V IDENTIFICATION, DESCRIPTION AND EVALUATION OF THE ENVIRONMENTAL, ACCUMULATIVE AND RESIDUAL IMPACTS OF THE REGIONAL ENVIRONMENTAL SYSTEM

This chapter concentrates the essence of the Environmental Impact Statement for the Proyecto Hidroeléctrico Veracruz, denominated Environmental Impact Assessment (EIA). The EIA is constituted as a tool that facilitates the identification of the from and magnitude of the work activities and/or activity with the environmental factors.

It shall be taken into consideration that the environmental impact defined as any modification to the natural or human surrounding, or of any of its elements or conditions directly or indirectly produced by all kind of human activities susceptible of modifying its environmental quality, may be both positive or negative.

Therefore, the integration of information related to the description of the projects and of the research and influence area (physical, biological and social aspects) is important. The assessment of the impacts will be both quantitative and qualitative, subject to the assessor's subjectivities, that is why it is important to select a methodology that jointly slants an unilateral decision.

V.1 Identification of the regional environmental system's structure and functions.

Bearing in mind the considerations in respect to the definition of environmental impact, as any modification to the natural or human surrounding, or of any of their elements or conditions directly or indirectly produced by all kind of human activities susceptible of modifying their environmental quality, and that may have both a positive or negative nature, it is understandable to find in this surrounding multiple alterations that range from simple landscape transformation to change in the climate conditions, due to natural or anthropic phenomenon.

The Proyecto Hidroeléctrico Veracruz, is placed in the mountain chain corresponding to the Zongolica and Mazateca sierras and involve the municipalities of San Juan Texhuacán, Mixtla de Altamirano and Zongolica.

The project will basically consist in the construction of a dam with approximate capacity of 200 thousand cubic meters; the construction of a conduction tunnel of 2,790 m long and "Portal" section with a surface of 9 m^2 with a transverse section 3.0 m width and 3.0 m height that will cross a hill in straight line form; the construction of a steel pipeline with a 1.2 m diameter and 2, 340 m long that will descend by the side of a ravine to the power house of the hydroelectric generation central; the construction of the power house and its substation that will receive the power generated and lastly, the installation of a transmission line of simple circuit 4.3 km long, with which the link with the other substation will be made.

The research zone is located in the north portion of the Papaloapan hydrologic basin, as affluent of the Axalticpac river and then to the Tonto river until arriving to the Alvarado river

mouth. The local drainage network includes the Apatlahuaya rivers that will supply the hydroelectric plant, the Zongolica river where the turbine water will be discharged and the Moyotepec, Coyolapa and Altotonga rivers, all of them tributary of Tonto river, important affluent of the Papaloapan river regulated by the Miguel Alemán dam before its discharge to the Papaloapan.

An ecosystem of Mesophyll Forest, Gallery Forest ad riparian vegetation prevails, with both pine and oak species, important within the system's functioning, considering their high economic potential, and that justifies to observe their protection and conservation as indicators of conserved sites.

V.1.1 Construction of the scenario modified by the project.

Based on the future scenario formulated in section IV.5, and considering the activities described in the section "Identification and description of the change, perturbations and effects sources", environmental factors sensible to the preparation, construction and operation activities of the Proyecto Hidroeléctrico Veracruz to be developed are identified, and include the dam wall axis and tunnel's entrance portal, oscillation ditch and the tunnel exit portal, pressure tube, power house, substation and transmission line zones, within a total area of 24.38 Ha. Table V.1 shows each of the environmental base lines, the attention subjects that might suffer alterations.

TABLE V.1. ATTENTION SUBJECTS IN THE SURROUNDING MODIFICATION

PHYSICAL ENVIRONMENT	BIOTIC ENVIRONMENT	SOCIO-ECONOMIC ENVIRONMENT
Atmosphere	Flora	Population
Geo-morphology	Fauna	Services
Lands	Landscape	Local/regional economy
Hydrology		

Within this future scenario, factors such as the geo-forms will not show a great alteration. The lands may see their current use and the potential one minimized to certain conditions established by the safety and muffling areas relative to the conduction line. A better water handling and care is foreseen, and its potential use in fish breeding activities. In this regard, the regulation of the exit flows that do not imply the modification of natural hydraulic talus or formation of meanders will be important.

The flora will not be significantly altered, mostly if the project includes a proposal for the forestall compensation and restoration, which directly benefits the recovery of habitats for the possible dispersion of bird fauna particularly, that due to the construction works, the movement of soil, vehicles and gas, dust and noise emissions, might be produced.

Due to the engineering outline design of the hydroelectric project in its several divisions, it does not generate strong impacts on the landscape units, and in the future the scenario will tend to improve with the application of the forestall recovery and compensation programs.

The local economic and social scenario will improve for the towns that will see in the development of the project an employment opportunity and utilization of the water resource.

V.1.2 Identification and description of the change sources, perturbations and effects.

Herein below are the different actions provided for in the project on the preparation, construction and operation of the Proyecto Hidroeléctrico Veracruz identified, emphasizing that the civil works corresponding to the tunnel, dam wall axis, power house, substation and foundation shoes of the transmission towers zones, comprise the modification of a territorial segment. (Table V.2).

TABLE V.2. PROJECT'S ACTIVITIES TREE

STAGE	ACTIVITIES	CLASSIFICATION
Site Preparation	Land cleaning	PR1
	Land outline	PR2
	Leveling	PR3
	Compacting	PR4
	Reads habilitation	PR5
Site Construction	Terreplein	CON1
	Excavations/Perforations	CON2
	Foundations	CON3
	Machinery movement	CON4
	Materials movement	CON5
	Water drifting	CON6
	Supplementary hydraulic works	CON7
	Coatings	CON8
	Towers shoes	CON9
	Platform (stuffing)	CON10
	Mounting	CON11
	Construction of edifications	CON12
	Camps	CON13
	Read system and supplementary works	CON14
	Signal system	CON15
Operation	Operations (dam activities)	OPE1
	Accidents	OPE2
	Vehicle transit	OPE3
	Waste handling and disposal	OPE4
	Supervision	OPE5
Maintenance	Performance of tests and inspections to equipment	MAN1
	Maintenance in premises and equipment	MAN2

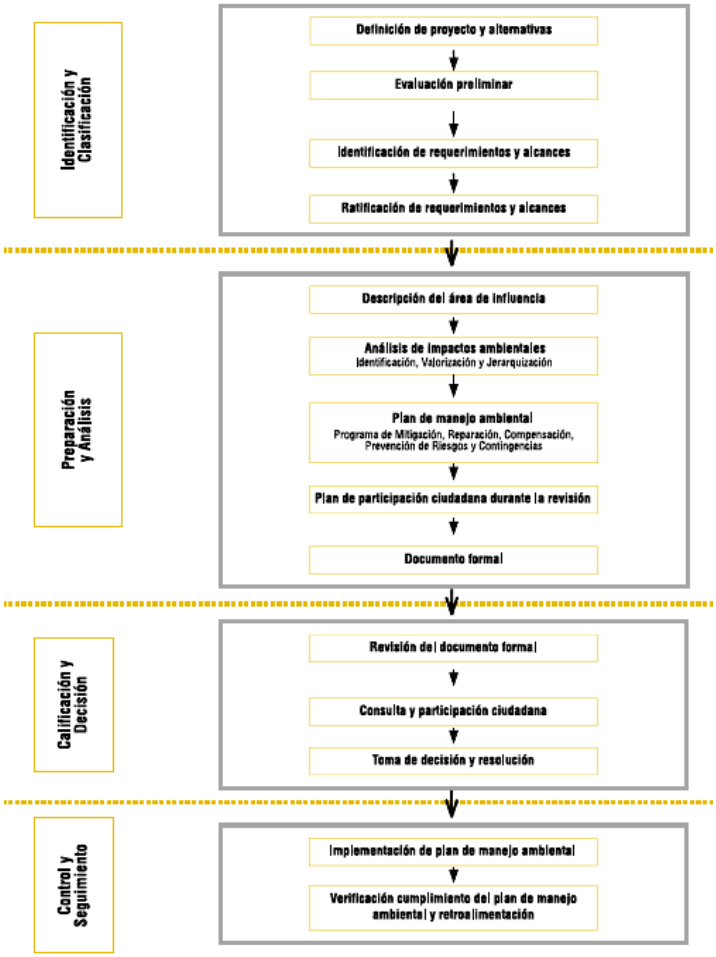
V.1.3 Quantitative and qualitative assessment of the changes generated in the regional environmental system.

The qualitative and quantitative assessment is summarized in tables V.7, V.8 and V.9, as a consequence of the impact identification processes and quantitative assessment and impacts hierarchically arranged.

V.2 Techniques to assess the environmental impacts

The assessment process described herein below, was carried out in an interdisciplinary form, with the participation of professionals specialized in each of the environmental elements assessed. Essentially, the process consisted in a detailed revision of the project in all its aspects and analysis of each of the activities that comprise it, as well as the impact produced thereby, based on the initial or reference environmental status. The process was completed with the identification of impacts and their assessment both for the construction and operation stages Fig. V.1.

DIAGRAM V.1. ENVIRONMENTAL IMPACT'S EVALUATION PROCESS



V.2.1 Impact Indicators

In order to be able to identify and predict and assess the impacts to be generated by the construction of the Projecto Hidroeléctrico Veracruz, several methods were applied, such as the pragmatic procedures (*Ad Hoc*), matrices, superposition and listings, resulting an adaptative procedure. In the environmental indicators section, it was necessary, above all, to define a tree of actions (Gómez, Orea, 1998), so together with the selection of environmental factors selected under the matrix method of Leopold (Leopold, 1971), they allow to assess the dimension of the alterations that might be present as a consequence of establishing the project. (Table V.3).

In the identification of impacts susceptible of occurring, the stages of site preparation and construction are differentiated, because due to the kind of project, they present consecutive stages and some similar impacts deserve to be differentiated such as the moving of lands, utilization of materials, concentration of personnel, utilization of construction machinery and equipment, etc. Now then, the operation stage is also different from the maintenance stage, regardless of their close relationship.

A broad and complete rage of environmental indicators carefully selected in accordance with the research zone particularities and the characteristics of the project to be developed were utilized and assessed, these indicators were assessed with different criteria both of qualitative and quantitative kind, with the space and time variables and additionally considering aspects such as the system's support capacity and the reversibility degree of the effects detected before the project and of the ones foreseen in the future scenario.

V.2.2 Indicative list of impact indicators

Specifically, for the project which is the subject matter hereof, the following impact indicators were selected for each of the environmental factors potentially impacted, as well as the one corresponding to the project's activities that influence such environmental factors.

ATMOSPHERE: Within this factor we found the indicators of gas emission, micro-climate, suspended particles, visibility and noise and vibrations, which keep a close relationship with the activities of vegetal coverage removal and land, the subsequent consequences of weathering, in addition to the mobilization of materials and the equipment and the machinery used theretofore.

LAND: Loss of fertile land, modification of current and potential use, erosion processes, external drainage, stability, geo-forms. In all the project stages, including the operation, there will be negative and positive effects in this factor. They relate to the cleaning of land, improvement of road systems, outlines, mobilization of machinery and equipment, restoration and potential future use, among other.

TABLE V.3. PROJECT'S ENVIRONMENTAL INDICATORS

Atmosphere	Micro-climate	AT3
	Visibility	AT4
	Noise	AT5
	Suspended particles	AT2
Land	Loss of fertile land	ST1

	Current use	SU2
	Potential use	SU3
	Erosion	SU4
	External drainage	SU5
	Stability	SU6
	Geo-forms	SU7
Water	Dripping	AG1
	Infiltration	AG2
	Phreatic level	AG3
	Superficial water quality	AG4
	Underground water quality	AG5
terrestrial / aquatic fauna	Habitat	FAT1
	Abundance	FAT2
	Trophic chains	FAT3
	Shifting	FAT4
	In conservation status	FAT5
terrestrial / aquatic vegetation	Abundance	VEGT1
	Composition	VEGT2
	Dominance	VEGT3
	In conservation status	VEGT4
Landscape	Panoramic view	PA1
	Naturalness	PA2
	Traffic	PA3
Socio-economic	Demography	SOC1
	Change of land use	SOC2
	Services demand	SOC3
	Employment	SOC4
	Local economy	SOC5
	Transportation and communication service	SOC6
	Safety	SOC7
	Public Health	SOC8

WATER: This factor is now a days the most cared one and is represented by the indicators of dripping, infiltration, phreatic level, superficial water quality, underground water. The retention of water, the works for its conduction, the increase in the flow regime, the productive utilization, the water role as regulator are important aspects when assessing this factor.

