

2. ENVIRONMENTAL IMPACT ASSESSMENT

2.1. Outline of the Environmental Impact Assessment (EIA) Survey

2.1.1. Objectives

The objectives of the survey are to understand present environmental conditions, and to analyze/forecast possible environmental impacts caused by the selected short-term pilot projects for the Study of National Tourism Development for the Republic of Guatemala.

2.1.2. Survey Area

The survey area basically covers the following Priority Tourism Development Areas (PTDA):

- The Area within a 50 km radius from the center of El Remate village in Peten Department;
- The Area within a 15 km radius from the center of San Cristóbal Verapaz municipality in Alta Verapaz Department; and
- The Area within a 15 km radius from the center of Momostenango municipality.

2.1.3. Targeted Proposed Projects

The EIA Survey was conducted for the following short-term pilot projects:

(1) El Petén PTDA

- "Tourism Improvement of Uaxactún Archeological Site,"
- "Tourism Improvement of Yaxhá and Nakúm Archeological Sites,"
- "Development of Maya Research and Learning Center,"
- "Tourism Improvement of Aguateca and El Ceibal Archaeological Sites,"
- "Development of Pasión River Cruise Facilities," and
- "Development of Archeological and Regional Cultural Center."

(2) Las Verapaces PTDA

- "Development of the Verapaz Eco-Corridor Interpretation Center," and
- "Tourism Improvement of Sierra Pampacche Cloud Forest Park."

(3) Southwestern Highlands PTDA

- "Development of Poncho Textile Museum and Demonstration Workshop," and
- "Development of Hot Spring Baths and Accommodation."

2.1.4. Contents of the Survey

(1) Survey methods

The EIA Survey was conducted in collaboration with a subcontracted local environmental consulting firm of Guatemala.

Field surveys were conducted to analyze the following items, which might be affected significantly by the above-mentioned projects:

- Water quality,
- Municipal waste generation/disposal situations,
- Soil erosion/landslide,
- Flora and fauna, and
- Rights of common.

The Survey was also conducted for other social and natural environmental impact items, which were analyzed based on the available existing data and information.

Moreover, the Survey also included the description of mitigation measures for expected significant adverse impacts, and proposed environmental monitoring plans, if they are necessary.

(2) EIA survey reporting

The contents and formats of each EIA Survey Report by the subcontracted local environmental consulting firm were prepared based on the present regulations in Guatemala regarding Environmental Impact Assessment. Then, each EIA Survey Report was compiled based on the following format as the summary EIA Survey Reports:

- Chapter 1 Introduction,
- Chapter 2 Description of the project: background, site location and main components of the project,
- Chapter 3 Present environmental conditions of the project area: natural environment, socio-economic environment,
- Chapter 4 Environmental impacts: project construction phase, project operation phase
- Chapter 5 Analysis of alternative plan,
- Chapter 6 Mitigation measures for adverse impacts,
- Chapter 7 Environmental monitoring plan, and
- Chapter 8 Conclusions and recommendations.

2.1.5. Main Outputs and Uses of the Survey Results for the JICA Study

The main output was the Reports of Environmental Impact Assessment (EIA) Survey for respective projects. The Survey results could be used for identifying the possible adverse impacts, for which mitigation measures should be considered. The Survey results also would be useful for preparing necessary environmental monitoring plans. The following sections present the summary of EIA survey results.

2.1.6. Legal Base

The EIA Survey was constantly supported by the legislative entities established in the Political Constitution of the Republic of Guatemala, Law for the Protection and Improvement of the Environment (decree 68-86 of the Congress of the Republic) and the booklet for Proceedings of Environmental Impact Assessment, issued by the Ministry of Environment and Natural Resources (MARN), INAB, and Institute of Anthropology and History of Guatemala (IDAEH), National Commission for Protected Areas (CONAP).

The treaties, standards and national and international studies for the aspects of the Project that for its nature require special attention, where considered as well.

Related to the standards and technical recommendations for the planning and operation of this Project, the standards and recommendations of the following sources that are commonly accepted:

- Ministry of Public Health and Social Assistance (MSPAS)
- Ministry of Work and Social Prevision (MTPS)
- Guatemalan Institute of Social Security (IGSS)
- Guatemalan Tourism Institute (INGUAT)
- World Health Organization (WHO)
- European Economic Community (BEC)

2.2. EIA Survey of the Tourism Improvement of Uaxactún Archeological Site

2.2.1. Objectives of the EIA survey

Based on the results of the IEE, the Project will enhance the present cultural assets. It also includes construction of the access road from present Uaxactún to Tikal archeological site. Although the access road could contribute to the regional economy in the remote area, the access road may cause adverse natural environmental impacts such as disturbance of the present habitats of the wildlife. Also, the smooth traffic on the access road may accelerate deforestation. Therefore, it is concluded that the Project needs an EIA survey.

The objectives of the EIA Survey are: to identify/evaluate possible environmental impacts, which could be caused by the project based on the available data/information and field reconnaissance; to analyze/forecast possible environmental impacts; to propose mitigation measures for possible significant adverse environmental impacts if necessary; and to recommend environmental monitoring plan.

2.2.2. Description of the Project

(1) Background

Uaxactún is a Mayan archaeological site, which is located at 20km to the north of Tikal. Therefore, visit to the site could be integrated into the itinerary to visit Tikal. Some 220,000 people visited Tikal National Park in the year 2000 according to IDAEH statistics. Most visitors leave the hotel early in the morning (even before sunrise) to visit the site and stay most of the days in one place due to the lack of other attractions nearby Tikal. To provide more alternative itineraries for the visitors, Uaxactún archaeological site would be developed as an "afternoon destination" combined with Tikal.

(2) Site location and main components of the project

Uaxactún archaeological site is located in the Flores Municipality in El Peten Department. The site is 18km to the north from Tikal and within the Maya Biosphere Reserve.

The Project consists of the improvement of the access road, 20 km long and 12 meters wide, between Tikal and Uaxactún with gravel surface.

Construction of a visitor Center, in an area of 200 m² with registration offices, information, security, resting areas, sanitary services, and wooden structure at one level. It will also have landscape architecture, signaling, information signs, public services, and equipment.

Electric Energy supplies 50 km from El Remate through Tikal, including the community of Uaxactún in the Project.

2.2.3. Present Environmental Conditions of the Project Area

(1) Natural environment

a. Climate

According to the INSIVUMEH of Flores in 1999, the annual average precipitation was 1,619 mm, relatively well distributed during the year; the months of more rain were from May to January.

The monthly maximum temperature is 30.3°C, and the monthly minimum temperature is 19.0°C. The humidity of the annual average is 83%.

b. Landscape

On the access route, going from Tikal with well-conserved vegetation, so the view is topped by the lateral vegetation, permitting only a panoramic view over the road in some parts of the hills. Outstanding is the great variety of trees appreciated in a closed jungle.

The landscape is panoramic; arriving to Uaxactún, because it shows a plain region, where the airport and a pond are located. The slope is not steep and is observed the livestock activities of the region the deforestation is found in the village (that is also an archeological site).

c. Characteristics of ecosystem

The main area of the Project site belongs to the Humid Subtropical Warm Forest bh-S(c) life zone.

The flora of the Project site is with little intervention, the exceptions are the places surrounding the archeological site Uaxactún. The jungle in the place is mainly association with wide leaves, bushes, and palm trees.

Most of the site has not been intervened and together with the soil and the jungle weather, which constitute an excellent habitat of different and interesting wild fauna. The main endangered species are birds (parrots, toucans) and other mammals such as jaguar and deer.

d. Geology and geomorphology

The hydrographic of the Project surrounding site consists of hills with soft slope and Karst drains. These are soils moderately deep with lightly bad drainage, developed on soft rock, in tropical humid zones. The relief is plain in big extensions, existing also waved areas with slopes from 2 to 4%.

The profile of the soil up to one meter deep is of claylike texture, followed by parental material of rock in formation of old marine sediments.

e. Hydrology

The Project site is inside the closed basin of the Holmul River.

f. Water quality

In order to understand the conditions of the water quality and bacteria conditions in the Project site, the water sampling had done in two waterfalls on the road to Tikal, Uaxactún on January 4, 2002.

According to the sampling results, the water quality in the referred parameters, compared to the standards of Guatemala, shows that this water may be used for human consumption, disinfected with chloride. In terms of the aquatic life, the water has a problem of low Dissolved Oxygen (DO).

g. Noise

In order to determine the sound levels in the surroundings of the Project, some measurements were done in the archeological site of Tikal, Uaxactún and along the access road to Uaxactún.

Comparing the noise levels registered with the ones proposed by the former National Commission for the Environment (present Ministry of Environment and Natural Resources). The noise levels do not exceed the norm for a residential and special area (school, rest areas, etc.) in Guatemala.

(2) Socio-economic environment

a. Demography

The population of the municipality of Flores (Petén), in the rural area as well as in the urban area is identified in its majority (52.0 %) and 26.2% of indigenous population of the department of Petén only 9.5% live in this municipality.

b. Economic activity

The main economic activities of the municipality are services, tourism and value-added activities, there are also agriculture and livestock in the south of the municipality, as well as manufacturing of wood furniture.

c. Wastes

The production of garbage of the municipality is estimated in less than 0.70 Kg per person per day, formed by organic biodegradable material in 60%. The municipality of Flores is about to initiate the operation of a sanitary disposal located at the south of the municipal capital, road from San Benito to San Francisco.

d. Archeological site

The archeological site Uaxactún is a ceremonial center, located to the north of Tikal, is one of the most important of the low lands of Petén. This city flourished during the late classic period. The archeological site has big palaces and different structures that were used as religious and astronomic buildings.

e. Rights of common

The local peoples near the protected areas and that lived there before it was declared a protected area, keep the right of property of the land, if they are not owners, and they are

organized through local leaders, who were be the auxiliary chiefs. In the case, the community has common right over the use of the land and limited use of the resources, having to fulfill the laws and the laws of the nation.

2.2.4. Environmental Impacts

A multidisciplinary professional group (AD-hoc Committee) was formed for the Environmental Impact Assessment (EIA) with experiences in environmental, social and health sciences that considered the legal, technical standards and those related to the environmental and health protection. Then the committee proceeded to identify and evaluate the actions of the Project that could cause environmental impacts on the area.

The group of experts that took part in the EIA, which were identified the possible impacts on the environments at the following phases:

- Project Construction Phase
- Project Operation Phase

(1) Project construction phase

The possible environmental impacts caused by the construction of the Project are the followings:

- Air quality: As the construction work and vehicles for the road improvement may cause emission of particles and gases, slight adverse impacts could occur;
- Wastes: The construction wastes and residual waters mainly due to the construction work of the access road and the visitor center will cause adverse impacts, if appropriate measures not conducted;
- Soil erosion: The road improvement works will need material of crushed rock, which is extracted from adjacent quarries through removing the surface soil. The works also could cause soil erosion, so the impacts will be slight adverse;
- Flora: The enlargement of the road and the cables for electric transmission will cause the disturbances of the present flora, so the impacts will be adverse;
- Fauna: The enlargement of the road and the cables for electric transmission will cause the disturbances on the habitats of birds and other mammals, so the impacts will be adverse, even though this is not a long-term activity;
- Traffic: It is inevitable that the local residents along the access road will be affected by the traffic nuisances mainly due to the construction vehicles;
- Landscape: The cables for electric transmission crossing the national park Tikal will cause slight adverse impacts.

- Employment: The construction activities could brought the benefits to the local peoples, providing alternative employment opportunities directly or indirectly, the impacts will be slight favorable.

(2) Project operation phase

The possible impacts on the environment due to the operation of the Project are the followings:

- Economic activities: The Project, particularly in the access road and the visitor center will enhance the regional economy of the Project surrounding area through tourism development;
- Traffic, public facilities: The access to the public facilities in the Project surrounding area will improved mainly due to the operation of the access road;
- Flora: The maintenance of the electric transmission will cause cutting of trees over and under the transmission line, the impact will be slight adverse. Also the easy access to the forest side by operation of the access road could cause acceleration of deforestation in the Project surrounding areas;
- Fauna: The maintenance of the electric transmission may cause nuisances for the habitats of the mammals, even though it is an eventual activity and on a specific part of the site, the impacts will be slight adverse;
- Landscape: The Project will integrate the facilities and landscape architecture so the impact will be slight favorable. Only the maintenance of the transmission line for electric energy, by cutting the top of the trees will affect the landscape adversely;
- Employment: The operation and maintenance of the Project will be generated directly or indirectly employment opportunities for part of the local peoples so it is considered that the impact is slight favorable.

2.2.5. Analysis of Alternative Plan

The possible impacts on the environment in the Project site without the Project are the followings:

- Economic activities: The regional economy of the Project site could not be improved without the Project;
- Air quality: The air quality will be kept at present level due to no construction works such as the traffic of construction vehicles;
- Water quality: The water quality will be kept at present level due to no construction work;
- Soil erosion: The present vegetation and forest cover will be prevented from the soil erosion;

- Fauna and flora: The habitats of the present fauna and flora will not be disturbed due to the road construction and electric lines; and
- Landscape: The present natural landscape will be kept.

2.2.6. Mitigation Measures for Adverse Impacts

In order to mitigate the possible adverse impacts, the following measures could be proposed:

(1) During the preparation phase

All the related institutions such as INGUAT, Ministry of Public Health and Social Assistance, Ministry of Environment and Natural Resources (MARN), CONAP, IDAEH and the Municipality of Flores should approve the Project.

