE, FUPNAPIB and other international NGOs and pressure groups • Water Board Representatives • Civil Society: CURLA of UNAH; INFOP, SAGO Media, law enforcement, private sector / multinational companies	Distribution of booklet for the Application of the Project's Environmental and Social Regulations and Procedures; notice boards; webpage, radio broadcast; regular reporting, grievance forms, iterative consultations These engagement tools include methods to: • Receive and register external communications from the public; • Screen and assess the issues raised and determine how to address them; • Provide, track, and document responses, if any; and		SAG, PIU

Activity	Stakeholders	Purpose	Timeframe	Responsible
		• Adjust the management program, as appropriate.		
Grievance Mechanism for Affected Stakeholders- Establish a grievance mechanism to receive and facilitate resolution of affected stakeholders' concerns and grievances	• Honduras State Institutions • Milk Producers (FENAGH, SAGO, CREL) • NGOs / Co-manager of the Wildlife Refuge • Water Board Representatives • Excluded Project Candidates • Potentially affected stakeholders	Present the Project Community Grievance Mechanism and resolution and feedback to complainant Grievance forms that include: 1.Grievance Reception and Registration 2.Screening and Prioritization 3.Examination 4.Resolution and Response 5.Closure (Please refer to Section 6 for more detail)		PIU through its Grievance Officer, supported by PAA Project Finance in-country representative

5.3 *OPERATIONS PHASE ENGAGEMENT*

During the operation phase, PAA Project Finance assumes no responsibility for the operation process (water extraction and water irrigation), which consist of the actual function of the irrigation equipment.

Engagement with Project beneficiaries and other key stakeholders will still be conducted by the PIU during early phases of the operation phase and later by the SAG directly. The engagement process will include:

- The PIU will prepare regular reports to the SAG including a summary of stakeholder engagement activities and all grievances received and resolved.
- The PIU will maintain updated the information in order to allow stakeholders to be informed about the educational offers, project and contact details and make available grievance forms.
- Information will be released every two (2) months regarding the project's progress.

5.3.1 *Approach to engagement*

Continued Stakeholder Engagement Management through the PIU

The PIU, in a proactive manner will commit to the following activities during operation phase:

- Respond in an efficient and timely manner to beneficiaries needs, questions, request of information, feedback on project implementation (irrigation system/equipment installation, water supply, among others
- Address any grievances
- Sustain a peaceful working relationship with stakeholders; in particular other water users and relevant institutional stakeholders
- Maintain information boards in the position (placed at the entrance to the SAG-PIU office and other location accessible to the communities), quantity, design and dimensions that are considered appropriate (For more information related to Stakeholder Engagement Tools see *Table* 5.2).
- Request support from PAA Project Finance with regards to provision of technical support related to the irrigation equipment.

Maintain Grievance Procedure

The following actions will be included but not limited to:

- PIU will continue to disseminate the grievance mechanism
- PIU to keep the complaints/suggestion mailboxes in good condition to receive the grievances that arose from the community.

- PIU to maintain an on-going reporting to the affected stakeholders in order to open a new channel for grievances.

5.4 ABANDONMENT PHASE ENGAGEMENT

PAA Project Finance assumes no responsibility for the decommissioning process. This phase refers to the decommissioning of water well and demobilisation of the irrigation equipment which will be conducted by the SAG and beneficiaries.

5.5 TOOLS

To achieve a consistent and effective stakeholder engagement programme, standardised tools need to be developed and reviewed by PAA Project Finance Project management with the approval of the SAG, for use in the engagements. The tools outlined in *Table 5.2* below will be key to stakeholder engagement in all phases of the Project, and the contents and messages shall be reviewed and approved prior to dissemination.

Table 5.2 Stakeholder Engagement Tools

Tool	Description
Project Information Booklet	• The SAG-PIU or designed entity will elaborate a booklet for the Application of the Project's Environmental and Social Regulations and Procedures. This document will be prepared in the local language and will be distributed during pre-operation phase engagements. • The booklet will provide a description of the proposed Project, the Project schedule for the engagement programme, contact details of the Project Implementation Unit (PIU), PAA Project Finance In-Country Representative or additional entity/SAG contact, and information on the grievance mechanism. • The booklet will be delivered to all the beneficiaries and will be available to the public for comments, potential concerns and grievances
Training Activities	• The Project Implementing Unit of the SAG, in collaboration with PAA Project Finance will design and conduct training on the project's environmental and social procedures.
Notice Board	• Notice boards will serve as information dissemination tools (contact details, grievance forms, educational programmes, recruitment updates, webpage link, etc.). • Notice boards will be erected at the entrance to the Implementing Unit of the SAG and PIU Office and at other agreed locations, accessible to the communities, and updated on a regular basis. • Project information will be available in local language. Wherever possible, maps or visual aids will be used to increase accessibility of the notices.
Radio Broadcast	• Local radio broadcasts will be used by the PIU to provide Project updates and information (to reach a broader audience) related to enrolment dates for trainings carried out by the educational and research institutions supporting the project.

Tool	Description
Regular Reporting to Stakeholders	• The PIU will prepare regular reports to the SAG; and in the case of issues and grievances related to the irrigation system will be transmitted to PAA Project Finance • The report shall include a summary of stakeholder engagement activities and all grievances received in the reporting period, any material deviations or non-compliances to the requirements of this SEP, planned activities for the next reporting period and any other issues of potential concern.
Focus Groups Discussions (FGD)	• Semi- structured approach for conducting engagements with different stakeholder groups for example men and elders, women with specific issues of concern and other party's non-beneficiaries from the project • The questions explored during a FGD can be grouped by specific themes (e.g. grievances, labour related issues, and livelihoods, gender issues, etc.).
Project leaflets	• The project benefits, the responsibilities, the selection criteria and the application procedure will be written in a project leaflets. The project leaflets can be obtained at the project area's key points (SAGO, municipality of Arenal and Olanchito, FENAGH, the project's local office, the SAG's website).
Complaints/Suggestion mailboxes	• The PIU will install several complaints/suggestion mailboxes at strategic points in Olanchito (such as the established Milk Collection Centres), specially to make allegations of corruption which can be approached anonymously
Stakeholder Engagement Register	• The PIU will maintain a stakeholder engagement register to plan and track engagements.

6 COMMUNITY GRIEVANCE MECHANISM

6.1 DEFINITIONS AND GOOD PRACTICE

The IFC's Good Practice Guide to addressing grievances from Project-affected communities describes a grievance as:

'a concern or complaint raised by an individual or a group within communities affected by company operations. Both concerns and complaints can result from either real or perceived impacts of a company's operations, and may be filed in the same manner and handled with the same procedure'

A Project-level grievance mechanism for affected communities is described as:

'a process for receiving, evaluating, and addressing project-related grievances from affected communities at the level of the company, or project'

The Community Grievance Mechanism should be broadly and regularly publicized, throughout the complete cycle of the project to ensure that comments, questions and grievances are appropriately channelled and registered.

6.2 PURPOSE

The Community Grievance Mechanism enables any stakeholder to make a complaint or a suggestion about the way the Project is being implemented. Grievances may take the form of specific complaints for damages/injury, concerns about routine Project activities, or perceived incidents or impacts.

The purpose of the Community Grievance Mechanism Procedure is to implement a formalised process (identification, tracking and redress) to manage complaints/grievances from communities and other local stakeholders during pre-operation and operation in a systematic and transparent manner that could potentially arise from the Irrigation Project, through the following key aspects (but not limited to):

- Writing and publicizing complaints/grievances
- Bringing them to third parties where needed
- Making the Grievance mechanism accessible
- Communicating the response and resolution to the complainants and providing feedback in a transparent manner
- Keeping good records for follow-up

In this Stakeholder Engagement Plan, the objective of PAA Project Finance is to enhance the current grievance mechanism developed by the SAG, providing structured actions to be taken into account by the pertinent

Authorities in order to give resolution and response of eventual complains/grievances that might arise from the affected stakeholders during the complete cycle of the Irrigation Project. The existing grievance mechanism will be tailored to serve the purpose of the Project and the needs of the potentially affected stakeholders including vulnerable groups.

6.3 *DETAILED GRIEVANCE PROCEDURE*

The SAG has in place a grievance mechanism that allows identifying negative attitudes with the aim to systematically transform concerns into positive experiences through an adequate response protocol. It is assumed that the Project Implementing Unit (PIU) will be in charge of managing this grievance mechanism for the Project on behalf of the SAG. The SAG grievance mechanism form, is indicated in the webpage[8], is presented below:

In addition to the webpage mentioned above, the contact details of the SAG to report any concern are indicated below:

[8] Retrieved from http://premperhn.com/sag-new/formulario-de-denuncias/

SAG - Secretaría de Agricultura y Ganadería Honduras
Colonia Loma Linda, Avenida La FAO, Bulevar Centroamérica. Tegucigalpa Honduras
Teléfono PBX: **(504) 2232-5029**
Correo electrónico: **infoagro@infoagro.hn**

Horario de atención: 9:00am a 5:00pm

Although grievance management is a responsibility of the SAG, PAA Project Finance will propose a series of actions (as a minimum) to the SAG in order to enhance the current grievance mechanism to have clear procedures that make filing grievances easy for communities with various levels of literacy and access to infrastructure. PAA Finance will also ensure that consultation on design of the mechanism provides for inclusion and participation of women in the grievance process, facilitating women's access. Trained personnel in handling gender-sensitive issues shall be part of the PIU team.

- Any person will be able to raise complaints in their own local language and anonymously. Illiterate people will be able to raise complaints verbally.
- Complaints will be received through designated access points and mechanisms:
  - The designated access points will be accessible especially for vulnerable people.

The information of physical exact location of the offices and complaint boxes will be given to Olanchito inhabitants in advance through notice boards, radio broadcast, webpage and meetings;

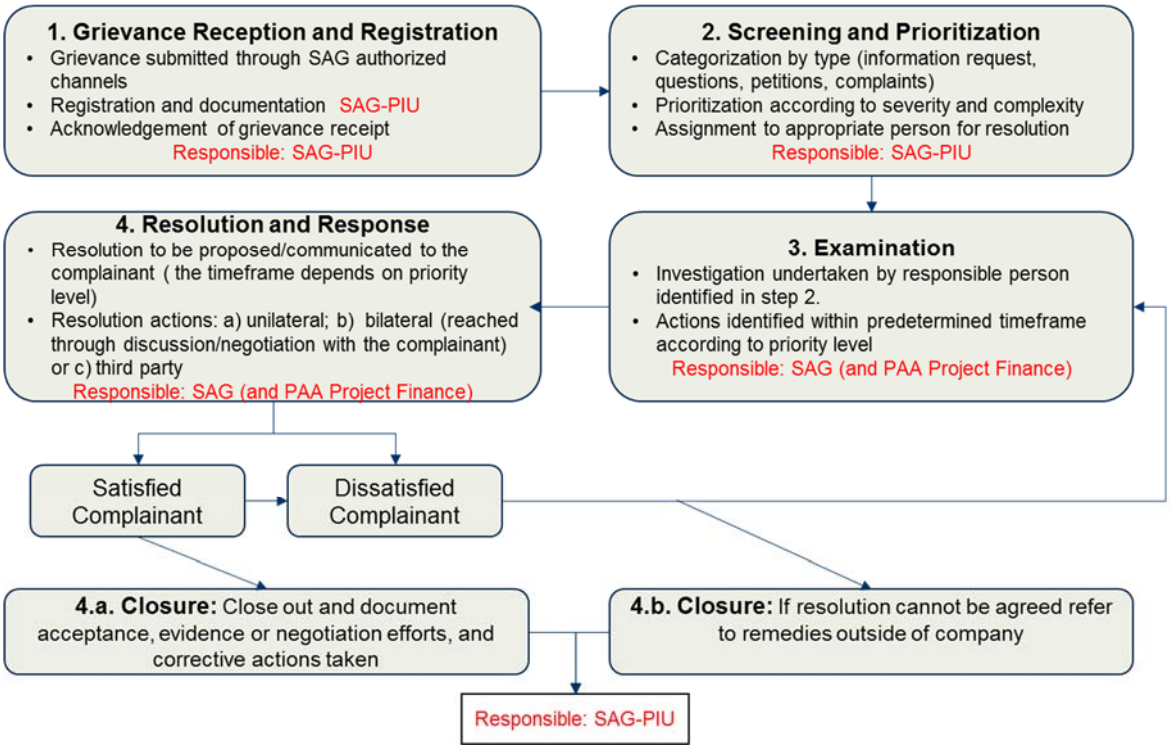
  - Face-to-face with PIU field staff;
  - By email and website;
  - By a letter;
  - Through a dedicated phone number;
  - Through complaint boxes at different locations (specially placed in the established Milk Collection Centres);
  - Through trusted third parties (such as NGOs);
  - Through traditional/local Authorities, leaders, etc.
- Upon receiving a complaint/grievance, the receptor (PIU) will explain the process with very clear timelines for the remaining steps in the procedures, and inform on how the complaint will be handled as well as the types of remedies that the SAG can, or cannot, provide. The receptor will ensure confidentiality of the complainant from the lodging of a grievance onwards. Only those directly involved in the examination process will be provided with the details. Sensitive information will only be disclosed upon users' knowledge and approval.
- Recording grievances at the time they come in will be the responsibility of the onsite personnel (PIU) who receives it at first place. A sample

Grievance Registration Form indicated in Annex C.1 shall be used to record complaints and shall be available both paper and electronically.

- Following this preliminary assessment of grievances, the SAG and PIU shall organize the process of review, validation and (if necessary) investigation of each grievance received, acknowledged, registered and provide grievance resolution in order to close out.
- The SAG-PIU shall monitor and chart the number of grievances on a weekly basis and if any complain is related to equipment installation process and technical support, this complain will be referred to the PAA Project Finance team, in order to take action to deal with the reasons behind the grievances arisen.
- A report with a summary of engagement activities and all resolved grievances shall be prepared regularly by the PIU and submitted to the SAG.

The grievance procedure in *Figure 6.1* is proposed to ensure an effective and timely response to community complaints and maintain good community and stakeholder relations, and incorporates relevant provisions in the SAG's general grievance procedure. It will be managed through the PIU during early phases of the Project, namely during pre-operation and early operation phase (until all irrigation systems are operational)

Figure 6.1 Grievance Mechanism



Source: ERM 2108

The following sections explain the procedure in detail:

6.3.1 Step 1: Grievance Receipt and Registration

Grievances or complaints shall be received through different channels and recorded by PIU and eventually PAA Project Finance in-country representative. It is also expected that grievances and complaints will be recorded during face to face meetings and FGDs as well as through webpage, mailboxes or office meetings.

In either case, the received grievances as well as the details of the complainants shall be noted down and passed on to the PIU/SAG for registration within the day of receipt. These grievances may be in written form or verbal complaints and shall be treated with equal respect. The filing of grievances shall be made easy for communities with various levels of literacy and shall be accessible and culturally appropriate (see Grievance Registration form in *Annex B.1*).

Once received, the PIU/SAG shall review and register the complaint. This activity shall entail capture of complete details of the complaint and may involve phone calls or meeting with the complainant, review of records of previous similar incidents or occurrences, any available evidence, supporting documents or statements. The details of the complaint shall be recorded in a grievance register/book/database for follow-up and future reference (see *Annex B.2*). During this process, the PIU/SAG shall also acknowledge receipt of the complaint within a standardised time period (ideally at reception) or within 12 hours and explain to the complainant the process including timelines of the remaining steps in the procedure.

6.3.2 Step 2: Screening and Prioritisation

All grievances will need to undergo some degree of screening and prioritisation. The responsible person (or grievance owner) and the nature of the examination (Step 3) will be determined by the type of grievance and the potential social risk attached to it. Prior to the start of the examination process therefore, the PIU/SAG shall establish the nature of the grievance to determine the measures needed for review and investigation. Depending on the circumstances of the complaint, various SAG-PIU units or departments may need to get involved, including PAA Project Finance team if their input is required by the SAG.

To expedite the screening process, all incoming grievances will be classified, according to their nature based on the following Stakeholder Grievance (SG) categories:

- SG 0: Request for information not directly related to the Project
- SG 1: Questions / Doubts
- SG 2: Requests / Petitions

- SG 3: Complaints

Complaints (SG 3) will be given a higher priority level and will be further classified into the following sub-categories:

- SG 3-A: Relatively minor and one-time problems
- SG 3- B: Relatively minor but repetitive problem
- SG 3- C: Significant, larger problems related to Project activities
- SG 3-D: Major claim, significant adverse impact on a larger group or several groups.
- SG 3- E: Major allegations regarding policy or procedures or legal issues

Following this preliminary assessment, the PIU/SAG will organize the process of review and investigation of each grievance received.

6.3.3 Step 3: Grievance Examination

The PIU /SAG will be designated as the central unit or person responsible for grievance evaluation and shall organize the process to validate the complaint's legitimacy and arrange for investigation of details. He/ she will determine the fate of a complaint within 48 hours of receipt; where he/she establishes that a complaint is not genuine or not related to the Project, he/she shall formally communicate the verdict to the complainant within 48 hours of receipt. If the complaint is established to be valid, the investigation process will begin and some complaints will need that the PIU/SAG units or departments and PAA Project Finance team get involved.

The investigations will involve meetings with responsible offices, dialogue over identified complaints, development of corrective actions, action time frames, and implementation of responsibilities. The PIU will document the proceedings and final communication to the complainant. The grievance evaluation/investigation process may also involve the complainant, depending on the category of complaint.

6.3.4 Step 4: Resolution and Feedback to Complainant(s)

Once complaint investigations are completed, the PIU/SAG shall draft a formal communication to the complainant, advising of findings and the outcome. He/she shall communicate the response, stipulate mutual commitments, and ask for the complainants' agreement. If the complainant is not satisfied with the resolution, or the outcome of the agreed corrective actions the response should be reviewed and if appropriate amended in light of any discussions or negotiations. If the complainant is still no satisfied, they should be free to take their grievances to a dispute resolution mechanism outside of the company grievance mechanism.

Proposed resolution actions may be of the following types:

- **Unilateral**: the PIU and SAG addresses the source of the problem directly (eg. reducing noise or dust).

- **Bilateral**: The PIU convenes a meeting with the complainant, and appropriate management levels (according to the complaint category) to reach a resolution through discussion or negotiation. As during the evaluation process, the SAG is committed to considering all the evidence and meeting with all the relevant parties, in an effort to give complainants every opportunity to present their views.

- **Third party**: Informally or through mediation.

While collating and communicating the response to the complainant, the PIU/SAG shall:

- Take photos or collect other documentary evidence to form a comprehensive record of the grievance and how it was resolved;

- Create a record of resolution internally, with the date and time it took place, and have responsible staff sign off;

- Have a meeting with the complainants to get a collective agreement to close out the claim; and

- If the issue was resolved to the satisfaction of the complainants, get a confirmation and file it along with the case documentation.

6.3.5 Step 5: Grievance Close-out and Register Update

Where the stakeholder is satisfied with the responses provided to their grievances, the specific grievances will be concluded by the SAG-PIU and the register updated to indicate as much. All correspondences will be filed and the corrective actions clearly updated against the grievances.

As stated in the previous section, if the complainant is not satisfied with the resolution, or the outcome of the agreed corrective actions, they should be free to take their grievances to a dispute resolution mechanism outside of the company grievance mechanism.

PAA Project Finance through their In-Country Representative will ensure that all grievances raised by all Project stakeholders are treated impartially, respectfully and confidentially

Table 7.1 describes the roles and responsibilities of the persons in charge to execute the irrigation project.

Table 7.1 Roles and Responsibilities with regards to stakeholder engagement and grievance management

Roles	Responsibilities	Project Phase
PAA Project Finance Manager (Madrid, Spain)	• Approve communication to relevant external interested and affected parties in line with the SEP and in close collaboration with the SAG through PIU. • Responsible for planning and delivery of the irrigation systems. • Responsible for offering training programmes to SAG technicians, with the support of PAA Project Finance In-Country Representative.	Pre-Operation
PAA Project Finance In-Country Representative	• Responsible to provide support to the SAG-PIU • As part of the support to the SAG-PIU, responsible for providing technical support to SAG representatives during pre-operation phase.. • Participation in communication and information sharing activities as per SEP • As part of the support to the SAG-PIU, responsible for addressing grievances in relation to irrigation equipment delivery	Pre-operation
SAG - Irrigation Department (responsible project representative)	• Responsible for appointment of a Project Implementation Unit (PIU) and its supervision. The PIU will be formed by a team covering the following functions: Project Director, administrative and logistics manager, agriculture and irrigation system technician consultancy and grievance management. • Responsible for appointment of the Technical Support of the SAG • Responsible for implementing, and maintaining Project programmes, including compliance with the SEP • Validation of selection criteria of potential beneficiaries by PIU.	All Phases
SAG – Project Implementing Unit (PIU) *Note: PIU will be operational during pre-operation and early operation phase). After this*	• Responsible for selecting the beneficiaries according to the defined criteria. • Responsible for organisation and delivery of beneficiaries' training. • Responsible for day-to-day implementation of the SEP and Grievance Mechanism including monitoring and • Responsible for managing grievances according to established procedure. • Responsible for providing monitoring activities of the irrigation equipment with the support of other organisations such as Milk Collection Centres or SAGO, FENAH and UMA of Olanchito	Pre-operation and partly during operation

Roles	Responsibilities	Project Phase

period the SAG will assume responsibility for engagement and grievance management	• Responsible for monitoring of the correct implementation and management of environmental and social measures related to the abandonment activities.
	• Act as the primary interface between the Project and stakeholders including:
	  • Responsible for providing technical support to beneficiaries during the irrigation equipment installation through the CRELs representatives.
	  • Providing beneficiary management and liaison as necessary to ensure successful Project outcomeEnsure to disclose planned engagement schedule to stakeholders
	• Providing support for the organisation of training on the project's environmental and social procedures for beneficiaries.
	• Prepare regular reports to the SAG
	• Responsible for maintaining a stakeholder engagement register to plan and track engagements and grievances.
	• Responsible for elaborating the booklet for the Application of the Project's Environmental and Social Regulations and Procedures and distribute to all the beneficiaries and the public during pre-operation phase engagements.
	• Ensure to implement and update the dissemination tools (the notice boards, complaints/suggestion mailbox, contact details, etc.)	

SAGO/FENAH/ UMA of Olanchito	• Responsible for monitoring the irrigation equipment in conjunction with the PIU. • Responsible for providing technical inspections	Operation
Other Project Staff and Contractors	• Understand and work within the requirements of the SEP • Attend meetings convened to discuss SEP issues when invited.	Pre-operation
Beneficiaries	• Correct use of the irrigation system, in compliance with guidelines received during the training programmes. • During the abandonment phase, the beneficiary will be responsible for the correct abandonment of the irrigation equipment and water wells.	Operation and abandonment

8 MONITORING AND REPORTING

8.1 STAKEHOLDER INVOLVEMENT IN PROJECT MONITORING

Monitoring of the irrigation equipment will be conducted by the PIU in collaboration with the SAGO, FENAH and UMA of Olanchito. Involvement of beneficiaries and project-affected stakeholders in monitoring Project implementation can assist in addressing their concerns and promote transparency. This can also empower communities as it enables them to have a role in addressing Project-related issues that affect their lives. This, in turn, strengthens relationships between the Project and its stakeholders.

Stakeholder involvement in monitoring of this Project will include the following:

- CRELs and stockbreeder's representatives will be involved in the technical inspections and monitoring of the irrigation equipment
- Involvement of affected stakeholders when selecting methods for any social surveys and in the analysis of results. Training will be conducted where needed to build capacities.
- Observations of audit activities by affected parties.
- Grievance follow-up meetings and calls with affected stakeholders in relation to installation of pumps, beneficiary selection and capacity building program.

8.2 REPORTING TO STAKEHOLDERS

The PIU will prepare regular reports to the SAG, which mainly describe as a minimum:

- Progress with implementation of the project
- Action Plans on issues that involve on-going risk to or impacts on affected stakeholders and on issues that the consultation process or grievance mechanism have identified as a concern to those stakeholders.
- A summary of engagement activities and all resolved grievances

The Performance Standards require that after completion of an environmental assessment the consultation and disclosure must continue throughout the life cycle of the project.

Additionally, other modes of reporting shall be prepared as outlined in *Table 8.1* below:

Table 8.1 Outline of Reports to Stakeholders

Report	Content	Stakeholder	Frequency
Environmental Audit Report	Evaluation of the Project's environmental and social performance	Lenders	To be defined by lenders
Monitoring Report	Evaluation of the correct implementation of the irrigation equipment	SAG	Yearly
Technical Inspections Reports	Inspections of the correct usage and maintenance of the irrigation system	PAA Project Finance, SAG, PIU	tbc
Training Reports	Training records conducted to the SAG technicians	PAA Project Finance	tbc
Progress Update Reports	Project development activities, challenges and opportunities	SAG	At agreed timelines

The internal schedule of preparation and dissemination of all formal disclosures shall be determined by the SAG-PIU and shall be communicated to PAA Project Finance.

The beneficiary responsibilities/requirements are indicated below:

- Attesting to the veracity of all documents to be included in the file for the irrigation equipment application.
- Attesting that the title deed submitted for the land where the irrigation system will be installed is free of all encumbrances, mortgages, and that they are the absolute owner of the property, as well as any other aspects of a legal nature that may affect their possession for a period of at least 10 years.
- Complying with and attesting to all the requirements demanded in the operating regulations of the agreement between the SAG and the beneficiary, which are mainly indicated below:
    - Application signed by the applicant producer.
    - Photocopy of public deed or any other title that is registered in the Property Institute of the Department to which the property to be cultivated and the irrigation equipment to be installed are ascribed.
    - Photocopy of the applicant's identity document.
    - Photocopy of the applicant's National Tax Registry (numerical RTN).
    - Proof of neighbourhood of the applicant issued by the Municipal Mayor, or their representative, for the place where the property in the application is located.
    - Investment plan or crop feasibility study that is being, or will be, carried out.
- Once the application has been approved by the Ministry of Agriculture and Livestock, the benefit fee amount must be settled.
- The beneficiary takes the responsibility for processing all permits related to their productive and commercial activity, if any.
- The beneficiary of the equipment must acquire all the usage rights for natural resources and any respective environmental permits necessary for their activity, which could include:
    - The environmental licence for the type of crop they wish to farm.
    - The water contract.
    - The permit for connecting any additional necessary equipment to the national electric power grid.
    - The permit for exploring and exploiting groundwater.
- The beneficiary shall be liable for the costs of the environmental services regarding the use of water or the corresponding environmental compensation.
- Covering all expenses for the loading, transport, and operability of the irrigation equipment from the city of delivery to its final destination (farm).
- If necessary, covering expenses for the conditioning of their water source, such as the drilling of underground water wells or the construction of a dug well near a surface water supply, in addition to all the associated accessories, materials, and other work required for the proper installation and functioning of the equipment.