TERRESTRIAL/AQUATIC FAUNA: As a result of actions that might fragment an ecosystem, the indicators of habitat, abundance, composition, trophic chains, shifting and observe species in conservation status are important. Therewith, we will be able to assess the possible decomposition of a biodiversity mainly marked by the vegetation and the presence of human activity in the zone.

TERRESTRIAL/AQUATIC VEGETATION: This factor is determinant in the preceding one and will be assessed as of the indicators of abundance, composition, dominance and conservation status of some of the species found. Without doubt, an effective environment handling plan will allow to mitigate the negative effects resulting from the removal of vegetation and its associations and positively compensate through restoration programs. Particular attention corresponds to the riparian vegetation that might be affected.

LANDSCAPE: Notwithstanding the zone does not involve Natural Protected Areas, nor eco-touristic value zones, it is important to conserve the unity of the landscape related to the Mesophyll Forest and Gallery Forest and their integration with the water course present in the Apatlahuaya River. In this factor panoramic view, naturalness, traffic are assessed, the works will be developed in a site that presents no landscape value, only the affectation that the works influence the existing landscape is considered.

SOCIO-ECONOMY: The generation of employment, may directly influence other socio-economic indicators such as the increase of the local demography, municipal services, transportation and communication services, public safety and health. This last indicator keeps a close relationship with the major beneficial impact which the performance of the proposed works will bring along regarding a life quality based on the better utilization but also taking care of the water resource.

V.2.3 Evaluation criteria and methodologies

V.2.3.1. Criteria

Once the actions and environment factors that, presumably, will be affected have been identified, a qualitative assessment of the project was carried out, and after this, the quantitative assessment of the impacts detected was carried out, based on the method expressed by Vicente Conesa, who proposes that the type elements, or cross boxes of the matrix, will be occupied by the assessment corresponding to eleven characteristics of the effect produced due to the action on the factor considered. These eleven characteristics are listed in Table V.4., and are described as follows:

By the environmental quality variation:

Positive impact: Is the one translated into improvements in the natural, socio-economic or cultural environment.

Negative impact: Is the impact translated into a loss of natural, esthetic-cultural, landscape, ecologic productivity value or in an increase of prejudices derived from the contamination, erosion and any other environmental risks in discordance with the ecologic-geographic structure, the character and personality of a given zone.

By the relation between the impact and the effect produced:

Direct impact: The effect has an immediate incidence in an environmental factor.

Indirect or secondary impact: The effect of which supposes an immediate incidence in respect to the interdependence or in general to the relationship of an environmental factor with another one.

By the persistence of the impact's consequences:

Temporary impact: An impact the effect of which supposes the non permanent alteration in time, with a temporary manifestation term that may be determined. If its effect is of less that one year it is called fleeting; if it lasts between 1 and 3 years, temporary and if it persists between 4 and 10 years it is called pertinacious.

Permanent impact: Supposes an alteration indefinite in time, that means that it is the impact that remains throughout the time. (Only an effect that lasts more tan 10 years is deemed as permanent).

By the extension of the area that suffers the impact:

Punctual impact: When the impacting action produces a very well located effect.

Partial impact: It is defined as the impact the effect of which supposes an incidence appreciable in the environment. The affectation area may correspond to values lower than 60% of the extension of the area considered.

Comprehensive impact: Its effect is detected in a great portion of the environment considered.

Total impact: Its effect is expressed generalized in all the surrounding considered.

Critical location impact: is defined as that in which the situation in which the impact is produced is critical. It regularly occurs in punctual impacts.

By the interrelation of actions that produce the impact and/or effects produced:

Simple impact: It is expressed only on one environmental component, or the action model of which is individualized, without consequences in the induction of new effects, nor in the accumulation nor on its synergy.

Cumulative impact: The one that when the inductor agent's action is extended in time, progressively increases its seriousness, due to the lack of elimination mechanisms with temporary effectiveness similar to the one of the increase of the agent causing harm.

By the possibility of returning to the initial conditions prior to the action, through natural means:

Reversible impact: The alteration may be assimilated by the surrounding in measurable form, at a short, medium or long term, due to the functioning of the natural processes of the ecologic succession and of the environment's self-depuration mechanisms.

Irreversible impact: Supposes the impossibility or extreme difficulty to return, through natural means, to the situation before the action producing it.

By the periodicity of the impact's apparition:

Irregular apparition impact: It is expressed in unpredictable form in the time and the alterations of which is precise to assess based on a probability of occurrence, mainly in those non periodic or non continuous circumstances, but of exceptional seriousness.

Periodical or discontinuous impact: The one expressed through alterations irregular or intermittent in their permanence.

Continuous impact: Presents a constant alteration in time, accumulated or not.

By the time in which the impact's consequences are expressed:

Latent impact (short, medium and long term): Its effect is expressed after certain time since the beginning of the activity that provokes it, as a consequence of a progressive contribution of substances or agents, initially immerse in a permitted threshold and due to the accumulation and/the synergy thereof, implies that the threshold is exceeded, being capable of causing serious problems due to its high unpredictability index. The incidence may be expressed, respectively, within the time comprised in an annual cycle, known as short term impact; before five years, known as medium term impact; or in a greater period, denominated as long term impact.

Critical moment impact: The one which at the time when the impacting action is originated is critical, regardless of the impact's expression time.

Immediate impact: Is defined as the one in which the period of time between the beginning of the action and the one when the impact is express is null.

By the reinforcement of two or more effects:

Simple or without synergism impact: It is expressed on only one environmental component, or the action model of which is individualized, without consequences in the induction of new effects, nor in the accumulation nor in the one of its synergy.

Synergic impact: Is the one produced when the joint effect of the simultaneous presence of several agents supposes an environmental incidence greater than the effect added from the individual incidences contemplated in isolated manner. Additionally, the impacts that throughout time cause the apparition of other new impacts are included. An effect may be moderately or highly synergic in accordance with this inter-relation.

By the possibility of the partial or total reconstruction of the factor affected through the human intervention:

Recoverable impact: Effect in which the alteration may be eliminated by human actions, establishing the timely corrective measures, that means that the impact in which the alteration implied may be restituted. Such recovery may be immediate, at a medium or long term.

Capable of being mitigated impact: Effect in which the alteration may be decreased in sustained manner, through the establishment of corrective measures.

Irrecoverable impact: Impact that considers that the environment alteration or loss implied is impossible of being repaired, whether by natural action or by human action.

By the environment's destruction intensity or degree:

Total impact: Is defined as the effect of which is expressed as a total modification or destruction of the environment, of the natural resources, or of its fundamental functioning procedures, that produce or might produce in the future repercussions appreciable therein.

Notable or very high impact: The one the effect of which is expressed as a modification to the environment, of the natural resources or of its fundamental functioning procedures, that produce or might produce in the future repercussions appreciable therein. It expresses an almost total destruction of the factor considered in case it produces the effect.

Medium and high impact: Those the effect of which is expressed as an alteration to the environment or any of its factors, the repercussions of which therein are considered located between the previous levels and the minimum affectation.

Minimum or low impact: Its effect express a minimum destruction of the factor considered.

By the importance of the effect of an action on a given environmental factor:

Compatible or irrelevant environmental impact: The recovery of which is immediate after ceasing the activity, and it needs no protecting or corrective practices. Regarding beneficial impacts, there are the ones appearing immediately after the activity which produces them, being very significant.

Moderate environmental impact: The recovery of which needs no protective or intense corrective practices, and in which the attainment of the initial environmental conditions requires a certain time. Regarding beneficial impacts, there are the ones appearing a while after the activity or work which produces them, and there very little significant.

Severe environmental impact: In which the recovery of the environment's conditions demands the adaptation of protective or corrective measures, and that, notwithstanding these measures, the recovery of which needs a long time period.

Critical environmental impact: The magnitude of which exceeds the acceptable threshold. A permanent loss is produced in the quality of the environmental conditions, without possible recovery, even with the adoption of protective or corrective measures.

V.2.3.2. Evaluation methodologies and justification of the selected methodology

Once the actions and environment factors that presumably, will be impacted thereby, have been identified, within the Proyecto Hidroeléctrico Veracruz, the project's qualitative assessment was carried out, therefrom, the quantitative assessment of the impacts detected took place based on the method expressed by Vicente Conesa, who suggests that the type elements, or the matrix cross boxes, will be occupied by the relevant assessment to eleven characteristics of the effect produced by the action on the factor considered. These eleven characteristics are listed in Table V.4.

The methodology of Vicente Conesa, better known as Importance Matrix (*Matriz de Importancia*), allows us to have an integral vision of the environmental problem, because all the project's inherent actions and the environmental factors involved are included. Notwithstanding this methodology, starts from the principle of the matrix methods Leopold (1977), Canter (1977), and Cheremisinoff and Morresi (1979), where the possible interactions of the project and the environment are shaped and where actions that generate more than one impact and the environmental factors affected by more than one action are defined, his selection was based on that it possesses more reliability levels when hierarchically arranging the experts' opinions, (Delphi Method) that the majority of the above mentioned methodologies fall in subjectivity.

The importance of the impact (I), or in other words the importance of the effect of an action on an environmental factor, must not be mixed-up with the importance of the environmental factor affected. The result equals to:

$$\mathbf{I = \pm \sum(3I + 2\,EX + MO + PE + RV + S + AC + EF + PR + MC)}$$

The importance acquires values between 13 and 100. The values lower than 25 are irrelevant or compatible. The moderate values present an importance between 25 – 50; the severe ones when the Importance is between 50 and 75 and critical when the value is higher than 75.

The modification in the element's features or characteristics in respect to their initial condition, was considered as significant and constituted the basis of the identification; also the modifications that might be exercised on related elements was considered as significant.

TABLE V.4 IMPACT'S IMPORTANCE

NATURE		**INTENSITY (i)** (Destruction Degree)	
- Beneficial impact	+ -	- Low	1
- Prejudicial impact	-	- Medium	2
- Changing effects	x	- High	4
		- Very high	8

		- Total	12
EXTENSION (EX) (area of influence)		**MOMENT (MO)** (Expression time)	
- Punctual	1	- Long term (more tan 5 years)	1
- Partial	2	- Medium term (from 1 to 5 years)	2
- Comprehensive	4	- Immediate (less tan 1 year)	4
- *Total*	8	- Critical	(+4)
- Critical	(+4)		
PERSISTENCE (PE) (Permanence of the effect)		**REVERSIBILITY (RV)**	
- Fleeting (less than 1 year)	1	- Short term	1
- Temporary (from 1 to 10 years)	2	- Medium term	2
- Permanent (more tan 10 years)	4	- Irreversible	4
SYNERGY (S) (Regularity of the expression)		**ACCUMULATION (AC)** (Progressive Increase)	
- without synergism (simple)	1	- Simple	1
- Synergic	2	- Accumulative	4
- Very synergic	4		
EFFECT (EF) (cause-effect relationship)		**PERIODICITY (PR)** (Regularity of the expression)	
- Indirect (secondary)	1	- Irregular or discontinuous	1
- Direct	4	- Periodical	2
		- Continuous	4
RECOVERABILITY (MC) (Reconstruction by human mean)		**IMPORTANCE (I)** I = ±3i +2EX+MO+PE+RV+S+AC+EF+PR+MC	
- Immediately recoverable	1	- Irrelevant	<25
- medium term recoverable	2	- Moderate	25-50
- Capable of being mitigated or compensable	4	- Severe	50-75
- Irrecoverable	8	- Critical	>75

V.3 Environmental impacts generated

V.3.1 Identification of impacts

Based on Tables V.2 and V.3, herein below is a description of the impacts to be generated in accordance with the environmental factors affected due to the activities developed by the project.

ATMOSPHERE

AT1 Gas Emissions

The main contamination sources of the air caused by combustive motors proceed from the exhaust gases (100% of CO, NO, lead compounds and particles, 55% HC), losses due to the evaporation of the fuel deposit and the carburetor (20% of HC), losses from the crankshaft case (25% HC), dust from the wheels (rubber), brake cover or brake lining and clutch disks (amianthus) of the equipment and machinery used in the site preparation and construction stages.