The development plan should be elaborated with all the stakeholders within the local peoples in order to prevent from the user conflicts. It is recommended to coordinate the local peoples as well as private sectors, where interference with electricity infrastructures might cause conflicts due to the cut of the supplies.

The Project should be designed with all the architectural elements that will allow the integration of the Project to the physical and natural environment of the zone.

It needs to conduct a flora study in order to avoid the adverse impacts on the present flora and ecosystems and hydrology studies to determine the flooding areas and height of the floods, to improve the drainage of the road.

It also needs to prepare the manual for operation and maintenance of the construction facilities.

(2) During the construction phase

Archaeologists and environmental specialists should supervise the Project site, so that the works do not damage the structures of the archeological site, as well as by technicians in terms of ecosystems.

The construction site should provide sanitary services and services for the collection of wastes for the workers.

It needs to revise the operation and maintenance manual for the facilities, including the septic tanks.

The landscape architecture should be done with native species from the surrounding place in order to harmonize the present natural landscape.

The construction works should be informed to the visitors in order to avoid accidents.

After obtaining the construction materials at the quarry, it should be closed and be reforested with local species.

The wire cables for the transmission of electric energy should follow the road side and based on the instructions from IDAEH and CONAP.

(3) During the operation phase

The persons, who is in charge of the operation of the Project should be trained and should follow the regulations on the matter and know the use of the manual for operation and maintenance of the facilities.

The Project should have internal regulations for the workers and for the users of the Project in terms of a better use of the facilities.

The municipality should provide services of solid wastes and residual waters. The facilities should have garbage equipment for enough volume and be distributed.

The workers and the facilities of the Project should fulfill the sanitary and functioning regulations of the Ministry of Public Health and Social Assistance as well as the regulations of INGUAT and IDAEH.

It needs to establish a maximum speed limit as 30 km/h on the access road.

The maintenance of the transmission line should affect the trees as little as possible.

2.2.7. Environmental Monitoring Plan

(1) Environmental monitoring plan

With the purpose of conserving the environment and human health, the following necessary monitoring activities could be proposed:

- Follow up and evaluate of the mitigation measures at each stage;
- Once the Project is operating, it should be evaluated every six months by the sanitary, tourism and IDAEH authorities to guarantee the fulfillment of the standards and regulations for the protection of the health and comfort of the users; and
- Supervise the maintenance activities of the road and the cables of the transmission line for electric energy.

(2) Recommended mitigation and monitoring cost

Prepare the operation and maintenance manual	US\$ 1,000
Archeological and flora study for the transmission wire	US\$ 3,000
IDAEH and CONAP supervision during construction	US\$ 15,000
Sanitary services and garbage recollection	US\$ 800
Protection to avoid accidents	US\$ 800
Information about construction program	US\$ 500
Training of personnel for the project	US\$ 1,200
Elaboration of regulations	US\$ 800
Garbage equipments	US\$ 300
Recovery and reforestation of the quarry area	US\$ 3,000

Road signaling	US\$ 1,500
Total	US\$ 27,900

2.2.8. Conclusion and Recommendations

(1) Conclusion

In terms of the Environmental Impact Assessment (EIA) Survey of the "Tourism Improvement of Uaxactún Archeological Site", it is concluded as follows:

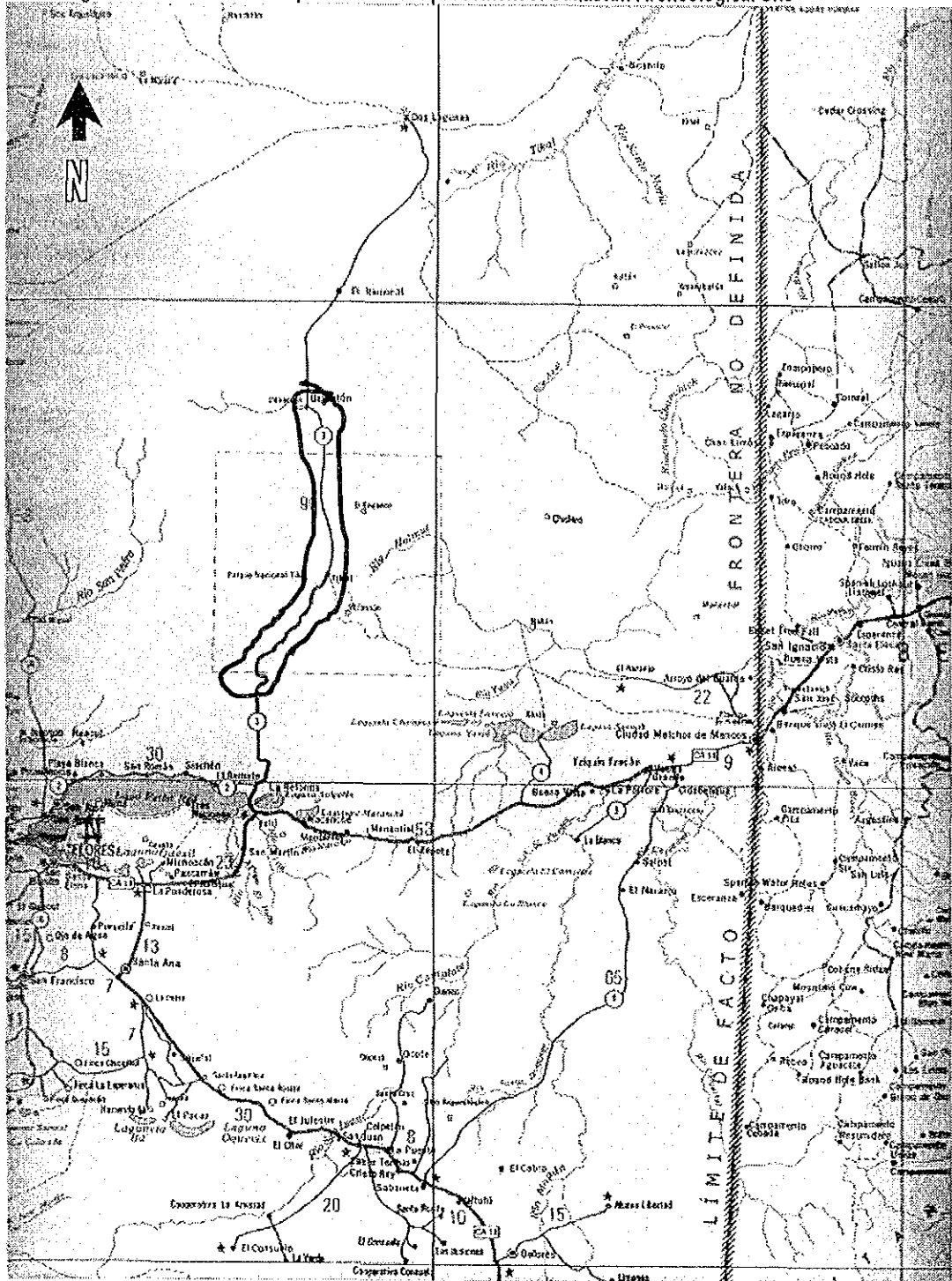
- In general, Tourism Improvement of Uaxactún Archeological Site Project will not cause serious adverse environmental impacts;
- The Project, in particular the access road and the visitor center will greatly contribute to the regional economy development in the remote areas;
- However, it needs to conduct investigations for archeology and flora study at the Project preparation phase in order to minimize the possible adverse impacts.

(2) Recommendations

In order to mitigate possible significant adverse impacts and to promote favorable impacts by the Project, it is recommended that the following actions should be considered:

- It is recommended to consider the reduction of the road of width of the access road from 12 m for taking in account of the traffic volume and mitigation of the disturbances of the present ecosystems such as the cut of trees and bushes;
- Through the different constructions phases, the workers must receive sanitary services, as well as collection of the solid wastes;
- The construction wastes should be disposed in an authorized site outside the protected areas;
- The gardening and landscape architecture should consider the reforestation with native species, and in relation to the archeological site;
- It is recommended to promote the visitor center in order to enhance cultural based tourism development;
- It should be established the traffic speed limit as less than 30 km/h for the peoples and wildlife on the access road.

Figure 2.1 Location map of Tourism Improvement of Uaxactún Archeological Site



Source: JICA Study Team

2.3. EIA Survey of the Tourism Improvement of Yaxhá and Nakúm Archeological Sites

2.3.1. Objectives of the EIA survey

Based on the results of the IEE, present cultural assets of the Yaxhá and Nakúm will enhance and improve its cultural tourism value. The Project also includes construction of the access road from present Yaxhá to Nakúm archeological site. Although the access road may contribute to the regional economy through the tourism development, the access road may cause disturbance of the present habitats of the wildlife as well as water contamination of the surrounding lakes. Therefore, it is concluded that the Project needs an EIA Survey.

The objectives of the EIA Survey are: to identify/evaluate possible environmental impacts, which could be caused by the Project based on the available data/information and field reconnaissance; to analyze/forecast possible environmental impacts, to propose mitigation measures for possible significant adverse environmental impacts if necessary; and to recommend environmental monitoring plan.

2.3.2. Description of the Project

(1) Background

A group of archaeology and sites located to the east of Tikal: Mundo Maya Organization identifies Yaxhá, Nakúm and El Naranjo, as high priority sites for tourism development. Among the three sites, Yaxhá and Nakúm have partly restored and, therefore, are evaluated to be ready for tourism development in the short-term.

(2) Site location and main components of the project

The Yaxhá and Nakúm sites are located in the Melchor de Mencos Municipality, in El Peten Department. The site is 70km east from Flores. Yaxhá is 15km and Nakúm is 30km north to La Maquina community on CA13 and within the Maya Biosphere Reserve Area.

The main components of the Project are; i) the improvement of the access road, 15 km long and 12 meters wide, between Yaxhá and Nakúm, gravel surface; ii) construction of a visitor center (200 m²) in Yaxhá, wooden structure at one level; iii) public services and equipment, landscape architecture, signaling, and signs; iv) construction of an information office, with resting areas; v) sanitary services; vi) registration office, vii) security gate of 100m² wooden structure at one level, and electric energy supply wiring from road CA-13.

2.3.3. Present Environmental Conditions of the Project Area

(1) Natural environment

a. Climate

The climatic conditions of the Project site are warm and humid weather. The annual average precipitation is 1,250mm, relatively well distributed during the year; the months of more rain are from May to January.

The annual average temperature is 20 °C in the Project surrounding area. The humidity of the annual average is 83%.

b. Landscape

The proposed access road to the archeological sites is a buffer zone with little forest coverage, livestock parceling, small commercial site and residences, in visual aspect and the landscape is open with views of pastures and forest hills to the back, followed by the highest part of the road before arriving to Yaxhá, where there are panoramic forest views, with little intervention and the lagoons. The site Yaxhá has open spaces where architectural structures alternate with the forest and lagoon. The predominant color is the green from the forest, alternating with the color of the water that has different shades during the day.

The access road to Nakúm presents a forest area without intervention, where the low zones with low drainage prevail; the landscape is forest and swamp area. There are open spaces in the archeological site, alternating the structures with vegetation. The predominant color is green from the forest alternating with dark brown from the soil in the flooding areas.

c. Characteristics of ecosystem

The main area of the Project site belongs to the Humid Subtropical Warm Forest bh-S[c] life zone.

The jungle in the Project surrounding places is mainly covered with wide leaves, bushes and palm trees.

Most of the sites has not been intervened and together with the soil. The jungle weather constitutes an excellent habitat of different and interesting wild fauna. The main endangered species are jaguar, deer in the site.

d. Geology and geomorphology

There are two units of soils. One corresponding to the Macanché series in Yaxhá, these soils is moderately deep, the texture is of plastic clay that cracks dry and saturated in rainy season, the soil presents a layer of vegetable residues in the surface with different degrees of decomposition. The relief is mostly plain with average slopes of 2% occupying some depressions that flood in the rainy season.

The soils of Nakúm are deeper and heavier clay than the Yaxhá's soils. The geography is plain in one depression with small hills where water accumulates, an average slope of 2%. The geological origin is similar to Yaxhá.

e. Hydrology

The Project site is inside the closed basin of the Holmul River and the lagoon system of Yaxhá and Sacnab.

f. Water quality

In order to understand the conditions of the water quality and bacteria conditions in the Project site, the water sampling was done in Yaxhá Lagoon and the Yaxhá River on January 4, 2002.

According to the sampling results, the water quality in the referred parameters, compared to the standards of Guatemala, shows that this water may be used for human consumption, disinfected with chloride. The water may be also used for recreation and conservation of aquatic life.

g. Noise

In order to determine the sound levels in the surroundings of the Project, some measurements were done in the archeological site Yaxhá, Nakúm, and road from Yaxhá to Nakúm.

Comparing the noise levels registered with the ones proposed by the former National Commission for the Environment (present Ministry of Environment and Natural Resources). The noise levels do not exceed the norm for a residential and special area (school, rest areas, etc.), and the noises from vehicles are temporary and short term.

(2) Socio-economic environment**a. Demography**

The population of the municipality of Melchor de Mencos (Petén), in the rural area as well as in the urban area is identified in its majority, who is belonging to the ethnic group *Ladino*.

At the departmental level, 26.2% of the population is indigenous. At the municipality level, 6.3% of the population is indigenous.

b. Main economic activities

Yaxhá and Nakúm are located within national parks, which needs for special protection. There are no communities inside the parks, and the economic activities are developed at the south direction of Yaxhá. The main activities are livestock, and subsistence agriculture (e.g., corn and beans).

c. Wastes

The production of garbage of the municipality is estimated in less than 50 Kg by the community per day, formed by organic biodegradable material in 70%. The people in the rural area dispose garbage in the empty sites of their property.