- Acquiring, on their own, all the accessories or materials that are needed to install the irrigation equipment from the site of the water supply to their property, as well as that necessary for the proper functioning of the equipment.
- Providing, on their own, all fluids such as lubricants, fuel, battery acids, and anything else necessary for the installation and start up of the irrigation equipment received, as well as electric power if necessary.
- Paying the compensation, where applicable, corresponding to third parties for the use of the irrigation equipment.
- If the beneficiary producer sells or loses the equipment, they must reimburse its value to the General Treasury of the Republic, and should they fail to do so, a case must be submitted to the corresponding judicial authorities.
- Complying with the objectives and commitments established in the Conditional Donation Agreement, as well as with the technical assistance and manuals recommended for the irrigation equipment.
- Correctly using and maintaining the irrigation equipment acquired through this Conditional Donation Agreement.
- Carrying out, on their own, all the equipment and hydrant pipe installation work on the plot where the received irrigation equipment is going to operate.
- Maintaining the equipment and its components, accessories, as recommended by the manufacturer or supplier.
- Taking responsibility for any damage to the equipment due to mishandling, theft, or loss, and repairing or replacing the parts within a period of no more than 30 days after the event has been detected.
- Additionally, they authorise the Ministry of Security or another related institution to designate the SAG to take the equipment away from them if they are not using it or are misusing it. The beneficiary will be responsible for transporting the equipment to SAGO's warehouse.
- The irrigation equipment acquired through the agreement between the SAG and the beneficiary cannot be unused as this would imply the immediate termination of the equipment agreement, nor can it be sold or used as collateral for a loan with a natural person or financial entity, nor removed from the property to which it is assigned or belongs, unless this is with the approval of the SAG.
- The irrigation equipment received by the beneficiary can only be handled or operated by the beneficiary and cannot be loaned, rented or temporarily used by any persons other than the beneficiary themselves.
- The responsibility for the management of water and soil resources lies with the beneficiary. The project only intervenes in raising awareness and contributes to the improvement of the educational offering for the beneficiary to acquire the knowledge and the will to implement preventive measures aimed at preserving the sustainability of the water and soil resources.
- Allowing the monitoring of the irrigation equipment for a period of no less than 10 years, by the SAG, SAGO, FENAGH, or the Environment Unit (*Unidad de Medioambiente* or UMA) of Olanchito, in order to verify its condition and correct operation. At the same time, providing information about the crops they are managing through its operation.

- The beneficiary must authorise technical inspections by the SAG, as well as provide the information requested by the SAG on the use of the equipment and crop yields.
- The SAG may authorise the transfer of the equipment or its damaged parts for repair, outside the property of the beneficiary.
- In the event of sale of the plot or transfer of ownership of the land exploited by the irrigation equipment, its beneficiary must deliver all of the Irrigation Equipment in good working condition to the SAG, whilst being responsible for all logistics expenses, as well as any other costs generated by this. The SAG will proceed to make a decision on the equipment. If the equipment is damaged, the beneficiary is obliged to replace it for the SAG so that it can be delivered to another producer in good condition.
- In the event that the equipment is transferred to another property owned by the same beneficiary, this party must inform the SAG in order to determine the technical feasibility, attaching the relevant data on the new property that is to be exploited, whilst entering into a new agreement according to the data on that property and the adjoining areas.
- Supporting the SAG in priority actions that are decreed in support of national food security or sovereignty.

ANNEX B.1: STAKEHOLDER ENGAGEMENT ACTIVITIES DURING ESIA FOR LENDERS PREPARATION (2017)

The following are attached:

- A 1 Stockbreeders' Socialisation Minutes (7.11.2017)
- A 2 Farm visits Minutes 7 (8.11.2017)
- A 3 Hummingbird Refuge Meeting Minutes ASIDE (9.11.2017)
- A 4 Braulio Pastor Minutes (9.11.2017)
- A 5 ICF meeting in Tocoa office Minutes (10.11.2017)
- A 6 Municipal Environmental Unit UMA-Olanchito Minutes (9.11.2017)
- A 7 ICF ICF-DE 626 -2017
- A 8 SAG-ICF Honduras Letter (October 2017)
- A 9 SAG-MIAMBIENTE Letter requesting water data from Water Resources Department
- A 9bis SAG-885-2017 TO ENG. Jose Antonio Galdames
- A 10 Letter to MiAmbiente - Project Categorisation
- A 11 Letter of Response Official Letter MiAmbiente no requirement ESIA for Aguan project - DMA-1132-2017
- A 12 MiAmbiente Response (31.10.2017)
- A 13 Alto Aguan Minutes (30.08.2017)
- A6 b Summary of Aguan Visits (Nov2017)
- A14a Alto Aguan meeting Minutes - MiAmbiente DECA Tegucigalpa – Attendance List (31.08.2017)
- A14b Alto Aguan meeting Minutes - MiAmbiente DECA Tegucigalpa - Attendance List – (31.08.2017)
- A15 ICF Letter with Map of Alto Aguan beneficiaries and protected areas - Sacre Environment (August 2017)

INCLUDE MINUTES OF MEETINGS IN PDF VERSION

ANNEX B.2: STAKEHOLDER ENGAGEMENT ACTIVITIES DURING ESIA UPDATE PREPARATION (2018)

Date	*Stakeholder*	*Objetive*	*Location*	*Participants*	*Photographs of the meetings undertaken*
18/06/2018	SAG and PAA Project	• Introduction to the project • Review of field survey planning	Hotel in Olanchito	**Core team:** Antonio Losilla (Integra Ingeniería) Marío Ochoa (SAG – Subdirector) Wendy Padilla (SAG – Engineer) Anke Alvarado (CINSA – Environmental Expert) Emilio García (PAA Project - PAA Project) Mario Murillo (PAA Project – PAA Project) Daniel Alonso (ERM – Consultant) +Rafael Palacios (SAG Olanchito)	
19/06/2018	SAG and PAA Project	• Project management and government organizations involved • Selection criteria for potential beneficiaries and fees	Hotel in Olanchito	**Core team**	

Date	*Stakeholder*	*Objetive*	*Location*	*Participants*	*Photographs of the meetings undertaken*
		• Technical aspects of the project • Baseline conditions • Training to beneficiaries			
	SAGO	• Organization of SAGO • Requirements to join SAGO • Profile of members of SAGO and their farms • Crops and production • Working conditions • Water management • Land tenure	SAGO offices in Olanchito	**Core team** + Rafael Palacios (SAG Olanchito) Santos Olmany (Fiscal SAGO) Gerardo Guevara (President SAGO) Victor Ponce (Treasury SAGO)	

Date	*Stakeholder*	*Objetive*	*Location*	*Participants*	*Photographs of the meetings undertaken*
	CREL Tejeras	• Understand management of a CREL	CREL Tejeras	**Core team** +Rafael Palacios (SAG Olanchito) *Informal meeting in the CREL – no attendance list is taken. Several members of the CREL*	
	Farm owned by Jose Guadalupe Bustillo	• Confirmation water extraction methods • Visit farm of a potential beneficiary to understand farm management (livestock, crops, water, chemical products, workers, economy, etc.) • Observation of habitats	Farm #30	**Core team** +Rafael Palacios (SAG Olanchito) Jose Guadalupe Bustillo (Farmer)	
20/06/2018	PAA Project	• Stakeholders identification	Hotel in Olanchito	Emilio García (PAA Project - PAA Project)	N/A

Date	Stakeholder	Objetive	Location	Participants	Photographs of the meetings undertaken
				Mario Murillo (PAA Project – PAA Project) Daniel Alonso (ERM – Consultant)	
	CRELs	• Organization of CRELs • Requirements to join CRELs • Profile of members of CRELs and their farms • Crops and production • Working conditions • Water management • Land tenure	CREL San Jerónimo	**Core team** +Rafael Palacios (SAG Olanchito) Natividad de Jesús Vargas (President CREL San Jerónimo) Ramón Rainerio Lubina (Member CREL Superación San Marco) Marco Adilio Mejía (Member CREL Superación San Marco) Osman Fajardo (Treasury CREL Leopoldo Durán Dueñas San Patricio)	
	Farm owned by Osman Fajardo	• Confirmation water extraction methods • Visit farm of a potential benefitiary to understand farm management (livestock, crops, water, chemical products,	Farm #165	**Core team** +Rafael Palacios (SAG Olanchito) Osman Fajardo (Farmer)	

Date	Stakeholder	Objetive	Location	Participants	Photographs of the meetings undertaken
		workers, economy, etc.) • Observation of habitats			
21/06/2018	Municipality of Olanchito	• Project introduction to the members of the municipality • Description of the municipality profile: socioeconomic, land tenure, health, etc. • Water and wastewater management in the municipality	Municipality of Olanchito	**Core team (updated):** Marío Ochoa (SAG – Subdirector) Wendy Padilla (SAG – Engineer) Anke Alvarado (CINSA – Environmental Expert) Emilio García (PAA Project - PAA Project) Daniel Alonso (ERM – Consultant) **+** Rafael Palacios (SAG Olanchito) José Tomás Ponce Pozas (Major) Froylan Ruiz (Head of Department Cadastre) Manuel Rojas (Head of UMA) Yolani Baltodano (Head of Department of Governability)	

Date	*Stakeholder*	*Objetive*	*Location*	*Participants*	*Photographs of the meetings undertaken*
	Municipality of El Arenal	• Project introduction to the members of the municipality • Description of the municipality profile: socioeconomic, land tenure, health, etc. • Water and wastewater management in the municipality	Municipality of El Arenal	**Core team** **+** Rafael Palacios (SAG Olanchito) Carlos Alberto Zuñiga (Major) Juan Ramón Lago (Department Cadastre) José Díaz (UMA) Engineer Montoya (Assistant)	
22/06/2018	SENASA	• Use and management of chemical products in the agriculture / livestock sector: fertilizers, herbicides and pesticides • Types of products • Quantities and application system	SAG office in Olanchito	**Core team (updated):** Emilio García (PAA Project - PAA Project) Mario Murillo (PAA Project – PAA Project) Daniel Alonso (ERM – Consultant) + Rafael Palacios (SAG Olanchito) Angel Arteaga (SENASA) David Vallecillo (SENASA)	

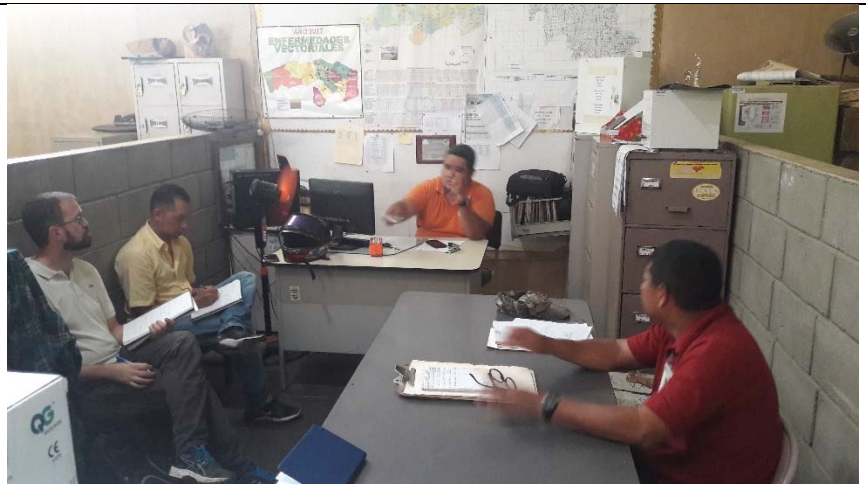
Date	*Stakeholder*	*Objetive*	*Location*	*Participants*	*Photographs of the meetings undertaken*
	INA (Instituto Nacional Agrario – Agrarian National Institute)	• Management of Cajas Rurales	SAG office in Olanchito	**Core team** **+**Rafael Palacios (SAG Olanchito) Carlos Eliseo Sánchez (Jefe Sectorial del INA en Olanchito – INA Local Lead in Olanchito)	
	Focal group: small farmers	• Socioeconomic profile: livestock, crops and production, financial conditions, profit, etc. • Working conditions • Water management • Land tenure • Expectations	CREL Salinas Gonzales	**Core team** **+**Rafael Palacios (SAG Olanchito) Nilia Zumilda Duarte (CREL Salinas Gonzales) (Farm: Los Guayacanes) José Francisco Salina Soto (CREL Salinas Gonzales) (Farm: Rancho el Jinete) Rocibel Orellana Torres (CREL Salinas Gonzales) (Farm: Finca el Mirador) Neri Elisabet Gomez (CREL Nueva Alianza) (Farm: Rancho La	

Date	Stakeholder	Objetive	Location	Participants	Photographs of the meetings undertaken
				Esperanza) and Elmer Alberto Santos Reyes (grandson of Neri and Eugenio Santos, owner) Jose Luis Hernández (CREL Nueva Alianza) (Farm: Rancho Tale)	
23/06/2018	Feria - Plan de Emprendurismo de la municipalidad de Olanchito	• Local products available in the feria	SAGO office in Olanchito	**Core team** *Informal visit – no interviews were conducted*	
	General visit to the project area	• Observation of habitats	N/A – whole project area was visited	**Core team**	N/A

Date	*Stakeholder*	*Objetive*	*Location*	*Participants*	*Photographs of the meetings undertaken*
24/06/2018	Hospital Olachito – Emergency Services	• Review of health conditions in the project area. • Vector transmission illnesses • Water consumption illnesses	Hospital Olanchito	**Core team** + Dra. Soraya Delgado	
	Farm owned by José Luis Chirinos	• Confirmation of water extraction methods • Visit farm of a potential benefitiary to understand farm management (livestock, crops, water, chemical products, workers, economy, etc.) • Observation of hábitats • Interview to worker in farm	Farm #108	**Core team** + José Luis Chirinos (farmer) Cristian Bustillos (worker)	

Date	*Stakeholder*	*Objetive*	*Location*	*Participants*	*Photographs of the meetings undertaken*
	Farm owned by Jesús Vallecillo	• Confirmation of water extraction methods • Visit farm of a potential benefitiary to understand farm management (livestock, crops, water, chemical products, workers, economy, etc.) • Observation of hábitats • Interview to worker (DOLE) in farm	Farm #128	**Core team** + Jesús Vallecillo (farmer) Marcos Tulio Zelaya (DOLE worker)	
25/06/2018	Indigenous worker	• Indigenous population in the area: location, socioeconomic profile, working conditions, conflict assessment, etc.	Aldea between Los Perritos and El Aguacate	**Core team** + Rafael Palacios (SAG Olanchito) Felix Soto (Indigenous worker)	

Date	*Stakeholder*	*Objetive*	*Location*	*Participants*	*Photographs of the meetings undertaken*
	Indigenous worker	• Indigenous population in the area: location, socioeconomic profile, working conditions, conflict assessment, etc.	Aldea between Los Perritos and El Aguacate	**Core team** + Rafael Palacios (SAG Olanchito) José Francisco Martínez (Indigenous worker)	
	AJAASPIB (Asociación de Juntas Administradoras se Sistemas de Agua del Sector Sur del Parque Nacional Pico Bonito)	• Water management	CREL Cruz Núñez	**Core team** + Rafael Palacios (SAG Olanchito) Carlos Estrada Cruz (Vicepresident AJAASPIB)	

Date	Stakeholder	Objetive	Location	Participants	Photographs of the meetings undertaken
	ASIDE and ICF	• Protected areas management: Emerald Hummingbird Wildlife Refuge in Honduras • Biodiversity • Hazards in biodiversity conversation • Interactions between irrigation project in Alto Aguan and the protected areas	Offices in Emerald Hummingbird Wildlife Refuge	**Core team** + Rafael Palacios (SAG Olanchito) Kenia Ponce (ICF) Dorian Rodríguez (Fuerzas Aéreas – Air Forces) José Luis Ramos (ASIDE)	
26/06/2018	Hospital Olachito – Health Secretary	• Review of health conditions in the project area. • Vector transmission illnesses • Water consumption illnesses • Activities conducted by Health Secretary – prevention plans and induction to the population	Hospital Olanchito	**Core team** + Marlon Banegas (Coordinador del Programa de Salud Ambiental del Municipio de Olanchito)	

Date	*Stakeholder*	*Objetive*	*Location*	*Participants*	*Photographs of the meetings undertaken*
	Farm owned by Angel Núñez – medium side farm	• Confirmation water extraction methods • Visit farm of a potential benefitiary to understand farm management (livestock, crops, water, chemical products, workers, economy, etc.) • Observation of hábitats • Interview to worker in farm	Farm #71	**Core team** + Angel Núñez (farmer) Marvin Antonio Díaz (worker)	
27/06/2018	N/A – travel to Tegucigalpa	N/A	N/A	N/A	N/A
28/06/2018	Secretary of Agriculture	• Summary and conclusions of field survey	Hotel in Tegucigalpa	**Core team** + Ing. Federico Brev (Delegate in the Secretary of Agriculture)	

Stakeholder Grievance Mechanism	
Grievance Registration Form	
Grievance Reference No:	Grievance Registration Date (dd/mm/year):
Full Name of SAG/PIU Representative and Position:	
Full Name of Complainant:	
Contact Information Please mark how you wish to be contacted (telephone, mail, e-mail).	By Telephone: _____ By Post: Please provide mailing address: _____ _____ _____ _____ By E-mail _____
Description of Grievance:	When did it happen (date and time)? What happened? Where did it happen? Who did it happen to? What is the result of the problem? Were there any witnesses? (*Continue on additional pages as required*)
Date of Grievance ----------	One time grievance (date _____) Happened more than once (how many times? _____) On-going (currently experiencing problem)
What would you like to see happen to resolve the problem?	

Signature: _____ Date: _____ Please return this form to:		
Action identified to resolve the grievance	*Date taken*	*By whom*
Complainant satisfaction with implemented action?		

ANNEX C.2: SAMPLE GRIEVANCE REGISTER LOG

No.	Grievance #	Date Received	Access point	Received by	Name of Complainant	Gender	Community/ Village of Origin	Brief Complaint/Grievance Description	Category
1	13-005-AP	23-ene-13	Municipality	XXXX	YYYY		Village A	Chicken got killed by company vehicle	

Acknowledgement date	Rapid Response by	Associated Dpt/ Contractor/Third Party	Complaint Owner	Proposed Resolution/Feedback to Complainant	Preliminary Resolution Date	Satisfied with Process (yes/no)?	If no, why not?	Conclusive Resolution Date	Satisfied with Outcome (yes/no)?	If no, why not?	Closure Date
24-Jan-13	XXX	Exploration	XXXX	Provide compensation to complainant							

ANNEX 2

ASSESSMENT OF POTENTIAL BENEFICIARIES (2017)

Nº BENEFICIAR IO	CREL	Nombre del Productor	Comunidad	Municipio	Nombre de la finca	Area (Ha)	Disponibilidad de agua para irrigación	Area disponible de riego (ha)	Tipo de Productor	Tipos de Cultivos	Cuenta con sistema de riego	Tipo de sistema con que cuenta
1	Andino Munguía	Amelia del Carmen Lozano	Calpules Aldea	Olanchito	Hda. El Guanacaste	70	Subterránea	70	Ganadero	Pasto	no	no
2	Andino Munguía	Danilo Meléndez	Calpules Aldea	Olanchito	La Cueva	56	Subterránea	56	Ganadero	Pasto	no	no
3	Andino Munguía	Darío Danilo Munguía Díaz	Calpules Aldea	Olanchito	Villa Real	21	Subterránea	21	Ganadero	Pasto	no	no
4	Andino Munguía	Dimas Omar Savillón	Calpules Aldea	Olanchito	Villa Sarahí	53		53	Ganadero	Granos Básicos, Pasto	no	no
5	Andino Munguía	Israel Munguía	Calpules Aldea	Olanchito	Villa Sandra	40	Subterránea	14	Ganadero	Pasto	no	no
6	Andino Munguía	Jairo Esaú Cárcamo Sandoval	Calpules Aldea	Olanchito	Pozo Seco	105	Subterránea	84	Ganadero	Pasto	no	no
7	Andino Munguía	Juan Emilio Munguía Meléndez	Calpules Aldea	Olanchito	Villa Ricarda	53	Subterránea	53	Ganadero	Pasto	no	no
8	Andino Munguía	Leroy Antonio Munguía Díaz	Calpules Aldea	Olanchito		56	Subterránea	56	Ganadero	Pasto	no	no
9	Andino Munguía	Leroy Antonio Munguía Puerto	Calpules Aldea	Olanchito	Los Pinos	18	Subterránea	18	Ganadero	Pasto	no	no
10	Andino Munguía	Luis Antonio Chavez	Calpules Aldea	Olanchito	Villa Nina	21	Subterránea	21	Ganadero	Pasto, Chile	no	no
11	Andino Munguía	Milton Armando Munguía	Calpules Aldea	Olanchito	Villa Ricarda	84	Subterránea	35	Ganadero	Pasto	no	no
12	Andino Munguía	Milton Emilio Munguía	Calpules Aldea	Olanchito	Villa Monserrat	46	Subterránea	35	Ganadero	Pasto	no	no
13	Andino Munguía	Tomas Dionisio Andino	Calpules Aldea	Olanchito	Villa Hermosa	84	Subterránea	56	Ganadero	Pasto	no	no
14	Armín Jerónimo Figueroa	AliRío Martínez Puerto	San Francisco	Olanchito	Santa Marta	196	Subterránea	196	Ganadero	Pasto	no	no
15	Armín Jerónimo Figueroa	Ana Alfredina Amaya	San Francisco	Olanchito	Las Amazonas	7	Subterránea	7	Ganadero	Pasto	no	no
16	Armín Jerónimo Figueroa	Cecilio Alejandro Diaz	San Francisco	Olanchito	Flor del Campo	70	Superficial	70	Ganadero	pasto	no	no
17	Armín Jerónimo Figueroa	Digna Emérita Hernández Urbin	San Francisco	Olanchito	Mango Moncho	599	Subterránea	21	Ganadero	Pasto	no	no
18	Armín Jerónimo Figueroa	Heliodoro Núñez	San Francisco	Olanchito	La Florida	140	Subterránea	14	Ganadero	pasto	no	no
19	Armín Jerónimo Figueroa	Mirian Elizabeth Zanchez Paz	San Francisco	Olanchito	Los Encinos	35	Superficial	7	Ganadero	pasto	no	no
20	Armín Jerónimo Figueroa	Walter Uyoa	Olanchito	Olanchito	Camila, Plan Grande	36	Superficial	25	Ganadero	Pasto	no	no
21	Bustillo Martínez	Camilo Bustillo	Santa Bárbara	Olanchito	Rancho Corozal	28	Subterránea	0	Ganadero	pasto	no	no
22	Bustillo Martínez	Camilo Eduardo Bustillo	Santa Bárbara	Olanchito	El Corozal	57	Subterránea	57	Ganadero	pasto	no	no
23	Bustillo Martínez	Carmen Patricia Bustillo	Santa Bárbara	Olanchito	Las Cruces	10	Subterránea	7	Ganadero	pasto	no	no
24	Bustillo Martínez	Claudia Lizeth Sosa	Carretera Punta Pa	Olanchito		35	Subterránea	35	Ganadero	pasto	no	no
25	Bustillo Martínez	Didier Martínez	Santa Bárbara	Olanchito	Hda. Guayacán	126	Subterránea	126	Ganadero	Pasto	no	no
26	Bustillo Martínez	Enil Anay Martínez	Santa Bárbara	Olanchito	Buenos Aires	61	Superficial	7	Ganadero	Pasto	si	Aspersión
27	Bustillo Martínez	Jesús Darío Martínez	Santa Bárbara	Olanchito	Villa Yeimi	17	Subterránea	17	Ganadero	Pasto	no	no
28	Bustillo Martínez	Jose Conrado Bustillo	Santa Bárbara	Olanchito	Potrero de Juan	10	Subterránea	10	Ganadero	pasto	no	no
29	Bustillo Martínez	Jose Elias Bustillo	Santa Bárbara	Olanchito	Chiripa	35		35	Ganadero	pasto	no	no
30	Bustillo Martínez	Jose Guadalupe Bustillo	Santa Bárbara	Olanchito	Rancho Crike	35	Superficial	35	Ganadero	pasto	no	no
31	Bustillo Martínez	José Román Martínez	Santa Bárbara	Olanchito	Yarely	6	Superficial	6	Ganadero	Pasto	si	Aspersión
32	Bustillo Martínez	Maria del Carmen Quezada Pag	Olanchito	Olanchito	Maria deL Carmen Queza	0	Superficial	35	Ganadero	pasto	no	no
33	Bustillo Martínez	Melvin Martínez	Santa Bárbara	Olanchito	Puntilla	91	Subterránea	7	Ganadero	pasto	no	no
34	Bustillo Martínez	Olga Martínez	Santa Bárbara	Olanchito	Villa Olga	133	Subterránea	70	Ganadero	Pasto	no	no
35	Bustillo Martínez	Ramon Armando Munguia	Santa Bárbara	Olanchito	El Aguan	35	Subterránea	35	Ganadero	pasto	no	no
36	Bustillo Martínez	Robilio Enrique Martínez	Santa Bárbara	Olanchito	Las Acacias	35	Superficial	21	Ganadero	Pasto	si	Aspersión
37	Bustillo Martínez	Ronal Arturo Molina Serrano	Santa Bárbara	Olanchito	Los Posos	84	Subterránea	84	Ganadero	pasto	no	no
38	Bustillo Martínez	Silvio Axduhal Bustillo	Santa Bárbara	Olanchito	Rancho Leyla	105	Superficial	63	Ganadero	Pasto	si	Aspersión
39	Cárcamo Martínez	Abdolio Herrera	El Ocote	Olanchito	El Puente	53	Subterránea	13	Ganadero	pasto	no	no
40	Cárcamo Martínez	Carlos Alfredo Posas Rodríguez	El Ocote	Olanchito	La Jaiba	32	Subterránea	14	Ganadero	Pasto	no	na
41	Cárcamo Martínez	Carlos Nasser	El Ocote	Olanchito	Finca Lia	7	Subterránea	7	Ganadero	Pasto	no	na
42	Cárcamo Martínez	Constantino Armando Nuñez	El Ocote	Olanchito	Las Vegas	91	Superficial	29	Agricultor y Ganadero	Pasto, Frijol y	no	na
43	Cárcamo Martínez	Dolores Jimenes	El Ocote	Olanchito	Rancho la Esperanza95	67	Subterránea	2	Ganadero	pasto	no	no
44	Cárcamo Martínez	Donaldo Ocampo	Teguajinal	Olanchito	Santa Teresa	7	Subterránea	0	Ganadero	pasto	no	no
45	Cárcamo Martínez	Exel Dilfredo Juarez	El Ocote	Olanchito	Rancho Loren	14	Subterránea	14	Ganadero	Pasto	no	na
46	Cárcamo Martínez	Filomena Martínez	El Ocote	Olanchito	La Mora	18	Subterránea	3	Ganadero	Pasto	no	na
47	Cárcamo Martínez	Guadalberto Sanchez	El Ocote	Olanchito	La Bonita	53	Subterránea	14	Ganadero	Pasto	no	no
48	Cárcamo Martínez	Hector Armando Melendez	El Ocote	Olanchito	El RosaRío	121	Subterránea	70	Agricultor y Ganadero	Pasto, Frijol y	no	na
49	Cárcamo Martínez	Hector Puerto Cárcamo	El Ocote	Olanchito	Rancho Buenos Aires	84	Subterránea	28	Ganadero	Pasto	no	na
50	Cárcamo Martínez	Ines Martínez Martínez	El Ocote	Olanchito		14	Subterránea	11	Ganadero	Pasto	no	na
51	Cárcamo Martínez	Joel Sanchez	El Ocote	Olanchito		70	Subterránea	14	Ganadero	Pasto	no	na
52	Cárcamo Martínez	Jorge Arturo Nuñez	El Ocote	Olanchito	Rancho los Cedros	109	Subterránea	109	Ganadero	Pasto	no	no
53	Cárcamo Martínez	Julio Sanchez	El Ocote	Olanchito		56	Subterránea	14	Ganadero	Pasto	no	na
54	Cárcamo Martínez	Kathy Jackeline Valdes	El Ocote	Olanchito	Angeles	1	Subterránea	1	Ganadero	Pasto	si	Aspersión
55	Cárcamo Martínez	Martha Lilian Vallecillos	El Ocote	Olanchito	La Confianza	65	Superficial	28	Ganadero	Pasto	no	na
56	Cárcamo Martínez	Melvin Omar Cano Zapata	El Ocote	Olanchito	El Corral	6	Subterránea	4	Agricultor y Ganadero	Pasto y Maiz	no	na
57	Cárcamo Martínez	Miguel Posas Rodríguez	El Ocote	Olanchito	Las Cejas	128	Subterránea	42	Ganadero	pasto	no	no
58	Cárcamo Martínez	Milton Edgardo Posas	El Ocote	Olanchito	El Paso	46	Subterránea	14	Ganadero	pasto	no	no
59	Cárcamo Martínez	Mirna Cárcamo	El Ocote	Olanchito	El Brazilete	70	Subterránea	7	Ganadero	Pasto	no	na
60	Cárcamo Martínez	Noe Antonio Solis	El Ocote	Olanchito	El RosaRío	28	Subterránea	3	Ganadero	pasto	no	no
61	Cárcamo Martínez	Rosa Acevedo	El Ocote	Olanchito	Rancho los Cascabeles	0	Superficial	7	Ganadero	pasto	no	no
62	Independiente	Miguel Angel Galeas	San Lorenzo	Olanchito	El Uno	280	Subterránea	14	Ganadero	pasto	no	no
63	CRELCA	Alejandro Martínez	Calpules Aldea	Olanchito	El Mazapan	7	Subterránea	6	Ganadero	Pasto	no	no
64	CRELCA	Jairo Ramón Romero Vallecillo	Calpules Aldea	Olanchito		6	Subterránea	6	Ganadero	Pasto	no	no
65	CRELCA	Jorge Andino	Calpules Aldea	Olanchito	Las Acacias	32	Río Calpules	32	Ganadero	Pasto	no	no
66	CRELCA	Juan R Posas	Calpules Aldea	Olanchito	Hda. Reitoca	70	Subterránea	56	Ganadero	Pasto	no	no
67	CRELCA	Julio Cesar Mejía	Calpules	Olanchito	El Eden	98	Superficial	0	Ganadero	pasto	no	no
68	CRELCA	Karla Patricia Posas Palma	Calpules Aldea	Olanchito	Soe	56	Río Calpules	56	Ganadero	Pasto	no	no
69	CRELCA	Luis Antonio Hoch Mejía	Calpules Aldea	Olanchito		140	Subterránea	70	Ganadero	Granos Básicos, Pasto	no	no
70	Cruz Nuñez	Alirio Cruz	San Marcos	Olanchito	La Laguna	42	Río San Marcos	42	Ganadero	Pasto	no	no
71	Cruz Nuñez	Angel Adan Nuñez	San Marcos	Olanchito	San Vicente	56	Subterránea	25	Ganadero	Pasto	no	no
72	Cruz Nuñez	Dilcia Cruz	San Marcos	Olanchito	La Laguna	14	Subterránea	14	Ganadero	Pasto	no	no
73	Cruz Nuñez	Ernesto Urbina Cruz	San Marcos	Olanchito		112	Río San Marcos	35	Ganadero	Pasto	no	no
74	Cruz Nuñez	Inocente Nuñez Salmerón	San Marcos	Olanchito		56	Río San Marcos	28	Ganadero	Pasto	si	Aspersión
75	Cruz Nuñez	Juan José Molina Puerto	San Marcos	Olanchito	Rancho Don Juan	98	Río San Marcos	35	Ganadero	Pasto	si	Aspersión
76	Cruz Nuñez	Leoncio Alfredo Cruz	San Marcos	Olanchito	San Lorenzo	21	Subterránea	14	Ganadero	Pasto	no	no
77	Cruz Nuñez	Leoncio Cruz	Olanchito	Olanchito	El Barracon	18	Subterránea	0	Ganadero	pasto	no	no
78	Cruz Nuñez	Manuel de Jesus Nuñez	San Marcos	Olanchito	La Estación	126	Subterránea	56	Ganadero	Pasto	no	no
79	Cruz Nuñez	Marco Antonio Cruz	San Marcos	Olanchito	La Laguna	14	Río San Marcos	14	Ganadero	Pasto	no	no