With the vegetation removal it is known that a decrease in the atmospheric quality and of the ecosystem in the zone exists, theretofore, it will be necessary to carry out a reforestation program to recover the samples removed due to the work.

When perforating the tunnel dust and particles are generated, which at continuous exposures and without personal protection, might produce pulmonary deceases in the workers.

During the project's site preparation and construction period, there will be a greater activity of machinery, mobile equipment that will produce contaminant gas emissions, dust and noise into the atmosphere, that will reduce the air quality and the natural acoustic status of the zone.

Also during the tunnel excavation works an emission of noise and important atmospheric contamination will exist, it being punctual, direct and temporary.

AT2 Total suspended particles

In the construction stage the air quality will be altered in an adverse and direct manner, by dust and suspended particles in the air, due to the moving of land, transportation of materials, among others. The continue exposures and without personal protection, might produce pulmonary deceases in the workers.

AT3 Micro-climate

The different actions that have a repercussion on a modification of the natural surrounding, mainly arboreal and shrub-like vegetation, will have a repercussion on the modification of the micro-climate present in the project zone, because less albedo zones will exist, increasing the temperature and decreasing the site's humidity. It is also constituted in a meteorological variable that may delay the work due to flooding or overflow risks that cause the dragging of material, sediments and garbage, both in the work zone and into the lower parts.

During the operation, by having the dam receptacle, the characteristics of the micro-climate will be affected, the humidity in the zones near the receptacle will be increased.

The severe weathering events such as precipitations, hailstorms and freezing, will provoke in some events, delays in the construction, modifying the work's planning conditions. These events constitute a risk during the site preparation and construction stages, both when carrying out excavations because the flooding risk exists, as in the cutting with landslide risks.

Additionally, the severe precipitations cause the dragging of material, sediments and garbage, both into the work zone and into the lower parts. The standstill of water in the excavations and low zones, makes the zones to become insalubrious facilitating the development of harmful fauna and plagues.

AT4 Visibility

This indicator intimately associated to the micro-climate that may be established both due to the meteorological conditions as well as those derived from the activities that generate heat, gas emissions and fractioned material in the site, may affect the visibility during the operations of vehicular transit, signaling, identification of important sites for the fauna, loading and unloading, instructions, among others, that directly influence the efficiency in the project's operability. Its punctual synergism is associated with dust, noise and vibration emissions, due to the equipment used, of explosives for the excavations in rock and of the tunnel, as well as its limited scattering will be important, but the impact will be of temporary and local nature.

AT5 Noise and vibrations

In the site, the dust, noise and vibration emissions, due to the construction equipment used and when explosives are used for excavations in rock and of the tunnel, as well as its limited scattering will be important, but he impact will have a temporary and local nature. This impact implies noise, launching of material, vibration and the wind gust produced by the use of explosives, that notwithstanding that there are of short duration, if no precaution measures are taken, may cause damages in nearby zones. The main component of an air wave generated by the blowing ups, is an impulsive noise of infrasonic range (low frequency power) that may lead to vibrations in the structures. It does not result prejudicial for persons, but provokes a greater effect (subjective) of the vibration when it is accompanied by the air wave. A vibration accompanied by air wave produces in the person an annoying sensation up to five times greater if the vibration were "silent".

In respect to the vibration, the construction of the tunnel will not only change the efforts inside the mean, but many times changes the mean itself; the use of explosives reduces the resistance of rocks and hard lands in all their surrounding.

In the operation stage of the power house it is estimated that the noises that can be emitted is the typical "buzzing" of the substation (40 dB approximately) and the vibration of the turbine when generating electricity, are not deemed important in the exterior part.

LAND

SU1 Loss of fertile land:

For the project a total surface of 24.38 ha is required, from which 10.54 ha are located in areas currently used for Coffee growing (plantation of coffee) which is developed together with shadow trees that will be necessary to demolish, 4.1 ha to agriculture fields (cultivation of corn, banana, sugar cane) and 1.43 ha used as pasture ground.

SU2,3 Current/potential use:

Given the project's characteristics and the alterations provoked by the project on the land, it may be deducted that this environment factor will have a partial alteration in all its attributes, in the specific sites where the excavations of the tunnel portals will be made, in the infrastructure location such as the placement of stools for the pipelines in the power house, substation and electric conduction line sites, as well as in the places for the unloading of materials. There are areas where native vegetation of Mesophyll Forest, Gallery Forest and

riparian vegetation still exists. The reservoir may create a fishing industry, and facilitate the agricultural production in the area, down stream from the reservoir, that, in some cases, may more than compensate the losses suffered in these sectors, as a result of the construction thereof.

The construction of the project will affect the open space, because it will provoke the separation and rupture of the territory, both in the dam, in the properties where the special structures are located, such as throughout the superficial pipeline.

The affectation by the project in accordance with the identified land uses is set forth as follows:

- Agriculture: For the project a surface of 10.54 is required in areas that are currently used for Coffee growing (plantation of coffee), 4.1 ha to agriculture fields (cultivation of corn, banana, sugar cane).

- Forestall: The land use change in forestall lands will be carried out (Gallery Forest, Oak-Pine Forest and Renewal of Pine Forest) in a surface equal to 4.29 Ha and in Coffee growing with shadow trees in a surface of 10.54 Ha, therefore, the forestall land use change is required in a total surface of 14.83 Ha.

- In accordance with the Technical Justification research carried out by the company Consultoría Forestal y Servicios Agropecuarios, S.A. de C.V. (COFOSA), the total number of trees that will be affected in the different construction sites amounts 1,023 trees distributed as follows:
    - Dam: 487 trees
    - Conduction line: 287 trees
    - Electric transmission line: 207 trees
    - Power house substation: 42 trees

- Housing: In the project's particular case, there are no population nucleus, nor isolated houses, nor in the reservoir zone or in the sites where the construction of infrastructure will be carried out.

SU4 Erosion

In accordance with the lands found, these present a variable susceptibility to erosion in accordance with their topography and of the same land, this action may be from moderate up to very high. During the site preparation and construction the talus and cuts will present material weakly adhered to the land walls therefore, they will be easily dragged due to dripping, because of the wind action or by their own weight action.

SU5 External drainage

The cuts and excavations for the construction of the project will in direct manner provoke the loss of potentially forestall land and also the existing dripping and infiltration pattern will be modified.

SU6 Stability

During the site preparation and construction the land stability will be threatened when carrying out excavations and cuts that modify the materials resting angles. With the moving of land, the cuts, excavations there might be loose blocks that may roll to lower parts, as well as failures provoked by the construction works themselves.

SU7 Geo-forms

In this regard the impact is local and punctual, because the affectation will only be in the sites where actions which change the morphology are carried out, such as leveling, stuffing and cuts. The additional effects of changes in the hydrology of the river basin, include variations in the phreatic level, down stream and up stream. In natural form, river water transport particles of very diverse size (from limos to great rolled cantos and rocks) depending on the turbulence and current speed. As both of them decrease, the particles tend to be deposited in the bottom as it occurs in natural form in the river low stretches and estuary. The same phenomenon is present when water enters into the reservoir, the speed decrease, causing the transportation capacity to decrease and that the particles are deposited, this way constituting in sewers of sediments from the reception basin.

WATER

AG1 Dripping:

In general manner, the dams fragment the fluvial ecosystems, isolating the biotic communities of the high basins from the ones living in the medium and low zones, the migrations and the species movements are interrupted and the river is separated from its plains and littorals. The project's location particular feature is that 2.5 km downstream from the intended dam water goes to a sewer to subsequently go out 2 km East in an air hole and a small fall, with which, in a particular manner for this project, this kind of impact with the construction of the project is not present, because this barrier is provided in a natural form.

In the rainy season the contributions to the Apaltlahuaya River will be increased due to the dripping of the intermittent currents and that will contribute a greater flow to the river, the impact will be in the water level oscillation.

AG2,3 Alteration in the natural infiltration and phreatic level:

The excavations and coatings will provoke the loss of the land's permeable features. Other actions also imply the interruption and/or temporary deviation of the river beds, caused by moving materials and by the placement of machinery and equipment. The construction of the project will provoke the variation of the place's hydrologic regime, that is, the water position, both in the phreatic level as within the rocks, its direction, motion speed and will provoke variations throughout time.

AG4,5 Superficial and underground water quality

It is possible to contaminate the superficial currents, the land and with that, possibly the underground water, due to de inappropriate disposal of waste, due to infiltration or percolation of fuels accidentally poured and due to the practice of defecation in the open, as well as due

to activities inherent to the construction such as hatchet-blow to fell trees, moving of lands, combustion gas, dusts etc. These impacts would be local and of temporary nature.

If the reservoir land is not adequately cleaned before flooding it, the decomposition of this vegetation would completely consume the oxygen levels in the water. This would affect the aquatic life. The products derived from the anaerobic decomposition include the hydrogen sulfide, that is harmful for aquatic organisms, and methane which is a green house gas. Carbon dioxide, the main gas produced, also presents green house risks.

In respect to the changes in the water quality in the dam, other than in the big dams, in the small reservoir such as the one proposed changes of physical-chemical parameters such as temperature, pH, dissolved oxygen, suspended solids, conductivity, may be much more appreciable due to environmental fluctuations, such as solar radiation, gas exchange (oxygenation), dragging of organic material, sedimentation, among others, even more, considering the retention periods exceeding 12 hours. These changes may be evident, at the time of the discharge on the receiving course, with the aeration great benefit, but with disadvantages on the aquatic biota stability.

TERRESTRIAL / AQUATIC FAUNA:

FAT1 Habitat

In the site preparation and construction stage, nesting will have a negative impact because a total of 1,023 trees will be demolished, which serve as perch and nest for birds. On the positive side, by handling them adequately as would be the case of the right of way in the transmission line, the lines and the structures may be beneficial for the fauna since they can receive nests and serve as perch for may birds, specially birds of prey.

FAT2,3 Abundance /composition / trophic chains

Globally, reservoirs provoke changes in the hydrology and the river surrounding, globally affecting the biodiversity. This fact affects not only fauna, but also the human activities developed in the river.

FAT4 Shifting

Due to the construction of dams, the fluvial ecosystems are fragmented, isolating the biotic communities of the high basins from the ones that live in the medium and low zones, birds migrations and species movement are interrupted and the river is separated from its plains and littorals. As previously mentioned, the location of the project has as a particular feature that 2.5 km downstream of the intended reservoir, water goes to a sewer to subsequently go out 2 km East in a air hole and a small fall, consequently, particularly for this project this kind of impact is not present with the construction of the project, because this barrier exists in a natural manner.

FAT5 In conservation status

In the Neo-tropical Region fauna included in NOM-059-SEMARNAT-2001 has been reported.

TABLE V.5 CONSERVATION STATUS

Family	Species	NOM-059-SEMARNAT-2001
Caluromydae	*Caluromys derbianus*	Endangered
Myrmecophagidae	*Tamandua mexicana*	Endangered
Procyonidae	*Bassaricus sumichrasti*	Subject to Special Protection
Procyonidae	*Procyon pigmeaus*	Endangered Specie restricted to Mexico
	Otonyctomys hatti	Threatened
	Reithrodontomys spectabilis	Threatened specie restricted to Mexico
	Xenomis nelsoni	Threatened specie restricted to Mexico

Source: Establishment of priorities for the conservation of neo-tropical terrestrial mammals of Mexico

TERRESTRIAL /AQUATIC VEGETATION:

VEGT1,2,3 Abundance/Composition/Dominance

The vegetation located within the dam receptacle area will be affected because it will be flooded, the elimination of the vegetation of the tunnel's entrance and exit portals, of the stretch where the superficial pipelines will be located, the area where the power house will be located and the stretch comprised for the laying of the electric transmission line.

It is possible to affect the vegetation associated for example to the group of epiphyte, this group may be utilized if adequately handled.

In addition to the herbaceous and shrub-like vegetation associated to the kind of vegetation such as the gramineous which do not require a specific handling or utilization as such.

Due to the lack of care in the construction works, both by moving equipment, as by the working personnel it is possible to unnecessarily harm the vegetation in lands near to the works.

Precautions shall be extreme and no materials or waste shall be thrown into the ravines, because they could harm considerable extensions of the vegetation down the ravine and provoke the mudding of the superficial currents.