In the urban area, there is a very deficient system for collection of solid wastes and an unsanitary disposition in inadequate sites; there are also clandestine sites where the population disposes the garbage. The municipality has plans for improvement of the recollection and final disposition system.

d. Archaeological site

The archaeological Site Yaxhá is monumental, including 500 buildings that extend in an area of 3 km settled on a hill, to the north of the lagoon of the Yaxhá, and the average height of the site is 240 m at sea level. This urban complex shows huge artificial platforms, boulevards and avenues that allow a better communication between groups and architectural complexes.

2.3.4. Environmental Impacts

A multidisciplinary professional group (AD-hoc Committee) was formed for the Environmental Impact Assessment (EIA) with experiences in environmental, social and health sciences that considered the legal, technical standards and those related to the environmental and health protection. Then, the committee proceeded to identify and evaluate the actions of the Project that could cause environmental impacts on the area.

The group of experts that took part in the EIA, which were identified the possible impacts on the environments at the following phases:

- Project Construction Phase
- Project Operation Phase

(1) Project construction phase

The possible environmental impacts caused by the construction of the Project are the followings:

- *Air quality, gases and particles: The construction works for the road improvement and the extraction of materials from the quarry will cause particles and gases, considering that this activity is not long-term, the impact will be adverse;*
- *Water quality: The road improvement and filling works at the low flood prone areas may cause water contamination. These activities are temporary and will be produced only during the construction phase. The impact will be slight adverse;*
- *Soil erosion: The removal of the vegetable coverage and the extraction of road construction materials could cause soil erosion;*
- *Flora: The enlargement of the road and the cables for electric transmission will cause cutting of trees and bushes, so the impact will be significantly adverse.*
- *Fauna, birds and wild mammals: The enlargement of the road and the cables for electric transmission will cause the cutting of trees and bushes as well as noise, which may disturb on the habitats of birds and terrestrial mammals, so the impacts will be slightly adverse;*
- *Traffic: The enlargement of the road and cables for electric transmission will cause inconveniences to the visitors, so the impact is considered as slight adverse;*

- Wastes: The construction wastes and residual waters will cause slight adverse impacts;
- Landscape: The cables for electric transmission crossing the archeological site Yaxhá may cause slight adverse impacts; and
- Employment: The construction works will generate job opportunities, which may not permanent, so the impacts will be slight favorable.

(2) Project operation phase

The possible impacts on the environment due to the operation of the Project are the followings:

- Economic activities: The improvement of the Project site by electricity and the road will offer a better attention to the visitors, so there are going to be more excursions, in consequence the impacts will be significant favorable;
- Traffic: The access road will greatly contribute to the mobility of the regional activities;
- Flora, trees and bushes: The maintenance of the line of electric transmission will cause cutting of trees over and under the transmission line, the impacts are slight adverse;
- Fauna, birds and terrestrial mammals: The maintenance of the line of electric transmission may cause nuisances for the habitats of the mammals, even though it is an eventual activity and on a specific part of the site, the impact will be slight adverse;
- Noise: As the traffic of the vehicles will increase on the access road, the traffic noise and speed will disturb the fauna. The impacts will be slight adverse;
- Landscape: The maintenance of the transmission line for electric energy, by cutting the top of the trees will affect the landscape so the impact might be slight adverse;
- Employment: The activities of functioning of the Center and information office, as well as the maintenance activities will be one of the employment opportunities for the local peoples, so the impact will be slight favorable.

2.3.5. Analysis of Alternative Plan

The possible impacts on the environment in the Project site without the Project are the followings:

- Economic activities: The regional economy of the Project site may not be improved without the Project;
- Air quality: No road construction and filling works does not cause air pollution;
- Water quality: The water contamination risks in the surrounding lagoons will not be caused by the Project;

- Soil erosion: The forest of the Project site has protected the soil from erosion without Project construction work;
- Fauna and flora: The habitats of the present fauna and flora will not be disturbed by the road construction and electric lines; and
- Landscape: The present natural landscape will be kept.

2.3.6. Mitigation Measures for Adverse Impacts

In order to mitigate the possible adverse impacts, the following measures could be proposed:

(1) During the preparation phase

All the related institutions, such as INGUAT, Ministry of Public Health and Social Assistance, Ministry of Environment and Natural Resources (MARN), CONAP, IDAEH, and the Municipality of Melchor de Mencos should approve the Project.

The Project should be designed with all the architectural elements that will allow the integration of the Project to the physical and natural environment of the zone.

It needs to conduct archeological study and flora study to prevent from the damages of the present regional properties and the ecosystems. It needs to conduct hydrology studies to determine the flooding areas and height of the floods and to improve the drainage of the road.

A manual for operation and maintenance of the facilities should be prepared.

(2) During the construction phase

Archaeologist and environmental specialists should supervise the Project site, so that the works do not damage the structures and the ecosystems of the archeological site.

It should provide sanitary services and services for the collection of wastes for the workers.

It needs to revise the operation and maintenance manual for the facilities, including the septic tanks.

The landscape architecture should be done with native species from the surrounding places.

Reforestation at the edge of the road from the intersection on road CA-13 to the entrance of Yaxhá Park should be considered.

The construction works should be informed in order to avoid accidents to the visitors.

The quarry for the construction materials, preferably should be located between the road CA-13 and Yaxhá, where is far from the archeological sites.

The wire cables for the transmission of electric energy should follow the road and follow the instructions from *IDAEH* and *CONAP*.

(3) During the operation phase

The persons, who is in charge of the operation of the Project should be trained and should follow the regulations on the matter and know the use of the manual for operation and maintenance of the facilities.

The Project should have internal regulations for the workers and for the users of the project in terms of a better use of the facilities.

The municipality should provide services of solid wastes and residual waters. The facilities should have garbage equipments for enough volume and be distributed.

The workers and the facilities of the Project should fulfill the sanitary and functioning regulations of the Ministry of Public Health and Social Assistance as well as the regulations of *INGUAT* and *IDAEH*.

It needs to establish a maximum speed as 30 km/h on the access road.

The maintenance of the transmission line should affect the trees as little as possible.

2.3.7. Environmental Monitoring Plan**(1) Environmental monitoring plan**

With the purpose of conserving the environment and human health, the following necessary monitoring activities could be proposed:

- Follow up and evaluate the mitigation measures at each phase;
- Once the Project is operating, it should be evaluated every six months by the sanitary authorities to guarantee the fulfillment of the standards and regulations for the protection of the health of the users;
- Take water samples from the Yaxhá and the Holmul River in order to monitor the water quality; and
- Supervise the maintenance activities of the road and the cables of the transmission line for electric energy.

(2) Recommended mitigation and monitoring cost

Prepare the operation and maintenance manual	US\$ 1,000
Archaeology and flora study	US\$ 4,500
IDAEH and CONAP supervision during construction	US\$ 15,000
Hydrologic study	US\$ 4,000
Sanitary services and garbage collection for operation	US\$ 900
Protection to avoid accidents	US\$ 800
Information in terms of construction works	US\$ 700
Training of personnel for the Project	US\$ 1,400
Elaboration of regulations	US\$ 1,000
Garbage equipment	US\$ 400

Recovery and reforestation of the quarry area	US\$ 3,600
Reforestation	US\$ 3,500
Signaling of the road	US\$ 1,500
Sampling water from the rivers	US\$ 1,800
Total	US\$ 41,100

2.3.8. Conclusion and Recommendations

(1) Conclusion

In terms of the Environmental Impact Assessment (EIA) Survey of the “Tourism Improvement of Yaxhá and Nakúm Archeological Sites”, it is concluded as follows:

- In general, Tourism Improvement of Yaxhá and Nakúm Archeological Site Project will not cause serious adverse impacts;
- The regional economy of the Project site will be improved mainly due to the operation of the access road and electricity by the Project implementation; and
- However, it needs to conduct archeology, flora, and hydrological study at the Project preparation phase as well as the water monitoring at the construction phase in order to minimize the possible adverse impacts.

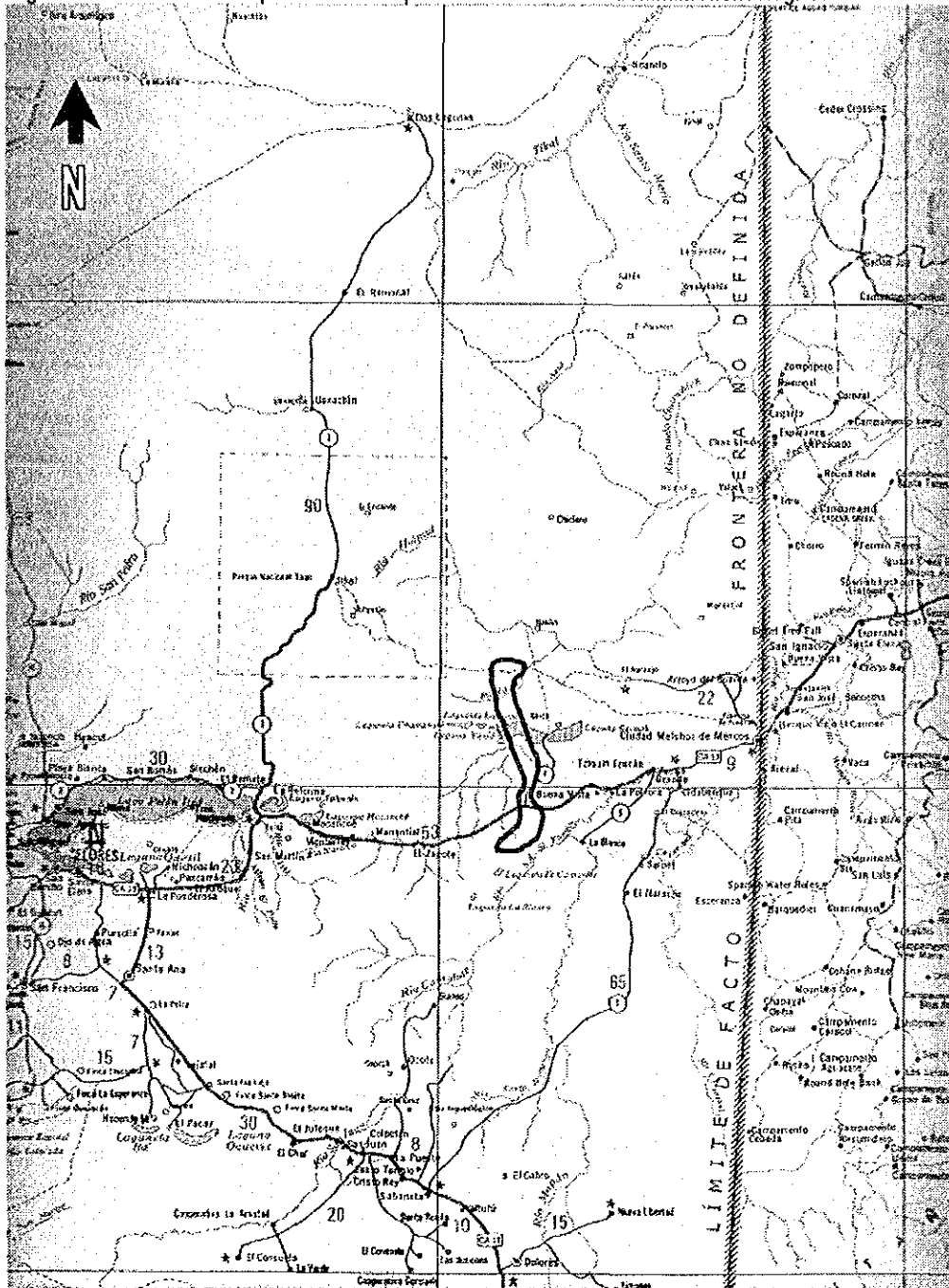
(2) Recommendations

In order to mitigate possible significant adverse impacts and to promote favorable impacts by the Project, it is recommended that the following actions should be considered:

- The construction and improvement works should fulfill architectural requirements from IDAEH and CONAP and integration of the work with landscape and nature;
- Before the construction of the transmission line for electric energy and improvement of the road, some archeological researches should be done to avoid damages to the present structures. It also needs to conduct a research of flora to protect the forests. It is recommended that the transmission line should be built at the border of the road;
- It is recommended that the borders between road CA-13 and park Yaxhá should be reforested with native species;
- It is proposed to hire the local peoples for the construction and operation of the Project;
- It is recommended to consider the reduction of the access road width from present 12 m, taking into account of the traffic volume and mitigation of the disturbances of the present ecosystems such as the cut of trees and bushes;
- The construction wastes should be disposed in an authorized site;

- The gardening and landscape architecture should consider the reforestation with native species, and in relation to the archeological site;
- It is recommended to promote the visitor center in order to enhance cultural based tourism development; and
- It is proposed to establish the traffic speed limit as 30 km/h for the visitors and wildlife on the access road.

Figure 2.2 Location map of Tourism Improvement of Yaxhá and Nakúm Archeological Site



Source: JICA Study Team

2.4. EIA Survey of the Development of Maya Research and Learning Center

2.4.1. Objectives of the EIA survey

Based on the results of the IEE, the construction activities may cause construction wastes, water contamination and construction noise in the site. The construction works also may cause disturbance of the present daily life such as the access to the public facilities due to the traffic congestion. Therefore, it is concluded that the Project needs an EIA survey.

The objectives of the EIA Survey are: to identify/evaluate possible environmental impacts, which could be caused by the project based on the available data/information and field reconnaissance; to analyze/forecast possible environmental impacts, to propose mitigation measures for possible significant adverse environmental impacts, if necessary; and to recommend environmental monitoring plan.