Nº BENEFICIAR IO	CREL	Nombre del Productor	Comunidad	Municipio	Nombre de la finca	Area (Ha)	Disponibilidad de agua para irrigación	Area disponible de riego (ha)	Tipo de Productor	Tipos de Cultivos	Cuenta con sistema de riego	Tipo de sistema con que cuenta
80	Cruz Nuñez	Miguel Antonio Cruz	San Marcos	Olanchito	Guayacán	70	Río San Marcos	70	Ganadero	Pasto	no	no
81	Cruz Nuñez	Nívida Argentina Cruz	San Marcos	Olanchito	Las Delicias	126	Río San Marcos	35	Ganadero	Pasto	si	Aspersión
82	Cruz Nuñez	Rigoberto Nuñez Salmerón	San Marcos	Olanchito	San Vicente	56	Río San Marcos	56	Ganadero	Pasto	no	no
83	Cruz Nuñez	Yunior Aldubin Martínez Salas	San Marcos	Olanchito	La Laguna	11	Río San Marcos	11	Ganadero	Pasto	no	no
84	Fabricio Puerto	Adalberto Paz	Puerto Escondido	Olanchito	El Paraiso	70	Subterránea	63	Ganadero	pasto	no	no
85	Fabricio Puerto	Eddy Alberto Posas Padilla	Puerto Escondido	Olanchito		154	Subterránea	7	Ganadero	Pasto	no	na
86	Fabricio Puerto	Edward Navarro	Puerto Escondido	Olanchito		126	Subterránea	4	Ganadero	Pasto	no	na
87	Fabricio Puerto	Fredy Lozano	Puerto Escondido	Olanchito	Rancho Baraja	53	Subterránea	14	Ganadero	Pasto	no	na
88	Fabricio Puerto	Hernan Calixto Posas	Puerto Escondido	Olanchito		91	Subterránea	7	Ganadero	Pasto	no	na
89	Fabricio Puerto	Hernan Posas	Puerto Escondido	Olanchito		49	Subterránea	4	Ganadero	Pasto	no	na
90	Fabricio Puerto	Jorge Alberto Melendez	Puerto Escondido	Olanchito	Villa Yesenia	41	Subterránea	7	Ganadero	Pasto	no	na
91	Fabricio Puerto	Jose Roberto Melendez	Puerto Escondido	Olanchito		35	Subterránea	2	Ganadero	Pasto	no	na
92	Fabricio Puerto	Juan Esau Sandoval	La Sabana de San C	Olanchito	San Fernando	4	Subterránea	57	Ganadero	pasto	no	no
93	Fabricio Puerto	Leonardo Miranda	Puerto Escondido	Olanchito		35	Subterránea	7	Ganadero	Pasto	no	na
94	Fabricio Puerto	Luis Alonzo Tablada	Puerto Escondido	Olanchito	El Guanacaste	32	Subterránea	18	Ganadero	Pasto	no	na
95	Fabricio Puerto	Luis Gustavo Orellana	Puerto Escondido	Olanchito	Santa Elena	7	Subterránea	7	Ganadero	Pasto	no	na
96	Fabricio Puerto	Luis Sanchez	Puerto Escondido	Olanchito		42	Subterránea	6	Ganadero	Pasto	no	na
97	Fabricio Puerto	Mario Ramon Espinoza	La Sabana de San C	Olanchito	La Pipa	161	Subterránea	161	Ganadero	pasto	no	no
98	Fabricio Puerto	Orlando Amancio Mejía	Calpules Aldea	Olanchito	Villa Nicha	35	Subterránea	161	Ganadero	pasto	no	no
99	Fabricio Puerto	Oscar Donaldo Martínez	Puerto Escondido	Olanchito	Finca el Eden	63	Superficial	14	Ganadero	pasto	no	no
100	Fabricio Puerto	Ramon Fernando Melendez Pos	Puerto Escondido	Olanchito	El corozal	51	Subterránea	1	Ganadero	Pasto	no	na
101	Fabricio Puerto	Vilfredo Lozano Avila	Puerto Escondido	Olanchito	Uchapita	67	Subterránea	63	Ganadero	Pasto	no	na
102	Heberto Chirinos Ponce	Antonio Chirinos Herrera	El Juncal	Olanchito	La Confianza	60	Subterránea	60	Ganadero	Pasto	no	na
103	Heberto Chirinos Ponce	Armando Soto Mejía	El Juncal	Olanchito	El Recreo	42	Subterránea	28	Ganadero	Pasto	no	na
104	Heberto Chirinos Ponce	Claudio Wilfredo Chirinos Herre	El Juncal	Olanchito	La Confianza	60	Subterránea	60	Ganadero	Pasto	no	na
105	Heberto Chirinos Ponce	Guerty Mariela Zelaya	El Juncal	Olanchito	Villa Guerty	56	Subterránea	35	Ganadero	Pasto	no	no
106	Heberto Chirinos Ponce	Jorge Alfonzo Zelaya	El Juncal	Olanchito	Janine	147	Subterránea	28	Ganadero	Pasto	no	na
107	Heberto Chirinos Ponce	José David Oliva	El Juncal	Olanchito		14	Subterránea	14	Ganadero	Pasto, maíz	no	no
108	Heberto Chirinos Ponce	José Luis Chirinos	El Juncal	Olanchito	El Potrillo	21	Subterránea	21	Ganadero	Pasto, maíz	no	no
109	Heberto Chirinos Ponce	José Román Ponce	El Juncal	Olanchito	Dunia	20	Superficial	2	Ganadero	Granos Básicos, Pasto	no	no
110	Heberto Chirinos Ponce	Martha Reyes	El Juncal	Olanchito		56	Subterránea	7	Ganadero	Pasto, maíz	si	Aspersión
111	Heberto Chirinos Ponce	Orfa Herrera	El Juncal	Olanchito		28	Subterránea	28	Ganadero	Pasto	no	no
112	Heberto Chirinos Ponce	Salma Marina Acosta Mejía	El Juncal	Olanchito	San Ignacio	18	Subterránea	7	Ganadero	Pasto	no	na
113	Heberto Chirinos Ponce	Victor Ramiro Cárcamo	El Jacal	Olanchito	El Marañón	44	Superficial	44	Ganadero	pasto	no	no
114	Heberto Chirinos Ponce	Victor Zelaya Ponce	El Juncal	Olanchito	La Coronada	11	Superficial	11	Agricultor y Ganadero	Pasto, maíz, Plátano	no	no
115	Heberto Chirinos Ponce	Leopoldo Duron	El Juncal	Olanchito		84	Subterránea	8	Ganadero	Pasto	no	na
116	Independiente	Alejandro Leonidas Puerto	El Nance	Olanchito	El Spray	22	Subterránea	22	Ganadero	pasto	no	no
117	Independiente	Anibal Alberto Nuñez Soto	La Estación, San Lo	Olanchito	La Estación	42	Subterránea	42	Ganadero	Pasto	no	no
118	Independiente	Arcadio Alfredo Cano	Teguajinal	Olanchito	La Cuarta	28	Subterránea	2	Ganadero	pasto	no	no
119	Independiente	Arlen Jeovany Vargas	El Nance	Olanchito	Sole	7	Subterránea	91	Ganadero	pasto	no	no
120	Independiente	Bernardo Virgilio Euceda	Olanchito	Olanchito	0	98	Subterránea	1	Ganadero	pasto	no	no
121	Independiente	Blas Odilio Dueñas Durán	El Nance	Olanchito	El Tigre	21	Subterránea	21	Ganadero	Pasto	no	no
122	Independiente	Dilcia Rely Jimenez de Mejía	Olanchito	Olanchito	Telica	73	Subterránea	70	Ganadero	Pasto	no	no
123	Independiente	Eduardo Enrique Posas	El Teoguajical	Olanchito	La Ceja	18	Subterránea	4	Ganadero	pasto	no	no
124	Independiente	Edwin Joel Sanchez	Teguajinal	Olanchito	La Galana	20	Subterránea	14	Ganadero	Pasto	no	na
125	Independiente	Elio Miguel Lozano	El Nance	Olanchito	Culuco	2	Superficial	2	Ganadero	pasto	no	no
126	Independiente	Heriberto Edgardo alfaro	Campo Cayo	Arenal	La Estancia	140	Río Aguan	91	Ganadero	Pasto	no	no
127	Independiente	Hernan Asuncion Reyes	El Nance	Olanchito	Villa Sarahí	28	Subterránea	28	Ganadero	pasto	no	no
128	Independiente	Jesus Vallecillo	El Nance	Olanchito	San Lorenzo	18	Superficial	18	Ganadero	pasto	no	no
129	Independiente	Joaquina Gonzales Núñez	El Barranco	Olanchito	San Ramón	105	Subterránea	70	Ganadero	Pasto	no	no
130	Independiente	Jorge Antonio Padilla	El Teoguajical	Olanchito	El Mulato	8	Subterránea	20	Ganadero	pasto	no	no
131	Independiente	Jorge Armando Puerto	El Nance	Olanchito	El Spray	17	Subterránea	17	Ganadero	pasto	no	no
132	Independiente	José Luis Galeas Puerto	San José	Olanchito	San José	35	Subterránea	7	Ganadero	Pasto	no	no
133	Independiente	Jose Miguel Angel Romero	Calpules Aldea	Olanchito	Villa Digna	70	Subterránea	42	Ganadero	Pasto	si	Aspersión
134	Independiente	José Nahúm Puerto	Santa Bárbara	Olanchito	Villa Raquel	7	Superficial	7	Ganadero	Pasto	si	Aspersión
135	Independiente	Jose Wilfredo Romero	Olanchito	Olanchito	Villa Elena	98	Subterránea	11	Ganadero	pasto	no	no
136	Independiente	Juan Lino Oseguera	Santa Bárbara	Olanchito	El Paso	30	Subterránea	0	Ganadero	pasto	no	no
137	Independiente	Ligia Bustillo	Santa Bárbara	Olanchito	La Flor	13	Subterránea	13	Ganadero	Pasto	no	no
138	Independiente	Luis Enrique Cárcamo		Olanchito	Rancho Colibri	86	Ambos	86	Ganadero	Maiz,Sorgo M	si	Aspersión
139	Independiente	Manuel de Jesus Ocampo	El Patrono	Olanchito	Miraflores	70	Superficial	0	Ganadero	pasto	no	no
140	Independiente	Maria Beatriz Santos Melendez	Macoa	Olanchito	mis lagunas	28	Subterránea	28	Ganadero	pasto	no	no
141	Independiente	Maria Eugenia Cárcamo Martín	Ocaciones	Olanchito	El Zapote	95	Ambos	18	Agricultor y Ganadero	Pastos y cere	no	
142	Independiente	Mario Adolfo Ocampo Bustillo	San Jerónimo	Olanchito	San Jerónimo	29	Subterránea	29	Ganadero	Pasto	no	no
143	Independiente	Mario Anibal Gonzales Flores	Olanchito	Olanchito	Palo Verde	175	Subterránea	175	Ganadero	pasto	no	no
144	Independiente	Mario Ramón Martínez Gonzale	San Francisco	Olanchito	Finca El Encanto	88	Subterránea	70	Agricultor y Ganadero	Granos Básicos, Pasto	no	no
145	Independiente	Marvin Hernández	El Nance	Olanchito	La Mulera	28	Subterránea	11	Ganadero	pasto	no	no
146	Independiente	Maximino Martínez	Santa Bárbara	Olanchito	Finca Guayacán	133	Subterránea	70	Ganadero	Pasto	no	no
147	Independiente	Melvin Martínez	Arenal	Olanchito	Puntilla	91	Subterránea	0	Ganadero	pasto	no	no
148	Independiente	Miguel Angel Galeas Puerto	El Ocote	Olanchito	RosaRío	280	Subterránea	21	Agricultor y Ganadero	Pasto, sorgo y	no	na
149	Independiente	Miguel Omar Ocampo	El Nance	Olanchito	San Gerónimo	14	Subterránea	14	Ganadero	Pasto	no	no
150	Independiente	Milexi Rodríguez	El Nance	Olanchito	El Spray	10	Subterránea	10	Ganadero	pasto	no	no
151	Independiente	Milton Armando Munguía	Calpules Aldea	Olanchito	Villa Monserrat	42	Subterránea	11	Ganadero	Pasto	no	no
152	Independiente	Milton Puerto	Santa Bárbara	Olanchito	Finca Buenos Aires	74	Superficial	14	Ganadero	Pasto	no	no
153	Independiente	Nelson Adalberto Flores	San Jerónimo	Olanchito	Villa Hermosa	25	Subterránea	25	Ganadero	Pasto	no	no
154	Independiente	Odin Alain Sanchez Posas	Teguajinal	Olanchito	La Roca	14	Superficial	14	Ganadero	pasto	no	no
155	Independiente	Ricardo Arturo Cruz Navarro	Aldea el Chaparral	Olanchito	El Dorado	123	Subterránea	14	Agricultor y Ganadero	sorgo y maiz	no	
156	Independiente	Sinia Yumisa Puerto Rosales	La Chorrera	Olanchito	Rancho San Vicente	35	Subterránea	14	Ganadero	Pasto	no	no
157	Independiente	Tomas Obdulio Nuñez	Carretera hacia Zap	Olanchito	Rancho El Mirador	15		15	Agricultor y Ganadero		no	
158	Independiente	Tulio M Dueñas	El Nance	Olanchito	La Ceiba	8	Subterránea	14	Ganadero	pasto	no	no

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159	Independiente	Yemil Eduardo Flores	San Jerónimo	Olanchito	Hacienda La Bendición	70	Subterránea	70	Ganadero	Pasto	no	no
160	Leopoldo Duran Dueñas	Asteria Nuñez Nuñez	San Patricio	Olanchito	Las Campiñas	91	Subterránea	11	Ganadero	Pasto	no	no
161	Leopoldo Duran Dueñas	CarlosRoberto Puerto Fúnez	San Patricio	Olanchito	La Esperanza	42	Subterránea	11	Ganadero	Pasto	no	no
162	Leopoldo Duran Dueñas	Derly Liliana Moya Nuñez	San Patricio	Olanchito	La Compañía	55	Subterránea	11	Ganadero	Pasto	no	no
163	Leopoldo Duran Dueñas	Edin Leobigildo Cárcamo Soto	San Patricio	Olanchito	San Patricio	91	Subterránea	4	Ganadero	Pasto	no	na
164	Leopoldo Duran Dueñas	Leopoldo Duran Dueñas	San Patricio	Olanchito	San Patricio	378	Superficial	11	Ganadero	Pasto	no	na
165	Leopoldo Duran Dueñas	Osman Fajardo/ Matilda Merce	San Patricio	Olanchito	Villa Massielle	140	Subterránea	35	Ganadero	Pasto	no	na
166	Martínez Hernández	Alirio Salatiel Martínez Orellana	Maloa	Olanchito	Rancho Texas	24	Subterránea	7	Ganadero	Pasto	no	na
167	Martínez Lobo	Adan Antonio Quezada	Santa Cruz Arenal	Olanchito	Aguan Ariiba	84	Subterránea	21	Ganadero	Pasto	no	na
168	Martínez Lobo	Allan Vicente Puerto	Santa Bárbara	Olanchito	Villa Paty	63	Subterránea	4	Ganadero	pasto	no	no
169	Martínez Lobo	Danilo Antonio Lozano	Santa Cruz Arenal	Olanchito	El Coyol	42	Subterránea	7	Ganadero	Pasto	no	na
170	Martínez Lobo	Ernesto Urbina	Santa Cruz Arenal	Yoro	Torre Fuerte	0	Superficial	0	Ganadero	pasto	no	no
171	Martínez Lobo	Francisco Fuentes	Santa Cruz	Yoro	El Encanto	35	Subterránea	0	Ganadero	pasto	no	no
172	Martínez Lobo	Gilda Araceli Fuentes	Santa Cruz Arenal	Yoro	Araceli	28	Superficial	6	Ganadero	pasto	no	no
173	Martínez Lobo	Jorge Ologorio Ramos	Tierra Blanca	Yoro	Casa Blanca	48	Superficial	35	Ganadero	pasto	no	no
174	Martínez Lobo	Juan Ramon Salmeron	Santa Cruz Arenal	Yoro	Rancho Timon	0	Subterránea	0	Ganadero	pasto	no	no
175	Martínez Lobo	Juana Deysi Martínez Nuñez	Santa Cruz Arenal	Olanchito	El Coyol	56	Subterránea	11	Agricultor y Ganadero	sacate de cor	no	na
176	Martínez Lobo	Juana Dolores Lozano	Santa Cruz	Arenal	INDIMAR	7	Río Aguan	7	Ganadero	Pasto	no	no
177	Martínez Lobo	Julio Lazo Murillo	Santa Cruz Arenal	Yoro	La Vega	3	Superficial	3	Ganadero	pasto	no	no
178	Martínez Lobo	Luis Alonzo Rodríguez	Santa Cruz Arenal	Yoro	Rancho Bonito	66	Subterránea	0	Ganadero	pasto	no	no
179	Martínez Lobo	Luis Roberto Reyes	Arenal	Olanchito	Villa Cori	0	Subterránea	0	Ganadero	pasto	no	no
180	Martínez Lobo	Marcio Anibal Lozano	Santa Cruz Arenal	Olanchito	Los Platanares	84	Subterránea	14	Ganadero	Pasto	no	na
181	Martínez Lobo	Marcio Fuentes	Santa Cruz Arenal	Yoro	Villa Franci	0	Subterránea	0	Ganadero	pasto	no	no
182	Martínez Lobo	Nelson Efrain Fuentes	El Barranco	Olanchito	Juinete	0	Superficial	0	Ganadero	pasto	no	no
183	Martínez Lobo	Oscar Amilcar Lobo Cruz	Santa Cruz	Arenal	El Chile	118	Subterránea	42	Ganadero	Pasto	no	no
184	Martínez Lobo	Rafael Landaverde	Santa Cruz	Arenal	Fortaleza	71	Subterránea	70	Ganadero	Pasto	no	no
185	Martínez Lobo	Telmo Orlando Fuentes	Santa Cruz Arenal	Yoro	Miramar	9	Subterránea	8	Ganadero	pasto	no	no
186	Mejía Rodríguez	Adan Ernesto Pineda	La Envidia	Olanchito	Rexx	35	Superficial	18	Ganadero	pasto	no	no
187	Mejía Rodríguez	Cesar Emilson Diaz Martínez	La Envidia	Olanchito	Finca Emily	44	Subterránea	44	Ganadero	Pasto	no	na
188	Mejía Rodríguez	Delmy Yolanda Martínez	La Envidia	Olanchito	**********	1	Subterránea	1	Ganadero	Pasto	no	na
189	Mejía Rodríguez	Difredo HilaRío Romero	La Envidia	Olanchito	La Esperanza	70	Subterránea	70	Ganadero	pasto	no	no
190	Mejía Rodríguez	Enil Osmin Cárcamo	La Envidia	Olanchito	Monterreal Serrano	70	Subterránea	35	Ganadero	Pasto	no	na
191	Mejía Rodríguez	Julio Cesar Mejía Diaz	La Envidia	Olanchito	El Paraiso	105	Subterránea	95	Ganadero	Pasto	no	na
192	Mejía Rodríguez	Leila Mariela Ochoa Gonzales	La Envidia	Olanchito	Finca Leyla	42	Subterránea	21	Ganadero	Pasto	no	na
193	Mejía Rodríguez	Luis Enrique Meza Romero	La Envidia	Olanchito	La Bendicion	42	Subterránea	11	Ganadero	Pasto	no	na
194	Mejía Rodríguez	Marlen Susana Diaz	La Envidia	Olanchito	Marx	18	Superficial	18	Ganadero	pasto	no	no
195	Mejía Rodríguez	Oscar Armando Cano	La Envidia	Olanchito	El Triangulo	21	Superficial	21	Ganadero	pasto	no	no
196	Mejía Rodríguez	Ramon Concepcion Cárcamo	La Envidia	Olanchito	Campo Zoyo	17	Superficial	70	Ganadero	pasto	no	no
197	Mejía Rodríguez	Ramon Heriberto Murillo	La Envidia	Olanchito	Villa Mary	55	Superficial	18	Ganadero	pasto	no	no
198	Mejía Rodríguez	Santos de Olivane Alvarado Zap	La Envidia	Olanchito	Los Tres Potrillos	112	Subterránea	35	Ganadero	Pasto	no	na
199	Puerto Lozano	Danilo Salomón Estrada Machig	San Jerónimo	Olanchito	La Vega	27	Subterránea	27	Ganadero	Pasto	si	Aspersión
200	Puerto Lozano	Elio Manuel Ocampo	San Jerónimo	Olanchito	Rancho La Vega	14	Río Aguan	14	Ganadero	Pasto	no	no
201	Puerto Lozano	Enirson Arnoldo Fúnez Lozano	San Jerónimo	Olanchito	Brisas del Aguan	56	Subterránea	28	Ganadero	Granos Básicos, Pasto	si	Aspersión
202	Puerto Lozano	Evelio Martínez	San Jerónimo	Olanchito	Culuco	53	Subterránea	12	Ganadero	pasto	no	no
203	Puerto Lozano	Fco Javier Funes Ortega	San Jerónimo	Olanchito	Los Hermanos	13	Río San Marcos	4	Ganadero	pasto	no	no
204	Puerto Lozano	Jeronimo Hernández	San Jerónimo	Olanchito	Villa Ana	39	Superficial	28	Ganadero	pasto	no	no
205	Puerto Lozano	José Armando Lozano Puerto	San Jerónimo	Olanchito	Rancho Yina	56	Superficial	21	Ganadero	Pasto	no	no
206	Puerto Lozano	Juan Ramón Vargas	San Jerónimo	Olanchito	Mira Playa	56	Subterránea	8	Ganadero	Pasto	no	no
207	Puerto Lozano	Julio Cesar Bustillo	San Jerónimo	Olanchito	Culuco	39	Superficial	14	Ganadero	pasto	si	si
208	Puerto Lozano	Natividad vargas	San Jerónimo	Olanchito	El Chaguite	42	Subterránea	21	Ganadero	Pasto	no	no
209	Puerto Lozano	Oscar René Bertrand	San Jerónimo	Olanchito	Los Profesores	35	Superficial	14	Ganadero	Pasto	si	Aspersión
210	Puerto Lozano	Ramón Ulises Puerto	San Jerónimo	Olanchito	La Bodega	39	Subterránea	39	Ganadero	Pasto	no	no
211	Puerto Lozano	Reina Puerto	San Jerónimo	Olanchito	Guaracan	8	Subterránea	8	Ganadero	pasto	no	no
212	Puerto Lozano	Roger Puerto Turcios	San Jerónimo	Olanchito	Puerto Alegre	117	Subterránea	28	Ganadero	Pasto	no	no
213	Salinas Gonzales	Constantino Valeriano Gonzale	Coyoles aldea	Olanchito	El Bunker	18	Subterránea	18	Ganadero	Pasto	si	Aspersión
214	Salinas Gonzales	Dilia Zumilda Duarte	Coyoles aldea	Olanchito	Los Guayacones	21	Superficial	3	Ganadero	pasto	no	no
215	Salinas Gonzales	Edman Orlando Zelaya Martíne	Coyoles aldea	Olanchito	San Luis	70	Superficial	7	Ganadero	Pasto	no	no
216	Salinas Gonzales	Jesus Reyes Martínez	Coyoles aldea	Olanchito	Rancho Geisy	28	Subterránea	28	Ganadero	pasto	no	si
217	Salinas Gonzales	Jhimy Armando Zelaya	Coyoles aldea	Olanchito	Rancho Alegre	70	Subterránea	4	Ganadero	Pasto	no	no
218	Salinas Gonzales	José Orlando Mejía	Coyoles aldea	Olanchito	El Tanque	8	Superficial	8	Ganadero	Pasto	no	no
219	Salinas Gonzales	Kidia Valessa Zelaya Martínez	Coyoles aldea	Olanchito	Agua Blanca	43	Subterránea	4	Ganadero	Pasto	no	no
220	Salinas Gonzales	Osman Renan Salinas Puerto	Coyoles aldea	Olanchito	Rancho El Limon	42	Superficial	4	Ganadero	pasto	si	si
221	Salinas Gonzales	Selvin Orlando Vargas	Coyoles aldea	Olanchito	El Paraiso	49	Superficial	21	Ganadero	Pasto	no	no
222	Salinas Gonzales	Victor Gonzales	Coyoles aldea	Olanchito	Victoria	203	Subterránea	203	Ganadero	pasto	no	no
223	Salinas Gonzales	Francisco Salinas	Coyoles	Olanchito		84	Subterránea	7	Ganadero	Pasto	no	na
224	Salinas Gonzales	German Aguirre Orellana	Coyoles	Olanchito		42	Subterránea	7	Ganadero	Pasto	no	na
225	Salinas Gonzales	Gloria Gonzales	Coyoles	Olanchito		42	Subterránea	7	Ganadero	Pasto	no	na