The land use change in forestall lands (Gallery Forest, Oak-Pine Forest and Renewal of Pine Forest) will be carried out in a surface equal to 4.29 Ha and in Coffee growing with shadow trees in a surface of 10.54 Ha, theretofore, the forestall land use change is required in a total surface of 14.83 Ha. In total 1,023 trees will be affected, which equal a total volume of 779.094 m^3 VTA.

TABLE V.6 VOLUME OF AFFECTED TREES

WORK	NAME AND SPECIES	VOLUME M^3 VTA
Dam	Aguacatillo *(Persea schiedeana)*	2.541
	Poplar *(Platanus lindiana)*	158.748
	Ceiba *(Bombax ellipticum)*	3.620
	Dragon *(Croton draco)*	0.677
	Oak *(Quercus castanea)*	29.001
	Ash *(Fraxinus uhdei)*	23.449
	Jonote *(Heliocarpus appendiculatus)*	0.624
	Liquidambar-Ocozote *(Liquidambar macrophylla)*	0.740
	Walnut *(Juglans pyriformis)*	12.599
	Palo Negro *(Garrya laurifolia)*	33.045
	Pine *(Pinus Oaxacana)*	24.720
	Quilite-Aile *(Alnus arguta)*	3.593
	Ramoncillo *(Trophis racemosa)*	14.692
	Timbre *(Inga spuria)*	11.909
	Yaco *(Tilia mexicana)*	0.564
Conduction line	Avocado *(Persea americana)*	1.545
	Aguacatillo *(Phoebe mexicana)*	4.998
	Aile *(Alnus arguta)*	0.308
	Annona *(Anona squamosa)*	0.437
	Calabur *(Ardicia compressa)*	6.616
	Red cedar *(Cedrela mexicana)*	32.885
	Ceiba *(Ceiba aesculifolia)*	6.581
	Chinene *(Persea schiedeana)*	17.586
	Oak *(Quercus castanea)*	0.261
	White fraxinela *(Fraxinus uhdei)*	2.066
	Ash *(Fraxinus uhdei)*	2.173
	Acacia *(Leucaena esculenta)*	0.894
	Jinicuil *(Inga jinicuil)*	0.584
	Jonote *(Heliocarpus appendiculatus)*	20.351
	Jonuxpepe	0.167
	Macuil *(Tabebuia pentaphylla)*	7.762
	Mango *(Mangifera indica)*	12.313
	Orange *(Citrus duramtium)*	0.513
	Walnut *(Juglans pyriformis)*	16.942
	Rose Apple *(Syzygium jambos)*	0.167
	Pototoca	0.167
	Tatil *(Comocladia palmeri)*	0.102
	Tepehuaje *(Lysiloma acapulcensis)*	0.753
	Teponaxtle	0.162
	Tescohuite	2.048
	Xochilcogual	58.283

WORK	NAME AND SPECIES	VOLUME M^3 VTA
	Yaco *(Tilia mexicana)*	1.888
	Yolosochit	2.965
	Yonosochit	0.335
	White sapodilla *(casimiroa edulis)*	0.261
Power House - Substation	Red cedar (*Cedrela Mexicana*)	2.130
	Chinene *(Persea schiedeana)*	0.753
	Jinicuil *(Inga jinicuil)*	11.359
	Mango *(Mangifera indica)*	0.804
	Xochilcogual	10.386
Transmission Line	Red cedar *(Cedrela mexicana)*	22.698
	Chinene *(Persea schiedeana)*	17.214
	Ash *(Fraxinus uhdei)*	1.092
	Jinicuil *(Inga jinicuil)*	126.771
	Jonote *(Heliocarpus appendiculatus)*	7.421
	Mango (Mangifera indica)	11.351
	Manzanilla olive *(Hipomanne Mancinella)*	4.149
	Walnut *(Juglans pyriformis)*	11.099
	Ocozote-Liquidambar *(Liquidambar macrophylla)*	3.020
	Obo *(Spondias mombin l.)*	4.594
	Palo Mulato *(Bursera simaruba)*	5.218
	Primerose *(Tabebuia donnell-smithii)*	3.694
	Xochilcogual	12.707
TOTAL		**779.094**

VEGT4 Species in status

Once the Technical Justification Research for preferably forestall Land Use Change was carried out, where an inventory of the existing vegetation was prepared, it was verified that 2 species included in the standard NOM-059-SEMARNAT-2001 exist, these are: Walnut (*Juglans pyriformis*) threatened and Yaco (*Tilia mexicana*) endangered.

LANDSCAPE

PA1,2 Panoramic view /naturalness

The landscape research presents two main focuses: The first one, considers the whole landscape, and identifies the landscape with the environment group, contemplating the latter as an indicator and synthesis of the interrelations among the abiotic and biotic elements. The second one to be considered is the visual landscape as an expression of the aesthetic, plastic and emotional values of the natural environment. That means that this factor interests as a space and visual expression of the environment.

The landscape will be impacted in the construction stage, due to the presence of personnel, construction material and equipment, with a temporary impact nature.

During the operation, the landscape will be modified due to the apparition of the dam receptacle, and by the elimination of the arboreal vegetation throughout the rail of the electric transmission line and throughout the pressure tube.

Upon the incorporation of the project, the impact will be due to intromission in the project structures, due to the apparition of the dam receptacle, and due to the engineering works, the change of relief, elimination of vegetation.

PA3 Traffic

This aspect results important both in landscape terms as well as indicator of the atmospheric quality and socio-economic trigger. The increase of dust clouds, human motion in a punctual, distributed and temporary manner, causes definitions of form, line and volume for the observer.

SOCIO-ECONOMIC

SOC1 Demography

Notwithstanding that the utilization of manual labor of the region is contemplated, the constructing company assigned, will bring its own executive employees into the work site, which will cause the mobilization of such personnel. The phenomenon of labor immigration to the project zone will exist, which might have and adverse repercussion due to the presence of several demands by the personnel retained in the work, such as the possible establishment of food peddler commerce and other articles not sanitarily regulated.

It is important to mention that in the different areas where the project will be carried out there is no population settled or fixed activity to be relocated because of the project.

SOC2 Land use change

The land value may be impacted due to its raise in price, because by requiring the lands to receive the project the price thereof might be increased.

SOC3 Services demand

Specially in the project's construction stage, an increase of services for the personnel working inside the project will exist, and at the same time this, in terms of the local economy will bring along a demand of services, including those basic such as recollection of waste, food supply, health services, groceries, food, among others.

SOC4,5 Employment/ local economy

The generation of employment, may directly influence another socio-economic indicators such as the increase of local demography, municipal services, transportation and communication services, public safety and health. This last indicator has a close relationship with the major beneficial impact to be brought by the performance of the works proposed in

respect to a life quality based on a better utilization but also taking care of the water resource. Informal commerce might arise (food, drinks, etc.) to satisfy the demand of the workers involved in the work.

During the construction stage up to 232 temporary employments will be generated for the maximum simultaneous activity period in the different fronts.

While for the operation stage, however permanent, only a total of 9 employments will be generated.

SOC6 Transportation system

During the construction works automobiles and trucks that will transit through the zone (the user) will be negatively impacted because they will cross construction areas, which will risk their safety due to the concentration of personnel, machinery and equipment. Among other benefits there will be trucks, the conservation of road systems and road safety.

SOC7 Safety

The existing access roads to the work site will be benefited because in order to transit them safely it is necessary that the same are in good condition.

Due to the concentration of personnel and trucks during the construction, it is possible that road system safety is threatened, and accidents might occur, mainly since the project will be developed in a rural zone, they are not used to the continual existence of vehicles and the concentration of personnel.

The transit of the zone will be impacted during the site preparation and construction stages due to the concentration of personnel to carry out the works and to the construction equipment and machinery, as well as to the trucks that will transport the material to be used for the construction and the products derived from the excavations left over, among others.

SOC8 Public health

The importance of water in the human life is central, not only because it is an indispensable element for the subsistence of all living beings, but also because it is necessary for the social and economic development of all communities. Water for life in its basic function guarantees the subsistence of the human beings. This hydroelectric project will produce electric power, the same that can indirectly support the economic development and improve the life quality in the area served. The hydroelectric projects have positive impacts in the society, since they contribute to increase wealthy in the local communities not only with the activities derived from the construction and maintenance of the premises, but with the fact that they provide electricity to the nearest surrounding.

V.3.2. Selection and description of significant impacts

<u>ATMOSPHERE:</u>

AT1 Gas Emissions

The removal of vegetation implies a decrease of living barriers that help gas self-depuration. Gases to be generated will be due to combustion motors derived from exhaust pipe gases (100% CO, NO, lead compounds and particles, 55% HC), of the equipment and machinery used in the site preparation and construction stages, which has a repercussion in the reduction of the air quality and the natural acoustic status of the zone.

AT2 Total suspended particles

In the construction stage the air quality will be adversely and directly affected, by dust and particles suspended in the air, due to land moving, transportation of materials, to the construction works and all those maneuvers that imply the use of machinery and automotives that generate contaminating emissions into the atmosphere. The excavations and perforations in connection with the tunnel will generate dust and particles, which upon continuous exposures and without personal protection, might produce pulmonary deceases in the workers.

AT5 Noises and vibrations

In the site, the emissions of dust, noise and vibrations, as well as their limited dispersion will be important, but the impact will be of temporary and local nature. In the construction stage there will be generation of noise and vibrations will be produced due to the construction equipment used and when explosives are used for excavations in rock and of the tunnel. The emission of noise and the atmospheric contamination will be punctual, direct and temporary. In respect to the vibration, the construction of the tunnel not only changes the efforts status inside the environment, but many times changes the environment itself; the use of explosives reduces the resistance of rocks and hand lands in all their surroundings. In the operation stage of the power house it is estimated that the noise that can be emitted is the characteristic “buzzing” of the substation (40 dB approximately) and the turbine vibration when generating the electricity, they are not considered important in the exterior part.

<u>LAND</u>

SU2,3 Current/potential use

This indicator will have a partial but important alteration in all its attributes, in the specific sites where excavations are made, of the tunnel portals, in the placement of infrastructure as well as in the placement of stools for the pipeline, in the power house sites, substation and towers of the electric transmission line, as well as in the places where materials are to be unloaded. In all of them there will be necessary to eliminate the layer of land which means a negative and located impact, but susceptible of being mitigated. The authorization form SEMARNAT for the forestall land use change (Gallery Forest, Oak-Pine Forest and Renewal of Pine Forest) will be required, in a surface equal to 4.29 Ha and in coffee with shadow trees in a surface of 10.54 Ha, therefore, the relevant authorization is required in a total surface of 14.83 Ha. The areas where the construction equipment and machinery are to be placed will be subject to a negative impact to the land because it could become contaminated due to the effect of fuel and lubricants leakages from the same equipment and even due to accidental leaking of materials. The sites that will receive the products derived from the excavation, as well as the lands that will serve for the temporary storage of material will be adversely impacted. The construction of the project will affect the open space, because it will provoke the separation

and rupture of the territory, both in the dam, in the properties where the special structures will be located, as well as throughout the superficial tube.

SU6 Stability

During the site preparation and construction the stability of the land will be threatened by carrying out excavations and cuts that modify the materials resting angles. With the land moving, cuts, excavations, there could be loosen blocks that may roll into the low parts, as well as failures produced by the construction works themselves. Cuts and excavations for the construction of the project will directly provoke the loss of potentially forestall land and also the existing dripping and infiltration pattern will be modified. Leveling, excavations, compressing and freight of materials will be performed. In the cuts it will be understood and defined as excavations performed at open air in the natural land; in the enlargement and dejection of talus. There could be loosening of material that affect low zones, mainly in the upper part of the Tepetzala ravine, site where the tunnel's exit portal will be located. In this place the vulnerability and the morphology of the slope will be related with three fundamental aspects with seismic events, gravitational effects and climate events. In summary, there could be materials weakly adhered to the land walls therefore, they can be easily dragged due to dipping, by the wind action or other meteorological effects or by their own weight's action.