2.4.2. Description of the Project

(1) Background

This is the core facility for Mayan archaeological study and exhibition. Proposed site is conveniently located on the Central American Highway 13 at the entrance to the Yaxhá, Nakúm and Naranjo triangle. The Mayan Research and Learning Center (MRLC) would be a place for research and learning archaeology and a tourist attraction for visitors who come to visit the Yaxhá – Nakúm – Naranjo triangle and are on their way to Belize.

(2) Site location and main components of the project

The MRLC site is located in the Municipality of Melchor de Mencos in El Peten Department. The site is 60km to the east from Flores at near junction of the access road to Yaxhá/ Nakúm and CA13 in La Máquina village.

The function of the Center is to offer facilities for the study and research of the Mayan archeology, to protect and exhibit archeological artifacts with security conditions and periodically locate exhibitions about relevant cultural themes like the calendar, astronomy and Mayan customs. These facilities could also function as administration of the Yaxhá - Nakúm - El Naranjo Triangle, and as a center all the archeological studies and researches of Peten.

The Center will be developed in a site of 0.5 hectares and will have the following elements: Central Building, office, laboratory, reading room, library, promotion room, restoration room, exhibition room, sanitary services, septic tanks, infiltration fields for residual waters and equipment. The total area in a roofed floor 1.500 m², which have two floors and concrete structure.

The museum will have a garden, pavement, lightning, signaling and information, area 3,000 m² and will have parking with 1,000 m² asphalt.

2.4.3. Present Environmental Conditions of the Project Area

(1) Natural environment

a. Climate

The annual average precipitation is 1,250 mm. There is rain during all the months of the year, but more in the months from May to December. The temperature varies from an average of 11.1 to 27.1°C. The relative humidity annual average is 83.2%.

b. Landscape

The landscape is panoramic; it shows a plain region where there are some floods because the slope is steep, so it is observed the parceling of the territory and a considerable deforestation. Referential area where the Project will be located, it is a closed area, with urban borders without vegetation.

c. Characteristics of ecosystem

The main area of the Project site belongs to the humid forest Montano low Subtropical bh-MB life zone.

The area with possibilities to develop this Project has been transformed from a humid dense forest to an exploitation of pastures for cattle exploitation, where only some bushes and trees exist, that are used to provide shadow to the cattle, and in the areas with more drainages will develop areas that are resistant to these conditions like the palm.

With the disappearance of the jungle, the great variety of fauna has also disappeared, mammals, birds, and turtles. The existing species are the following: Sparrow Hawk, rodents, and herons.

d. Geology and geomorphology

The area of the Project includes the soils Macánche Series according to the classification of Soil Recognition of the Republic of Guatemala.

These soils are general wave topography with slopes up to 3%, with some hills with some depression areas that are flooded during rainy season.

e. Hydrology

The body of surface water near the Project site is the Yaxhá lagoon.

f. Water quality

According to the physical and chemical analysis based on water sampling on January 4, 2002, Yaxhá Lagoon shows the following characteristics.

The water quality samples, in the referred parameters, compared to the standard in Guatemala, shows that this water is used for human consumption, disinfected with chloride.

g. Noise

In order to understand the sound levels in the Project surrounding areas, some measurements were done in the crossing of roads on CA 13 and the road access to the archeological site Yaxhá.

Comparing the noise levels registered with the ones proposed by the National Commission for the Environment, before the Ministry of Environment and Natural Resources. The noise levels do not exceed the standard for a residential and special area (school, rest, etc.).

(2) Socio-economic environment

a. Demography

The population of the municipality of Melchor de Mencos (Petén), in the rural area as well as in the urban area is identified in its majority as belonging to the ethnic group, Ladino. At the departmental level, 26.2% of the Petén population is indigenous. At the municipality level, 6.3% of the population is indigenous.

b. Main economic activities

The main economic activities of the municipality are agriculture and livestock, and some commercial activities, concentrated mainly in the municipal center located in the border between Guatemala and Belize.

c. Wastes

In the residential area of the Project site, there is a very deficient system for collection of solid wastes and an unsanitary disposition in inadequate sites; there are also clandestine sites where the people dispose the garbage. The municipality has plans for improvement of the collection and final disposition system.

2.4.4. Environmental Impacts

A multidisciplinary professional group (AD-hoc Committee) was formed for the Environmental Impact Assessment (EIA) with experiences in environmental, social and health sciences that considered the legal, technical standards and those related to the environmental and health protection. Then, the committee proceeded to identify and evaluate the actions of the Project that could cause environmental impacts on the area.

The group of experts that took part in the EIA, which is identified the possible impacts on the environments at the following phases:

- Project Construction Phase
- Project Operation Phase

(1) Project construction phase

The possible environmental impacts caused by the construction of the Project are the followings:

- Air quality: The proposed building and the parking will be lightly affected by the excavation and paving activities, these are temporal activities so it is considered that the impacts will be slight adverse;
- Waste: It may cause a slight adverse impact due to the construction wastes, which may be stored or disposed in the pastures;
- Landscape: The construction wastes and works will cause an unpleasant views such as illegal dumping; and
- Employment: Employment opportunities will may generate through all the actions at the Project construction phase, considering that only one part of the local peoples will be directly or indirectly benefited.

(2) Project operation phase

The possible impacts on the environment due to the operation of the Project are the followings:

- Economic activities: The Center will be a contribution to development of domestic tourism which will benefit the local peoples, so the impacts will be light favorable;
- Landscape: The development of the Center will have an architectural design that will take into account of the qualities/color of the construction materials and will integrate them the natural qualities, so the impact will be significantly favorable to the scenic views and landscape;
- Cultural Property: The archeological sites, by the functioning of the site, concentrating investigation and protecting heritage, will have a significant favorable impact;
- Employment: The Center will be a direct and indirect source of employment opportunities for part of the population of Melchor de Mencos, so it is considered that the impacts will be slightly favorable; and
- Wastes: The liquid wastes caused by the operation of the Project will cause impacts in the environment, if the appropriate countermeasures were not taken.

2.4.5. Analysis of Alternative Plan

The possible impacts on the environment in the Project site without the Project are the followings:

- Economic activities: Economic activities will not enhanced without the new tourism attractions by the Project;
- Water quality: Water pollution risks such as residual water will not occurred by the Project; and

- Landscape: The present natural landscape will be kept. However, the scenic view, which has one of the tourism values, will not be improved.

2.4.6. Mitigation Measures for Adverse Impacts

In order to mitigate the possible adverse impacts, the following measures could be proposed:

(1) During the preparation phase

The development plans of the Project such as the building location should formulate with all the relating agencies as well as the communities.

The Project should be designed with all the architectural elements that will allow the integration of the Project to the physical and natural environment of the zone.

(2) During the construction phase

The Project construction site should provide sanitary services and services for the collection of wastes for the workers.

It needs to create a green belt around the Project site with the native species.

It needs to prepare the operation and maintenance manual for the facilities.

(3) During the operation phase

The persons, who is in charge of the operation of the Project should be trained and should follow the regulations for operation and maintenance of the facilities.

The municipality should collect solid wastes at a minimum of three times a week. The facilities should have garbage equipments for operating the enough wastes, collection and disposal be distributed.

The workers and the facilities of the Center should fulfill the sanitary and functioning regulations of the Ministry of Public Health and Social Assistance.

2.4.7. Environmental Monitoring Plan

(1) Environmental monitoring plan

With the purpose of conserving the environment and human health, the following necessary monitoring activities could be proposed:

- Follow up and evaluate the proposed mitigation measures at each phase;
- Once the Center is operating, it should be evaluated every six months by the sanitary, and *IDAETH* authorities to guarantee the fulfillment of the standards and regulations for the protection of the health and comfort of the users.

(2) Recommended mitigation and monitoring cost

Wastes facilities for the workers	US\$	500
Operation and maintenance manual for the facilities	US\$	1,500

Create a green belt around the Project site	US\$ 3,500
Personnel training program	US\$ 1,200
Total	US\$ 6,700

2.4.8. Conclusion and Recommendations

(1) Conclusion

In terms of the Environmental Impact Assessment (EIA) Survey of the "Development of Maya Research and Learning Center", it is concluded as follows:

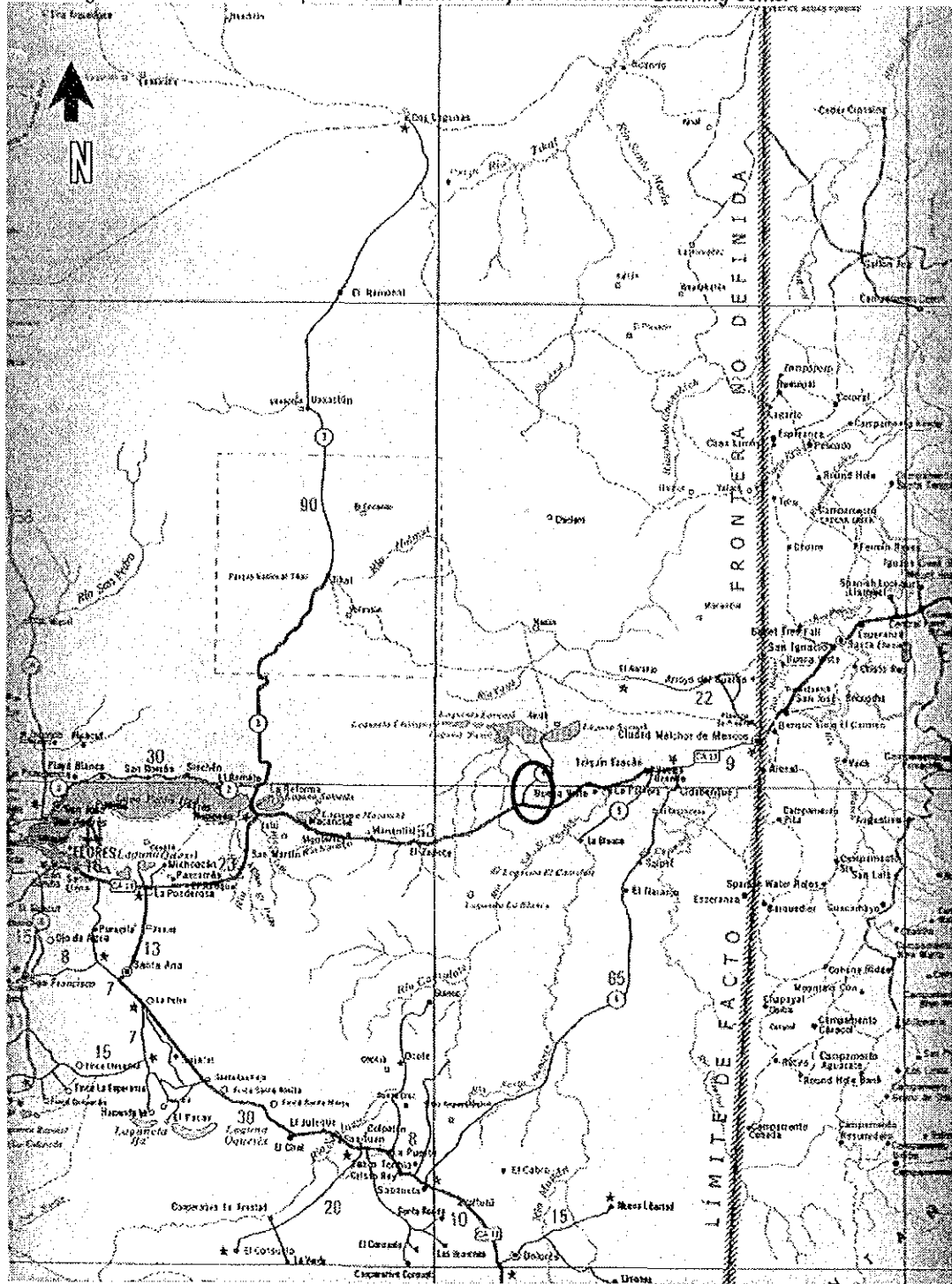
- In general, Development of Maya Research and Learning Center Project will not cause serious adverse impacts;
- However, solid wastes during the operation phase may cause significant adverse impacts in the aspects of esthetics and health, it needs to conduct appropriate measures such as preparation of the authorized landfill area near the Project site.

(2) Recommendations

In order to mitigate possible significant adverse impacts and to promote favorable impacts by the Project, it is recommended that the following actions should be considered:

- It is recommended to consider a solution for the final disposal of the solid wastes, one of the options are separation in the place, the organic bio degradable part could be developed together with the local peoples and the rest be recollected by the local municipality;
- Build the Center with all the architectonic, sanitary and integration requirements of the work to the landscape and nature;
- It needs to explain the Project to the community and integrate it to the development of the community and to hire the local peoples from the community;
- During the construction of the Center, the workers should receive sanitary services, as well as the services for collection of the solid wastes; and
- The gardening and landscape architecture should be taken into account of the reforestation with native species.

Figure 2.3 Location map of Development of Maya Research and Learning Center



Source: JICA Study Team

2.5. EIA Survey of the Tourism Improvement of Aguateca and El Ceibal Archaeological Sites

2.5.1. Objectives of the EIA survey

Based on the results of the IEE, present cultural assets of the Aguateca and El Ceibal will enhance and improve its cultural tourism value by the Project. Although the access pathway will contribute to the regional economy through the tourism development, it may cause disturbance of the present habitats of the wildlife, water contamination, and the present natural landscape. Therefore, it is concluded that the Project needs an EIA survey.