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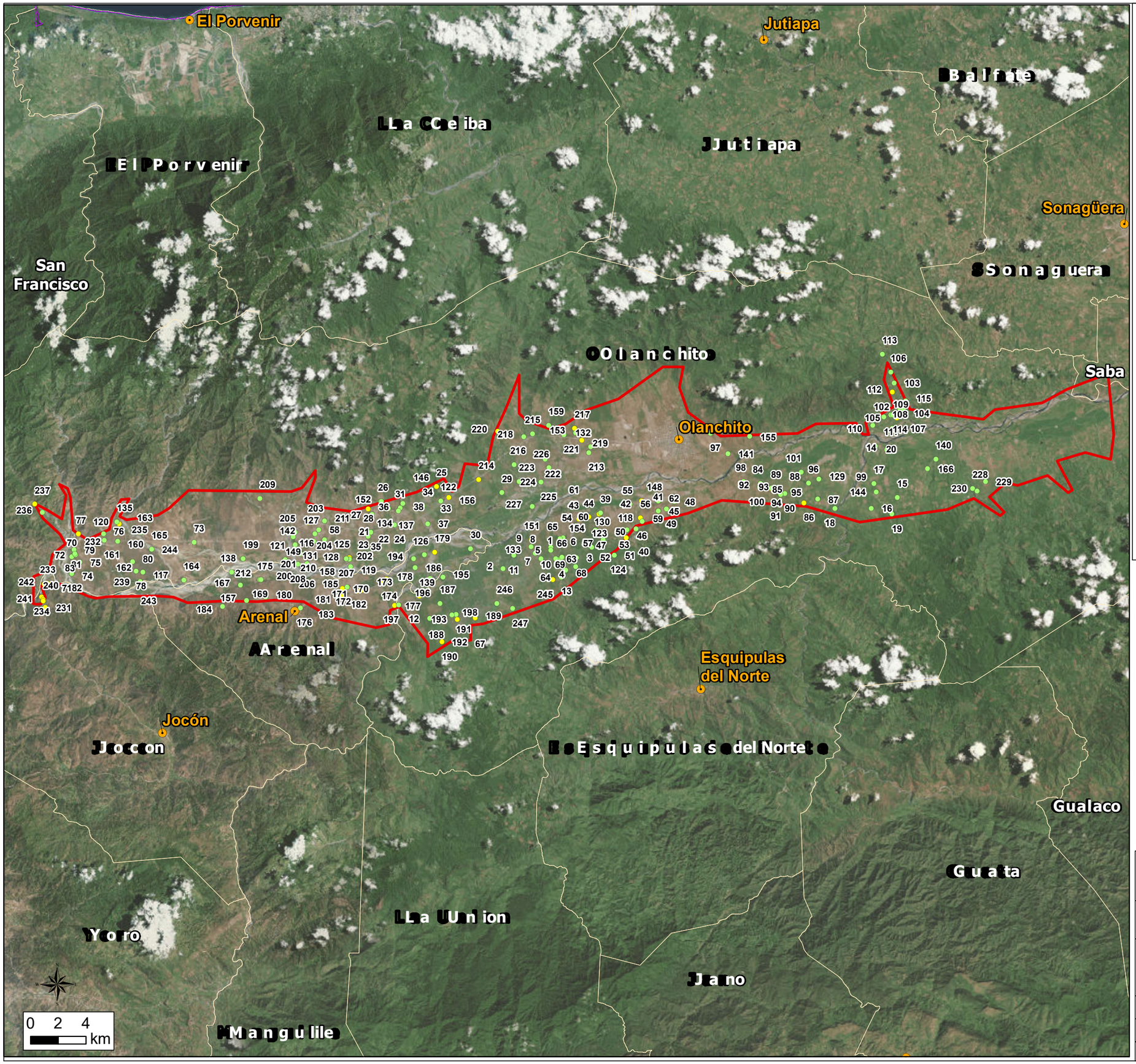
226	Salinas Gonzales	Jose Ricardo Ramos	Coyoles	Olanchito		56	Subterránea	7	Ganadero	Pasto	no	na
227	Salinas Gonzales	Luis Alonzo Rosales	Coyoles	Olanchito		70	Subterránea	14	Ganadero	Pasto	no	na
228	Salvador Figueroa	Armando Sosa	El Bambú	Olanchito	Unión de Hermanos	35	Río Cahuaca	35	Ganadero	Pasto	no	no
229	Salvador Figueroa	José Nicolas Fúnez Tejada	El Bambú	Olanchito	El Mango	140	Subterránea	53	Agricultor y Ganadero	Palma, Pasto	no	no
230	Salvador Figueroa	Wilfredo Sosa	El Bambú	Olanchito	Rancho La Concepción	21	Subterránea	21	Ganadero	Pasto	no	no
231	Superación	Nelson Darío Navarro Aquino	Río Abajo	Jocon	Rancho Nacho	21	Superficial	4	ganadero	Sorgo	si	tiene abunda
232	Superación	Carlos Humberto Urbina Cruz	Río Abajo	Jocon	La Concepción	7	Ambos	0	Agricultor y Ganadero	maiz,frijol, sa	no	
233	Superación	Jorge Enrique Urbina Cruz	Río Abajo	Jocon	La Concepción	19	Superficial	19	Agricultor y Ganadero	leche,sandia,	no	
234	Superación	Victor Manuel Puerto Suazo	Las Delicias, San M	Olanchito	Los Tres Hermanos	0	Subterránea	21	Ganadero	Pasto	no	
235	Superación	Carlos Alberto Bourdeth	Las Delicias, San M	Olanchito	Villa Lala	7	Subterránea	7	Ganadero	Pasto	no	
236	Superación	Jose Antonio Valle Urbina	Las Delicias, San M	Olanchito	El Sauce	84	Subterránea	7	Ganadero	Pasto	no	
237	Superación	Manuel Santiago Murillo Contr	Las Delicias, San M	Olanchito		3	Subterránea	3	Ganadero	Pasto	no	
238	Superación	Enil Josue Murillo Contreras	Las Delicias, San M	Olanchito	Los Olivos	21	Subterránea	21	Ganadero	Pasto	no	
239	Superación	Marco Antonio Mejía Perez	Las Delicias, San M	Olanchito	La Estación	15	Subterránea	15	Ganadero	Pasto	no	
240	Superación	Marco Antonio Urbina Cruz	Las Delicias, San M	Olanchito	Las Brisas	42	Subterránea	42	Ganadero	Pasto	no	
241	Superación	Adilio Cruz Salmeron	Las Delicias, San M	Olanchito	Río Abajo	4	Subterránea	4	Ganadero	Pasto	no	
242	Superación	Carlos Roberto Urbina	Las Delicias, San M	Olanchito	Las Delicias	70	Subterránea	70	Ganadero	Pasto	no	
243	Superación	Cesar Agusto Romero Arteaga	Las Delicias, San M	Olanchito	Estación	21	Subterránea	21	Agricultor y Ganadero	Pasto	no	
244	Superación	Ramon Reynerio Urbina Sandov	Las Delicias, San M	Olanchito	Rancho Victoria	0	Subterránea	7	Ganadero	Pasto	no	no
245	Andino Munguía	Abel Posas	Calpules Aldea	Olanchito	Piñon	39	Ambos	39	Ganadero	Pasto	no	no
246	Independiente	Nora Azucena Galindo Lozano	Nombre de Jesus	Olanchito	Los 4 Hermanos	130	Superficial	130	Ganadero	Pasto	no	no
247	Andino Munguía	Carlos Darío Romero	Calpules Aldea	Olanchito	Casa Blanca	11	Superficial	11	Ganadero	Pasto	no	no
248	Andino Munguía	Emil Edgardo Martinez	Calpules Aldea	Olanchito	Agua Blanca	28	Subterranea	28	Ganadero	Pasto	no	no
249	Andino Munguía	Carlos alberto Melendez	Calpules Aldea	Olanchito	Agua Blanca	38	Subterranea	38	Agricultor y Ganadero	Pasto y Maiz	no	no
250	Andino Munguía	Pablo Antonio Melendez	Calpules Aldea	Olanchito	El Higuero	21	Subterranea	21	Agricultor y Ganadero	Pasto y Maiz	no	no
251	Independiente	Jorge Antonio Munguia Melend	Calpules Aldea	Olanchito	Hacienda Jalisco	14	Subterranea	14	Ganadero	Pasto	no	no
252	CRELCA	Concepción	Calpules Aldea	Olanchito	El Cabloal	21	Ambos	21	Ganadero	Pasto	no	no
253	CRELCA	Jose leonardo Hernandez Andin	Calpules Aldea	Olanchito	Brazilete	11	Subterranea	11	Ganadero	Pasto	no	no
254	CRELCA	Julio Melendez	Calpules Aldea	Olanchito	El Heredero	27	Ambos	27	Ganadero	Pasto		no
255	CRELCA	Calpules Aldea	Calpules Aldea	Olanchito	El Mango	35	Ambos	14	Agricultor y Ganadero	maiz, pasto	no	no
256	Mejía Rodríguez	la Envidia	Calpules Aldea	Olanchito	Villa El Carmen	35	Ambos	14	Agricultor y Ganadero	Pasto	no	no
257	Independiente	Ana Olinda Mejía Puerto	San Jose Aldea	Olanchito	Cucapa	70	Ambos	70	Agricultor y Ganadero	Pasto	no	no
258	Mejía Rodríguez	David Antonio Funez Mejia	La Envidia		los Toloas	21	Ambos	21	Agricultor y Ganadero	Pasto	no	no
259	Independiente	Luis Martinez	Tejeras	Olanchito		0	Subterranea	0	Ganadero	Pasto	no	no
260	Bustillo Martínez	Saul Bustillo	Tejeras	Olanchito	Local del creel	1	Ambos	1	Ganadero	Pasto	si	Aspersión
261	Bustillo Martínez	Basilio Bustillo	Santa Bárbara	Olanchito	El Higuero	4	Subterranea	4	Ganadero	Pasto	no	no
262	Bustillo Martínez	Jose Andres Lozano	Santa Bárbara	Olanchito	Rancho Lucita	26	Subterranea	26	Ganadero	Pasto	no	no
263	Bustillo Martínez	Juan Blas Puerto	Santa Bárbara	Olanchito	Villa Zoila	28	Superficial	28	Ganadero	Pasto	no	no
264	Bustillo Martínez	Amilcar Reyes	Santa Bárbara	Olanchito	Rancho Aguan	49	Superficial	49	Ganadero	Pasto	no	no
265	Bustillo Martínez	Walter Martinez Trochez	Tejeras,Olanchito	Olanchito	Rancho Norteño	32	Superficial	32	Ganadero	Pasto	no	no
266	Bustillo Martínez	Miguel Angel Galeas Puerto	Tejeras,Olanchito	Olanchito	Rancho Galeas	36	Ambos	14	Ganadero	Pasto	si	no
267	Bustillo Martínez	Irene Martinez	Santa Bárbara	Olanchito	Brisas de Aguan	56	Ambos	56	Ganadero	Pasto	no	no
268	Bustillo Martínez	Carmen Gerardina Martinez	Santa Bárbara	Olanchito	Tolondron	84	Ambos	4	Ganadero	Pasto	si	no
269	Bustillo Martínez	Juan Blas Bustillo	Tacualtuste	Olanchito	Angelica	25	Subterranea	21	Ganadero	Pasto	si	no
270	Bustillo Martínez	Jose Ramon Rosales	Santa Bárbara	Olanchito	El tres de vasto	56	Superficial	35	Agricultor y Ganadero	Pasto y Maiz	no	no
271	Bustillo Martínez	Guillermo Francisco Florea Bust	Santa Bárbara	Olanchito	La Ceiba	21	Ambos	21	Agricultor y Ganadero	Pasto	no	no
272	Independiente	Milton Jesus Puerto Oseguera	San Juan	Olanchito	Las Bujajas	175	Ambos	105	Agricultor y Ganadero	Pasto	Si	no
273	Cruz Nuñez	Denis Omar Garcia Puerto	San Marcos	Olanchito	Rio Chiquito	70	Ambos	18	Ganadero	Pasto	no	no
274	Cruz Nuñez	Carlos Alberto Estrada Calbatos	San Marcos	Olanchito	paso de rio San Marcos a	35	Superficial	28	Agricultor y Ganadero	Pasto	si	no
275	Cruz Nuñez	Lauro Nuñez	San Marcos	Olanchito	Rio Chiquito	105	Superficial	28	Ganadero	Pasto	si	no
276	Cruz Nuñez	Melvin Urbina Nuñez	San Marcos	Olanchito	Rio Aguacate	140	Superficial	18	Ganadero	Pasto	no	no
277	Cruz Nuñez	Jose Antonio Salas	San Marcos	Olanchito	Las Flores	196	Ambos	35	Ganadero	Pasto	si	no
278	Armín Jerónimo Figueroa	Carlos Urribiera	San Francisco	Olanchito	EL Bosque	28	Ambos	8	Agricultor y Ganadero	Pasto	no	no
279	Armín Jerónimo Figueroa	Roger Dario Nuñez	San Francisco	Olanchito	Cantarranas	28	Subterranea	28	Ganadero	Pasto	no	no
280	Armín Jerónimo Figueroa	Jairo Cruz	San Francisco	Olanchito	La permuta	70	Subterranea	14	Ganadero	Pasto	no	no
281	Armín Jerónimo Figueroa	Mabel Figueroa	San Francisco	Olanchito	Mabel Figueroa	53	Superficial	53	Ganadero	Pasto	no	no
282	Armín Jerónimo Figueroa	Jose Luis Nuñez Sondres	San Francisco	Olanchito	Jose Luis Nuñez Sandres	49	Subterranea	49	Agricultor y Ganadero	Pasto	no	no
283	Armín Jerónimo Figueroa	Onis Hayde Saandoval	San Francisco	Olanchito	El Paraiso	74	Subterranea	42	Ganadero	Pasto	no	no
284	Independiente	Jose leonardo Miranda Quezad	Puerto Escondido	Olanchito	Finca Oropel	140	Subterranea	35	Agricultor y Ganadero	Pasto	si	Aspersión
285	Fabricio Puerto	Ramon Melendez	Sabana San Carlos	Olanchito	Creel Fabricio Puerto	4	Subterranea	4	Ganadero	Pasto	no	no
286	Heberto Chirinos Ponce	Jorge Alfonzo Zelaya	Juncal	Olanchito	Janine	51	Subterranea	42	Ganadero	Pasto	no	no
287	Heberto Chirinos Ponce	Adalberto Mejia Soto	Juncal	Olanchito	La Esperanza	21	Ambos	14	Agricultor y Ganadero	Pasto y Maiz	no	no
288	Heberto Chirinos Ponce	Wilfredo Soto Mejia	Juncal	Olanchito	El Barracon	20	Superficial	14	Agricultor y Ganadero	Pasto y Maiz	no	no
289	Heberto Chirinos Ponce	Jose luis Mendoza Rivera	Juncal	Olanchito	el guanacaste	28	Subterranea	21	Agricultor y Ganadero	Pasto	no	no
290	Heberto Chirinos Ponce	Jorge Arturo Colindres Carcamo	Juncal	Olanchito	El eden	42	Subterranea	42	Agricultor y Ganadero	Pasto	no	no
291	Heberto Chirinos Ponce	Carlos Augusto Zelaya Rivera	Juncal	Olanchito	Los Carlos	42	Subterranea	7	Agricultor y Ganadero	Pasto y Maiz	no	no
292	Martínez Lobo	Justo Roberto Puerto Tinoco	Santa Cruz	Arenal	Modelo	123	Subterranea	11	Ganadero	Pasto	no	no
293	Martínez Lobo	Jose Arturo Mejia	Santa Cruz	Arenal	Rancho Durango	229	Subterranea	14	Ganadero	Pasto	no	no
294	Martínez Lobo	Francisco Joaquin Romero	Santa Cruz	Arenal	La Esperanza	104	Subterranea	104	Ganadero	Pastos	no	no
295	Martínez Lobo	Samuel Mendoza	Santa Cruz	Arenal	Rancho Chitor	35	Subterranea	20	Ganadero	Pastos	no	no
296	Martínez Lobo	Amilcar Lobo	Santa Cruz	Arenal	no tiene	21	Subterranea	18	Ganadero	Pastos	no	no
297	Martínez Lobo	Hector Danilo Mejia Romero	Santa Cruz	Arenal	Rancho Grande	120	Subterranea	14	Ganadero	Pasto	no	no
298	Leopoldo Duran Dueñas	Marco Antonio Cruz Ocampo	San Patricio	Olanchito	Hacienda Ocote Alto	56	Subterranea	42	Ganadero	Pastos	no	no
299	Leopoldo Duran Dueñas	Rony Rogelio Nuñez Cruz	San Patricio	Olanchito	Villa el Carmen	28	Superficial	28	Ganadero	Pastos	no	no
300	Leopoldo Duran Dueñas	Fredis Felipe Cruz Ocampo	San Patricio	Olanchito	Monte de Sion	42	Superficial	28	Ganadero	Pasto	no	no
301	Independiente	Wladimiro Lozano Avila	Olanchito	Olanchito		18	Ambos	18	Ganadero	Pasto	no	no

Note: Potential beneficiaries highlighted in orange refer to the 227 potential beneficiaries who met the preliminary selection criteria based on the CINSA and PAA Project Finance preliminary assessment conducted in 2017



Legend

- POTENTIAL BENEFICIARIES WHO MET THE PRELIMINARY CRITERIA (227) (*)
- POTENTIAL BENEFICIARIES WHO DID NOT MEET THE PRELIMINARY CRITERIA (74) (*)
- PROYECT AREA
- MUNICIPAL CENTER
- MUNICIPAL LIMIT
- HONDURAS NATIONAL BOUNDARY

Note:
(*) Based on findings of November 2017 field survey by CINSA and PAA Project Finance

Proyected Coordinate System: WGS_1984_UTM_Zone_16N
Datum: D_WGS_1984

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Project: Aguan Irrigation Project	Site: *HONDURAS Olanchito*
Figure: 1	Potential Beneficiaries
Scale: see graphic scale	Project Number: 0463668
Version: 00	Date: August 2018
Paper: A3	Author: MCP
Reviewed by: DA	Project Manager: EF
File: map1.mxd	Client: PAA PROJECT FINANCE

ANNEX 3

FIELD SURVEY PHOTO LOG

ANNEX 1.1

FIELD SURVEY 2017

(11/2017)  On-site sessions and interviews with stakeholders, CRELES and beneficiaries.	**(11/2017)**  On-site sessions and interviews with stakeholders, CRELES and beneficiaries.
(11/2017)  On-site sessions and interviews with stakeholders, CRELES and beneficiaries.	**(11/2017)**  On-site sessions and interviews with stakeholders, CRELES and beneficiaries.
(08/11/2017)  Interview with director of ASIDE in RVSCEH.	**(19/06/2017)**  Interview with director of ASIDE in RVSCE.

(08/11/2017)  Interview with director of ASIDE in RVSCEH.	**(08/11/2017)**  Interview with director of ASIDE in RVSCEH.
(08/11/2017)  Visit to CREL Cruz – Núñez: possible beneficiary.	**(08/11/2017)**  Interview with producer in Santa Rosa.
(08/11/2017)  Interview with producer belonging to CREL Leopoldo Duran Dueñas San Patricio community.	**(08/11/2017)**  Interview with producers of right side of Aguan River.

(08/11/2017)  Visit of a possible superficial water source in San Marcos river in Santa Rosa.	**(08/11/2017)**  Rancho Don Juan, using underground water source.
(08/11/2017)  Protection stall for underground well in Leopoldo Duran Dueñas.	**(08/11/2017)**  Underground well with pump beside Aguan River.
(08/11/2017)  Underground well with pump beside Aguan River.	**(08/11/2017)**  Rogelio Cruz, Ocotes Altos: underground well.

(08/11/2017)  Possible water source inspection in an affluent of Aguan River, south side.	**(08/11/2017)**  Visit to producer beside Aguan river.
(08/11/2017)  Visit to producer beside Aguan river.	**(08/11/2017)**  Visit to producer beside Aguan river.
(08/11/2017)  Visit to producer with water pumping equipment.	**(08/11/2017)**  Visit to producer with water pumping equipment.

(08/11/2017)  Possible water source inspection in an affluent of Aguan River, south side.	**(08/11/2017)**  Visit to Production area in Hacienda Santa Rosa.
(08/11/2017)  Production area.	**(08/11/2017)**  Beef cattle stall in Rancho Don Juan.
(08/11/2017)  Corn production area of producer belonging to CREL Leopoldo Duran Dueñas.	**(08/11/2017)**  Beef cattle stalls in Rogelio Cruz, Ocotes Altos.

(08/11/2017)  Storage and milk cooling infrastructure in CREL Leopoldo Duran Dueñas San Patricio's community.	**(08/11/2017)**  CREL Salvador F.
(08/11/2017)  CREL Fabricio y Puerto y Asociados.	**(08/11/2017)**  CREL Superación.
(08/11/2017)  CREL Mejía Rodríguez.	**(08/11/2017)**  Well drilling.

(08/11/2017)  Well drilling.	**(08/11/2017)**  Dry Tropical Forest.
(08/11/2017)  Dry Tropical Forest.	**(08/11/2017)**  Aguan river in Arenal
(08/11/2017)  CREL Mejía Rodríguez.	**(08/11/2017)**  Well drilling.