WATER

AG4 Superficial and underground water quality

The selective release of muddy water from the reservoir is often used to reduce the sedimentation existing inside the river. However, the release of sediments may alter the river's physical-chemical quality. The areas where concrete is applied, will not be capable of absorbing and letting pass the superficial water, loosing in a small proportion the feeding to the underground river beds of the zone. The main water quality parameters that may be modified are the solids dissolved and in suspension and the nutrients caused by the land moving, as well as the fats and hydrocarbons due to accidental pouring in the areas for the utilization of machinery, storehouses and handling of oils and fuels. The water chemical composition in a reservoir may be very different from the one entering and going out. This is because the water storage process generated physical, chemical and biological changes in the water withheld and in the underlying land and rock, in the case of the project the storage will be of 24 hours that is why it is expected that these changes may be minor. Given its influence on the physical, chemical and biologic processed, the water temperature is a very important parameter when assessing the reservoir impacts on the aquatic inhabitants located downstream. Changes in the water temperature affect the spawning of fish, the length of the growing period and the growing rate.

In respect to the changes in the water quality in the dam, other than in the big dams, in the small reservoir such as the one proposed, the changes of the physical-chemical parameters such as temperature, pH, Dissolved Oxygen, Suspended Solids, Conductivity, may be much more appreciable due to environmental fluctuations, such as solar radiation, gas exchange (oxygenation), dragging of organic material, sedimentation, among others, even more, considering the retention times exceeding 12 hours. These changes may be evident, at the time of the discharge on the receiving course, with the great benefit of aeration, but with disadvantages on the stability of the aquatic biota.

TERRESTRIAL /AQUATIC FAUNA

FAT2 Abundance /composition / trophic chains

Globally, the reservoirs provoke changes in the hydrology and the river surrounding, globally affecting the biodiversity. It is important to observe the breeding and reproduction areas, finding the refuges and burrows located mainly in caves, in talus holes, trees and rocks basis. The release of fine material on substrates of permeable gravel may have catastrophic consequences on fish eggs and larvae.

FAT4 Shifting

As a consequence of felling of trees, hatchet-blowing to fell trees and excavation, the fauna living in the project's area of impact will emigrate to nearby places with the same environmental characteristics to those required by them.

TERRESTRIAL /AQUATIC VEGETATION

VEGT1,2,3 Abundance /Composition /Dominance

The vegetation located within the dam receptacle area will be affected due to its flooding, the elimination of vegetation of the tunnel entrance and exit portals, of the stretch where the superficial tube will be located, the area where the power house will be located and the stretch that comprises the laying of the electric transmission line. The wooded volume is estimated in 779.094 m^3 VTA. It is also possible that the rest of the existing vegetation is unnecessarily affected, due to the lack of care in the construction works, due to the mobilization of equipment, and by the work personnel, which may contaminate the superficial water, the terrestrial food chains and eliminate the desirable species. Precautions must be extreme and no materials or waste shall be thrown to the ravines, because considerable extensions of vegetation may be harmed in the lower part of the ravine and the mudding of the superficial currents.

SOCIO-ECONOMY

SOC4 Employment / Local economy

Hydroelectric projects have positive impacts in the society, because they contribute to increase richness of the local communities not only with the activities derived from the construction and maintenance of the premises, but with the fact that they provide electricity to the nearest surrounding. The generation of employment and the improvement of the local economy is for sure one of the most important indicators to assess an ecological-social project. Employment may directly influence other socio-economic indicators such as increase of the local demography, municipal services, transportation and communication services, public safety and health. This last indicator keeps a close relationship with the greater beneficial impact to be brought by the works proposed in respect to a life quality based on a better utilization but also to take care of the water resource. Informal commerce might arise (food, drinks, etc.) to satisfy the demand of the workers involved in the work. The regional economy will be benefited by the work because work sources will be generated, which represents an income for the maintenance of the region's economic activity. During the construction stage up to 232 temporary employments will be generated for the period of

maximum simultaneous activity in the different fronts. While for the operation stage only a total of (9) employments will be generated. Due to the concentration of personnel involved in the work, they will be benefited by the economic distribution represented by the rents of the places where they will live, as well as of the first need services that will be demanded. On the other hand, they will be benefited because their services will be required in order for the personnel to arrive to the site determined by the constructing company to be taken to the work.

SOC8 Public health

This hydroelectric project, even though it is at a small scale and with self-supply purposes, will produce electric power that can support the economic development and improve the life quality of the area served. The hydroelectric projects have positive impacts in the society, because they contribute to increase the richness in the local communities, not only with the activities derived from the construction and maintenance of the premises, but also with the fact that it will be a source of clean energy and will indirectly benefit the zone because the project is interconnected to a substation of the national electric distribution network. However, the existence of a labor migration phenomenon to the project zone shall be taken into account, which might have and adverse effect by presenting several demands by the personnel retained in the work, such as the possible establishment of food peddler commerce and of other articles not sanitarily regulated. The recollection of solid waste during the construction, the constructing company will be responsible for the recollection, storage and transportation to the nearest municipal garbage dumps for the waste generated. Due to the concentration of personnel and trucks during the construction, it is possible that the road system safety is threatened, and accidents might occur, mainly since the project will be developed in a rural zone, they are not used to the presence and continuous circulation of vehicles and to the concentration of personnel. The project might favorably reduce the gastro-intestinal diseases and the population will have an essential resource for the hygiene of its foods and for the personal use with better quality water. Finally the workers' health may be threatened in the construction stages due to work risks inherent to the work. It could be also threatened due to the lack of adequate hygiene, as well as due to the consumption of contaminated foods and because of drinking water of a quality inadequate for its consumption.

V.4 Evaluation of the environmental impacts

Herein below are the matrixes constructed once the main project actions have been identified and break down the environmental factors possibly affected. This section includes the quantitative assessment, based on the different levels of greater reliability when hierarchically arranging the experts' opinions (Delphi Method) which reduces the evaluator's subjectivity (Table V.7).

TABLE V.7 IMPORTANCE UNITS FOR THE ENVIRONMENTAL INDICATORS

Medio	Unidad de Importancia
Atmósfera	***89***
Emisión de gases	24
Partículas suspendidas	24
Microclima	24
Visibilidad	6
Ruido	3
Suelo	***214***
Pérdida de suelo fértil	31
Uso actual	36
Uso potencial	14
Erosión	14
Drenaje externo	3
Estabilidad de laderas	4
Geomorfas	3
Agua	***179***
Escorrentía	71
Infiltración	63
Nivel freatico	24
Calidad agua superficial	55
Calidad agua subterranea	7
Fauna terrestre/acuática	***107***
Habitat	29
Abundancia	11
Cadenas Tróficas	18
Desplazamiento	8
En estatus de conservación	2
Vegetación terrestre/acuática	***232***
Abundancia	16
Composición	27
Dominancia	21
En estatus de conservación	6
Paisaje	***89***
Vista panorámica	27
Naturalidad	16
Tráfico	9
Socioeconómico	***89***
Demografía	19
Cambio de uso del suelo	32
Demanda servicios	32
Empleo	35
Economía local	2
Servicio de transporte y comunicaciones	2
Seguridad	4
Salud Pública	4

TABLE V.8 IDENTIFICATION AND QUALITATIVE ASSESSMENT MATRIX

FACTORES AMBIENTALES	Preparación del Sitio					Construcción del Sitio															Operación					Mantenimto	
	Actividades					*Actividades*															*Actividades*					*Actividades*	
	PR1	PR2	PR3	PR4	PR5	CON1	CON2	CON3	CON4	CON5	CON6	CON7	CON8	CON9	CON10	CON11	CON12	CON13	CON14	CON15	OPE1	OPE2	OPE3	OPE4	OPE5	MAN1	MAN2
AT1					-																		-	-			
AT2	-	-	-	-	-	-	-	-	-	-			-	-	-		-	-	-				-	-			
AT3							-		-	-											+		-		+	+	+
AT4							-		-	-													-				
AT5	-		-	-	-	-	-	-	-	-			-	-	-		-	-	-		-		-		-	-	-
SU1	-	-	-	-	-	-	-		-	-											+				+	+	+
SU2	-	-	-	-	-	-	-		-	-					-		-	-	-		+				+	+	+
SU3	+	+	+	+	+	+	+		+	+					+		+	+	+								
SU4							-		-	-										+		-	-				
SU5			+	+	+	+	-		-	-	+	+								+		-	-				
SU6	-	-	-	-	-	-	-		-	-	+	+								+							
SU7	-	-	-	-	-	-	-		-	-																	
AG1	-	-	-	-	+	-	-	-	-	-	+	+			-		-	-	-								
AG2	-	-	-	-	-	-	-	-	-	-	+	+			-		-	-	-								
AG3			-	-	-	-	-	-						-	-		-	-	-								
AG4						-	-	-	-	-	+	+	-	-	-		-	-	-	+	+	-	-	-	+	+	+
AG5											+	+								+	+	-	-	-	+	+	+
FA1	-	-	-	-	-	-	-		-	-																	
FA2					-					-																	
FA3					-					-											+				+	+	+
FA4					-					-														-			
FA5	-	-	-	-	-	-	-		-	-											+				+	+	+
VEG1	-	-			-	-																					
VEG2	-	-			-	-															+				+	+	+
VEG3	-	-			-	-																					
VEG4	-	-			-	-																					
PA1					-																+				+	+	+
PA2					+	-	-		-	-											+				+	+	+
PA3	-	-	-	-	-	-	-		-	-										+	+				+	+	+
SOC1							+		+	+											+				+	+	+
SOC2	+	+	+	+		+	+	+	+	+			+		+		+	+	+								
SOC3							+		+	+	+	+		+		+				+	+	+	+		+	+	+
SOC4	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+							
SOC5	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+								
SOC6							-		-	+							-	-	-		+	-	+		+	+	+
SOC7							+		+	+				+		+				+	+	-	-		+	+	+
SOC8							-		-	-	+	+								+	+	-	-		+	+	+

TABLE V.9 CALCULATION OF IMPORTANCE FORT HE INTERACTIONS FOUND

CÁLCULO DE LA IMPORTANCIA

CLAVE	RELACIÓN	INTENSIDAD	EXTENSIÓN	MOMENTO	PERSISTENCIA	REVERSIBILIDAD	SINERGIA	ACUMULACIÓN	EFECTO	PERIODICIDAD	RECUPERABILIDAD	IMPORTANCIA	1 NATURALEZA
1	PR1/AT2	1	1	1	4	1	1	1	4	1	1	19	-
2	PR1/AT5	1	1	1	4	1	1	1	4	1	1	19	-
3	PR1/SU1	4	4	4	4	4	2	4	4	4	4	50	-
4	PR1/SU2	4	4	4	4	4	2	4	4	4	4	50	-
5	PR1/SU3	1	1	1	4	1	1	1	4	1	1	19	+
6	PR1/SU6	1	1	1	4	1	1	1	4	1	1	19	-
7	PR1/SU7	1	1	1	4	1	1	1	4	1	1	19	-
8	PR1/AG1	2	1	4	4	2	2	4	4	4	4	36	-
9	PR1/AG2	4	1	4	4	2	2	4	4	4	4	42	-
10	PR1/FA1	8	4	4	2	4	4	4	4	4	4	62	-
11	PR1/FA5	2	4	4	2	2	2	4	4	4	4	40	-
12	PR1/VEG1	1	8	4	4	4	2	4	4	4	4	49	-
13	PR1/VEG2	1	1	4	2	4	4	4	4	4	4	35	-
14	PR1/VEG3	4	4	2	4	4	2	4	4	4	8	52	-
15	PR1/VEG4	4	4	2	4	4	2	4	4	2	8	50	-
16	PR1/PA3	2	2	4	2	2	2	4	4	2	4	34	-
17	PR1/SOC2	2	2	2	2	2	2	4	4	2	4	32	+
18	PR1/SOC4	1	1	2	2	1	2	4	4	2	4	26	+
19	PR1/SOC5	4	4	2	4	4	2	4	4	4	4	48	+
20	PR2/AT2	4	4	2	2	2	2	4	4	2	4	42	-
21	PR2/SU1	4	4	4	4	2	2	4	4	4	4	48	-
22	PR2/SU2	4	1	4	4	2	2	4	4	4	4	42	-
23	PR2/SU3	1	4	2	2	2	2	4	1	2	2	28	+
24	PR2/SU6	1	1	4	4	4	2	1	4	4	2	30	-
25	PR2/SU7	4	1	4	4	2	2	4	4	4	4	42	-
26	PR2/AG1	4	4	2	2	2	2	4	4	2	4	42	-
27	PR2/AG2	1	1	2	2	1	2	4	4	2	4	26	-
28	PR2/FA1	1	1	2	2	1	2	4	4	2	4	26	-
29	PR2/FA5	1	4	4	4	2	2	4	4	4	4	39	-
30	PR2/VEG1	2	4	4	2	2	2	4	4	4	4	40	-
31	PR2/VEG2	2	4	4	2	2	2	4	4	4	4	40	-
32	PR2/VEG3	1	1	4	4	4	2	4	4	4	8	39	-
33	PR2/VEG4	4	4	4	4	4	2	4	4	4	4	50	-
34	PR2/PA3	4	4	4	4	4	2	4	4	4	4	50	-
35	PR2/SOC2	2	2	4	2	2	2	4	4	2	4	34	+
36	PR2/SOC4	2	2	2	2	2	2	4	4	2	4	32	+
37	PR2/SOC5	1	1	2	2	1	2	4	4	2	4	26	+
38	PR3/AT2	4	4	2	4	4	2	4	4	4	4	48	-
39	PR3/AT5	4	4	4	4	4	2	4	4	2	4	48	-
40	PR3/SU1	4	1	4	4	2	2	4	4	4	4	42	-