The objectives of the EIA Survey are: to identify/evaluate possible environmental impacts, which could be caused by the project based on the available data/information and field reconnaissance; to analyze/forecast possible environmental impacts, to propose mitigation measures for possible significant adverse environmental impacts as necessary; and to recommend environmental monitoring plan.

2.5.2. Description of the Project

(1) Background

It is needed to develop tourism attractions between Cobán and Flores in order to promote overland trip, which is Sayaxché Tourism Sub-Center, having strategic importance. Major archaeological sites within the day-trip area of Sayaxché Tourism Sub-Center are El Ceibal and Aguateca.

(2) Site location and main components of the project

The Ceibal and Aguateca sites are located in the Sayaxché Municipality in El Peten Department. The site is 60km to the south from Flores on the way to Cobán. El Ceibal is 15km to the east from Sayaxché along the Pasión River and Aguateca is also 15km to the south from Sayaxché overlooking Laguna Petexbatún.

The main components of the Project are: i) the construction of a museum with an area of 100 m² with wood structure, ii) one level and an exhibition patio of 1000 m² for exposition of pottery and steles. Also the Project includes the construction of a visitor center of 150 m² of one level and wooden structure with public services, landscape architecture, information signs, and access pathway (2.0 Km length, wide of 1.5m, and gravel pavement).

2.5.3. Present Environmental Conditions of the Project Area

(1) Natural environment

a. Climate

The total annual average precipitation is 1,967 mm during the months of May to January. The average temperature of the areas is 26°C.

b. Landscape

The project site has natural conditions of latifolia forest, but there are open space areas without forest coverage or with agricultural land in the zones near the site. Relating to the area, where the Project will locate, it is a jungle area, which is formed by forest with open space areas and some degree of intervention.

c. Characteristics of ecosystem

The main area of the Project site belongs to the Very Humid forest Subtropical bh-MB life zone.

The natural vegetation is of a tropical high forest and the corresponding to the area of Ceibal. The tropical forest is main flora of the Project site. The fauna of the project site is abundant by large and small mammals, many kinds of birds, and reptiles.

d. Geology and geomorphology

These soils are deep with bad drainage of topography moderately inclined with slopes up to 2% in the plazas, and alluvium sediments deposited in the riverbank of the Pasión River.

e. Hydrology

The main surface water near the Project site is the Pasión River, which is discharged into the Usumacinta River, that flows into the Gulf of México.

f. Water quality

In order to understand the conditions of the water quality conditions in the Project site, the water sampling was done on January 4, 2002.

The water quality level exceeded the Guatemalan standard for drinking water. The situations need to establish a purifying treatment for drinking. However, the water quality level normally accepted, according to international standards for recreation use.

g. Noise

In order to determine the sound levels in the surroundings of the Project, some measurements were done in Ceibal Archeological site.

Comparing the noise levels registered and proposed by the former National Commission for the Environment (the former *CONAMA*), which was reconstructed as the Ministry of Environment and Natural Resources. The noises levels do not exceed the norm for a residential area.

(2) Socio-economic environment

a. Demography

The population of the municipality of Sayaxché (Petén), in the rural area as well as in the urban area is identified in its majority, which is belonging to the ethnic group, *kekchí*.

At the departmental level, 26.2% of the Petén population is indigenous. At the municipality level, 52.1% of the population is indigenous.

b. Main economic activities

The main economic activity of the project area is livestock, and agriculture. There is also commercial activity, because Sayaxché is one of the commercial centers along the road that goes from Flores to Cobán and the communities that have developed at the riverbank of the Pasión River.

c. Wastes

A waste collection system for solid wastes has the municipality, but not efficient. The service is irregular, which causes the existent of empty sites where the local peoples leaves garbage, the municipality has an unsanitary disposal site.

d. Rights of common

Among half of the local peoples of Sayaxché is of "*kekchi*", who follows the tradition of respect to the elderly, who are the leaders of the community among them. They are elected the auxiliary mayor who has a lot of influence in the decisions of the community.

The rest of the people's practices and their rights through the authorities are legally instituted by the central government.

e. Archaeological site

The Ceibal archaeological site was the biggest old settlement of the region. It is formed by a ceremonial center that covers an approximately area of 1 km² distributed on three high hills. The Ministry of Education declared it as a National Park.

2.5.4. Environmental Impacts

A multidisciplinary professional group (AD-hoc Committee) was formed for the Environmental Impact Assessment with experiences in environmental, social and health sciences that considered the legal, technical standards and those related to the environmental and health protection. Then the committee proceeded to identify and evaluate the actions of the Project that could cause environmental impacts on the area.

The group of experts that took part in the EIA identified the possible impacts on the environments on the following phases:

- Project Construction Phase
- Project Operation Phase

(1) Project construction phase

The possible environmental impacts caused by the construction of the Project are the followings:

- Landscape: The construction activities, including the reconditioning of the path and the construction wastes of the works will cause an unpleasant sight. However, some mitigation measures are already considered and are disturbed. Also, some efforts for the construction activities are temporary, so the impacts will be slight adverse;

- Noise: The noise caused by the electric energy generator will disturb the birds and terrestrial mammals. The effects will be little adverse impact;
- Fauna, flora: The present fauna and flora might be disturbed, if the proposed access pathway not be selected to prevent from the disturbances of the present fauna and flora; and
- Employment: The employment opportunities will brought a light favorable impacts, because all the actions of the construction phase will cause benefit directly or indirectly part of the local peoples.

(2) Project operation phase

The possible impacts on the environment due to the operation of the Project are the followings:

- Economic activities: The Project, particularly in the access pathway will contribute to the development of the regional economy in the Project surrounding site;
- Flora, trees: The site is object of protection, so the trees cannot be cut, as the result, the impact will significantly favorable;
- Fauna, birds and terrestrial animals: The site with its natural conditions and existent flora, make of the area a natural sanctuary for the fauna, which the landscape architecture will improve, the impact will be significant favorable; and
- Cultural property: The improvement of the archaeological site will offer better attention to the visitors so there will be more excursions, so the impact will be significant favorable.

2.5.5. Analysis of Alternative Plan

The possible impacts on the environment in the Project site without the Project are as follows:

- Economic activities: The regional economy of the Project surrounding area could not be vitalized without the Project;
- Cultural property: The archeological and the surrounding tourism sites could not be enhanced without the Project; and
- Flora, fauna: The present fauna and flora may be disturbed, even though the Project site is one of the Protected area of Guatemala.

2.5.6. Mitigation Measures for Adverse Impacts

In order to mitigate the possible adverse impacts, the following measures could be proposed:

(1) During the preparation phase

All the related institutions, such as *INGUAT*, Ministry of Public Health and Social Assistance, Ministry of Environment and Natural Resources (*MARN*), *CONAP*, and *IDAEH*. The municipality of Sayaxché could approve the Project.

The Project should be designed with all the architectural elements that will allow the integration of the Project to the physical and natural environment of the zone.

It needs to prepare an operation and maintenance manual for the facilities.

It also needs to establish an environmental guideline in order to conserve the present landscape and to prevent from the deforestation, in particular the riverbank of the Pasión River.

(2) During the construction phase

Archeologists should supervise the Project site, so that the works do not cause damages to the present structures.

The access pathway should be improved with local materials such as crushed limestone, where steps are needed. The access pathway have to be made with logs, the handles should be made with logs or branches, do not use foreign materials in order to contribute to the local economy.

The Project site needs to provide sanitary services and services for the collection of wastes for the workers.

The landscape architecture should be done with native species of the area, preferably palm trees of trees of precious woods.

The construction works should be informed and protected to avoid accidents of the visitors.

(3) During the operation phase

The persons, who is in charge of the maintenance of the Project should be trained and follow the regulations in order to understand the use of the manual for operation and maintenance of the facilities.

The Project should have internal regulations for the workers of the Project, which have a better use of the facilities.

The municipality should provide services for collection of solid wastes. The facilities should have garbage equipment for enough volume and be appropriately distributed.

The workers and the facilities of the Project should fulfill the sanitary and functioning regulations of the Ministry of Public Health, as well as the regulations of the *INGUAT* and *IDAEH*.

It needs to protect and to conserve the forests based on the proposed environmental guideline inside the Project site. The electric energy generator should be isolated to diminish the noise levels.

2.5.7. Environmental Monitoring Plan

(1) Environmental monitoring plan

With the purpose of conserving the environment and human health, the following necessary monitoring activities could be proposed:

- Follow up and evaluate each phase of the mitigation measures;
- Once the Project is operating, it should be evaluated at every six months by the sanitary authorities to guarantee the fulfillment of the standards and regulations for the protection of the health of the users; and
- Evaluate the noise levels at every three months.

(2) Recommended mitigation and monitoring cost

Prepare the operation and maintenance manual for the facilities	US\$ 1,000
Archeological Supervision from IDAEH during the construction	US\$ 15,000
Sanitary services and recollection of the wastes for the operatives	US\$ 800
Protection to prevent from the accidents	US\$ 1,000
Information in terms of the construction works	US\$ 500
Training for Project personnel	US\$ 1,000
Elaboration of regulations	US\$ 800
Garbage equipment	US\$ 350
Isolation of the electric energy generator	US\$ 2,000
Noise Monitoring	US\$ 800
Total	US\$ 23,250

2.5.8. Conclusion and Recommendations

(1) Conclusion

In terms of the Environmental Impact Assessment (EIA) Survey of the "Tourism Improvement of Aguateca and El Ceibal Archeological Sites", it is concluded as follows:

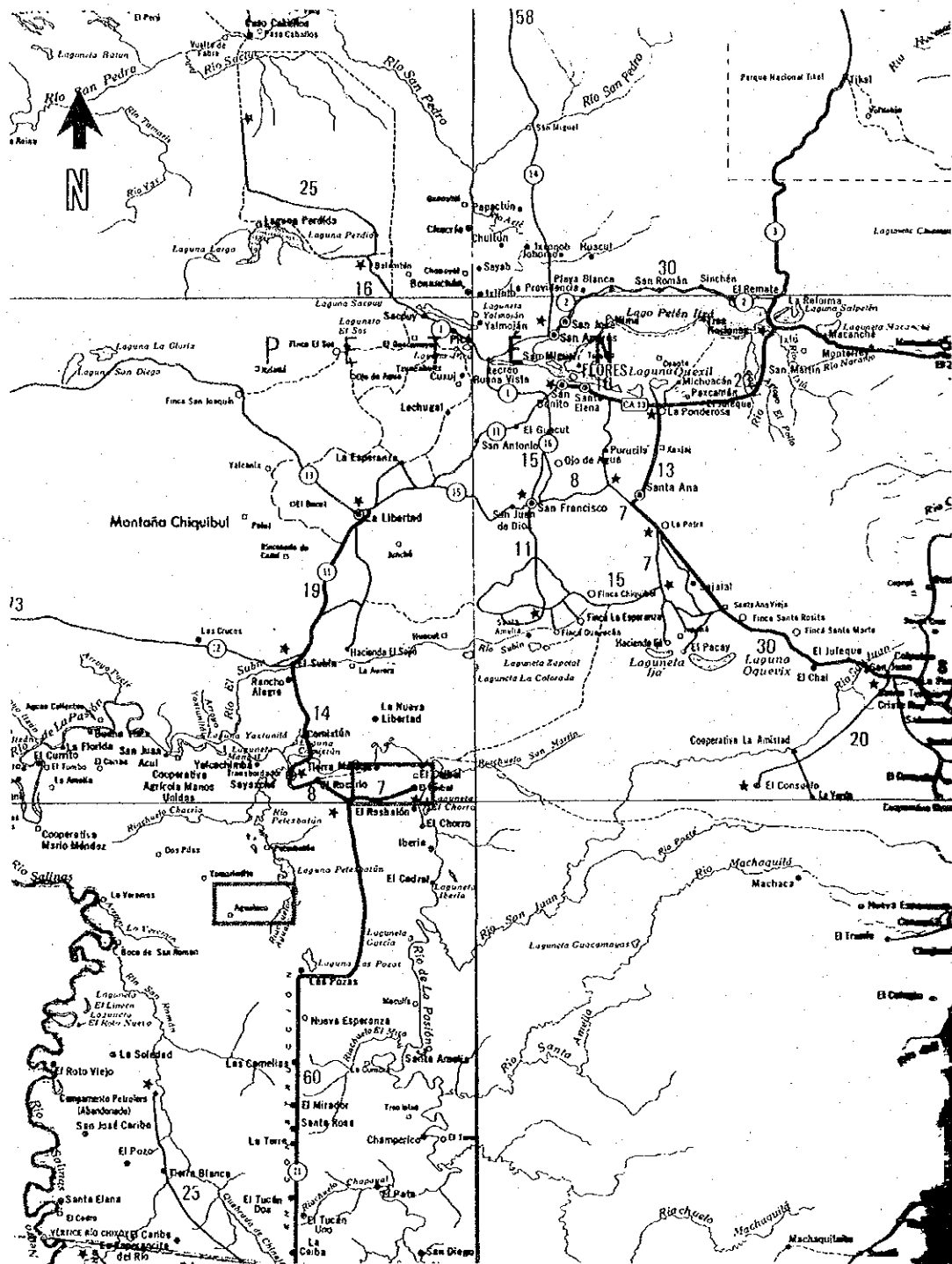
- In general, Tourism Improvement of Aguateca and El Ceibal Archeological Sites Project will not cause serious adverse impacts; and
- However, the proposed access pathway should be selected the route more carefully in order to prevent the present fauna and flora from the disturbance.