(08/11/2017)  Visit of a possible superficial water source in San Marcos river in Santa Rosa.	**(08/11/2017)**  Visit of a possible superficial water source in San Marcos river in Santa Rosa.
(08/11/2017)  Dry Tropical Forest.	**(08/11/2017)**  Aguan river in Arenal.
(08/11/2017)  CREL Mejía Rodríguez.	**(08/11/2017)**  Interview with director of ASIDE in RVSCEH.

(08/11/2017)  Interview with director of ASIDE in RVSCEH.	**(08/11/2017)**  Interview with director of ASIDE in RVSCEH.
(08/11/2017)  Interview with director of ASIDE in RVSCEH.	**(08/11/2017)**  Rancho Don Juan, using underground water source.
(08/11/2017)  Rancho Don Juan, using underground water source.	**(08/11/2017)**  Rancho Don Juan, using underground water source.

FSL-01 (21/06/2018)

Banana plantation (background) near Arenal

FSL-02 (23/06/2018)

Hummingbird in the hotel in Olanchito

FSL-03 (19/06/2018)

SAGO site in Olanchito

FSL-04 (19/06/2018)

Main building of CREL Tejeras

FSL-05 (19/06/2018)

Arable field, surrounded by irrigated forage field (camerún) in farm #30

FSL-05 (19/06/2018)

Tractor in farm #30

FSL-05 (19/06/2018)

Herbicide (combatran) in farm #30

FSL-06 (19/06/2018)

Groundwater well in farm #30

FSL-07 (26/06/2018)

Soil profile: gravels and pebbles in a sandy matrix

FSL-08 (20/06/2018)

Forage in farm #165

FSL-08 (20/06/2018)

Cowhouse in farm #165

FSL-09 (20/06/2018)

CREL building where meeting with representatives of different CRELES is conducted

FSL-10 (21/06/2018)

Aguan River: high turbidity due to recent rainfalls

FSL-11 (22/06/2018)

Main building of SAG in Olanchito

FSL-12 (22/06/2018)

CREL Salinas Gonzales y Asociados, where the meeting with farmers owning small farms is conducted

FSL-12 (20/06/2018)

CREL Salinas Gonzales y Asociados: WC with septic tank system by filtration to the subsoil

FSL-12 (22/06/2018)

CREL Salinas Gonzales y Asociados: tree plantation for generation of wood

FSL-13 (23/06/2018)

Forage in the western section of the Project Area, near the community of Perritos

FSL-14 (23/06/2018)

San Marcos River: low water level

FSL-15 (23/06/2018)

Forage plantation in San Lorenzo de Arriba. Some cattle is observed in the background

FSL-15 (23/06/2018)

Detail of forage plantation in San Lorenzo de Arriba

FSL-15 (23/06/2018)

Dead turtle found in farm in San Lorenzo de Arriba

FSL-16 (23/06/2018)

White-headed capuchin (*Cebus capucinus*) in the Tourism Center La Mora

FSL-16 (23/06/2018)	**FSL-17 (23/06/2018)**
	
White-tailed deer (*Odocoileus virginianus*) in the Tourism Center La Mora	Asphalted road, fence, telephone cables and electrical line
FSL-18 (23/06/2018)	**FSL-18 (23/06/2018)**
	
Electrical line and fence next to the road	Forage, fence, pond and electrical line next to the road
FSL-18 (23/06/2018)	**FSL-18 (23/06/2018)**
	
Deciduous vegetation	Transport by horse

FSL-19 (23/06/2018)  Very dry tropical forest	**FSL-20 (23/06/2018)**  Road and communication antenna
FSL-21 (23/06/2018)  Farm next to the road: aerial water storage tank	**FSL-21 (23/06/2018)**  Farm next to the road: low tree density
FSL-21 (23/06/2018)  Farm next to the road: low tree density	**FSL-22 (23/06/2018)**  Village next to the road

FSL-23 (23/06/2018)

Water reservoir next to the road. Great white egrets (*Ardea alba*)

FSL-23 (23/06/2018)

Water reservoir next to the road. Great white egrets (*Ardea alba*)

FSL-24 (23/06/2018)

Village of Coyoles

FSL-24 (23/06/2018)

DOLE facilities in Coyoles

FSL-24 (23/06/2018)

Petrol station in Coyoles

FSL-24 (23/06/2018)

Shop in Coyoles

FSL-25 (23/06/2018)

Signal of a water purification system

FSL-25 (23/06/2018)

Road and community where the signal of a water purification system was found

FSL-26 (23/06/2018)

Wood processing facility next to road

FSL-27 (23/06/2018)

Irrigation system in a forage crop

FSL-27 (23/06/2018)

People leaving protected area with wood

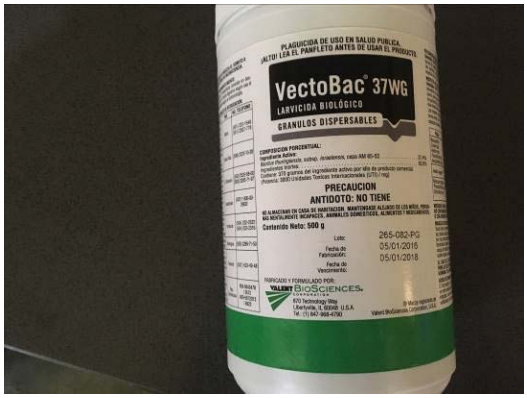
FSL-27 (23/06/2018)

Bird in electrical line

FSL-28 (23/06/2018)  New urban area development in Olanchito	**FSL-29 (23/06/2018)**  African Palm plantation
FSL-29 (23/06/2018)  Forage crop	**FSL-30 (23/06/2018)**  Orange plantation
FSL-31 (31/06/2018)  Irrigation system	**FSL-31 (23/06/2018)**  Banana plantation

FSL-32 (23/06/2018)  Aguan River: brown color of water due to sediments	**FSL-32 (23/06/2018)**  View of the Aguan River from bridge. A great white heron observed
FSL-32 (23/06/2018)  Sand and gravel extraction in the Aguan River	**FSL-32 (23/06/2018)**  Abandoned/stolen emergency water level station
FSL-32 (31/06/2018)  Abandoned/stolen meteorological station	**FSL-33 (24/06/2018)**  Hospital Dr. Anibal Murillo in Olanchito

FSL-33 (26/06/2018)



Bioproduct used to fight vector diseases

FSL-33 (26/06/2018)

Map of vector disease cases in the area of Olanchito

FSL-34 (24/06/2018)

Unpaved streets and church in the community of Juncal

FSL-35 (24/06/2018)

Cowhouse under construction in farm #108

FSL-35 (31/06/2018)

Forage crop in farm #108

FSL-35 (24/06/2018)

Small silage in farm #108

FSL-35 (24/06/2018)

Forage crop and cattle in farm #108

FSL-36 (23/06/2018)

Groundwater well with pump in farm #108

FSL-37 (23/06/2018)

Pond and cow in farm #108

FSL-38 (24/06/2018)

Former water potabilization system in the community of Juncal

FSL-39 (24/06/2018)

Groundwater font the community of Juncal

FSL-39 (24/06/2018)

Petrol station owned by the CREL Eberto Chirinos Ponce

FSL-39 (24/06/2018)

Main building of CREL Eberto Chirinos Ponce

FSL-39 (24/06/2018)

Aerial water storage tank in CREL Eberto Chirinos Ponce

FSL-40 (24/06/2018)

Poultry farm for production of eggs

FSL-41 (24/06/2018)

Cattle and forage crop in farm #128

FSL-41 (24/06/2018)

Calves in cowhouse in farm #128

FSL-41 (24/06/2018)

Pond in farm #128

FSL-41 (24/06/2018)  Pond in farm #128	**FSL-42 (24/06/2018)**  Detail of banana plantation: plastic protection of fruits
FSL-43 (24/06/2018)  Groundwater well and pump	**FSL-44 (26/06/2018)**  Groundwater well in farm #71 providing water cattle consumption
FSL-44 (26/06/2018)  Water pile for the cattle in farm #71. Tadpoles are observed	**FSL-44 (26/06/2018)**  Forage in farm #71. In the background, natural vegetation kept by the farmer for conservation purposes, even though it is not protected

FSL-44 (26/06/2018)

Cattle in farm #71

FSL-45 (26/06/2018)

Groundwater well in farm #71 providing water for human consumption

FSL-46 (25/06/2018)

Creek, tributary of Aguan River

FSL-46 (25/06/2018)

Degradation of natural habitats in upper areas of the valley into forage crops, typically used during the dry season

FSL-47 (25/06/2018)

CREL Cruz Nuñez, where meeting with AJASPIIB is conducted

FSL-47 (25/06/2018)

Milk conservation deposits in CREL Cruz Núñez

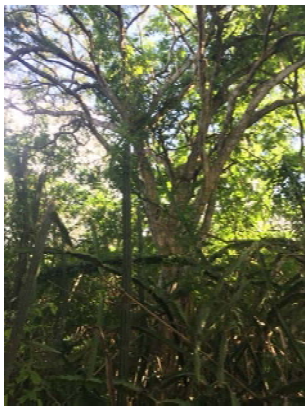
FSL-47 (25/06/2018)

Intermediary deposit to filter milk in CREL Cruz Núñez

FSL-48 (25/06/2018)

American black vultures feeding on dead horse

FSL-49 (25/06/2018)



Very dry tropical forest in RVSCHE

FSL-49 (26/06/2018)

Very dry tropical forest in RVSCHE

FSL-49 (25/06/2018)

Black-chested spiny-tailed iguana in RVSCHE

FSL-49 (25/06/2018)

Very dry tropical forest in RVSCHE

FSL-49 (25/06/2018)  Species of lizard in RVSCHE	**FSL-49 (25/06/2018)**  ASIDE offices in RVSCHE
FSL-50 (26/06/2018)  Soil profile: predominance of gravels	**FSL-51 (26/06/2018)**  Tributary of the Aguan River: good riverine vegetation
FSL-51 (26/06/2018)  Fishes in a tributary of the Aguan River	**FSL-51 (26/06/2018)**  Dead amphibian in a road next to a tributary of the Aguan River

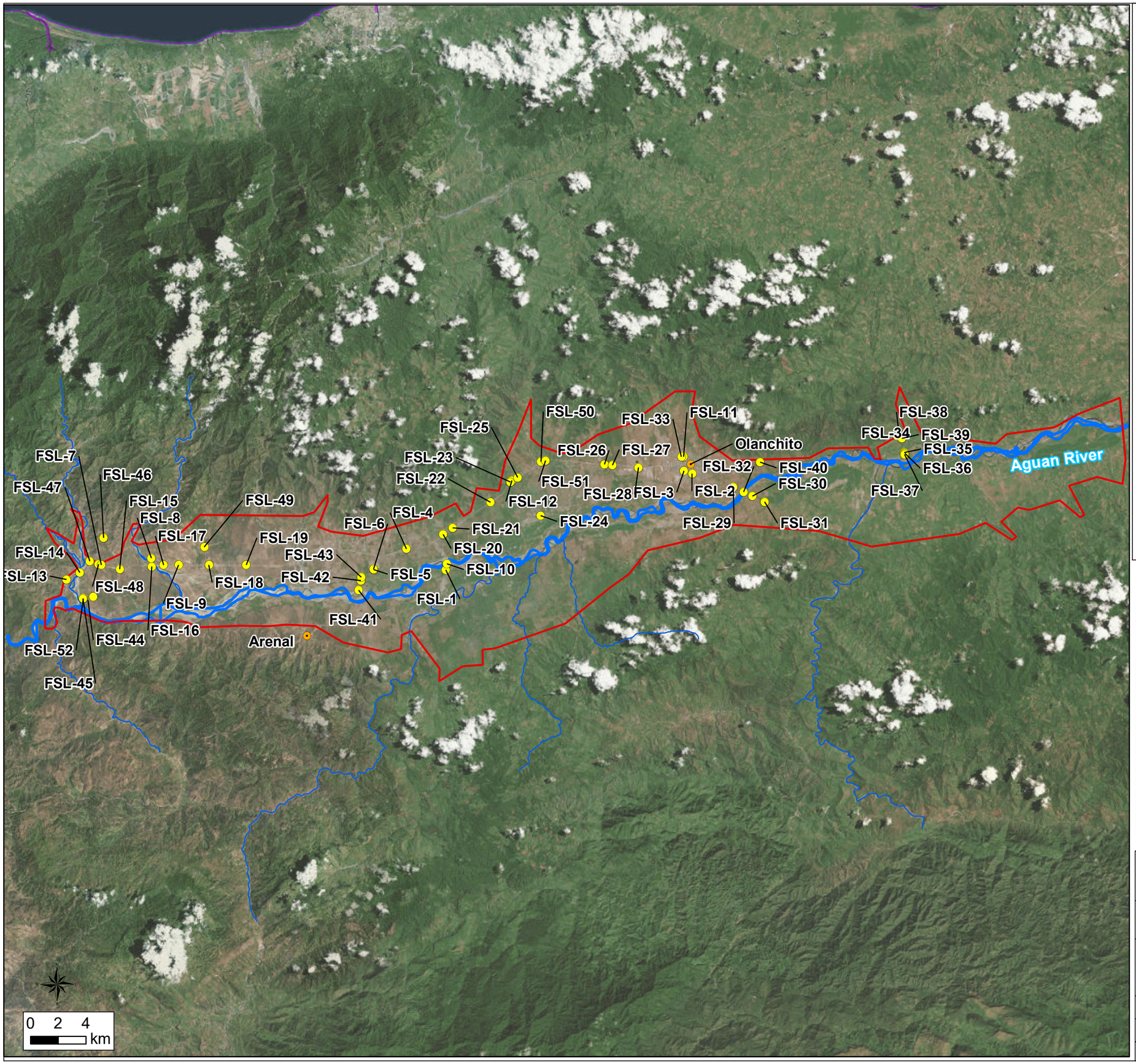
FSL-52 (26/06/2018)  Forage crops in farm #71	**FSL-52 (26/06/2018)**  Forage crops and veteran tree in farm #71
FSL-52 (26/06/2018)  Medicinal plant (savila) in farm #71	**FSL-52 (26/06/2018)**  Forage crops in farm #71

ANNEX 1.2

FIELD SURVEY 2018

ANNEX 4

FIELD SURVEY MAPS



Legend

- FIELD SURVEY LOCATIONS
- PROYECT AREA
- MUNICIPAL CENTER

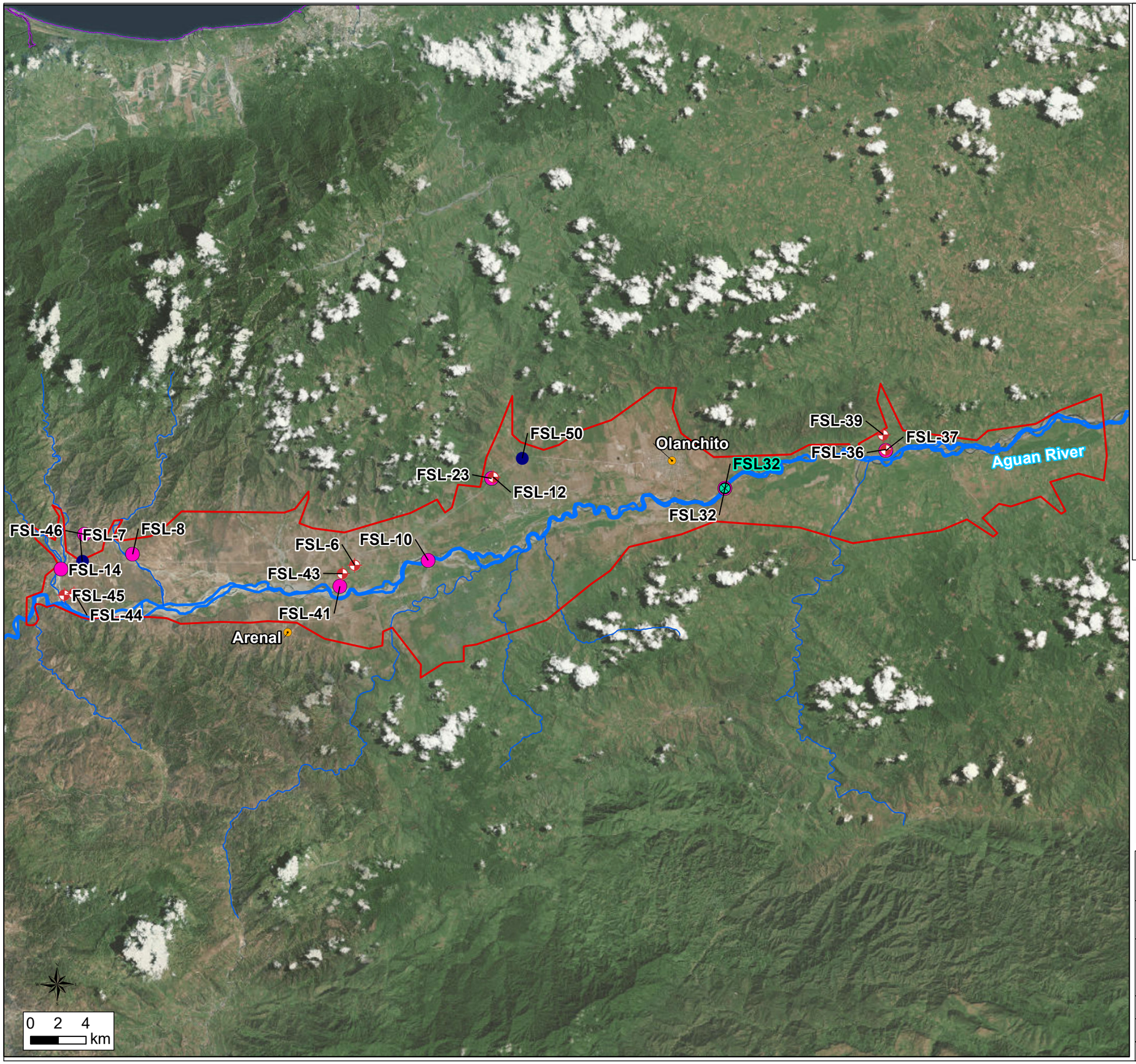
HYDROGRAPHIC NETWORK

- MAIN RIVER
- SECONDARY RIVERS
- HONDURAS NATIONAL BOUNDARY

Geographic System: WGS_1984_UTM_Zone_16N
Datum: D_WGS_1984

ERM Iberia S.A.
Paseo de la Castellana 184, 3º
28046 Madrid
Tel. +34 91 411 1440
Fax +34 91 563 6213

Project: Aguan Irrigation Project	Site: *HONDURAS Olanchito*
Figure: 1	Field Survey Map
Scale: see graphic scale	Project Number: 0463668
Version: 00	Date: August 2018
Paper: A3	Author: MCP
Reviewed by: DA	Project Manager: EF
File: map1.mxd	Client: PAA PROJECT FINANCE



Legend

- METEOROLOGICAL STATION
- SOIL PROFILE
- SURFACE WATER FEATURE
- GROUNDWATER WELL
- PROYECT AREA
- MUNICIPAL CENTER

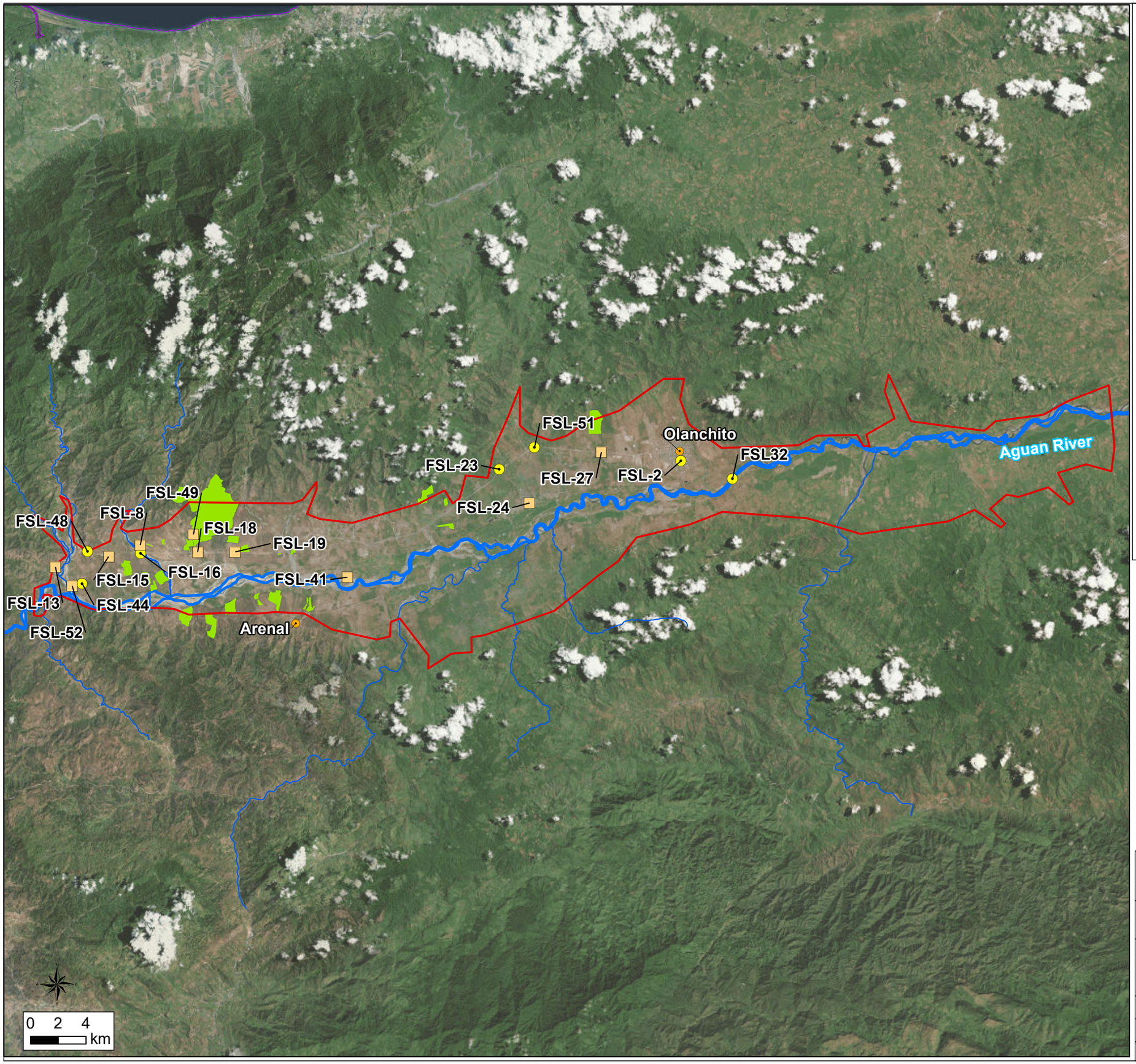
HYDROGRAPHIC NETWORK

- MAIN RIVER
- SECONDARY RIVERS
- HONDURAS NATIONAL BOUNDARY

Geographic System: WGS_1984_UTM_Zone_16N
Datum: D_WGS_1984

ERM Iberia S.A.
Paseo de la Castellana 184, 3º
28046 Madrid
Tel. +34 91 411 1440
Fax +34 91 563 6213

Project: Aguan Irrigation Project	Site: *HONDURAS Olanchito*
Figure: 2	Physical Baseline Field Survey Map
Scale: see graphic scale	Project Number: 0463668
Version: 00	Date: August 2018
Paper: A3	Author: MCP
Reviewed by: DA	Project Manager: EF
File: map2.mxd	Client: PAA PROJECT FINANCE



Legend

- OBSERVATIONS OF FLORA
- OBSEVATIONS OF FAUNA
- WILDLIFE REFUGE HONDURAN EMERALD HUMMINGBIRD (RVSCEH_Decree 32-2015)
- PROYECT AREA
- MUNICIPAL CENTER

HYDROGRAPHIC NETWORK

- MAIN RIVER
- SECONDARY RIVERS
- HONDURAS NATIONAL BOUNDARY

Geographic System: WGS_1984_UTM_Zone_16N
Datum: D_WGS_1984

ERM Iberia S.A.
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28046 Madrid
Tel. +34 91 411 1440
Fax +34 91 563 6213

Project	Site
Aguan Irrigation Project	*HONDURAS Olanchito*

Figure: 3 — Biological Baseline Field Survey Map

Scale	Project Number	Client
see graphic scale	0463668	PAA PROJECT FINANCE
Version: 00	Date: August 2018	
Paper: A3	Author: MCP	Reviewed by: DA
Project Manager: EF	File: map3.mxd	

ANNEX 5

LITHOLOGICAL PROFILE OF ABSTRACTION WELLS IN THE PROJECT AREA

PUMP A

PERFORACION POZOS
FINCA ORGANICA DE CULUCO. (ALVESA)

Perforador	Braulio Pastor	EQUIPO PROPIO STFH
Diseno	Roberto Ochoa / G Valdivia M	
Fecha	Octubre del 2005	

PERFORACION # 5 PARA POZO DE EXPLOTACION # 1

CARACTERISTICAS DEL POZO # 1

Caudal de bombeo maximo	**1500 GPM**	**Abatimiento**	**35 pies**
Caudal de explotacion	**1350 GPM**	**Abatimiento**	**30 pies**