TABLE V.9 CALCULATION OF IMPORTANCE FORT HE INTERACTIONS FOUND (Continuation)

CÁLCULO DE LA IMPORTANCIA

CLAVE	RELACIÓN	INTENSIDAD	EXTENSIÓN	MOMENTO	PERSISTENCIA	REVERSIBILIDAD	SINERGIA	ACUMULACIÓN	EFECTO	PERIODICIDAD	RECUPERABILIDAD	IMPORTANCIA	2 NATURALEZA
41	PR3/SU2	2	4	4	2	2	2	4	4	4	4	40	-
42	PR3/SU3	2	4	4	2	2	2	4	4	4	4	40	+
43	PR3/SU5	1	1	4	2	2	2	4	4	2	4	29	+
44	PR3/SU6	1	1	4	2	2	2	4	4	2	4	29	-
45	PR3/SU7	2	2	4	2	2	2	4	4	2	4	34	-
46	PR3/AG1	4	4	2	4	4	2	4	4	4	4	48	-
47	PR3/AG2	4	4	4	2	2	2	4	4	2	4	44	-
48	PR3/AG3	2	2	4	2	2	2	4	4	2	4	34	-
49	PR3/FA1	1	4	2	2	2	2	4	1	2	2	28	-
50	PR3/FA5	4	2	2	2	2	2	4	4	2	4	38	-
51	PR3/PA3	1	1	4	4	4	2	4	4	4	8	39	-
52	PR3/SOC2	2	2	2	2	4	2	4	4	2	4	34	+
53	PR3/SOC4	2	2	4	2	2	2	4	4	2	4	34	+
54	PR3/SOC5	4	1	4	4	2	2	4	4	4	4	42	+
55	PR4/AT2	2	4	4	2	2	2	4	4	4	4	40	-
56	PR4/AT5	1	8	4	4	4	2	4	4	4	4	49	-
57	PR4/SU1	2	2	2	2	2	2	4	4	2	4	32	-
58	PR4/SU2	4	4	2	4	4	2	4	4	2	8	50	-
59	PR4/SU3	1	1	4	2	2	2	4	4	2	4	29	+
60	PR4/SU5	2	2	4	2	2	2	4	4	2	4	34	+
61	PR4/SU6	4	4	2	4	4	2	4	4	4	4	48	-
62	PR4/SU7	4	4	4	2	2	2	4	4	2	4	44	-
63	PR4/AG1	2	2	4	2	2	2	4	4	2	4	34	-
64	PR4/AG2	1	4	2	2	2	2	4	1	2	2	28	-
65	PR4/AG3	4	2	2	2	2	2	4	4	2	4	38	-
66	PR4/FA1	1	1	4	4	4	2	4	4	4	8	39	-
67	PR4/FA5	2	4	2	4	4	2	4	4	4	8	46	-
68	PR4/PA3	4	4	2	4	4	2	4	4	2	8	50	-
69	PR4/SOC2	4	2	2	2	4	2	4	4	2	4	40	+
70	PR4/SOC4	2	4	4	4	2	2	4	4	4	4	42	+
71	PR4/SOC5	4	1	4	4	2	2	4	4	4	4	42	+
72	PR5/AT1	2	8	4	4	4	2	4	4	4	4	52	-
73	PR5/AT2	2	8	4	4	4	2	4	4	4	4	52	-
74	PR5/AT5	2	2	2	2	2	2	4	4	2	4	32	-
75	PR5/SU1	4	4	2	4	4	2	4	4	2	8	50	-
76	PR5/SU2	1	1	2	4	2	2	4	4	2	8	33	-
77	PR5/SU3	1	1	2	4	2	2	4	4	2	8	33	+
78	PR5/SU5	2	2	4	2	2	2	4	4	2	4	34	+
79	PR5/SU6	1	1	2	4	2	2	4	4	2	8	33	-
80	PR5/SU7	1	1	2	4	2	2	4	4	2	8	33	-

TABLE V.9 CALCULATION OF IMPORTANCE FORT HE INTERACTIONS FOUND (Continuation)

CÁLCULO DE LA IMPORTANCIA

CLAVE	RELACIÓN	INTENSIDAD	EXTENSIÓN	MOMENTO	PERSISTENCIA	REVERSIBILIDAD	SINERGIA	ACUMULACIÓN	EFECTO	PERIODICIDAD	RECUPERABILIDAD	IMPORTANCIA	3 NATURALEZA
81	PR5/AG1	1	1	2	4	2	2	4	4	2	8	33	-
82	PR5/AG2	1	1	2	4	2	2	4	4	2	8	33	-
83	PR5/AG3	4	4	2	4	4	2	4	4	4	4	48	-
84	PR5/FA1	4	4	4	2	2	2	4	4	2	4	44	-
85	PR5/FA2	2	2	4	2	2	2	4	4	2	4	34	-
86	PR5/FA3	2	1	2	2	2	2	4	4	2	4	30	-
87	PR5/FA4	4	2	2	2	2	2	4	4	2	4	38	-
88	PR5/FA5	4	2	2	4	2	2	4	4	4	8	46	-
89	PR5/VEG1	1	1	4	2	2	2	4	4	2	4	29	-
90	PR5/VEG2	2	2	2	2	2	2	4	4	2	4	32	-
91	PR5/VEG3	1	1	4	2	2	2	4	4	2	4	29	-
92	PR5/VEG4	4	4	4	4	4	2	4	4	4	4	50	-
93	PR5/PA1	1	1	4	4	4	2	4	4	4	8	39	-
94	PR5/PA2	1	1	4	4	4	2	4	4	4	8	39	-
95	PR5/PA3	2	2	2	2	4	2	4	4	2	4	34	-
96	CON1/AT2	4	4	4	4	2	2	4	4	4	4	48	-
97	CON1/AT5	4	1	4	4	2	2	4	4	4	4	42	-
98	CON1/SU1	2	4	4	2	2	2	4	4	4	4	40	-
99	CON1/SU2	1	8	4	4	4	2	4	4	4	4	49	-
100	CON1/SU3	2	2	2	2	2	2	4	4	2	4	32	+
101	CON1/SU5	1	1	4	2	2	2	4	4	2	4	29	+
102	CON1/SU6	2	2	4	2	2	2	4	4	2	4	34	-
103	CON1/SU7	4	4	2	4	4	2	4	4	4	4	48	-
104	CON1/AG1	4	4	4	2	2	2	4	4	2	4	44	-
105	CON1/AG2	2	2	4	2	2	2	4	4	2	4	34	-
106	CON1/AG3	2	1	2	2	2	2	4	4	2	4	30	-
107	CON1/AG4	4	2	2	2	2	2	4	4	2	4	38	-
108	CON1/FA1	2	2	4	2	2	2	4	4	4	4	36	-
109	CON1/FA5	4	1	4	4	2	2	4	4	4	4	42	-
110	CON1/VEG1	4	4	4	4	2	2	4	4	4	4	48	-
111	CON1/VEG2	4	4	4	4	2	2	4	4	4	4	48	-
112	CON1/VEG3	1	8	4	4	4	2	4	4	4	4	49	-
113	CON1/VEG4	4	4	4	4	4	2	4	4	4	4	50	-
114	CON1/PA2	2	2	2	2	2	2	4	4	2	4	32	-
115	CON1/PA3	2	2	2	2	2	2	4	4	2	4	32	-
116	CON1/SOC2	1	1	2	2	2	2	4	4	2	4	27	+
117	CON1/SOC4	2	1	2	2	2	2	4	4	2	4	30	+
118	CON1/SOC5	2	1	2	2	2	2	4	4	2	4	30	+
119	CON2/AT2	2	8	4	4	4	2	4	4	4	4	52	-
120	CON2/AT3	1	1	4	4	4	2	4	4	4	8	39	-

TABLE V.9 CALCULATION OF IMPORTANCE FORT HE INTERACTIONS FOUND (Continuation)

CÁLCULO DE LA IMPORTANCIA

CLAVE	RELACIÓN	INTENSIDAD	EXTENSIÓN	MOMENTO	PERSISTENCIA	REVERSIBILIDAD	SINERGIA	ACUMULACIÓN	EFECTO	PERIODICIDAD	RECUPERABILIDAD	IMPORTANCIA	4 NATURALEZA
121	CON2/AT4	2	2	2	2	4	2	4	4	2	4	34	-
122	CON2/AT5	2	8	4	4	4	2	4	4	4	4	52	-
123	CON2/SU1	4	4	4	4	2	2	4	4	4	4	48	-
124	CON2/SU2	2	8	4	4	4	2	4	4	4	4	52	-
125	CON2/SU3	2	4	4	2	2	2	4	4	4	4	40	+
126	CON2/SU4	1	8	4	4	4	2	4	4	4	4	49	-
127	CON2/SU5	2	2	2	2	2	2	4	4	2	4	32	-
128	CON2/SU6	4	4	2	4	4	2	4	4	4	4	48	-
129	CON2/SU7	2	8	4	4	4	2	4	4	4	4	52	-
130	CON2/AG1	2	8	4	4	4	2	4	4	4	4	52	-
131	CON2/AG2	2	1	2	2	2	2	4	4	2	4	30	-
132	CON2/AG3	4	2	2	2	2	2	4	4	2	4	38	-
133	CON2/AG4	4	2	2	2	2	2	4	4	2	4	38	-
134	CON2/FA1	1	1	4	4	4	2	4	4	4	8	39	-
135	CON2/FA5	1	1	4	4	4	2	4	4	4	8	39	-
136	CON2/PA2	2	2	2	2	4	2	4	4	2	4	34	-
137	CON2/PA3	4	2	2	2	4	2	4	4	2	4	40	-
138	CON2/SOC1	4	4	4	4	2	2	4	4	4	4	48	+
139	CON2/SOC2	4	1	4	4	2	2	4	4	4	4	42	+
140	CON2/SOC3	2	4	4	2	2	2	4	4	4	4	40	+
141	CON2/SOC4	1	8	4	4	4	2	4	4	4	4	49	+
142	CON2/SOC5	2	2	2	2	2	2	4	4	2	4	32	+
143	CON2/SOC6	4	4	2	4	4	2	4	4	4	4	48	-
144	CON2/SOC7	4	4	4	2	2	2	4	4	2	4	44	+
145	CON2/SOC8	2	2	4	2	2	2	4	4	2	4	34	-
146	CON3/AT2	2	1	2	2	2	2	4	4	2	4	30	-
147	CON3/AT5	4	2	2	2	2	2	4	4	2	4	38	-
148	CON3/AG1	1	1	4	4	4	2	4	4	4	8	39	-
149	CON3/AG2	2	2	2	2	4	2	4	4	2	4	34	-
150	CON3/AG3	4	2	2	2	4	2	4	4	2	4	40	-
151	CON3/AG4	4	4	4	4	2	2	4	4	4	4	48	-
152	CON3/SOC2	4	1	4	4	2	2	4	4	4	4	42	+
153	CON3/SOC4	2	4	4	2	2	2	4	4	4	4	40	+
154	CON3/SOC5	1	8	4	4	4	2	4	4	4	4	49	+
155	CON4/AT2	2	8	4	4	4	2	4	4	4	4	52	-
156	CON4/AT3	4	4	2	4	4	2	4	4	4	4	48	-
157	CON4/AT4	2	8	4	4	4	2	4	4	4	4	52	-
158	CON4/AT5	2	8	4	4	4	2	4	4	4	4	52	-
159	CON4/SU1	2	1	2	2	2	2	4	4	2	4	30	-
160	CON4/SU2	1	1	4	4	4	2	4	4	4	8	39	-