(2) Recommendations

In order to mitigate possible significant adverse impacts and to promote favorable impacts by the Project, it is recommended that the following actions should be considered:

- The construction and improvement of the Project should fulfill the architectural requirements by IDAEH and CONAP with the landscape and nature;
- An archaeological research of the Project construction site during the project preparation phase is recommended for confirming present archeological structures in order to establish restrict areas;
- It is proposed to conduct a constant supervision by IDAEH and INGUAT during the construction phase;
- It is recommended to hire the local people for the Project construction and operation works in order to contribute to the local economy;
- During the Project construction phase, the workers needs to receive sanitary services and solid wastes collection services;
- The construction wastes should be disposed in a site, which is authorized by the municipality;
- The landscape architecture should be considered the reforestation with native species, and in relation to the archeological site, for this purpose the Project should ask the assistances from IDAEH and other related organizations; and
- It needs to promote the proposed museum as a core center to improve the tourism and educational attractions of the surrounding area.

Figure 2.4 Location map of Tourism Improvement of Aguateca and El Ceibal Archeological Site



2.6. EIA Survey of the Development of Pasión River Cruise Facilities

2.6.1. Objectives of the EIA survey

Based on the results of the IEE, the Project site is located within one of the protected areas, although the proposed project facilities are small scale. An EIA survey is needed based on present Guatemala's regulations. The boat piers and mooring facilities may cause water contamination in the Pasión River. It is concluded that the Project needs an EIA survey.

The objectives of the EIA Survey are: to identify/evaluate possible environmental impacts, which could be caused by the project based on the available data/information and field reconnaissance; to analyze/forecast possible environmental impacts, to propose mitigation measures for possible significant adverse environmental impacts as necessary; and to recommend environmental monitoring plan.

2.6.2. Description of the Project

(1) Background

A remarkable characteristic of the archaeological sites such as Ceibal and Aguateca are the access by boat, which provides natural attractions of river and lake scenery and opportunity to observe wildlife such as birds, butterflies, and crocodiles. The trip by boat is expected to bring a favorable change in the monotonous itineraries of archaeological tourism.

(2) Site location and main components of the project

The Ceibal and Aguateca sites are located in the Sayaxché Municipality in El Peten Department. The site is 60km to the south from Flores on the way to Cobán. El Ceibal is 15km to the east from Sayaxché along the Pasión River and Aguateca is also 15km to the south from Sayaxché overlooking Laguna Petexbatún.

The main components of the Project are: the construction of three docks and docking facilities, concrete structure, each one with its terminal of 50 m², with sanitary services, wooden structures at one floor. Each dock is located in the archaeological site of Aguateca, Archaeological site of El Ceibal and Public beach of Sayaxché with a souvenir store of 30 m² wooden structure, one level, this site will be developed in the river bank of the Pasión River.

2.6.3. Present Environmental Conditions of the Project Area

(1) Natural environment

a. Climate

The total annual average precipitation in the Project Area is 1,967 mm during the months of May to January. The average temperature of the Areas is approximately 26°C.

b. Landscape

The Project site has natural conditions of latifolia forest and fluvial landscape, with panoramic of great beauty, but in the route there are open spaces without forest coverage or with agriculture, in the zones near the Project site.

Petexbatún lagoon is an open space surrounded by forest and topped by a mountain. The aquatic plants, which is complemented the beautiful lake view.

In Sayaxché, the landscape of the public beach is mixed with the town environment and services, lack of cleaning, which is not in harmony with nature.

c. Characteristics of ecosystem

The main area of the Project site belongs to the very humid forest subtropical bh-MB life zone.

The natural vegetation is of a tropical high forest, including palm, Ceibal, and other plants. The tropical forest is main flora of the Project site. The fauna of the Project site is abundant by variety of mammals such as many kinds of birds, snakes, and reptiles.

d. Geology and geomorphology

In the case of Aguateca, the topography is waved with slopes from 10 to 40% and alternative hills. The soils are deep with bad drainage of topography moderately inclined with slopes up to 2% in the plazas and 8% in the paths, and alluvium sediments deposited in the riverbank of the Pasión River.

e. Hydrology

The Project site is the riverbank of the Pasión River, which is discharged into the Usumacinta River, that flows into the Gulf of México.

f. Water quality

In order to understand the conditions of the water quality and bacteria conditions in the Project site, the water sampling was conducted in the Pasión River and Petexbatún Lagoon on January 4, 2002.

The water quality level exceeded the Guatemalan standard for drinking water. The situations need to establish a purifying treatment for drinking. However, the water quality level normally accepted, according to international standards for recreation use.

g. Noise

In order to determine the sound levels in the surroundings of the Project site, some measurements were conducted in the surroundings of Ceibal Archeological site.

Only the fluvial transportation such as ferry and vehicles generate noise at the Sayaxché public beach surrounding area.

Comparing the noise levels with the standard, which registered and proposed by the former National Commission for the Environment (*CONAMA*), which was reconstructed as the *MARN*, the noises do not exceed the standard for a residential area in Guatemala.

(2) Socio-economic environment

a. Demography

The population of the municipality of Sayaxché in Petén department, in the rural area as well as in the urban area is identified in its majority as belonging to the ethnic group of *kekchí*.

At the departmental level, 26.2% of the Petén population is indigenous. At the municipality level, 52.1% of the population is indigenous.

b. Archeological site

The Ceibal archeological site was the biggest old settlement of the region. It is formed by a ceremonial center that covers an approximately 1 km² distributed on three high hills, each separated by big hollows that drain to the river, each one has a great concentration of buildings, assigning groups like A, B, C and D. It was declared as National Park by the Minister Agreement No.A-51-903 of the Ministry of Education.

The Aguateca Archeological site is located on a hill that borders with the Petexbatún Lagoon. In Sayaxché, there is a small archaeological site, located to the northeast of the town and borders with the river.

c. Main economic activities

The main economic activity of Sayaxché is livestock and commerce. Also, the local peoples cultivate subsistence crops (corn and beans) at the south of the municipality.

d. Wastes

The local area of the Project site has a municipal system for collection of the solid wastes, but is not effective, the service is irregular, which causes the unsanitary dumping, where the local peoples leave the garbage. The municipality has a site for dumping the wastes.

e. Rights of common

Almost a half of the local peoples of Sayaxché is of *kekchí* tribe. One of the traditions is to respect the elder persons, who are the leaders of the community, among them they elect the auxiliary major who has a lot of influence in the decisions making of the community.

2.6.4. Environmental Impacts

A multidisciplinary professional group (AD-hoc Committee) was formed for the Environmental Impact Assessment (EIA) and the EIA Survey with experiences in environmental, social and health sciences that considered the legal, technical standards and those related to the environmental and health protection. Then the committee proceeded to identify and evaluate the actions of the Project that could cause environmental impacts on the area.

The group of experts that took part in the EIA, which are identified the possible impacts on the environments at the following phases:

- Project Construction Phase

- Project Operation Phase

(1) Project construction phase

The possible environmental impacts caused by the construction of the Project are the followings:

- Water quality: The constructions are conducted in the waters of the rivers and their riverbank, which could cause generation of water contamination and particles. So it is considered that the impacts will be light adverse, even though it will be a temporary activity;
- Fauna: The construction of the docks will cause slight adverse impacts in terms of the habitat of fish in the Pasión River, but it will be a temporary activity;
- Traffic: The temporary construction works could cause the barrier for the access to the archeological sites, so the impacts will be slight adverse;
- Landscape: The construction works and construction wastes could cause an unpleasant view, but the construction work is temporary. So the impacts will be slight adverse; and
- Employment opportunity: It will have a slight favorable impact. Because, the construction works needs the local man powers at all the construction phase. The local peoples will get economic benefits by the works.

(2) Project operation phase

The possible impacts on the environment due to the operation of the Project are the followings:

- Water quality: It will be affected by discharges of the residual waters of the Project facilities, such as the dock terminals, and discharge of the oils from the boat engines, so the impacts will be slight adverse;
- Wastes: The solid wastes may throw away into the Pasión River and Petexbatun Lagoon from the boats or docking sites. So it is considered that the impacts will be slight adverse;
- Cultural property: The improvement of the Project site will offer a better attention to the visitor, which will bring more excursionists, in consequence the impacts will be significant favorable;
- Landscape: The Project will be developed in the Pasión River and Petexbatun Lagoon. So it offers a panoramic view, the impacts will be slight favorable, additionally, the facilities in Sayaxché will be improved;
- Economic activities and Traffic: The archeological sites will have better facilities for fluvial communication so the impacts will be significant favorable;

- Employment opportunity: The river cruise activities will bring an economic benefit and one of the sources of the incomes for the part of the local peoples. So it is considered that the impacts will be slight favorable.

2.6.5. Analysis of Alternative Plan

The possible impacts on the environment in the Project site without the Project are the followings:

- Water quality: The lack of dock causes water contamination when the boats dock, so the impacts are slight adverse;
- Fauna: The construction of the docks could cause slight adverse impacts in terms of the habitat of fish in the Pasion River; and
- Economic activities, transportation: The regional economy of the Project site and the surrounding areas will not improved due to no fluvial communication.

2.6.6. Mitigation Measures for Adverse Impacts

In order to mitigate the possible adverse impacts, the following measures could be proposed:

(1) During the preparation phase

All the related institutions, such as INGUAT, Ministry of Public Health and Social Assistance, Ministry of Environment and Natural Resources (*MARN*), *CONAP*, *IDAEH*, and the Municipality of Melchor de Mencos should approve the Project and the location site.

It is imperative to investigate the water rights in the Project site in order to prevent from the user conflicts among the water users.

The Project should be designed with all the architectural elements that will allow the integration of the Project to the physical and natural environment of the zone.

It needs to conduct hydrological studies in the river and the lagoon to determine the fluctuation levels of the floods.

It should be prepared an operation and maintenance manual for the facilities.

It needs to conduct studies of sanitary engineering to find the best solution to treatment and final disposition of the residual waters from the terminals and souvenir shop.

(2) During the construction phase

Archaeologists should supervise the Project site, so that the works do not cause damage to the site structures.

It needs to execute the construction works in dry season, when the water level of the River is lower. The Area should have sanitary services and services for the collection of wastes for the workers.

It needs to revise the operation and maintenance manual for the facilities.

It should be provided the information about the construction activities to alert the visitors.

(3) During the operation phase

The persons, who is in charge of maintenance of the Project should be trained and should follow the regulations in order to understand the use of the manual for operation and maintenance of the facilities.

The cruise services and dock operations should have internal regulations for a better use of the facilities and protection of the present water fauna.

The relating municipalities should provide services for collection of the solid wastes. The facilities and boats should have garbage equipment for enough volume.

The workers of the docks, facilities and cruises should fulfill the sanitary and functioning regulations of the Ministry of Public Health and Social Assistance as well as the regulations of *INGUAT* and *IDAEH*, *CONAP* and the Municipality of Sayaxché.

2.6.7. Environmental Monitoring Plan

(1) Environmental monitoring plan

With the purpose of conserving the environment and human health, the following necessary monitoring activities could be proposed:

- Follow up and evaluate each phase of the mitigation measures;
- Once the Project is operating, it should be evaluated every six months by the sanitary, IDAEH and CONAP authorities to guarantee the fulfillment of the standards and regulations for the protection of the health and comfort of the users; and
- Monitor the water quality, every three months in the Areas near the docks.

(2) Recommended mitigation and monitoring cost

Hydrological Studies to determine floods	US\$ 3,000
Prepare the manual for operation and maintenance	US\$ 800
Archaeological Supervision during the construction	US\$ 1,500
Studies of options for the construction of docks	US\$ 1,500
Studies of Sanitary Engineering	US\$ 1,800
Sanitary services and recollection of wastes for the operatives	US\$ 800
Training for project personnel and boat drivers	US\$ 1,000
Elaboration of regulations	US\$ 800
Garbage equipments	US\$ 350
Water Monitoring	US\$ 500
Total	US\$ 11,050

2.6.8. Conclusion and Recommendations

(1) Conclusion

In terms of the Environmental Impact Assessment (EIA) Survey of the “Development of Pasión River Cruise Facilities”, it is concluded as follows:

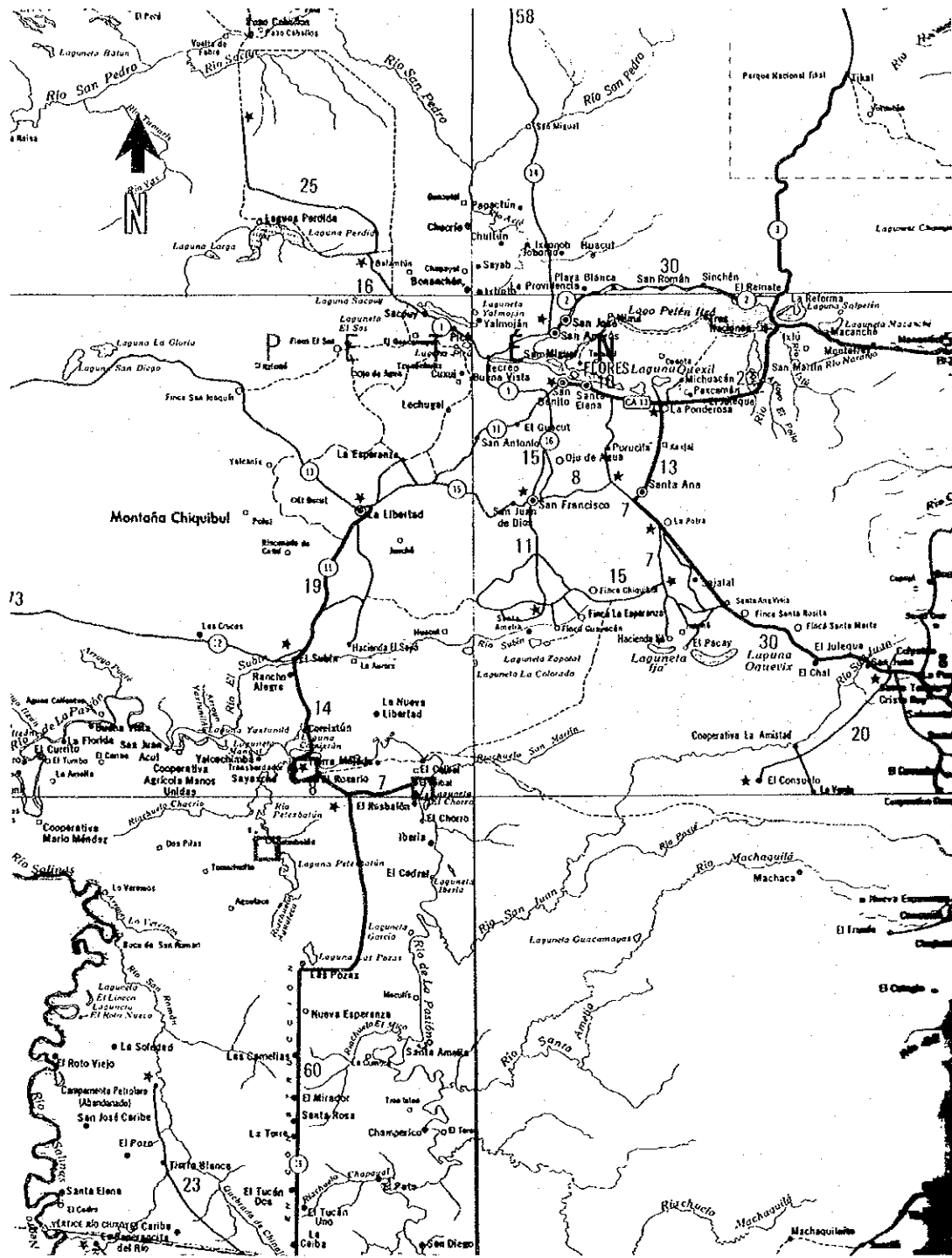
- In general, Development of Pasión River Cruise Facilities Project will not cause serious adverse impacts;
- The regional economy of the Project site and the surrounding areas will be improved due to the new fluvial communication by the Project implementation; and
- However, it is imperative to investigate the present water rights, and to conduct archaeology as well as sanitary study in order to prevent from the conflicts and the local properties.

(2) Recommendations

In order to mitigate possible significant adverse impacts and to promote favorable impacts by the Project, it is recommended that the following actions should be considered:

- The works of construction and improvement should fulfill the architectural requirements from IDAEH and CONAP and integrate the work to landscape and the nature;
- It needs to conduct the hydrological study of the floods during the preparation phase of the Project;
- It should be designed the docks taking into account of the level fluctuations and be built it during the season when the water levels are the lower;
- The residual waters should be sanitarily disposed, avoiding contamination of the waters;
- During the Project construction phase, the workers must receive sanitary services, as well as collection of the solid wastes; and
- The regulation concerning the use of the facilities and rules of the river cruise should be taken into account of the protection of fauna and flora, discharges the wastes, and the oil spills to the River.

Figure 2.5 Location map of Development of Pasion River Cruise Facilities



Source: JICA Study Team

2.7. EIA Survey of the Development of Archaeology and Regional Culture Center

2.7.1. Objectives of the EIA survey

Based on the results of the IEE, the construction activities of the building may cause construction wastes and water contamination, as well as construction noise in the surrounding residential area, although the project will contribute to the local economy of the Sayaxché area. It is concluded that the Project needs an EIA survey.

The objectives of the EIA Survey are: to identify/evaluate possible environmental impacts, which could be caused by the project based on the available data/information and field reconnaissance; to analyze/forecast possible environmental impacts, to propose mitigation measures for possible significant adverse environmental impacts as necessary; and to recommend environmental monitoring plan.

2.7.2. Description of the Project

(1) Background

The areas surrounding Sayaxché have many archaeological sites and the artifacts found in the excavations need a place for restoration, preservation and protection against theft, which is a serious problem in the archeological sites of the area. While Sayaxché is located on the main route to Cobán and Palenque, the suggested site is conveniently located to exhibit these artifacts for the tourists visiting the area.

(2) Site location and main components of the Project

Sayaxché town is located 60 km south from Flores in the Sayaxché Municipality, in El Peten Department. The candidate Project site is the south border of the Pasión River.

The main components of the Project are a center building, which is the total area at a roofed floor 1,000 m² with two floors and concrete structure. The center will have a garden, pavement, lightning, signaling/information, and will have parking (600m² asphalt pavement).

2.7.3. Present Environmental Conditions of the Project Area

(1) Natural environment

a. Climate

The annual average precipitation is 1,967mm with a maximum of 2,245 mm and a minimum of 1,477 mm in El Porvenir, which is near the Project site. There is rain during all the year, but more in the months from May to December. The average annual temperature is 26 °C. The humidity annual average humidity is 85%.

b. Landscape

The main landscape of the Project site is townscape without forest coverage and the riverbanks, where have erosion processes and unstable. The Pasión River is suitable for river transportation of daily life. The landscape outside the town is rural with strong human intervention such as agriculture and livestock activities. The town is used as a

focus for distribution of commercial activities and traffic of vehicles and people up and down the river.

c. Characteristics of ecosystem

The main area of the Project site belongs to the very humid forest Subtropical bh-MB life zone.

The Project site does not have endemic flora due to its intervention, observing only few representative species like Cedar.

With the disappearance of the jungle, the great variety of fauna such as mammals, birds, and turtles of the Project site has been disappeared. The species that still exist are sparrow hawk, rodents, and herons.

d. Geology and geomorphology

The soils are deep, with bad drainage, topography moderately inclined with slopes up to 2%, and alluvium sediments deposited in the riverbanks of the *Pasión River*.

These soils have been eroded by the deforestation of the forest, having a profile of plastic clay of a dark gray color up to 90 cm, approximately and then the a substrate of alluvium of the Tertiary era.

e. Hydrology

The body of surface water closer to the Project is the *Pasión River*.

f. Water quality

In order to understand the conditions of the water quality and bacteria conditions in the Project site, the water sampling was done in *Yaxhá Lagoon* on January 4, 2002.

The water quality level exceeded the Guatemala's standard for drinking water. The situations need to establish a purifying treatment for drinking. However, the water quality level normally accepted, according to international standards for recreation use.

g. Noise

In order to determine the sound levels in the surroundings of the Project, some noise measurements were conducted in the cross section of the roads going to *Cobán*, the landing track and the archaeological site of *Sayaxché*.

Comparing the noise levels with the standard, which registered and proposed by the former National Commission for the Environment (*CONAMA*), which was reconstructed as the *MARN*, the noises levels do not exceed the standard for a residential area in Guatemala.

(2) Socio-economic environment

a. Demography

The population of the municipality of *Sayaxché* in *Petén Department*, in the rural area as well as in the urban area are identified in its majority as belonging to the ethnic group of *kekchí*.

At the departmental level, 26.2% of the Petén population is indigenous. At the municipality level, 52.1% of the population is indigenous.

b. Main economic activities

The main economic activity of the Project area is livestock and agriculture. There is also commercial activity, because Sayaxché is one of the commercial centers along the road that goes from Flores to Cobán and the communities that have developed at the riverbank of the Pasión River.

c. Wastes

A waste collection system for the solid wastes has the municipality, but not effective. The service is irregular, which causes the existent of empty sites where the local peoples leave the garbage; the municipality has an unsanitary disposal site.

d. Rights of common

Among half of the local peoples of Sayaxché is of *Kekchí*, who follows the tradition of respect to the elderly, who are the leaders of the community among them. They are elected the auxiliary mayor who has a lot of influence in the decisions of the community.

e. Archeological site

The archeological site has a major hill rock and various platforms surrounding it, it is located at the south shore of the Pasión River.

2.7.4. Environmental Impacts

A multidisciplinary professional group (AD-hoc Committee) was formed for the Environmental Impact Assessment (EIA) and the EAI Survey with experiences in environmental, social and health sciences that considered the legal, technical standards and those related to the environmental and health protection. Then the committee proceeded to identify and evaluate the actions of the Project that could cause environmental impacts on the area.

The group of experts that took part in the EIA identified the possible impacts on the environments at the following phases:

- Project construction Phase
- Project operation Phase

(1) Project construction phase

The possible environmental impacts caused by the construction of the Project are the followings:

- Erosion: During the construction of the building and parking, it will be slightly affected by the excavation and paving activities, these activities are temporal, so it is considered that the impacts are slight adverse;

- **Public facilities:** The recreational facilities such as present football field, will be closed by the construction of the proposed building and the parking and landscape architecture, so it will be a slight adverse impact;
- **Cultural property:** The construction of the proposed center building will cause slight adverse impacts on the present cultural properties, if appropriate preventive measures such as implementation of a archeological survey;
- **Noise:** The construction noise relating the building construction may cause adverse impacts in the residential area near the Project site;
- **Wastes:** The construction wastes may cause an adverse impact, if the appropriate construction wastes disposal;
- **Landscape:** The movement of soils, the excavation and construction wastes will cause an unpleasant aspect, the construction activity is transitory so the impact will be slight adverse; and
- **Employment opportunity:** *The employment will have a slight favorable impact, due to all the actions in the construction phase considering that part of the local peoples may receive benefits in directly or indirectly.*

(2) Project operation phase

The possible impacts on the environment due to the operation of the Project are the followings:

- **Economic activities:** The local peoples in the residential and commercial zone near the Project site will receive benefits by the functioning of the center so the impact will be significantly favorable;
- **Landscape:** The development of the Center will be considered an architectural design that will take in account of the present natural view and will integrate it the natural environment so the impact will be significantly favorable to the scenic views and landscape;
- **Cultural property:** The archeological sites, by the functioning of the site, concentrating investigation and protecting heritage, will be a significant favorable impact; and
- **Employment opportunity:** The Center will be a source of direct or indirect employment for part of the local peoples, so it is considered that the impacts will be slightly favorable.

2.7.5. Analysis of Alternative Plan

The possible impacts on the environment in the Project site without the Project are the followings:

- Economic activities: The regional economy of the Project site could not improved through tourism development without the Project;
- Noise: *Construction noise will not occur in the residential area near the Project site;*
- Landscape: The present landscape is a pleasant view in the Project site, but it needs improvement because it was subject of degradation for its previous use; and
- Waste: *The construction wastes will not cause by the Project construction. However, the waste problems in the residential area near the Project site may not solve without the Project.*

2.7.6. Mitigation Measures for Adverse Impacts

In order to mitigate the possible adverse impacts, the following measures could be proposed:

(1) During the preparation phase

All the related institutions, such as INGUAT, Ministry of Public Health and Social Assistance, Ministry of Environment and Natural Resources (*MARN*), *CONAP*, *IDAEH*, and the Municipality of Sayaxché should approve the Project.

The Project should be designed with all the architectural elements that will allow the integration of the Project to the physical and natural environment of the zone.

It needs to prepare the operation and maintenance manual for the facilities, including the septic tank.

Before the construction of the Center building, it needs to conduct archeological investigations in the site in order to prevent from the damages of the present archaeological monuments.

(2) During the construction phase

Archaeologists should supervise the Project site, so that the works do not damage the structures of the Sayaxché site.

The Project site should have sanitary services and services for the collection of wastes for the workers. It needs to revise the operation and maintenance manual for the facilities.

It should be prepared to create a green belt around the Project with native species of the surrounding area, preferably trees of precious woods and palm trees.

(3) During the operation phase

The persons, who is in charge of the maintenance of the Center should be trained and should follow the regulations in order to understand the use of the manual for operation and maintenance of the facilities.

The proposed Center should have internal regulations for a better use of the facilities, for the workers and for the users of the Center.

The relating municipality should provide services of solid wastes and residual waters. The facilities should have garbage equipment for enough volume and be distributed.

The workers and the facilities of the Center should fulfill the sanitary and functioning regulations of the Ministry of Public Health and Social Assistance as well as the regulations of *INGUAT* and the *IDAEH*.

2.7.7. Environmental Monitoring Plan

(1) Environmental monitoring plan

With the purpose of conserving the environment and human health, the following necessary monitoring activities could be proposed:

- Follow up and evaluate each phase of the mitigation measures;
- Once the Center is operating, it should be evaluated every six months by the sanitary, and IDAEH authorities to guarantee the fulfillment of the standards and regulations for the protection of the health of the users.

(2) Recommended mitigation and monitoring cost

Archaeological investigations	US\$	2,500
Operation and maintenance manual for the facilities	US\$	1,000
Wastes facilities for the workers	US\$	500
Create a green belt around the Center site	US\$	2,000
Archaeological Supervision during the construction	US\$	1,500
Total	US\$	7,500

2.7.8. Conclusion and Recommendations

(1) Conclusion

In terms of the Environmental Impact Assessment (EIA) Survey of the "Development of Archaeology and Regional Culture Center", it is concluded as follows:

- In general, *Development of Archeology and Regional Culture Center Project* will not cause serious adverse impact;
- However, the location of the Center building should be based on the present soil conditions and fauna and flora.