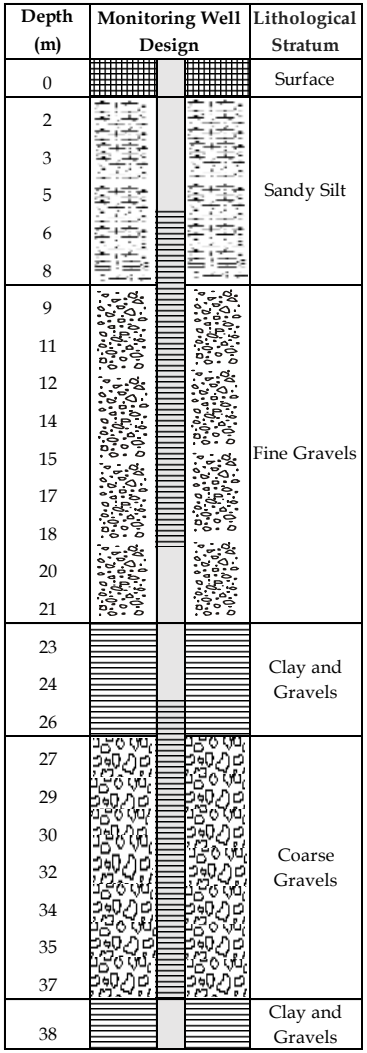
PROFUNDIDAD PIES		LITOLOGIA ESTRATO	ESTRUCTURA CAPTACION POZO
0		SUPERFICIE	BASE CONCRETO 5 PIES
5		LIMO ARENOSO	
10	NIVEL FREATICO	LIMO ARENOSO	TUBO CIEGO DE 0 A 20 PIES
15		LIMO ARENOSO	DE 14 PULG , ESPESOR 1/4.
20		LIMO ARENOSO	
25	20 pies	GRAVA FINA	
30		GRAVA FINA	
35		GRAVA FINA	REGILLA ACERO INOXIDABLE
40		GRAVA FINA	14 PULG DE DIAM, SLOT 40
45		GRAVA FINA	DE 20 PIES A 60 PIES.
50		GRAVA FINA	
55		GRAVA GRUESA	
60		GRAVA GRUESA	
65		GRAVA GRUESA	
70	70 pies	ARCILLA Y GRAVA	
75		ARCILLA Y GRAVA	TUBO CIEGO DE 70 A 85 PIES
80		ARCILLA Y GRAVA	
85	85 pies	ARCILLA Y GRAVA	
90		GRAVA GRUESA	REGILLA ACERO INOXIDABLE
95		GRAVA GRUESA	14 PULG DE DIAM, SLOT 40
100		GRAVA GRUESA	DE 85 PIES A120 PIES.
105		GRAVA GRUESA	
110		GRAVA GRUESA	
115		GRAVA GRUESA	
120		GRAVA GRUESA	
125	125 pies	ARCILLA Y GRAVA	TUBO CIEGO DE120 A 125 PIES

Original graphic (in Spanish)

DRILLING #5 FOR EXPLOTATION PUMP #1

DESCRIPTION OF PUMP #1

Maximum pumping rate	1500 GPM	Dejection	10.6 m
Operating Flow	1350 GPM	Dejection	9.1 m



Summary of original graphic (in English)

PUMP B

PERFORACION POZOS
FINCA ORGANICA DE CULUCO. (ALVESA)

Perforador	Braulio Pastor	EQUIPO PROPIO STFH
Diseno	Roberto Ochoa / G Valdivia M	
Fecha	Enero del 2006	

PERFORACION # 4 PARA POZO DE EXPLOTACION # 2

CARACTERISTICAS DEL POZO # 2

Caudal de bombeo maximo	**1500 GPM**	**Abatimiento**	**30 pies**
Caudal de explotacion	**1350 GPM**	**Abatimiento**	**25 pies**

PROFUNDIDAD PIES		PERFIL	LITOLOGIA ESTRATO	ESTRUCTURA CAPTACION POZO
0			SUPERFICIE	BASE CONCRETO 5 PIES
5			LIMO ARENOSO	
10	NIVEL FREATICO		LIMO ARENOSO	TUBO CIEGO DE 0 A 20 PIES
15			LIMO ARENOSO	DE 14 PULG , ESPESOR 1/4.
20			LIMO ARENOSO	
25	20 pies		GRAVA FINA	
30			GRAVA FINA	
35			GRAVA FINA	REGILLA ACERO INOXIDABLE
40			GRAVA FINA	14 PULG DE DIAM, SLOT 40
45			GRAVA FINA	DE 20 PIES A 60 PIES.
50			GRAVA FINA	
55			GRAVA GRUESA	
60			GRAVA GRUESA	TUBO CIEGO DE 60 A 70 PIES
65	60 pies		ARCILLA Y GRAVA	DE 14 PULG , ESPESOR 1/4.
70	70 pies		ARCILLA Y GRAVA	
75			GRAVA GRUESA	
80			GRAVA GRUESA	
85			GRAVA GRUESA	
90			GRAVA GRUESA	REGILLA ACERO INOXIDABLE
95			GRAVA GRUESA	14 PULG DE DIAM, SLOT 40
100			GRAVA GRUESA	DE 80 PIES A120 PIES.
105			GRAVA GRUESA	
110	110 pies		ARCILLA Y GRAVA	TUBO CIEGO DE120 A 125 PIES

Original graphic (in Spanish)

DRILLING #4 FOR EXPLOTATION PUMP #2

DESCRIPTION OF PUMP #2

Maximum pumping rate 1500 GPM 1500 GPM Dejection 9.1 m

Operating Flow 1350 GPM Dejection 7.6 m

Depth (m)	Monitoring Well Design	Lithological Stratum
0		Surface
2		Sandy Silt
3		
5		
6		
8		Fine Gravels
9		
11		
12		
14		
15		
17		Coarse Gravels
18		
20		Clay and Gravels
21		
23		Coarse Gravels
24		
26		
27		
29		
30		
32		
34		Clay and Gravels

Summary of original graphic (in English)

PUMP C

PERFORACION POZOS
FINCA ORGANICA DE CULUCO. (ALVESA)

Perforador	Braulio Pastor	EQUIPO PROPIO STFH
Diseno	Roberto Ochoa / G Valdivia M	
Fecha	Enero 2006	

PERFORACION # 1 PARA POZO DE EXPLOTACION # 3

CARACTERISTICAS DEL POZO # 3

Caudal de bombeo maximo	**1700 GPM**	**Abatimiento**	**22 pies**
Caudal de explotacion	**1350 gpm**	**Abatimiento**	**20 pies**

PROFUNDIDAD PIES		PERFIL	LITOLOGIA ESTRATO	ESTRUCTURA CAPTACION POZO
0			SUPERFICIE	BASE CONCRETO 5 PIES
5			LIMO ARENOSO	
10	NIVEL FREATICO		LIMO ARENOSO	TUBO CIEGO DE 0 A 15 PIES
15			ARENA Y GRAVA FINA	DE 14 PULG , ESPESOR 1/4.
20	15 pies		GRAVA FINA	
25			GRAVA FINA	
30			GRAVA FINA	
35			GRAVA FINA	REGILLA ACERO INOXIDABLE
40			GRAVA FINA	14 PULG DE DIAM, SLOT 40
45			GRAVA FINA	DE 10 PIES A 70 PIES.
50			GRAVA FINA	
55			GRAVA GRUESA	
60			GRAVA GRUESA	
65			GRAVA GRUESA	
70	70 pies		GRAVA GRUESA	
75	75 pies		ARCILLA Y GRAVA	TUBO CIEGO DE 70 A 75 PIES

Original graphic (in Spanish)

DRILLING #1 FOR EXPLOTATION PUMP #3

DESCRIPTION OF PUMP #3

Maximum pumping rate 1700 GPM Dejection 6.7 m

Operating Flow 1350 GPM Dejection 6.1 m

Depth (m)	Monitoring Well Design	Lithological Stratum
0		Surface
2		Sandy Silt
3		
5		Sand and fine gravel
6		Fine Gravels
8		
9		
11		
12		
14		
15		
17		Coarse Gravels
18		
20		
21		
23		Clay and Gravels

Summary of original graphic (in English)

PUMP D

PERFORACION POZOS
FINCA ORGANICA DE CULUCO. (ALVESA)

Perforador	Braulio Pastor	EQUIPO PROPIO STFH
Diseno	Roberto Ochoa / G Valdivia M	
Fecha	Octubre del 2005	

PERFORACION # 2 PARA POZO DE EXPLOTACION # 4

CARACTERISTICAS DEL POZO # 4

Caudal de bombeo maximo	**1500 GPM**	**Abatimiento**	**32 pies**
Caudal de explotacion	**1350 GPM**	**Abatimiento**	**30 pies**

PROFUNDIDAD PIES		PERFIL	LITOLOGIA ESTRATO	ESTRUCTURA CAPTACION POZO
0			SUPERFICIE	BASE CONCRETO 5 PIES
5			LIMO ARENOSO	
10	NIVEL FREATICO		LIMO ARENOSO	TUBO CIEGO DE 0 A 20 PIES
15			LIMO ARENOSO	DE 14 PULG , ESPESOR 1/4.
20			LIMO ARENOSO	
25	20 pies		GRAVA FINA	
30			GRAVA FINA	
35			GRAVA FINA	REGILLA ACERO INOXIDABLE
40			GRAVA FINA	14 PULG DE DIAM, SLOT 40
45			GRAVA FINA	DE 20 PIES A 60 PIES.
50			GRAVA FINA	
55			GRAVA GRUESA	
60			GRAVA GRUESA	
65	60 pies		ARCILLA Y GRAVA	
70			ARCILLA Y GRAVA	
75			ARCILLA Y GRAVA	TUBO CIEGO DE 60 A 80 PIES
80	80 pies		ARCILLA Y GRAVA	
85			GRAVA GRUESA	
90			GRAVA GRUESA	REGILLA ACERO INOXIDABLE
95			GRAVA GRUESA	14 PULG DE DIAM, SLOT 40
100			GRAVA GRUESA	DE 80 PIES A120 PIES.
105			GRAVA GRUESA	
110			GRAVA GRUESA	
115			GRAVA GRUESA	
120			GRAVA GRUESA	
125			ARCILLA Y GRAVA	TUBO CIEGO DE120 A 125 PIES

Original graphic (in Spanish)

DRILLING #2 FOR EXPLOTATION PUMP #4

DESCRIPTION OF PUMP #4

Maximum pumping rate 1500 GPM Dejection 9.7 m

Operating Flow 1350 GPM Dejection 9.1 m

Depth (m)	Monitoring Well Design	Lithological Stratum
0		Surface
2		Sandy Silt
3		
5		
6		
8		Fine Gravels
9		
11		
12		
14		
15		
17		Coarse Gravels
18		
20		Clay and Gravels
21		
23		
24		
26		Coarse Gravels
27		
29		
30		
32		
34		
35		
37		
38		Clay and Gravels

Summary of original graphic (in English)

PUMP E

PERFORACION POZOS
FINCA ORGANICA DE CULUCO. (ALVESA)

Perforador	Braulio Pastor	EQUIPO PROPIO STFH
Diseno	Roberto Ochoa / G Valdivia M	
Fecha	Noviembre del 2005	

PERFORACION #3 PARA POZO DE EXPLOTACION # 5

CARACTERISTICAS DEL POZO # 5

Caudal de bombeo maximo	**1800 GPM**	**Abatimiento**	**25 pies**
Caudal de explotacion	**1500 GPM**	**Abatimiento**	**20 pies**

PROFUNDIDAD PIES	PERFIL	LITOLOGIA ESTRATO	ESTRUCTURA CAPTACION POZO
0		SUPERFICIE	BASE CONCRETO 5 PIES
5		LIMO ARENOSO	
10	NIVEL FREATICO	LIMO ARENOSO	TUBO CIEGO DE 0 A 15 PIES
15	15 pies	GRAVA FINA	DE 14 PULG , ESPESOR 1/4.
20		GRAVA FINA	
25		GRAVA FINA	
30		GRAVA FINA	
35		GRAVA FINA	REGILLA ACERO INOXIDABLE
40		GRAVA FINA	14 PULG DE DIAM, SLOT 40
45		GRAVA FINA	DE 15 PIES A 65 PIES.
50		GRAVA FINA	
55		GRAVA GRUESA	
60		GRAVA GRUESA	
65	65 pies	GRAVA GRUESA	TUBO CIEGO DE 65 A 70 PIES
70	70 pies	ARCILLA Y GRAVA	DE 14 PULG , ESPESOR 1/4.
75			

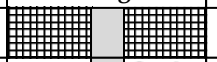
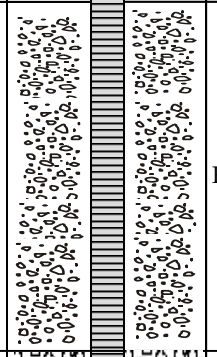
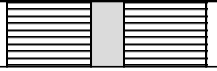
Original graphic (in Spanish)

DRILLING #3 FOR EXPLOTATION PUMP #5

DESCRIPTION OF PUMP #5

Maximum pumping rate 1800 GPM Dejection 7.6 m

Operating Flow 1500 GPM Dejection 6.1 m

Depth (m)	Monitoring Well Design	Lithological Stratum
0		Surface
2		Sandy Silt
3		
5		Sand and fine gravel
6		Fine Gravels
8		
9		
11		
12		
14		
15		
17		Coarse Gravels
18		
20		
21		Clay and Gravels

Summary of original graphic (in English)

Bomba "C"

Aguan River

Bomba "A"

Bomba "B"

Bomba "D"

Bomba "E"

0 1 2 km

Legend

- ABSTRACTION WELL
- PROYECT AREA
- MUNICIPAL CENTER

HYDROGRAPHIC NETWORK

- MAIN RIVER
- SECONDARY RIVERS
- HONDURAS NATIONAL BOUNDARY

Geographic System: WGS_1984_UTM_Zone_16N
Datum: D_WGS_1984

ERM Iberia S.A.
Paseo de la Castellana 184, 3º
28046 Madrid
Tel. +34 91 411 1440
Fax +34 91 563 6213

Project: Aguan Irrigation Project	Site: *HONDURAS Olanchito*
Figure: 1	Abstraction wells
Scale: see graphic scale	Project Number: 0463668
Version: 00	Date: August 2018
Paper: A3	Author: MCP
Reviewed by: DA	Project Manager: EF
File: map1.mxd	Client: PAA PROJECT FINANCE

ANNEX 6

HIGH SENSITIVE FLORA AND FAUNA

FLORA - *Bakeridesia molinae*	
	**Habitat and ecology** No specific information is available. **Conservation and protection information** • Endemic: YES • IUCN: Not assessed • CITES: Not assessed • Special Concern Species in Honduras: NO
Distribution Bakeridesia (Malvaceae) is a genus of tall shrubs native to the seasonally dry forests of Mexico, Central America, and northwestern South America. According to Donnell, Aliya & Cantino, Philip & Ballard, Jr., Harvey. (2015), *B. molinae* is endemic from Honduras, consistently with information available from RVSCEH.	
Taxonomy note *Bakeridesia integerrima* (Hook. f.). D. M. Bates is a highly polymorphic and widely distributed species recognized by Bates (1973). Individuals assigned to this name are found in eastern Mexico (in the states of Tamaulipas, San Luis Potosí and Veracruz), Central America (Honduras and Nicaragua), and northwestern South America (Colombia, Venezuela and Ecuador). The Bakeridesia integerrima complex is a geographically and morphologically variable group consisting of populations that have been variously assigned to *B. integerrima*, *B. molinae*, *B. bakeriana*, and *B. subcordata*.	
Description It differs from most other genera in tribe Malveae in having a lacerate wing (or wing remnant) on the dorsal margin of the mericarp.	
Source of information Donnell, Aliya & Cantino, Philip & Ballard, Jr., Harvey (2015). RVSCEH reports	

FLORA - *Caesalpinia yucatanensis (subsp. Hondurensis)*

Habitat and ecology

Found in wet forests and scrubs, ascends to an altitude of 300 m.

Conservation and protection information

- Endemic: YES
- IUCN: Not assessed
- CITES: Not assessed
- Special Concern Species in Honduras: NO
- According to RVSCEH reports, this species should be assessed as CR by IUCN

Distribution

The species is original from a small area in Central America, it is present in southern Mexico, especially in the Yucatán peninsula, in Belize, Guatemala and Honduras. Central America to Honduras.

Description

Small twisted tree, branching heavily with a spreading crown to 5 m ht. Bark greenish grey, smooth, slightly shiny, covered in pale grey-brown pustulating lenticels, inner bark green. Leaves recently flushed and immature, leaf rachis tinged reddish. Striking show of bright yellow flowers attracting numerous small bees. Calyx yellow or greenish yellow, petals bright vermillion, banner petal with yellow glands to the rear, stamen filaments and style greenish yellow, densely white, hairy at the base, anthers dirty yellow brown. A few multiple glossy green pods. Infrequent, scattered. Lightly disturbed dry thorn scrub with *Haematoxylon brasiletto*, *Acacia picachensis*, *Chloroleucon mangense* and *Guaiacum sanctum*.

Source of information

https://plants.jstor.org/stable/10.5555/al.ap.specimen.k000081719

New York Botanical Garden: http://sweetgum.nybg.org/science/vh/specimen_details.php?irn=545058

<table>
<tr><th colspan="2">FLORA - Cappariocordis yunckeri</th></tr>
<tr><td rowspan="2">No specific photograph is available.</td><td>Habitat and ecology
No specific information is available.</td></tr>
<tr><td>Conservation and protection information
• Endemic: YES
• IUCN: Not assessed
• CITES: Not assessed
• Special Concern Species in Honduras: NO</td></tr>
<tr><td colspan="2">Distribution
Endemic species of Honduras. It was rediscovered by Paul House in 2011 and had not been registered for 50 years. There are only two known individuals in the world and the points where they are found are unique. By the year 2020, the presence of Cappariocordis yunckeri is expected to increase from 0 to 7-13 fragments (25-49%) of the RVSCEH, and that the number of individuals of reproductive age of this species increases from zero to the range of 51-100.</td></tr>
<tr><td colspan="2">Description
No specific information is available.</td></tr>
<tr><td colspan="2">Source of information
RVSCEH reports</td></tr>
</table>

FLORA - *Dioon mejiae*

Habitat and ecology

This species is typically an understorey component of semi-deciduous tropical rain forest and is found on steep slopes and in canyons, but also grows on flat terrain. Some populations thrive in sandy soil or sandy to clayey alluvial deposits, while others grow in loamy, limestone-derived soils; in soils weathered from metamorphics (schists, gneisses); etc.

Conservation and protection information

- Endemic: YES
- IUCN: LC
- CITES: Appendix II
- Special Concern Species in Honduras: NO

This species has important cultural value and is hence protected by local inhabitants. This species' biggest threat comes from habitat destruction as a result of the conversion of habitat to farmland and to a lesser extent the effects of logging and road-building on the habitat.

Distribution

This species occurs in the states of Colon, Olancho and Yoro of Honduras. Recent surveys in Honduras indicate that there are many large and healthy subpopulations with little evidence of decline despite use by local people.

Description

Dioon mejiae is a small to medium, erect and usually unbranched cycad species mimicking the look of short palm trees. It is a very tropical looking Dioon that resembles *Dioon spinulosum*, though usually much shorter, or *Dioon rzedowskii* in appearance. It show well developed aerial stems growing in habitat up to 1 m in length over centuries. It is usually a vigorous grower that holds a number of leaves in the crown. Primeval cycads like this *Dioon mejiae* are some of the oldest plants still living on the planet that trace their origins back to the ancient flora of the early Mesozoic era more than 170 million years ago. It is dioecious - it takes two plants to produce viable seeds.

Source of information

RVSCEH reports
IUCN website: http://www.iucnredlist.org/details/42184/0
http://www.llifle.com/Encyclopedia/PALMS_AND_CYCADS/Family/Zamiaceae/18072/Dioon_mejiae

<table>
<tr><th colspan="2">FLORA - Eugenia lempana</th></tr>
<tr><td rowspan="2">No specific photograph is available.</td><td>Habitat and ecology
No specific information is available.</td></tr>
<tr><td>Conservation and protection information
• Endemic: YES
• IUCN: Not assessed
• CITES: Not assessed
• Special Concern Species in Honduras: NO</td></tr>
<tr><td colspan="2">Distribution
Endemic species of Honduras.</td></tr>
<tr><td colspan="2">Description
No specific information is available.</td></tr>
<tr><td colspan="2">Source of information
RVSCEH reports</td></tr>
</table>

<table>
<tr><th colspan="2">FLORA - Eugenia coyolensis</th></tr>
<tr><td rowspan="2">No specific photograph is available.</td><td>Habitat and ecology
A species of the dry Atlantic lowlands.</td></tr>
<tr><td>Conservation and protection information
• Endemic: YES
• IUCN: CR
• CITES: Not assessed
• Special Concern Species in Honduras: NO</td></tr>
<tr><td colspan="2">Distribution
Endemic species of Honduras. According to RVSCEH reports, it is a regular species, expected to remain in the future, taking into account it is present in 25% and 49% of the fragmented monitored.</td></tr>
<tr><td colspan="2">Description
No specific information is available.</td></tr>
<tr><td colspan="2">Source of information
RVSCEH reports
IUCN website: http://www.iucnredlist.org/details/37446/0</td></tr>
</table>

<table>
<tr><th colspan="2">FLORA - Leucaena lempirana</th></tr>
<tr><td rowspan="2">No specific photograph is available.</td><td>Habitat and ecology
A highly localised species confined to northern Honduras. It is found in degraded forests.</td></tr>
<tr><td>Conservation and protection information
• Endemic: YES
• IUCN: VU
• CITES: Not assessed
• Special Concern Species in Honduras: NO</td></tr>
<tr><td colspan="2">Distribution
Endemic species of Honduras (North of the country).</td></tr>
<tr><td colspan="2">Description
No specific information is available.</td></tr>
<tr><td colspan="2">Source of information
RVSCEH reports
IUCN website: http://www.iucnredlist.org/details/37484/0</td></tr>
</table>

<table>
<tr><th colspan="2">FLORA - Lonchocarpus trifolius</th></tr>
<tr><td rowspan="2">No specific photograph is available.</td><td>Habitat and ecology
Pine-oak forests.</td></tr>
<tr><td>Conservation and protection information
• Endemic: YES
• IUCN: CR
• CITES: Not assessed
• Special Concern Species in Honduras: NO</td></tr>
<tr><td colspan="2">Distribution
Endemic species of Honduras. Only a seldom collected tree is reported. RVSCEH reports referred that only one individual of this species has been observed.</td></tr>
<tr><td colspan="2">Description
No specific information is available.</td></tr>
<tr><td colspan="2">Source of information
RVSCEH reports
IUCN website: http://www.iucnredlist.org/details/30704/0</td></tr>
</table>

<table>
<tr><th colspan="2">FLORA - Lonchocarpus yoroensis</th></tr>
<tr><td rowspan="2">No specific photograph is available.</td><td>Habitat and ecology
Generally found in dry forests.</td></tr>
<tr><td>Conservation and protection information
• Endemic: NO
• IUCN: CR
• CITES: Not assessed
• Special Concern Species in Honduras: NO</td></tr>
<tr><td colspan="2">Distribution
Native from Honduras; Mexico; Nicaragua.</td></tr>
<tr><td colspan="2">Description
A rarely collected tree.</td></tr>
<tr><td colspan="2">Source of information
RVSCEH reports
IUCN website: http://www.iucnredlist.org/details/37453/0</td></tr>
</table>

FLORA – *Opuntia hondurensis*	
	**Habitat and ecology** No specific information is available. **Conservation and protection information** • Endemic: YES • IUCN: Not assessed • CITES: Appendix II • Special Concern Species in Honduras: NO
Distribution Endemic species from Honduras.	
Description No specific information is available.	
Source of information RVSCEH reports	

<table>
<tr><th colspan="2">FLORA – Parathesis vulgata</th></tr>
<tr><td rowspan="2">No specific photograph is available.</td><td>Habitat and ecology
Mainly occurring at middle and upper elevations of mountain slopes, the species is found in areas of rainforest or cloud forest.</td></tr>
<tr><td>Conservation and protection information
• Endemic: NO
• IUCN: EN
• CITES: Not assessed
• Special Concern Species in Honduras: NO</td></tr>
<tr><td colspan="2">Distribution
Guatemala; Honduras</td></tr>
<tr><td colspan="2">Description
No specific information is available.</td></tr>
<tr><td colspan="2">Source of information
RVSCEH reports
IUCN website: http://www.iucnredlist.org/details/37461/0</td></tr>
</table>

FLORA – *Stenocereus yunckeri*

Habitat and ecology

No specific information is available.

Conservation and protection information

- Endemic: NO
- IUCN: Not assessed
- CITES: Appendix II
- Special Concern Species in Honduras: NO
- According to RVSCEH reports, this species should be assessed as CR by IUCN

Distribution

Native of the Baja California Peninsula and other parts of Mexico, Arizona in the USA, Colombia, Venezuela and Central America. According to RVSCEH reports, it is a regular species, expected to remain in the future, taking into account it is present in more than 25% of the fragmented monitored.

Description

No specific information is available.

Source of information

RVSCEH reports.

FLORA – *Vanilla planifolia*

Habitat and ecology

This species can be found in subtropical/tropical moist lowland forest. It seems to prefer moist forest, seasonally dry in spring, and favours calcareous terrain. It is absent in volcanic areas and in the wet tropical rainforests of Mexico. In moister areas, it can be found in secondary, mature forests. It flowers mainly in April to May, towards the end of the dry season.

Conservation and protection information

- Endemic: NO
- IUCN: EN
- CITES: Appendix II
- Special Concern Species in Honduras: NO
- This species is mainly threatened by habitat reduction and unregulated exploitation for scientific collections and research. Furthermore, wild individuals are extracted to be planted in existing vanilla plantations and for hybridization trials with cultivated individuals.

Distribution

Native to Mexico, where it can be found in the states of Puebla, Oaxaca, Chiapas, Quintana Roo. It is also native to Belize. It occurs at altitudes of 150 to 900 m asl, rarely to 1300 m asl. Also found in Florida, Central and South America in countries such as in Venezuela, Ecuador, Panamá.

Description

Vanilla planifolia is a tropical vine, which can reach a length of over 30 m. It has thick, fleshy stems and greenish flowers that open early in the morning and are pollinated by bees. The flowers have only a slight scent, with no element of the vanilla flavour or aroma. Once pollinated, the ovaries swell and develop into fruits called 'pods' similar to long, thin runner beans over a period of four weeks. The pods contain thousands of tiny black seeds.

Source of information

RVSCEH reports.
IUCN website: http://www.iucnredlist.org/details/103090930/0
Kew Gardens website: http://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:262578-2

FLORA – *Zamia standleyi*

Habitat and ecology

This species is found along the valleys of the northern rivers from moist hillsides, semixeric woodlands, disturbed secondary scrub, areas of regrowth and in cultivated fields.

Conservation and protection information

- Endemic: YES
- IUCN: VU
- CITES: Appendix II
- Special Concern Species in Honduras: NO

Distribution

Endemic species from Honduras. It is found in the northern river valleys of Honduras (Colon, Atlantida, Yoro and Cortez provinces), from San Pedro Sula eastward toward the Caribbean coast, reported as far east as the Río Platano.

Description

No specific information is available.