TABLE V.9 CALCULATION OF IMPORTANCE FORT HE INTERACTIONS FOUND (Continuation)

CÁLCULO DE LA IMPORTANCIA

CLAVE	RELACIÓN	INTENSIDAD	EXTENSIÓN	MOMENTO	PERSISTENCIA	REVERSIBILIDAD	SINERGIA	ACUMULACIÓN	EFECTO	PERIODICIDAD	RECUPERABILIDAD	IMPORTANCIA	NATURALEZA
													5
161	CON4/SU3	1	1	4	4	4	2	4	4	4	8	39	+
162	CON4/SU4	2	2	2	2	4	2	4	4	2	4	34	-
163	CON4/SU5	4	2	2	2	4	2	4	4	2	4	40	-
164	CON4/SU6	4	4	4	4	2	2	4	4	4	4	48	-
165	CON4/SU7	4	1	4	4	2	2	4	4	4	4	42	-
166	CON4/AG1	2	4	4	2	2	2	4	4	4	4	40	-
167	CON4/AG2	1	8	4	4	4	2	4	4	4	4	49	-
168	CON4/AG4	2	8	4	4	4	2	4	4	4	4	52	-
169	CON4/FA1	4	4	2	4	4	2	4	4	4	4	48	-
170	CON4/FA5	2	8	4	4	4	2	4	4	4	4	52	-
171	CON4/PA2	2	2	4	2	2	2	4	4	2	4	34	-
172	CON4/PA3	2	1	2	2	2	2	4	4	2	4	30	-
173	CON4/SOC1	4	2	2	2	2	2	4	4	2	4	38	+
174	CON4/SOC2	2	1	2	2	2	2	4	4	2	4	30	+
175	CON4/SOC3	2	2	2	2	2	2	4	4	2	4	32	-
176	CON4/SOC4	1	1	2	4	2	2	4	4	2	4	29	+
177	CON4/SOC5	2	2	2	2	2	2	4	4	2	4	32	+
178	CON4/SOC6	2	1	4	2	2	2	4	4	2	4	32	+
179	CON4/SOC7	2	2	2	4	4	2	4	4	2	4	36	+
180	CON4/SOC8	1	2	2	2	2	2	4	4	2	4	29	-
181	CON5/AT2	2	2	2	2	2	2	4	4	2	4	32	-
182	CON5/AT3	2	2	2	2	2	2	4	4	2	4	32	-
183	CON5/AT4	2	2	2	2	2	2	4	4	2	4	32	-
184	CON5/AT5	2	2	2	2	2	2	4	4	2	4	32	-
185	CON5/SU1	4	4	2	4	4	4	4	4	2	4	48	-
186	CON5/SU2	2	2	4	2	2	2	4	4	2	4	34	-
187	CON5/SU3	2	2	2	2	2	2	4	4	2	4	32	+
188	CON5/SU4	2	1	4	2	2	2	4	4	2	4	32	-
189	CON5/SU5	4	2	2	2	2	2	4	4	2	4	38	-
190	CON5/SU6	2	2	2	4	4	2	4	4	2	4	36	-
191	CON5/SU7	1	2	2	2	2	2	4	4	2	4	29	-
192	CON5/AG1	2	2	2	2	2	2	4	4	2	4	32	-
193	CON5/AG2	2	2	2	2	2	2	4	4	2	4	32	-
194	CON5/AG4	2	2	2	2	2	2	4	4	2	4	32	-
195	CON5/FA1	2	2	2	2	2	2	4	4	2	4	32	-
196	CON5/FA2	2	2	2	2	2	2	4	4	2	4	32	-
197	CON5/FA3	2	2	2	2	2	2	4	4	2	4	32	-
198	CON5/FA4	2	2	2	2	2	2	4	4	2	4	32	-
199	CON5/FA5	4	4	2	4	4	4	4	4	2	4	48	-
200	CON5/PA2	4	4	2	4	4	4	4	4	2	4	48	-

TABLE V.9 CALCULATION OF IMPORTANCE FORT HE INTERACTIONS FOUND (Continuation)

CÁLCULO DE LA IMPORTANCIA

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CLAVE	RELACIÓN	INTENSIDAD	EXTENSIÓN	MOMENTO	PERSISTENCIA	REVERSIBILIDAD	SINERGIA	ACUMULACIÓN	EFECTO	PERIODICIDAD	RECUPERABILIDAD	IMPORTANCIA	NATURALEZA
201	CON5/PA3	2	2	4	2	2	2	4	4	2	4	34	-
202	CON5/SOC1	2	2	2	2	2	2	4	4	2	4	32	+
203	CON5/SOC2	2	1	4	2	2	2	4	4	2	4	32	+
204	CON5/SOC3	4	2	2	2	2	2	4	4	2	4	38	+
205	CON5/SOC4	2	2	2	4	4	2	4	4	2	4	36	+
206	CON5/SOC5	1	2	2	2	2	2	4	4	2	4	29	+
207	CON5/SOC6	2	2	2	2	2	2	4	4	2	4	32	+
208	CON5/SOC7	2	2	2	2	2	2	4	4	2	4	32	+
209	CON5/SOC8	2	2	2	2	2	2	4	4	2	4	32	+
210	CON6/SU5	1	1	2	4	4	2	4	4	2	4	31	+
211	CON6/SU6	1	1	2	4	4	2	4	4	2	4	31	+
212	CON6/AG1	1	1	2	4	4	2	4	4	2	4	31	+
213	CON6/AG2	1	1	2	4	4	2	4	4	2	4	31	+
214	CON6/AG4	2	2	2	4	2	2	4	4	2	4	34	+
215	CON6/AG5	2	1	2	2	2	2	4	4	2	4	30	+
216	CON6/SOC3	2	2	2	2	2	2	4	4	2	4	32	+
217	CON6/SOC4	4	1	4	2	2	2	4	4	2	4	38	+
218	CON6/SOC5	2	1	4	2	1	2	4	4	2	4	31	+
219	CON6/SOC8	1	1	2	2	2	2	4	4	2	4	27	+
220	CON7/SU5	1	1	4	4	4	2	4	4	2	4	33	+
221	CON7/SU6	1	1	4	4	4	2	4	4	4	8	39	+
222	CON7/AG1	1	1	4	4	4	2	4	4	4	8	39	+
223	CON7/AG2	2	2	2	2	4	2	4	4	2	4	34	+
224	CON7/AG4	4	2	2	2	4	2	4	4	2	4	40	+
225	CON7/AG5	4	4	4	2	2	2	4	4	2	4	44	+
226	CON7/SOC3	4	4	4	2	2	2	4	4	2	4	44	+
227	CON7/SOC4	2	2	2	2	2	2	4	4	2	4	32	+
228	CON7/SOC5	4	1	4	2	2	2	4	4	2	4	38	+
229	CON7/SOC8	2	1	4	2	1	2	4	4	2	4	31	+
230	CON8/AT2	1	1	2	2	2	2	4	4	2	4	27	-
231	CON8/AT5	1	1	4	4	4	2	4	4	2	4	33	-
232	CON8/AG4	1	1	4	4	4	2	4	4	2	4	33	-
233	CON8/SOC2	1	1	4	4	4	2	4	4	4	8	39	+
234	CON8/SOC4	1	1	4	4	4	2	4	4	4	8	39	+
235	CON8/SOC5	2	2	2	2	4	2	4	4	2	4	34	+
236	CON9/AT2	4	2	2	2	4	2	4	4	2	4	40	-
237	CON9/AT5	2	2	2	4	2	2	4	4	2	4	34	-
238	CON9/AG3	2	1	2	2	2	2	4	4	2	4	30	-
239	CON9/AG4	2	2	2	2	2	2	4	4	2	4	32	-
240	CON9/SOC3	2	1	4	2	1	2	4	4	2	4	31	+

TABLE V.9 CALCULATION OF IMPORTANCE FORT HE INTERACTIONS FOUND (Continuation)

CÁLCULO DE LA IMPORTANCIA

CLAVE	RELACIÓN	INTENSIDAD	EXTENSIÓN	MOMENTO	PERSISTENCIA	REVERSIBILIDAD	SINERGIA	ACUMULACIÓN	EFECTO	PERIODICIDAD	RECUPERABILIDAD	IMPORTANCIA	7 NATURALEZA
241	CON9/SOC4	1	1	2	2	2	2	4	4	2	4	27	+
242	CON9/SOC5	1	1	4	4	4	2	4	4	2	4	33	+
243	CON9/SOC7	1	1	4	4	4	2	4	4	4	8	39	+
244	CON10/AT2	2	1	4	4	4	2	4	4	2	4	36	-
245	CON10/AT5	2	2	2	2	4	2	4	4	2	4	34	-
246	CON10/SU2	4	2	2	2	4	2	4	4	2	4	40	-
247	CON10/SU3	2	2	2	4	2	2	4	4	2	4	34	-
248	CON10/AG1	2	1	2	2	2	2	4	4	2	4	30	-
249	CON10/AG2	2	2	2	2	2	2	4	4	2	4	32	-
250	CON10/AG3	4	1	4	2	2	2	4	4	2	4	38	-
251	CON10/AG4	2	1	4	2	1	2	4	4	2	4	31	-
252	CON10/SOC2	1	1	2	2	2	2	4	4	2	4	27	+
253	CON10/SOC4	1	1	4	4	4	2	4	4	2	4	33	+
254	CON10/SOC5	1	4	1	4	2	2	4	4	2	4	34	+
255	CON11/SOC3	1	1	2	4	2	2	4	4	2	4	29	+
256	CON11/SOC4	2	2	2	2	2	2	4	4	2	4	32	+
257	CON11/SOC5	1	1	2	1	2	2	4	4	2	4	26	+
258	CON11/SOC7	4	4	4	4	4	2	4	4	2	4	48	+
259	CON12/AT2	4	4	4	4	4	2	4	4	2	4	48	-
260	CON12/AT5	4	4	4	4	4	2	4	4	2	4	48	-
261	CON12/SU2	4	4	4	4	4	2	4	4	2	4	48	-
262	CON12/SU3	4	4	4	4	4	2	4	4	2	4	48	+
263	CON12/AG1	2	2	2	4	4	2	2	4	4	4	36	-
264	CON12/AG2	2	2	4	4	2	2	4	4	2	4	36	-
265	CON12/AG3	2	2	4	4	2	2	4	4	2	4	36	-
266	CON12/AG4	2	2	4	4	2	2	4	4	2	4	36	-
267	CON12/SOC2	2	2	4	4	2	2	4	4	2	4	36	+
268	CON12/SOC4	1	1	4	4	4	2	4	4	4	8	39	+
269	CON12/SOC5	1	1	4	4	4	2	4	4	4	8	39	-
270	CON12/SOC6	2	2	2	2	4	2	4	4	2	4	34	-
271	CON13/AT2	4	2	2	2	4	2	4	4	2	4	40	-
272	CON13/AT5	4	2	2	2	4	2	4	4	2	4	40	-
273	CON13/SU2	4	4	4	2	2	2	4	4	2	4	44	-
274	CON13/SU3	2	2	4	2	2	2	4	4	2	4	34	+
275	CON13/AG1	2	2	2	2	2	2	4	4	2	4	32	-
276	CON13/AG2	2	1	4	2	2	2	4	4	2	4	32	-
277	CON13/AG3	4	2	2	2	2	2	4	4	2	4	38	-
278	CON13/AG4	2	2	2	4	4	2	4	4	2	4	36	-
279	CON13/SOC2	1	1	4	4	4	2	4	4	4	8	39	+
280	CON13/SOC4	2	2	2	2	4	2	4	4	2	4	34	+

TABLE V.9 CALCULATION OF IMPORTANCE FORT HE INTERACTIONS FOUND (Continuation)