(2) Recommendations

In order to mitigate possible significant adverse impacts and to promote favorable impacts by the Project, it is recommended that the following actions should be considered:

- It needs to build the Center with all the architectonic, sanitary and integration requirements of the work to the landscape and nature;

2.8. EIA Survey of the Development of Verapaz Eco-Corridor Interpretation Center

2.8.1. Objectives of the EIA survey

Based on the results of the IEE, present unique wildlife habitat areas will enhance and improve its nature tourism value by the Project, which includes construction of the interpretation building. Also, the interpretation center will promote understanding of the conservation significances to the visitors. However, the building location and maintenance should be considered based on the soil conditions of the sites and water contamination risks. It is concluded that the Project needs an EIA survey.

The objectives of the EIA Survey are: to identify/evaluate possible environmental impacts, which could be caused by the project based on the available data/information and field reconnaissance; to analyze/forecast possible environmental impacts, to propose mitigation measures for possible significant adverse environmental impacts as necessary; and to recommend environmental monitoring plan.

2.8.2. Description of the Project

(1) Background

The Verapaz Eco-Corridor refers to the area in Las Verapaces that constitutes part of Guatemala's Ecological Corridor system. Formulation of the Eco-Corridor is considered essential to secure Las Verapaces' nature tourism destination image.

(2) Site location and main components of the project

Verapaz Eco-Corridor Interpretation Center is located in the Municipality of Purulhá, in Baja Verapaz Department. Candidate site is 45km to the southeast from Cobán. It is conveniently located in the vicinity of Biotopo Mario Dary on the C.A. Highway 14 that leads to Guatemala City.

The main components of the Project are consists of the development of an Interpretation Center (500m², concrete structure), landscaping, public services and sanitary facilities such as septic tank.

2.8.3. Present Environmental Conditions of the Project Area

(1) Natural environment

a. Climate

According to the *INSIVUMEH* Meteorological Station in Cobán, the annual precipitation in average is of 2,194 mm and of the rainfall in 9 months from May to January. The average annual temperature is 18.8°C with a maximum average of 25.2°C and a minimum of 13.6°C.

b. Landscape

The landscape surroundings of the area for the Interpretation Center for the Eco Corridor of Las Verapaces, presents various outstanding facets, such as pristine forest (biotope protected area, Holm oak forest, and pines, etc.) extensive area of agriculture farms of nontraditional products for export (leather leaves and ornamental) proliferation zone for

precarious housing in not planned places for it. The area is found for subsistence agriculture and deforestation views form the route CA-14.

c. Characteristics of ecosystem

The area is mainly located in the pluvial forest Montano low Subtropical (bh-MB) life zone.

The area where the Center is going to be build borders along the paved road that goes to the municipality of Purulhá, which has already been intervened for crops, pastures, coffee, and corn, but there are disperse trees such as oak, pine, and others.

The fauna has considerably reduced due to the deforestation; some of the remaining birds are wild pigeon and quail. There are some wild animals such as rabbits, squirrels and armadillos.

d. Geology and geomorphology

The profile of the soil is formed by a superficial soil of Franco clayey texture, of a dark brown color and in the subsoil to 90 cm. It has the same texture only of color yellow to reddish brown. The clay particles that form the soil texture have less density than the water, so it is easily moved by it, causing erosion of different degrees. The soils have been deforested in a great part, which may caused different types of erosion.

e. Hydrology

The surface water bodies near the Project are: Quebrada Colorada and Quebrada de la Cruz, both affluent to the Panimá River basin of the Polochic River.

f. Water quality

The Quebrada Colorada crosses the Biotope Mario Dary, and the sample for the physical-chemical and bacteriologic analysis was taken on December 19, 2001.

The water in the Project site is not suitable for human consumption according to the Guatemalan regulations for drinking water. According to international regulations accepted in the country, the water could be used for recreation and conservation of aquatic life.

The Quebrada de la Cruz crosses the town of Purulhá and at its there is garbage that some people of the community throw there.

g. Noise

In order to determine the sound levels in the surroundings of the Project, some measurements where done in three spots: Biotope Mario Dary, Purulhá Community and road CA-14.

In general, the noise levels do not exceed the Guatemala's standard. The noise level increase mainly due to the traffic, but this is a temporary noise.

(2) Socio-economic environment

a. Demography

The population of the municipality of Purulhá (Baja Verapaz), in the rural area as well as in the urban area is identified in its majority as belonging to the Mayan ethnic groups of Pocomchí and Kekchí.

At a departmental level, 55.5% of the Baja Verapaz population is indigenous. At the municipality level, 89.7% of the population is indigenous.

b. Main economic activities

The economic activity of the Project site is agriculture, livestock, wood industry, production of ornamental plants, and commerce. The agriculture of subsistence is developed in 5.4% of the land the rest of the land is occupied by large farms or families.

c. Wastes

The local peoples generates 0.40 kg/day garbage per person, which consists of 75% are food residues. Most of the wastes deposit in empty sites near their houses or in the edge of the fall de la Cruz, because of the deficient service of waste collection by the local municipality. The municipal authorities have planned a future project for improvement of collection and disposition of wastes.

d. Rights of common

Among the indigenous majority group of the Project area, there is social cohesion and respect for the elderly. This degree of cohesion causes joint relations like the right based in customs. The respect for hierarchy of the state is respected, from the municipal mayor that names auxiliary majors and ministries, these last ones in charge of the communication between municipal authorities and the community.

2.8.4. Environmental Impacts

A multidisciplinary professional group (AD-hoc Committee) was formed for the Environmental Impact Assessment and the EIA Survey with great experience in environmental, social and health sciences that considered the legal, technical standards and those related to the environmental and health protection. Then the committee proceeded to identify and evaluate the actions of the project that could cause environmental impacts on the area.

The group of experts that took part in the EIA, which are identified the possible impacts on the environments at the following phases:

- Project Construction Phase
- Project Operation Phase:

(1) Project construction phase

The possible environmental impacts caused by the construction of the Center are as follows:

- Erosion processes: The construction activities could cause erosion, even though it is a temporary activity, the impacts will be slightly adverse;
- Flora, bushes, and crops: The Project site cannot be used for agriculture and the deposition of the construction wastes, which will cause slightly adverse impacts on the present fauna and flora;
- Landscape: Because of the construction works of the center, it will have a slight adverse impact on the natural landscape such as disturbance of the present landscape; and
- Employment opportunity: The construction works of the Center will give direct and indirect employment to the local peoples. The impacts will be slightly favorable.

(2) Project operation phase

The possible impacts on the environment due to the operation of the Center are as follows:

- Wastes: The solid wastes by the visitors and the local peoples will cause slight adverse impacts, if appropriate measures were not taken;
- Flora and fauna: Reforestation will be a slight favorable impact by landscaping architecture; and
- Landscape: Proposed landscaping will cause favorable impacts on the present landscape.

2.8.5. Analysis of Alternative Plan

The impacts on the environment without the Project are as follows:

- Erosion risks: The erosion risks will decrease due to no construction works;
- Fauna and flora: No construction works will not cause the disturbances of present fauna and flora; and
- Landscape: No landscaping and the construction activities will not change the present landscape.

2.8.6. Mitigation Measures for Adverse Impacts

In order to mitigate the possible adverse impacts, the following measures could be proposed:

(1) During the preparation phase

The construction site of the Center should be selected in order to prevent from the possible soil erosion.

The treatment of the liquid wastes through septic tanks and absorption wells or infiltration fields should be made based on the sanitary recommendations from the Ministry of Public Health.

(2) During the construction phase

It needs to provide sanitary services and services for the collection of wastes for the workers.

It is proposed to hire the local peoples as the workers for the Center.

The landscaping and reforestation should be considered with the local species in the green areas.

It needs to revise a manual for operation and maintenance of the facilities, including treatment for residual waters.

(3) During the operation phase

The person, who will be in charge of operation and maintenance of the Center should be trained and should follow the regulations for the operation and maintenance of the facilities, including the system for final disposal of residual waters and septic tank.

The Center should have internal regulations for a better use of the facilities, for the workers and for the users of the Center.

2.8.7. Environmental Monitoring Plan

(1) Environmental monitoring plan

With the purpose of conserving the environment and human health, the following monitoring activities should be done:

- Follow up and evaluate each phase of the proposed mitigation measures.
- Once the Center is operating, it should be evaluated every six months by the sanitary, authorities to guarantee the fulfillment of the standards and regulations for the protection of the health and comfort of the users.

(2) Recommended mitigation and monitoring cost

Sanitary engineering study to dispose residual waters	US\$	1,300
Sanitary services and waste collection for the workers	US\$	500
Reforestation and protection slopes	US\$	1,000
Training for personnel participating on the Project	US\$	800
Educational program for the local peoples	US\$	1,000
Preparation of manual for operation and maintenance	US\$	900
Total	US\$	5,500

2.8.8. Conclusion and Recommendations

(1) Conclusion

In terms of the Environmental Impact Assessment (EIA) Survey of the “Development of the Verapaz Eco Corridor Interpretation Center”, it is concluded as follows:

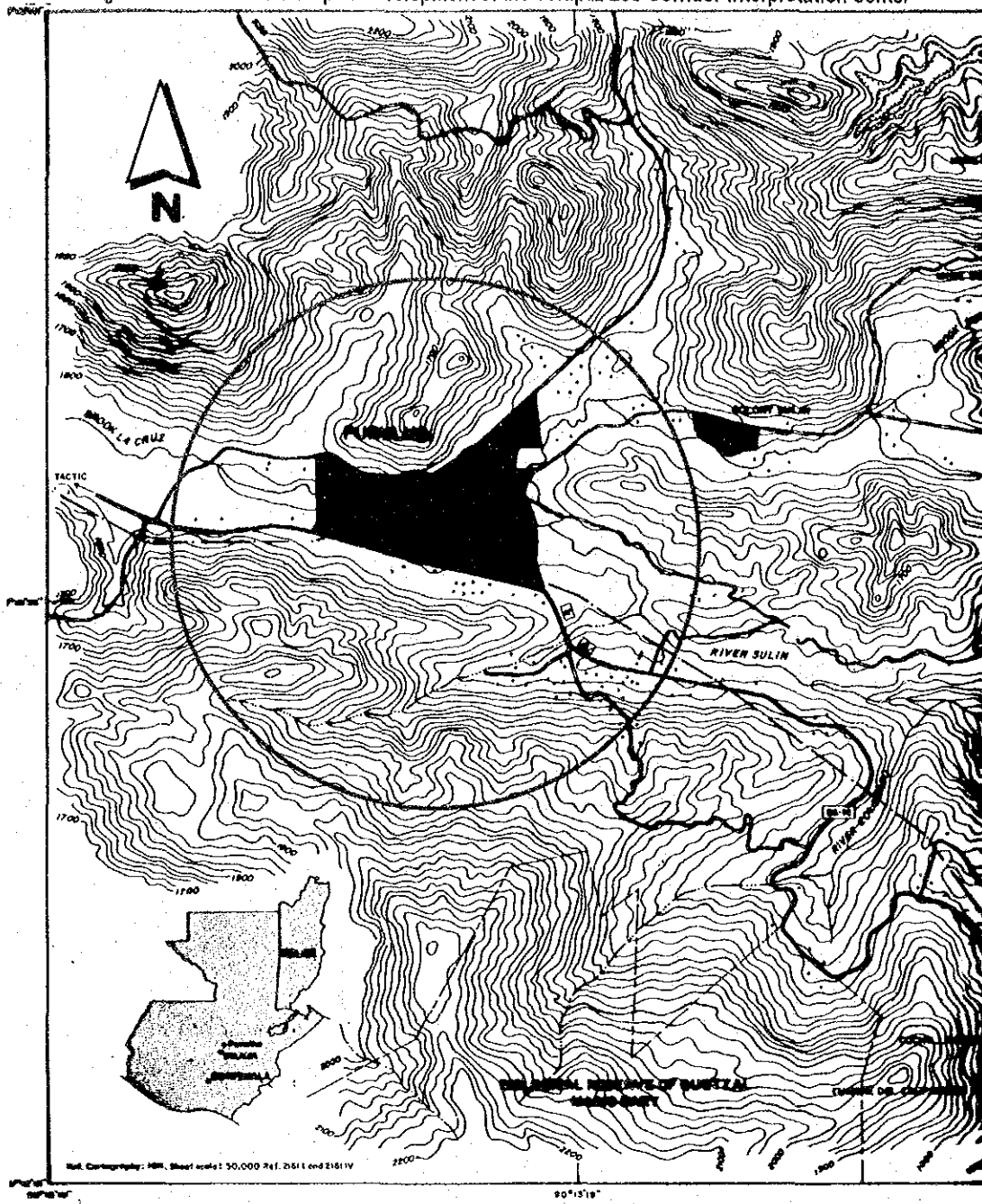
- In general, Development of the Verapaz Eco Corridor Interpretation Center Project will not cause serious adverse impact;
- However, solid wastes may cause significant adverse impacts, if the users and workers of the Centers were not disposed and were collected the wastes by the municipality.

(2) Recommendations

In order to mitigate possible significant adverse impacts and to promote favorable impacts by the Project, it is recommended that the following actions should be considered:

- “Verapaz Eco Corridor Interpretation Center” should be built with all the architecture, sanitary requirements in order to conserve the present landscape and nature;
- The development plan of the Project should be elaborated with all the management entity of the site as well as the local peoples;
- During the Project construction phase, solid waste collection equipments for the workers should be provided;
- *The municipality should consider for an efficient collection and final disposition service of the solid wastes in the Center; and*
- *INGUAT and CONAP should take initiative to promote the Center with the municipality and related NGOs.*

Figure 2.7 Location map of Development of the Verapaz Eco Corridor Interpretation Center



Source: JICA Study Team