Source of information

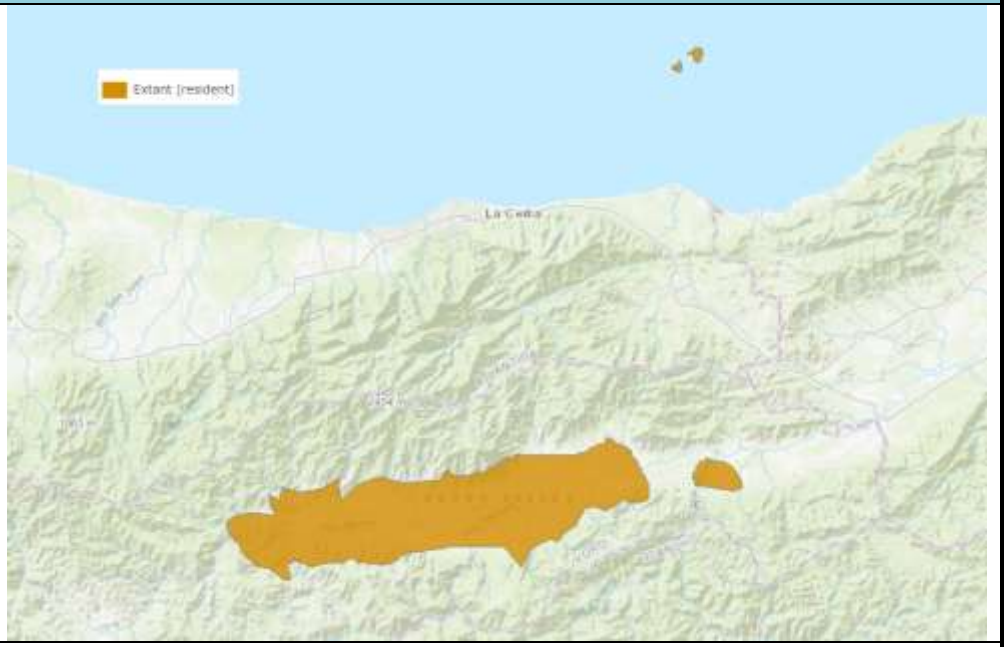
RVSCEH reports.
IUCN website: http://www.iucnredlist.org/details/42157/0

REPTILES - *Ctenosaura melanosterna*	
	**Habitat and ecology** The Black-chested Spiny-tailed Iguana inhabits tropical and subtropical dry forest and scrubland from 0 to 250 meters above sea level. It is semi-arboreal and diurnal, taking refuge in hollow logs and rock crevices at night. On Cayos Cochinos, iguanas utilize forest edge habitat consisting of sandy beach strand vegetation and rocky cliffs, as well as areas of open forest, including tree fall gaps. Within the Valle de Aguán it is found most often in undisturbed tropical scrub forests consisting of abundant *Acacia* and cacti, where it retreats in the hollows of these dominant species. This iguana is omnivorous, consuming fruit, flowers, leafy vegetation, arthropods, a variety of lizards, birds (especially fledglings), and carrion.
	Conservation and protection information • Endemic: YES • IUCN: CR • CITES: Appendix II • Special Concern Species in Honduras: NO The primary threat to the Black-chested Spiny-tailed Iguana is habitat destruction and fragmentation. Limited habitat destruction occurs on both islands of the Cayos Cochinos as palm trees are harvested for thatch roofs. The amount of destruction within the Valle de Aguán poses a much larger threat. Land conversion for agriculture began in the 1970s in this region. Dole Fruit Company has a large and expanding banana plantation, causing optimal habitat to be continually cleared and pesticides to be spread throughout the area. Smaller scale destruction also occurs as land is being cleared for cattle. Adult iguanas and eggs are sought for both immediate consumption and sale. On Cayos Grande, individuals are collected for consumption, but this threat is much more extreme within the Valle de Aguán.

REPTILES - *Ctenosaura melanosterna*

Distribution

Endemic species from Honduras. The Black-chested Spiny-tailed Iguana is known only from the Valle de Aguán in northern Honduras and the Cayos Cochinos Archipelago off the Caribbean coast of Honduras, where it occurs primarily on the two largest islands: Cayo Mayor (Grande) and Cayo Menor (Pequeño). The total population size is not known, but is estimated to be less than 5,000 mature individuals within the two range areas (Aguán Valley and Cayos Cochinos). Although the geographic range of this iguana is substantially greater for the Valle de Aguán subpopulation than for the Cayos Cochinos subpopulation, the density of individuals throughout the Valle is extremely low, making this species very rare within this part of its range and seldom observed.



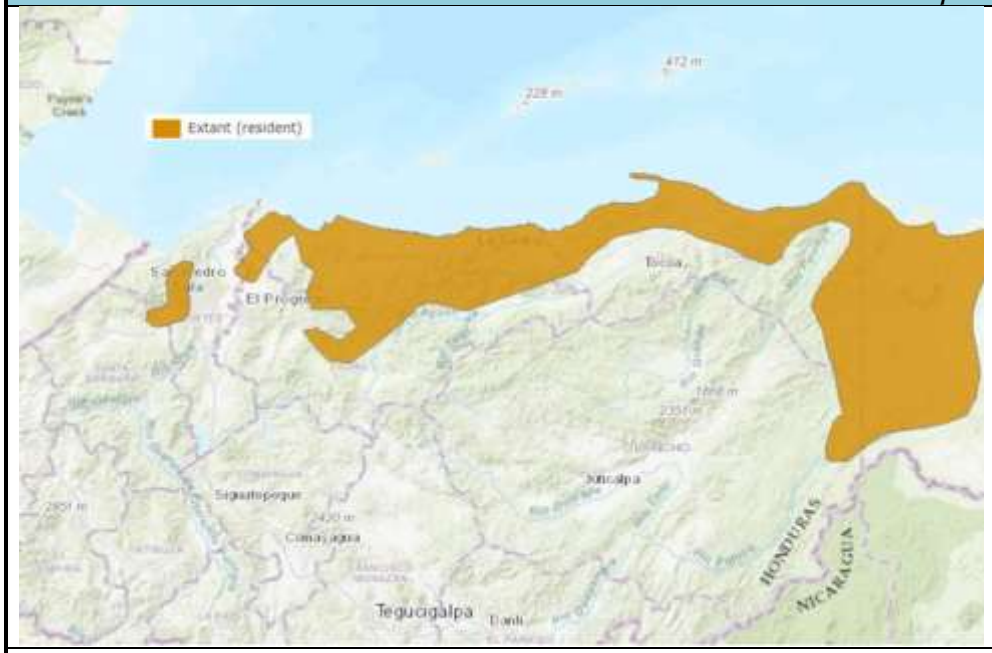
Description

On Cayo Menor, marked sexual dimorphism in size has been observed with males being larger. Males are territorial, with multiple females and juveniles residing within the territory. Nesting takes place in sandy substrates from April through July, with 7-18 eggs laid per nest. Hatchlings emerge from June through September. In captivity, the Black-chested Spiny-tailed Iguana lives from 10 to 15 years and reaches sexual maturity at 2 to 3 years. They lay eggs twice a year in February/March and August/September. Clutch sizes range from 11 to 41 eggs. The incubation period ranges from 85 to 90 days. Hatchlings have a snout-vent length of 41-52 mm, a total length of 114-149 mm, and average weight of 4 grams.

Source of information

RVSCEH reports.

IUCN website: http://www.iucnredlist.org/details/44189/0

REPTILES - *Sphaerodactylus dunni*	
	**Habitat and ecology** This species occurs in lowland wet and dry forest where it inhabits the leaf litter of closed canopy forest. It is diurnal. It is not known to occur in secondary forest. It occurs at elevations from 60-700 m. **Conservation and protection information** • Endemic: YES • IUCN: LC • CITES: Not assessed • Special Concern Species in Honduras: NO
Distribution Endemic species from Honduras (North of the country).	
Description No specific information is available.	
Source of information RVSCEH reports. IUCN website: http://www.iucnredlist.org/details/178652/0	

BIRDS - *Amazilia luciae*

Habitat and ecology

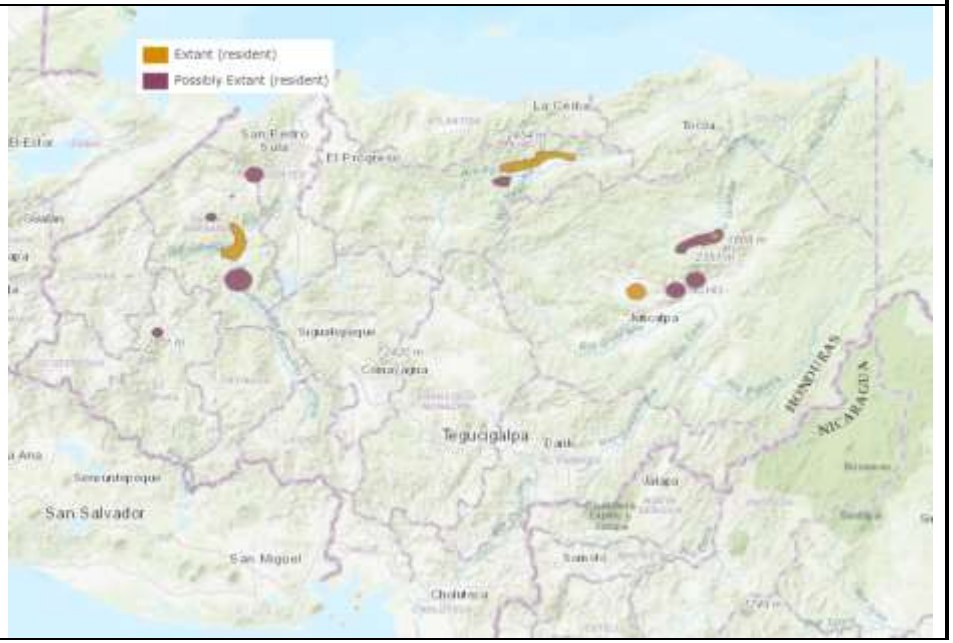
Specific to arid forests, especially the Very Dry Tropical Forest. In intact areas of Very Dry Tropical Forest, it becomes quite common, especially during the breeding season when fights between males are common. According to RVSCEH reports, more than 20 individuals were seen in a 250 meter transept during a monitoring.

Conservation and protection information

- Endemic: YES
- IUCN: EN
- CITES: Appendix II
- Special Concern Species in Honduras: NO

Distribution

Endemic species from Honduras. Amazilia luciae occurs in the arid interior valleys of Honduras, where it is currently known from three sites in the northeast, and has recently been rediscovered in the west of the country. In addition to Olanchito and Arenal, it is reported in the dry forest of the municipality of San Esteban, in the department of Olancho and in Santa Bárbara. It is estimated that the emerald hummingbird population in the protected area is approximately 1,200 individuals, reported in 16 of the 27 fragments of dry forest that are currently protected as part of the RVSCEH. It should be noted that the degree of conservation of these fragments is variable, observing individuals of emerald hummingbird in altered sites.



Description 9.5 cm. Medium-sized, green hummingbird. Male has glittering blue-green throat and upper chest, sometimes appearing grey, mottled dusky. Rest of underparts pale grey with mottled green sides. Bright green upperparts with bronzy tinge on uppertail-coverts. Bronze-green tail. Black bill with reddish mandible and dark tip. Female similar with less intense and more restricted gorget. Immature has greyish throat spotted turquoise. VoiceSlightly metallic ticking repeated steadily. Also buzzy chatters.
Source of information RVSCEH reports. IUCN website:

Municipality	Hamlet	Settlement
Olanchito	Agalteca	Agalteca
	Armenia	Armenia Cooperativa El Destino
		Cooperativa El Destino
	Bálsamo Oriental	Bálsamo Oriental
	Barranco	Barranco
	Boca de Mame	Boca de Mame
	Calpules	Calpules
		Hacienda Jalisco
		San Andrés
		Hacienda Reitoca
		Dinamarca
		Pozo Seco
	Campo Agua Buena	Campo Agua Buena
	Campo Bálsamo	Campo Bálsamo
	Campo Calpules	Campo Calpules No.2
		Campo Calpules
	Campo El Chorro	Campo Drake
		Campo El Chorro
	Campo Limones No.4	El Cinco
		Campo Limones No.4
	Campo Limones No.6	Campo Limones No.6
	Campo Nerones	Campo Nerones
		Cooperativa Luz y Esperanza
	Campo Nuevo	Campo Nuevo
	Campo Palo Verde No.2	Campo Palo Verde No.2
	Campo Rosario	Campo Rosario
	Campo Trojas No.2	Campo Trojas No.2
	Campo Trojas No.3	Campo Trojas No.3
	Chorrera	La Puntilla
		Paso El Cayo
		Hacienda La Flor
		Hacienda San Vicente
		Chorrera
	Cliftón	Cliftón
	Cooperativa Brisas de Cuyamapa	Cooperativa Fé y Esperanza
		Cooperativa Brisas de Cuyamapa
	Cooperativa Doce de Diciembre	Cooperativa Brisas de Monga Lt
	Coyoles	Coyoles
	Coyoles Central	Coyoles Central
	El Carril	El Carril
	El Chaparral	Hacienda Moreno
		El Jícaro
	El Nance	Paso de Arenal
		Culuco
		Hacienda Los Piñones
		El Nance
	El Ocote	El Ocote
		Chirinos
		Campo Rosario No.1
		Campo El Olvido

	Buenos Aires
	Las Minas
	Hacienda El Rosario
La Reforma	La Reforma
La Sabana de San Carlos	Bocatema
	La Sabana de San Carlos
Las Hicoteas	Jaguas Arriba
	Jaguas Abajo
	La Zanja
Las Minas	Las Minas
	El Roble
Maloa	Piedra del Tigre
	El Desvío de Maloa
	La Hacienda
	La Conferencia
	Maloa
	Loma de Plata
	San Pedro
Medina	Medina
Méndez	Jalisco
	Hacienda Uchapa
	Méndez
	Tibombo
	Finca San Carlos
Nombre de Jesús	Casa Blanca
	Nombre de Jesús
	Hacienda Santa Lucía
Olanchito	El Crucete
	San Luis
	Hacienda La Revista
	Olanchito
	Hacienda La Meseta
	Hacienda La Florida
	Hacienda San Félix
	Hacienda Santa Clara
	Hacienda El Tempisque
Potrerillos	Ciudad Vieja
	Potrerillos
	Hacienda Germania
	El Puente
	Nuevo Londres
Puerto Escondido	Hacienda Santa Rita
	El Barranco de Santa Ana
	El Masical
	Puerto Escondido
Sabanetas	Sabanetas
San Dimas	San Dimas
	Buena Vista
San Francisco	Plan Grande
	San Francisco
	Hacienda El Edén
San Jerónimo	San Jerónimo

	San José	San José
		San José Arriba
	San Juan	San Juan
	San Lorenzo Abajo	Las Lajas
		Hacienda La Mora
		El Enea
		El Agua Caliente
		San Patricio
		San Lorenzo Abajo
	San Lorenzo Arriba	Buenos Aires
		La Estación
		Hacienda San Vicente
		Sabana Larga
		La Laguna
		Hacienda Ocotes Altos
		Los Horcones
		El Zangarro
	San Marcos	Las Delicias
		El Pacífico
		Hacienda La Isla
		Hacienda San José
		Hacienda El Sauce
		Río Chiquito
	Santa Bárbara	Santa Bárbara
	Tacualtuste	Tacualtuste
	Teguajinal	La Ceja
		Teguajinal
	Tejeras	El Tolondrón
		Tejeras
	Tepusteca	Tepusteca
	Trojas	La Envidia
El Arenal	Arenal	Hacienda Modelo o Villa Estela
		La Hacienda
	Campo El Cayo	Campo Rojo
		Buenos Aires
		Tiestos
		Campo El Cayo
	Champerío El Cayo	Bomba Nueve
		Champerío El Cayo
	Santa Cruz	Santa Cruz
	Tierra Blanca	Rancho Bonito
		La Jigua
		Tierra Blanca

ANNEX 8

SUMMARY OF THE WATER RESOURCE BALANCE

CONTENTS

1 INTRODUCTION

The present Annex provides a summary of the of the Water Resource Balance conducted by PAA Project Finance and Integra Ingeniería in 2017, as part of the Project Design. Such water balance was done in order to evaluate the water availability for the irrigation project in a large area of the Alto Aguan River valley.

The objective of this Annex is to provide the basic information of the water resource balance in the context of the ESIA, so that it is understood the impact assessment regarding the water abstraction.

2 INPUT DATA

The following data were considered in the water balance assessment:

- Situation of Water Resources in Central America. Global Water Partnership (March, 2017).
- Data on the flow measurements of river in the basin and sub-basins of Alto Aguan taken by PAA Project and SAG in May 2017.
- Diagnosis and Analysis of the Water and Sewerage Sector, CONASA (October, 2016).
- Evaluation of water resources in natural regime of the National Autonomous University of Honduras, Honduran Institute of Earth Science and the Energy and Natural Resources, Environment and Mining – Directorate General of Water Resources.
- Water sector diagnosis in Olanchito Municipality report, 2010, financed by the Canadian International development agency. ("Diagnóstico del Sector del Agua y Saneamiento en el Municipio de Olanchito", 2010).
- The Centre for Public Works Studies and Experimentation of Spain (CEDEX - *Centro de Estudios y Experimentación de Obras Públicas*) carried out an evaluation of water resources in natural regime of the Honduran territory, using a hydrologic model that simulates the main flows and water transferences from the atmosphere, soil and aquifer. The simulation covered the monthly period between the years 1970/71 until 2001/02.
- Information obtained during the technical visits on site conducted by PAA Project and Integra Ingeniería in 2017, especially the surveys carried out and existing underground wells gauging with historic data which enable the evaluation of the future behavior.

3 HONDURAN WATER BALANCE

The main socioeconomic variables that have an impact on the use of water were analysed for the year 2003 and forecasted for the year 2025 (based in document *Situation of Water Resources in Central America*), with the following main conclusions for Honduras, in a nation-wide approach:

- Data in 2003:
  - Gross demand of water: 1,900 hm^3/year.
  - Consumptive demand of water: 1,000 hm^3/year.
- Forecasts for the year 2025, if the irrigation potential identified in the country is developed:
  - Gross demand of water: 7,500 hm^3/year.
  - Consumptive demand of water: 5,000 hm^3/year.
- The water consumption due to irrigation will increase from 60% of the total water consumption in Honduras (2003) to 75-80% (2025).

4 AGUAN RIVER BASIN WATER BALANCE

4.1 ANNUAL WATER CONSUMPTION BY THE PROJECT

The maximum demand of water by the Project has been calculated by PAA Project Finance and Integra Ingeniería, taking into account that irrigation with groundwater will be limited to the dry period of approximately 3 months / year. The following table provides a summary of the estimated water consumption.

Table 1 Summary of maximum water consumption by the Project

Weekly provision of water	Monthly provision of water	Annual provision of water (3 months irrigation)	Annual provision by hectare	Maximum irrigation surface in the Project Area	Maximum water consumption by the Project in 1 year
32 l/m^2	137 l/m^2	480 l/m^2	4,800 m^3	3,110 ha	14.928,000 m^3

Source: PAA Project Finance and Integra Ingeniería, 2017 – Edited by ERM, 2018

4.2 SURFACE WATER

The Aguan River Basin is composed by the Aguan River and its tributaries. It has a surface of 10,266 km^2. The Aguan River has a length of 275 km and a maximum altitude of 1,300 ASL.

CEDEX evaluation of water resources in natural regime of the Honduran territory provides data about the water balance in the different basins in Honduras. The balances[1] are provided both monthly and yearly. They are included in the tables below:

Table 2 Annual water balance in the Aguan Basin (2003 and 2025)

Balance 2003 (Hm^3)	Balance 2025 (Hm^3)
2,000 – 5,000	2,000 – 5,000

Source: PAA Project Finance and Integra Ingeniería, 2017 – Edited by ERM, 2018

Table 3 Monthly water balance in the Aguan Basin (2003 and 2025)

Month	Balance 2003 (Hm^3)	Balance 2025 (Hm^3)
May	200 - 300	50 - 100
June	200 - 300	150 - 200
July	300 - 500	300 - 500
August	300 - 500	300 - 500
September	300 - 500	200 - 300
October	500 - 700	300 - 500
November	300 - 500	500 - 700
December	300 - 500	500 - 700
January	200 - 300	300 - 500
February	300 - 500	200 - 300
March	200 - 300	150 - 200
April	50 - 100	25 - 50

Source: PAA Project Finance and Integra Ingeniería, 2017 – Edited by ERM, 2018

These water balances show that there is not any negative water balance in the global Aguan River Basin neither in the year 2003 nor in the year 2025.

In the case of the sub-basins data, some negative balances were observed in the 2025 forecast (limited to three sub-basins and limited to 2 months), these can be balanced by the groundwater recharge into the basin, which is always positive. The following should be taken into account:

- The north mountain range Aguan River Valley, especially in the Alto Aguan, has rainfall levels of 3,000 mm/year, which guarantees the recharge of the Alluvial Aquifer of the Aguan River.
- This contribution would compensate the partial sub-basins negative balances.

Table 4 below provides a summary of the key hydrological data from the Aguan River Basin.

[1] The original water balance developed by PAA Project and Integra Ingeniería in 2017 provides additional information by sub-basins. However, for the purpose of the ESIA, the general information about the Aguan River Basin is considered sufficient.

Table 4 Aguan River Basin: key hydrological data

Parameter	Average value	Maximum value	Minimum value
Rainfall (mm/year)	1,648	2,022	1,334
Potential evaporation (mm/year)	1,248	1,320	1,184
Underground supply (mm/year)	281		
Specific supply (mm/year)	560	887	281
Total supply (Hm^3)	**6,162**		

Source: Diagnóstico del Sector del Agua y Saneamiento en el Municipio de Olanchito" report, 2010

Taking into account that the municipality has a water flow of 22,181,187 m^3/year in 2010 based on the data provided by water supply sources gauging stations (Municipality Olanchito, 2010), the availability of surface water sources has been estimated of 267 m^3/person/year in 2010, expected to decrease to 185 m^3/person/year in the future[1].

4.3 GROUNDWATER

Four different aquifers are found in the Project Area:

- Highly productive and extensive aquifer (intergranular flow): it includes the alluvial deposits of the Aguan River Valley. Groundwater levels in this aquifer are between 20 and 30 m depth. Wells in this aquifer show water flows ranging between 4 to 30 l/s.
- Local aquifers moderate to highly productive (fissures flow): it includes the geological unit "Valle de Angeles – Kva). Groundwater levels in this aquifer are between 60 and 70 m depth. Wells in this aquifer show water flows ranging between 1 and 20 l/s.
- Aquifers local to extensive poor or moderately productive (fissures flow): it includes the volcanic rocks not differentiated (Tv). No information about groundwater levels nor water flows is available.
- Rocks with local and limited underground water resources: it includes the unit "Esquistos Cacaguapa - Pzm". No information about groundwater levels nor water flows is available.

It should be noted that most of the Project Area is located on the Alluvial deposits of the Aguan River Valley, which is an extensive and highly productive aquifer.

The water balance assessment conducted by PAA Project and Integra Ingeniería estimates that the maximum Project water consumption (14.93 Hm^3) would produce a theoretical depletion of the groundwater less than 0.5 m, considering a static regime. Such static regime therefore does not consider any recharge in the aquifer. As described before, the north mountain range

[1] Diagnóstico del Sector del Agua y Saneamiento en el Municipio de Olanchito" report, 2010

Aguan River Valley has rainfall levels of 3,000 mm/year, part of which contribute to the recharge of the Alluvial Aquifer of the Aguan River. Moreover, recharge in the Aguan River Valley is described to be between 350 and 680 mm / year. This recharge would compensate (or would keep a negligible groundwater depletion) the estimated groundwater depletion (0.5 m) in static regime.

4.4 INFILTRATION

The infiltration refers to the entry of water from the surface into the soil. It is a process that is directly related to the conditions and characteristics of the surface of the soil and it depends on the soil's infiltration capacity and the intensity of the rain (Chow et al., 1964).

Based on monthly water infiltration maps of Honduras, the average annual volume of water infiltrated in the Project Area ranges from a maximum of 1,357.11 Hm^3 to a minimum of 383.30 Hm^3. This minimum volume corresponds to the minimum annual volume of water available in the Project Area due to water infiltration.

The following Table 5 presents the maximum and minimum average volume of water infiltrated in the Project Area categorised in three categories (Sector A being the area of the project with the highest volume of water infiltrated and Sector C the area of the project with the lowest).

Sectors of Project Area	Sector A (Hm^3)		Sector B (Hm^3)		Sector C (Hm^3)	
Infiltrated water availability	1,357.11	968.13	968.13	645.71	682.88	383.80

Source: PAA Project Finance and Integra Ingeniería, 2017 – Edited by ERM, 2018

5 CONCLUSION

According to the Water Resource Balance conducted by PAA Project Finance and Integra Ingeniería in 2017, together with the studies carried out by the CEDEX and the Honduran Autonomous National University, there is a minimum volume of available water in the Project Area of approximately 384 Hm^3 due to water infiltration to which translates into a positive balance in the Alto Aguan of 384 Hm^3.

Considering that the irrigation demand is estimated of 14.93 Hm^3/year, it can be concluded that the planned irrigation is feasible and does not alter the environment conditions of the area or the system´s sustainability.

ANNEX 8

CRITICAL HABITAT ASSESSMENT

CONTENTS

LIST OF ACRONYMS

The following table presents a list of acronyms in the context of the critical habitat assessment.

Acronym	**Definition**
AoI	Area of Influence
BAP	Biodiversity Action Plan
BMP	Biodiversity Management Plan
CH	Critical Habitat
CHR	Critical Habitat Review
CR	Critically Endangered (IUCN classification)
DD	Data Deficient (IUCN classification)
DMU	Discrete Management Unit
EIA	Environmental Impact Assessment
EN	Endangered (IUCN classification)
EDGE	Evolutionarily Distinct and Globally Endangered
ERM	Environmental Resources Management
GN	Guidance Note to the PS6
IBA	Important Bird Area
IFC	International Finance Corporation
IUCN	International Union of the Conservation of Nature
KBA	Key Biodiversity Area
LC	Least Concern (IUCN classification)
NG	Net Gain
NNL	No Net Loss
NT	Near Threatened (IUCN classification)
PS6	Performance Standard 6 (IFC)
SCFR	
VU	Vulnerable (IUCN classification)
WWF	World Wildlife Fund

GLOSSARY OF TERMS

The following table presents a list of definitions in the context of the critical habitat assessment.

Acronym	Definition
Biodiversity	The structural, functional and compositional attributes of an area, ranging from genes to landscapes.
Critical Habitat	Areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered (CR) and/or Endangered (EN) species; (ii) habitat of significant importance to endemic and / or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and / or unique ecosystems; and/or (v) areas associated with key evolutionary processes (see IFC PS6, Paragraph 16).
Critically Endangered	A taxon is Critically Endangered (CR) when it is facing an extremely high risk of extinction in the wild in the immediate future, as defined by IUCN criteria (www.iucnredlist.org).
Endangered	A taxon is Endangered (EN) when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future, as defined by the IUCN criteria (www.iucnredlist.org) or provisionally assessed by expert group.
Endemic	A species that has ≥ 95 % of its global range inside the country or region of analysis (IFC PS6 GN79).
Habitat	The environmental or ecological area in which an animal, plant species or other organism lives.
IUCN Red List	This list has been developed by the International Union for Conservation of Nature (IUCN) and details the global conservation status of a wide range of biological species. The Red List website is http:/www.iucnredlist.org.
Keystone species	A species that has a disproportionate effect on its environment relative to its biomass and whose removal initiates significant changes in ecosystem structure and loss of biodiversity
Mitigation	Measures designed to avoid, reduce or remedy adverse negative impacts.
Modified Habitat	An area that may contain a large proportion of plant and/or animal species of non-native origin, and / or where human activity has substantially modified the primary ecological functions and species composition.
Natural Habitat	An area composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary functions and species composition.
Near Threatened	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
Net Gain	Net Gain is defined by in IFC PS6 (paragraph 18) as additional conservation outcomes that can be achieved for the biodiversity values for which the critical habitat was designated. Net gains may be achieved through the development of a biodiversity offset and/or through the implementation of programs that could be implemented in situ (on-the-ground) to enhance habitat, and protect and conserve biodiversity.
No Net Loss	No net loss is defined as the point at which project-related impacts on biodiversity are balanced by measures taken to avoid and minimize the project's impacts, to undertake on-site restoration and finally to

	offset significant residual impacts, if any, on an appropriate geographic scale (e.g., local, landscape-level, national, regional)
Offset	Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development and persisting after appropriate avoidance, minimization and restoration measures have been taken.
Restricted Range	Restricted range species include those with ranges in the following criteria: endemic to a site or found globally at fewer than 10 sites; animal species having a distribution range less than 50,000 km2; or bird species with a global breeding range less than 50,000 km2.
Vulnerable	A taxon is Vulnerable (VU) when it is not Critically Endangered (CR) or Endangered (EN) but is facing a high risk of extinction in the wild in the medium-term future, as defined by the IUCN criteria (www.iucnredlist.org).

1 INTRODUCTION

This Annex presents the outputs of an assessment of the extent to which the Alto Aguan River Valley Irrigation Project triggers the natural and critical habitat provisions of IFC Performance Standard 6. It determines which areas within the Project footprint constitute natural habitat, which areas constitute modified habitats, and which habitats (natural or modified) and species found within the ecological landscape in and around the Project footprint may be regards as critical habitat triggers by Lenders.

Critical habitats are characterised by high biodiversity values, which are determined by species, ecosystems and ecological processes. This assessment is a requirement of IFC PS6[1] to manage risks and avoid, mitigate, and offset impacts to areas with high biodiversity values. Different levels of mitigation measures / project design apply in non-critical habitat and in critical habitat. Whilst, no net loss of biodiversity[2] is required in non-critical habitats, net gain of biodiversity[3] is required in the case of critical habitats. This difference (no net loss vs net gain) might result in a higher level of project mitigation requirements (including changes in the project design and offset measures).

Prior to funding projects, most lenders require a demonstration of how environmental and social impacts / risks associated with the project will be managed. The IFC's Performance Standards are the most internationally accepted guidance for projects on how to achieve this. For biodiversity-related impacts, IFC PS6 is used, as described before. IFC PS6 divides habitats into three types that require different levels of management of effects: modified, natural, and critical. Critical habitats require the highest level of assessment and management of effects.

Some specific requirements of IFC PS6 include the following:

- As a matter of priority, avoid impacts on biodiversity and ecosystem services. When avoidance of impacts is not possible, measures to minimise impacts and restore biodiversity and ecosystem services should be implemented, in line with the mitigation hierarchy.
- For critical habitat, retain external experts with appropriate regional experience to assist in the development of appropriate mitigation and management.

1 IFC (2012) Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.
2 No net loss is defined (IFC PS6) as the point at which project-related impacts on biodiversity are balanced by measures taken to avoid and minimize the project's impacts, to undertake on-site restoration and finally to offset significant residual impacts, if any, on an appropriate geographic scale (e.g., local, landscape-level, national, regional).
3 Net gain is defined (IFC PS6) as additional conservation outcomes that can be achieved for the biodiversity values for which the critical habitat was designated. Net gains may be achieved through the development of a biodiversity offset and/or the implementation of programs that could be implemented in situ (on-the-ground) to enhance habitat, and protect and conserve biodiversity.

The main objective of this Annex is to identify key biodiversity features of concern that may be qualified as Critical Habitat, and impacted by the Project. Key biodiversity features were identified using the process and criteria described in the IFC PS6. The process involves the following:

- Defining the Discrete Management Unit (DMU).
- Characterising the environmental baseline through desktop review and focused field survey (See *Section 5.4*).
- Reviewing the habitats within the DMU to determine the presence of Natural or Modified Habitat.
- Reviewing the conservation status of species present in the DMU.
- Determining the presence of Critical Habitat within the DMU.
- Recommending measures to address risks related to Critical Habitat.

The assessment presented here has been informed by the ESIA undertaken for the Project.

2 METHODOLOGY

2.1 OVERVIEW

Critical Habitat is defined in IFC PS6, paragraph 16:

'Critical habitats" are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.'

The description of these criteria (along with their quantitative thresholds (for the first three criterions) are further described in the associated Guidance Notes .

The IFC PS6 describes three steps that should be used to identify and characterize Critical Habitat. Step 1: Stakeholder Consultation/Initial Literature Review
Aim: To obtain an understanding of biodiversity within the landscape from the perspective of all relevant stakeholders. This has taken place during fieldwork for the ESIA (see references to the field survey conducted in June 2018 in *Section 5.4,* including meetings with different stakeholders).

Step 2: In-field Data Collection and Verification of Available Information

Aim: To collect field data and verify available detailed information necessary for the critical habitat review. This has been done in the process of developing this EIA (see references to the field survey conducted in June 2018 in *Section 5.4*).

Step 3: Critical Habitat Determination

Aim: Determine whether the project is situated in Critical Habitat.
Analysis and interpretation of the desktop and field data collected.

An overview of the results of the CH are described, along with recommended actions in Section 3 of this Annex.

2.2 CRITICAL HABITAT CRITERIA

The term Critical Habitat is broadly defined in Paragraph 16 of IFC PS6 as areas with high biodiversity value. This includes areas that meet one or more of the following criteria:

- Criterion 1: Critically Endangered (CR) and/or Endangered (EN) Species.
- Criterion 2: Endemic and/or Restricted-range Species.
- Criterion 3: Migratory and/or Congregatory Species.
- Criterion 4: Highly Threatened and/or Unique Ecosystems.
- Criterion 5: Key Evolutionary Processes.

Further description of each of the criteria is detailed in IFC PS6, a summary of each follows below.

2.2.1 Criterion 1: Critically Endangered and/or Endangered Species

The IFC PS6 defines Endangered (EN) and Critically Endangered (CR) according to IUCN and as reported on the IUCN Red List of Threatened Species (Red List). The guidance on applying a particular listing is as follows:

- If the species is listed nationally or regionally as EN or CR, in countries that adhere to IUCN guidance, the critical habitat determination will be made on a project by project basis in consultation with competent professionals.

2.2.2 Criterion 2: Endemic and/or Restricted-range Species

The IFC PS6 provides the following definitions for endemic and restricted-range species.

An endemic species is defined as one that has ≥ 95% of its global range inside the country or region of analysis.

A restricted-range species is defined for animals as:

- Those species which have an extent of occurrence of 50,000 km^2 or less.
- Plants are more commonly referred to as "endemic".

2.2.3 Criterion 3: Migratory and Congregatory Species

The IFC PS6 defines migratory species as any species of which a significant proportion of its members cyclically and predictably move from one geographical area to another (including within the same ecosystem).

Congregatory species are those whose individuals gather in large groups on a cyclical or otherwise regular and/or predictable basis, form colonies. These congregation can occur for non-breeding purposes (e.g. foraging, roosting) or due to bottleneck sites where significant numbers of individuals of a species pass over a concentrated period of time (e.g. during migration).

2.2.4 Criterion 4: Highly Threatened and/or Unique Ecosystems

The IFC PS6 defines highly threatened or unique ecosystems as those that are at risk of significantly decreasing in area or quality; are of small spatial extent; and/or contain unique assemblages of species including assemblages or concentrations of biome-restricted species (i.e. species whose distributions are largely or wholly confined to one biome).

2.2.5 Criterion 5: Key Evolutionary Processes

Evolutionary processes are often strongly influenced by structural attributes of a region, such as its topography, geology, soil and climate over a period of time. The IFC PS6 suggests that this criterion is defined by: (1) physical features of a landscape that might be associated with particular evolutionary processes; and/or (2) sub-populations of species that are phylogenetically or morphogenetically distinct and may be of special conservation concern given their distinct evolutionary history (i.e. Evolutionarily Distinct and Globally Endangered (EDGE) species or Evolutionary Significant Units at population level).

Criterion 5 is usually considered to be heavily reliant on scientific knowledge, and thus would be triggered in areas that have already been thoroughly investigated or where significant research has been conducted that may have already indicated the potential or existence of unique evolutionary processes.

Furthermore the Guidance Notes indicates that internationally and/or nationally recognized areas of high biodiversity value will likely qualify as critical habitat.

2.2.6 Quantitative Criteria for Criterions 1 to 3

The IFC PS6 recognises that there are gradients of critical habitat or a continuum of degrees of biodiversity value associated with critical habitats based on the relative vulnerability (degree of threat) and irreplaceability (rarity or uniqueness) of the specific location. This gradient or continuum of criticality is true for all criteria. Even within a location designated as Critical Habitat there might be habitats or habitat features of higher or lower biodiversity value. There also will be cases where a project is sited within a greater area recognized as Critical Habitat, but where the specific project site itself has been highly modified. This is particularly the case in this project, where the project actions will take place in highly modified habitat.

The Guidance Notes detail the tiers of Critical Habitat. For Criteria 1 to 3, quantitative thresholds are provided to assign critical habitat into either Tier 1 or Tier 2. Criteria 1 through 3 are focused on species level, whilst Criteria 4 and 5 focus on ecosystem and landscape levels. *Table 2.1* details the relevant thresholds.

Table 2.1 Quantitative Thresholds for Tiers 1 and 2 of Critical Habitat Criteria 1 to 3

Criteria	Tier 1	Tier 2
Criterion 1. Critically Endangered (CR)/ Endangered (EN) Species	(1a) Habitat required to sustain ≥ 10 percent of the global population of a CR or EN species/subspecies where there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species. (1b) Habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management sites globally for that species.	(1c) Habitat that supports the regular occurrence of a single individual of a CR species and/or habitat containing regionally- important concentrations of a Red-listed EN species where that habitat could be considered a discrete management unit for that species/ subspecies. (1d) Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species. (1e) As appropriate, habitat containing nationally/regionally important concentrations of an EN, CR or equivalent national/regional listing.
Criterion 2. Endemic/ Restricted Range Species	(2a) Habitat known to sustain ≥ 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species (e.g., a single-site endemic).	(2b) Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgment.
Criterion 3. Migratory/ Congregatory Species	(3a) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 95 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle where that habitat could be considered a discrete management unit for that species.	(3b) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent but < 95 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle and where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment. (3c) For birds, habitat that meets Birdlife International's Criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance. (3d) For species with large but clumped distributions, a provisional threshold is set at ≥5 percent of the global population for both terrestrial and marine species.

Criteria	Tier 1	Tier 2
		(3e) Source sites that contribute ≥ 1 percent of the global population of recruits.

Source: IFC, 2012 (Guidance Note 89 to PS6)

Criterion 4 is triggered by ecosystems that are threatened, house unique assemblages of biome-restricted species, or are recognized for high conservation value, including protected areas. No quantitative thresholds are provided by the IFC Performance Standards; nonetheless, quantitative categories and criteria from Rodriguez et al. (2011) and Bland et al. (2016) may be applied to evaluate ecosystem status if availability and quality of data allow.

Criterion 5 applies to landscape-level features that can influence key evolutionary processes. Key landscape features such as unique topography that creates unique habitats and areas important for climate change adaptations have been identified using literature review and through expert consultation. This criterion also applies at the species level for 'distinct species' which includes those coined as 'Evolutionarily Distinct and Globally Endangered' (EDGE) (GN 95 IFC 2012b). Species within the unit of analysis identified as EDGE species where evaluated for Critical Habitat on a case-by-case basis.

3 CRITICAL HABITAT DETERMINATION

Based on the biodiversity data obtained as part of Steps 1 and 2 (i.e. desktop study and field survey), information is screened against the criteria and thresholds.

3.1 DISCRETE MANAGEMENT UNIT

The scale at which a critical habitat determination takes places depends on underlying ecological processes for the habitat in question and is not necessarily limited to the footprint of the project. For Criteria 1 to 3, the determination of critical habitat is based on a Discrete Management Unit (DMU), an area that has a definable boundary within which the biological communities have more in common with each other than they do with those outside the boundary:

'*A discrete management unit may or may not have an actual management boundary (e.g., legally protected areas, World Heritage sites, KBAs, IBAs, community reserves) but could also be defined by some other sensitive ecologically definable boundary (e.g., watershed, interfluvial zone, intact forest patch within patchy modified habitat, seagrass habitat, coral reef, concentrated upwelling area, etc.). The delineation of the management unit will depend on the species (and, at times, subspecies) of concern.*'

In the case of the Alto Aguan River Valley Irrigation Project, the definition of the DMU in order to determine the quantitative thresholds for CH become largely irrelevant. Whether the DMU is defined as the whole of the Aguan River watershed as one extreme case, or the footprint of the protected area on the other, the species and habitats involved would provide the same calculations. What has become clear and is stated in *Section 5.4.4* of the ESIA, is that the size of the protected area is a mix of biological features (areas where the very dry forest patches are better preserved) and socio-economic (areas where landowners have volunteered to relinquish land use change), and as such the size and location of the habitat which could qualify as Critical extends beyond the current protected area. On the other hand the Aguan River Valley is a mosaic of natural and modified habitats, which available evidence discards for the latter the possibility of being classified as Critical. In terms of connectivity, in fact the mobility of the key species which have determined the protection of the area is actually low or very low, thus the patchiness and mosaic pattern of the area is a difficulty in the preservation of genetically viable population sets in each well preserved habitat patch. In any case, and for the purposes of defining CH ,as mentioned, the DMU is largely irrelevant as the nature of the potential CH will be restricted to those very dry and dry forests, as recognized by local and international institutions.

3.2 HABITATS

According to the *Section 5.4.1* of the ESIA, habitat categorizations in the Project's AoI include:

- Agricultural fields and pastures.
- Grassland.
- Aquatic systems.
- Urban and rural areas.
- Shrubland and forest, including: very dry tropical forest, dry tropical forest and other types of shrubland and forest (e.g. conifer forests, mixed areas, etc.).

3.2.1 Natural Habitat

According existing habitat categorizations, Natural Habitats correspond to well preserved vegetation (terrestrial) habitat (very dry and dry tropical forest), along with those of existing water bodies.

3.2.2 Modified Habitat

With regards to Modified Habitats, these would correspond to all identified areas with secondary vegetation, especially secondary forest (sparsely/ partially vegetated), grassland which most of the times are abandoned areas that were used by livestock in the past, and agricultural fields and pastures.

3.3 CRITERIA 1 AND 2

3.3.1 Identification of Trigger Species

Species identified during the desktop search as being likely to be present within the DMU have been screened in order to identify those that are classified as EN or CR as well as their endemicity/range restriction. *Table 3.1* shows the species identified.

Table 3.1 ***IUCN Red List Terrestrial Species and Status***

Scientific name	Endemic	IUCN
Flora		
Bakeridesia molinae	Yes	-
Caesalpinia yucatanensis (subsp. Hondurensis)	Yes	-
Capparicordis yunckeri	Yes	-
Dioon mejiae	Yes	LC
Eugenia lempana	Yes	-
Eugenia coyolensis	Yes	CR
Leucaena lempirana	Yes	VU
Lonchocarpus trifolius	Yes	CR
Lonchocarpus yoroensis	-	CR
Opuntia hondurensis	Yes	-

Scientific name	Endemic	IUCN
Parathesis vulgata	-	EN
Stenocereus yunckeri	-	CR (*)
Vanilla planifolia	-	EN
Zamia standleyi	Yes	VU
Reptiles		
Ctenosaura melanosterna	Yes	CR
Sphaerodactylus dunni	Yes	LC
Birds		
Amazilia luciae	Yes	EN

Notes: (*) See *Annex 6* for further clarifications.
Source: Documents RVSCEH – Edited by ERM, 2018

3.3.2 Discussion

Depending on each species features as described in the preceding table, their tier status according to Criterions 1 and 2 are discussed in the following tables.

Table 3.2 Criteria 1 and 2 Tier Status for Amazilia luciae

Criterion 1: Critically Endangered and/or Endangered Species		
Tier 1	a	It is considered certain that over 10% of the global population may occur in the DMU.
	b	Given the biology of the species and geographical features of the unit of analysis, the DMU may be considered a discrete management site.
Criterion 2: Endemic and / or restricted range species		
Tier 1	a	It is considered certain that over 95% of the global population may occur in the DMU.

Table 3.3 Criteria 1 and 2 Tier status for Ctenosaura melanosterma

Criterion 1: Critically Endangered and/or Endangered Species		
Tier 1	a	It is considered certain that over 10% of the global population may occur in the DMU.
	b	Given the biology of the species and geographical features of the unit of analysis, the DMU may be considered a discrete management site.
Criterion 2: Endemic and / or restricted range species		
Tier 1	a	It is considered certain that over 95% of the global population may occur in the DMU.

Table 3.4 Criterion 2 Tier status for Sphaerodactylus dunni

Criterion 2: Endemic and / or restricted range species		
Tier 1	a	Taking into account its distribution map, it is not expected that over 95% of the global population of this species may occur in the DMU.
Tier 2	b	DMU is certain to sustain regular occurrence of single individuals or groups, considering their limited extent of occurrence (range restriction), it is likely that between over 1% to less than 95% may inhabit the DMU; and thus may be considered a discrete management site.

Table 3.5 Criteria 1 and 2 Tier status for Endemic and / or CR / EN flora

It is considered that the presence of endemic and or CR / EN plant species within the DMU is certain. Though there is a lack of data with regards to the distribution and abundance of some of these species, it is highly likely that most of them are range restricted. Thus under a precautionary approach identified species are assessed as likely of triggering critical habitat under Criterions 1 and 2, a short review of the tier criteria is presented.		
Criterion 1: Critically Endangered and/or Endangered Species		
Tier 1	a	It is considered likely that over 10% of the global of some species may potentially occur in the DMU.
	b	Given the biology of these plant species and geographical features of the unit of analysis, it is considered probable that the DMU may be considered a discrete management site.
Tier 2	c	It is certain that that DMU sustain regular occurrence of single individuals or groups, and thus probable that it may contain regionally important concentrations or be a discrete management site for the endangered species.
	d	It is considered likely that the loss of habitat at DMU level may impact long-term survivability of species.
	e	Habitats within the DMU may likely contain nationally/regionally important concentrations.
Criterion 2: Endemic and / or restricted range species		
Tier 1	a	It is considered probable that over 95% of the global population of any of these species may occur in the DMU.
Tier 2	b	DMU is certain to sustain regular occurrence of single individuals or groups, considering their limited extent of occurrence (range restriction), it is likely that between over 1% to less than 95% may inhabit the DMU; and thus may be considered a discrete management site.

3.4 CRITERION 3

There is currently no information that indicates that the DMU or part of it represents a major flyway where migratory birds would congregate on a cyclical/regular basis in a number in excess of 1% of its global population.

3.5 CRITERION 4

According to the table below the main habitats that comprise the DMU have been assessed qualitatively against IFC descriptors for endangered ecosystems.

Table 3.6 Critical Habitat Identification of Highly Threatened or Unique Ecosystems

Identified habitat type within the DMU	**Critical habitat criteria**			**Critical habitat trigger**
	At risk of significantly decreasing in area or quality	**Small spatial extent**	**Presence of unique assemblages of species**	
Very dry forest	Yes	Yes	Yes	Yes
Dry forest	Yes	Yes	Probable	Yes

As specified in *Section 5.4.1* of the ESIA, the surface of very dry tropical forest has decreased significantly. It is considered that the existing surface nowadays only represent 2% of the original surface:

- In 1938, the surface of very dry tropical forest was about 30,000 ha.
- In 2000, the surface was estimated in 8,495 ha.
- In 2009, the surface was estimated in 2,962.8 ha.

In addition to this high level of reduction of the surface of this habitat, it is also a very fragmented habitat. Because of this, the RVSCEH is formed by a number of spread and isolated areas across the Aguan River Valley.

With regards to the presence of unique assemblages in the forested habitats of the DMU, previous sections have discussed the presence of sensitive fauna (both endemic and of high conservation concern) which suggest that unique species assemblages exist.

3.6 CRITERION 5

Criterion 5 is mainly defined by the presence of physical landscape features that may be associated to particular evolutionary processes as well as the presence of subpopulations of species that are phylogenetically or morphogenetically distinct and may be of special conservation concern given their distinct evolutionary history (e.g. EDGE).

With regards to the former, the DMU seemingly has no major physical features that may set it apart from other areas that may be found along the ecoregion. Whilst for the latter, none of the species initially screened the following are considered EDGE species.

This criterion may overlap with Criterion 2 for endemic species (IFC, 2012). It has been noted that extensive surveys are required to gain a better understanding of the biodiversity features in the area (especially presence of endemic flora, as well as distribution of screened species throughout the earlier sections of this report). Thus information is not sufficient to determine whether or not critical habitat is triggered for the DMU under Criterion 5.

3.7 APPLICATION OF ADDITIONAL CRITERIA

It is not clear what the protected area would be designated according to IUCN Protected Area designation which ranges from strict protection Category I to resource managed areas Category VI). Brauneder et al. (2018) commented that IUCN management categories Ia, Ib and II (e.g. Strict Nature Reserves and National Parks) are explicitly mentioned in GN6, indicating they should be treated as critical habitat; whereas for management categories III-VI and areas for which the IUCN management category was not reported or not assigned (as is the case for the Honduran Emerald Wildlife Refuge) may qualify as

critical habitat if underlying biodiversity values align with critical habitat criteria. Given the latter, it is deemed that the DMU does qualify as Critical Habitat with regards to the management status of the Honduran Emerald Wildlife Refuge.

4 CONCLUSIONS

4.1 OVERVIEW

Three animal species inhabiting the DMU trigger classification as Critical Habitat. In addition, there are several species of endangered or endemic flora which are thought to be range restricted which would trigger the designation.

The forest habitats found in the DMU would also trigger classification as Critical Habitat based on their scarcity, existing trends in forest cover loss, and for their ability to host specific biodiversity values.

4.2 IMPLICATIONS FOR THE PROJECT

The IFC Performance Standards sets compliance objectives requiring the demonstration of No Net Loss (NNL) and potentially Net Gain (NG) measures for proposed projects located within either Natural and Critical habitats; or a combination of these. In terms of Natural Habitat the Project is not to significantly convert or degrade natural habitats, and mitigation measures are to be designed to achieve no net loss of biodiversity where feasible.

4.2.1 *Critical Habitat*

In areas of Critical Habitat, PS6 paragraph 17 indicates the Project is not to implement any project activities unless certain conditions are met, these are shown in *Table 4.1* along with a brief discussion on their status.

Table 4.1 Review of Project conditions located in Critical Habitat.

Conditions for Projects in critical habitat	Status of Aguan River Valley Irrigation Project
No other viable alternatives within the region exist for development of the Project on Modified or Natural habitats that are not Critical	Project location intrinsic to the climatic region, which is inherent of the presence of CH
The Project does not lead to measurable adverse impacts on those biodiversity values for which the Critical Habitat was designated, and on the ecological processes supporting those biodiversity values	Based on the ESIA findings, it is considered unlikely that significant adverse impacts may occur on CH trigger species/habitats.
The project does not lead to a net reduction in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period of time	Based on the ESIA findings, it is considered unlikely that significant net reduction may occur on CH trigger species/habitats over a reasonable period of time.
A robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the client's management program	The ESIA advances the main features of the BMP indicating that the Project shall implement specific management and monitoring programs for sensitive species.

In such cases where the Project is able to meet the requirements, the mitigation strategy is to be described in a Biodiversity Management or Action Plan and will be designed to achieve, when relevant, net gains of those biodiversity values for which the Critical Habitat was designated.

Net Gain measures should be applied to the biodiversity components that are confirmed to trigger Critical Habitat, unless the Project demonstrates that it will not impact those biodiversity components. In this case, to implement the requirements identified in the various studies (ESIAs, CHR) the Project will develop a Biodiversity Management Plan (BMP) to consolidate mitigations and management related to biodiversity protection. The BMP will provide a comprehensive plan for the Project to address issues of biodiversity protection. The implementation of mitigation measures will avoid or reduce impacts and risks to acceptable levels. In addition, the BMP will address specific requirements related to Critical Habitat as specified in the IFC Performance Standards:

'*Net gains may be achieved through the biodiversity offset, and in instances where a biodiversity offset is not part of the client's mitigation strategy (i.e., there are no significant residual impacts), net gains would be obtained by identifying additional opportunities to enhance habitat and protect and conserve biodiversity.*'

Specifically, the BMP will describe how net gain is to be achieved for the key species and habitats of concern. Considering that there are no significant residual impacts to those species and habitats derived from the project, those will no entail offsets, but will rather be additional opportunities to enhance habitat and protect and conserve biodiversity.