CÁLCULO DE LA IMPORTANCIA

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CLAVE	RELACIÓN	INTENSIDAD	EXTENSIÓN	MOMENTO	PERSISTENCIA	REVERSIBILIDAD	SINERGIA	ACUMULACIÓN	EFECTO	PERIODICIDAD	RECUPERABILIDAD	IMPORTANCIA	NATURALEZA
281	CON13/SOC5	4	2	2	2	4	2	4	4	2	4	40	+
282	CON13/SOC6	4	4	2	4	4	2	4	4	4	4	48	-
283	CON14/AT2	4	4	4	2	2	2	4	4	2	4	44	-
284	CON14/AT5	2	2	4	2	2	2	4	4	2	4	34	-
285	CON14/SU2	2	2	2	2	2	2	4	4	2	4	32	-
286	CON14/SU3	2	1	4	2	2	2	4	4	2	4	32	-
287	CON14/AG1	4	2	2	2	2	2	4	4	2	4	38	-
288	CON14/AG2	2	2	2	4	4	2	4	4	2	4	36	-
289	CON14/AG3	4	4	4	4	2	2	4	4	2	4	46	-
290	CON14/AG4	4	4	4	4	2	2	4	4	2	4	46	-
291	CON14/SOC2	2	2	4	2	2	2	4	4	2	4	34	+
292	CON14/SOC4	2	2	2	2	2	2	4	4	2	4	32	+
293	CON14/SOC5	2	1	4	2	2	2	4	4	2	4	32	+
294	CON14/SOC6	4	2	2	2	2	2	4	4	2	4	38	+
295	CON15/SU4	2	2	2	4	4	2	4	4	2	4	36	+
296	CON15/SU5	2	4	4	4	4	4	4	4	4	4	46	+
297	CON15/SU6	2	4	4	4	4	4	4	4	4	4	46	+
298	CON15/AG4	2	4	4	4	4	4	4	4	4	4	46	+
299	CON15/AG5	2	4	4	4	4	4	4	4	4	4	46	+
300	CON15/PA3	4	4	4	4	4	2	4	4	2	4	48	+
301	CON15/SOC3	2	2	4	2	2	2	4	4	2	4	34	+
302	CON15/SOC4	2	2	2	2	2	2	4	4	2	4	32	+
303	CON15/SOC7	2	1	4	2	2	2	4	4	2	4	32	+
304	CON15/SOC8	4	2	2	2	2	2	4	4	2	4	38	+
305	OPE1/AT3	2	2	2	4	4	2	4	4	2	4	36	+
306	OPE1/AT5	1	1	2	2	2	2	4	4	2	4	27	-
307	OPE1/SU1	1	1	2	1	1	2	4	4	2	4	25	+
308	OPE1/SU2	2	4	4	4	4	4	4	4	4	4	46	+
309	OPE1/AG4	2	4	4	4	4	4	4	4	4	4	46	+
310	OPE1/AG5	2	4	4	4	4	4	4	4	4	4	46	+
311	OPE1/FA3	4	2	2	2	2	2	4	4	2	4	38	+
312	OPE1/FA5	4	4	4	4	4	2	4	4	2	4	48	+
313	OPE1/VEG2	2	2	4	2	2	2	4	4	2	4	34	+
314	OPE1/PA1	2	2	2	2	2	2	4	4	2	4	32	+
315	OPE1/PA2	2	1	4	2	2	2	4	4	2	4	32	+
316	OPE1/PA3	4	2	2	2	2	2	4	4	2	4	38	+
317	OPE1/SOC1	2	2	2	4	4	2	4	4	2	4	36	+
318	OPE1/SOC3	2	2	2	4	4	2	4	4	2	4	36	+
319	OPE1/SOC6	2	4	4	4	4	4	4	4	4	4	46	+
320	OPE1/SOC7	2	2	2	2	2	2	4	4	2	4	32	+

TABLE V.9 CALCULATION OF IMPORTANCE FORT HE INTERACTIONS FOUND (Continuation)

CÁLCULO DE LA IMPORTANCIA

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CLAVE	RELACIÓN	INTENSIDAD	EXTENSIÓN	MOMENTO	PERSISTENCIA	REVERSIBILIDAD	SINERGIA	ACUMULACIÓN	EFECTO	PERIODICIDAD	RECUPERABILIDAD	IMPORTANCIA	NATURALEZA
321	OPE1/SOC8	4	2	2	2	2	2	4	4	2	4	38	+
322	OPE2/SU4	2	2	2	4	4	2	4	4	2	4	36	-
323	OPE2/SU5	1	1	4	4	4	2	4	1	4	2	30	-
324	OPE2/AG4	1	1	4	4	4	2	4	1	4	2	30	-
325	OPE2/AG5	2	2	2	2	4	2	4	1	2	2	29	-
326	OPE2/SOC3	4	2	2	2	4	2	4	1	2	2	35	+
327	OPE2/SOC6	2	4	4	4	2	2	4	4	2	4	40	-
328	OPE2/SOC7	2	4	4	4	2	2	4	4	4	4	42	-
329	OPE2/SOC8	2	2	4	2	2	2	4	4	2	4	34	+
330	OPE3/AT1	2	2	2	2	2	2	4	4	2	4	32	-
331	OPE3/AT2	2	1	4	2	2	2	4	4	2	4	32	-
332	OPE3/AT3	4	2	2	2	2	2	4	4	2	4	38	-
333	OPE3/AT4	2	2	2	4	4	2	4	4	2	4	36	-
334	OPE3/AT5	1	1	4	2	2	2	4	4	2	1	26	-
335	OPE3/SU4	1	1	4	2	2	2	4	4	2	1	26	-
336	OPE3/SU5	1	1	4	2	2	2	4	4	2	1	26	-
337	OPE3/AG4	1	1	4	2	2	2	4	4	2	1	26	-
338	OPE3/AG5	1	1	4	2	2	2	4	4	2	1	26	-
339	OPE3/SOC3	1	1	4	2	2	2	4	4	2	1	26	+
340	OPE3/SOC6	2	4	4	4	4	4	4	4	4	4	46	+
341	OPE3/SOC7	2	4	4	4	4	4	4	4	4	4	46	+
342	OPE3/SOC8	2	4	4	4	4	4	4	4	4	4	46	+
343	OPE4/AT1	2	4	4	4	4	4	4	4	4	4	46	-
344	OPE4/AT2	2	2	2	4	4	2	4	4	4	4	38	-
345	OPE4/AG4	2	2	2	4	4	2	4	4	4	4	38	-
346	OPE4/AG5	2	2	2	4	4	2	4	4	4	4	38	-
347	OPE4/FA4	4	4	4	4	2	2	4	4	2	4	46	-
348	OPE5/AT3	4	4	4	4	2	2	4	4	2	4	46	+
349	OPE5/AT5	2	2	4	2	2	2	4	4	2	4	34	+
350	OPE5/SU1	2	2	2	2	2	2	4	4	2	4	32	+
351	OPE5/SU2	2	1	4	2	2	2	4	4	2	4	32	+
352	OPE5/AG4	4	2	2	2	2	2	4	4	2	4	38	+
353	OPE5/AG5	2	2	2	4	4	2	4	4	2	4	36	+
354	OPE5/FA3	2	4	4	4	4	4	4	4	4	4	46	+
355	OPE5/FA4	2	4	4	4	4	4	4	4	4	4	46	+
356	OPE5/VEG2	2	4	4	4	4	4	4	4	4	4	46	+
357	OPE5/PA1	2	4	4	4	4	4	4	4	4	4	46	+
358	OPE5/PA2	2	2	2	4	4	2	4	4	4	4	38	+
359	OPE5/PA3	2	2	2	4	4	2	4	4	4	4	38	+
360	OPE5/SOC1	2	2	2	4	4	2	4	4	4	4	38	+

TABLE V.9 CALCULATION OF IMPORTANCE FORT HE INTERACTIONS FOUND (Continuation)

CÁLCULO DE LA IMPORTANCIA

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CLAVE	RELACIÓN	INTENSIDAD	EXTENSIÓN	MOMENTO	PERSISTENCIA	REVERSIBILIDAD	SINERGIA	ACUMULACIÓN	EFECTO	PERIODICIDAD	RECUPERABILIDAD	IMPORTANCIA	NATURALEZA
361	OPE5/SOC3	4	4	4	4	2	2	4	4	2	4	46	+
362	OPE5/SOC6	4	4	4	4	2	2	4	4	2	4	46	+
363	OPE5/SOC7	4	2	2	2	2	2	4	4	2	4	38	+
364	OPE5/SOC8	2	2	2	4	4	2	4	4	2	4	36	+
365	MAN1/AT3	2	4	4	4	4	2	4	4	4	4	44	+
366	MAN1/AT5	4	4	4	4	4	2	4	4	4	8	54	-
367	MAN1/SU1	2	2	2	2	2	2	4	4	2	4	32	+
368	MAN1/SU2	2	4	2	4	2	2	4	4	2	4	38	+
369	MAN1/AG4	2	2	2	4	4	2	4	4	4	4	38	+
370	MAN1/AG5	2	2	2	4	4	2	4	4	4	4	38	+
371	MAN1/FA3	2	2	2	4	2	2	4	4	2	4	34	+
372	MAN1/FA5	4	4	4	4	2	2	4	4	2	4	46	+
373	MAN1/VEG2	4	4	4	4	2	2	4	4	2	4	46	+
374	MAN1/PA1	2	4	2	4	2	2	4	4	2	4	38	+
375	MAN1/PA2	4	4	4	2	2	2	4	4	4	4	46	+
376	MAN1/PA3	2	2	2	2	2	2	4	4	2	4	32	+
377	MAN1/SOC1	2	4	2	2	2	2	4	4	2	4	36	+
378	MAN1/SOC3	4	4	4	4	4	2	4	4	2	4	48	+
379	MAN1/SOC6	1	1	2	4	4	2	4	4	2	4	31	+
380	MAN1/SOC7	2	2	2	2	2	2	4	4	2	4	32	+
381	MAN1/SOC8	4	4	2	4	4	2	4	4	2	4	46	+
382	MAN2/AT3	4	4	4	4	2	2	4	4	2	4	46	+
383	MAN2/AT5	4	4	4	4	2	2	4	4	2	4	46	-
384	MAN2/SU1	4	4	4	4	2	2	4	4	2	4	46	+
385	MAN2/SU2	4	4	4	4	2	2	4	4	2	4	46	+
386	MAN2/AG4	4	4	4	4	2	2	4	4	2	4	46	+
387	MAN2/AG5	4	4	4	4	2	2	4	4	2	4	46	+
388	MAN2/FA3	4	4	4	4	2	2	4	4	2	4	46	+
389	MAN2/FA5	4	4	4	4	2	2	4	4	2	4	46	+
390	MAN2/VEG2	4	4	4	4	2	2	4	4	2	4	46	+
391	MAN2/PA1	4	4	4	4	2	2	4	4	2	4	46	+
392	MAN2/PA2	4	4	4	4	2	2	4	4	2	4	46	+
393	MAN2/PA3	4	4	4	4	2	2	4	4	2	4	46	+
394	MAN2/SOC1	4	4	4	4	2	2	4	4	2	4	46	+
395	MAN2/SOC3	4	4	4	4	2	2	4	4	2	4	46	+
396	MAN2/SOC6	4	4	4	4	2	2	4	4	2	4	46	+
397	MAN2/SOC7	4	4	4	4	2	2	4	4	2	4	46	+
398	MAN2/SOC8	4	4	4	4	2	2	4	4	2	4	46	+

TABLE V.10 HIERARCHICALLY ARRANGED IMPORTANCE MATRIX

FACTORES AMBIENTALES	UNIDADES DE IMPORTANCIA	Preparación del Sitio					Construcción del Sitio															Operación					Mantenimto		Ij	I_{RI}
		Actividades					*Actividades*															*Actividades*					*Actividades*			
		PR1	PR2	PR3	PR4	PR5	CON1	CON2	CON3	CON4	CON5	CON6	CON7	CON8	CON9	CON10	CON11	CON12	CON13	CON14	CON15	OPE1	OPE2	OPE3	OPE4	OPE5	MAN1	MAN2		
AT1	24					52																		32	46				130	0.00
AT2	24	19	42	48	40	52	48	52	30	52	32			27	40	36		48	40	44				32	38				720	18.56
AT3	24							39		48	32											36		38		46	44	46	329	0.00
AT4	3							34		52	32													36					154	0.00
AT5	31	19		48	49	32	42	52	38	52	32			33	34	34		48	40	34		27		26		34	54	46	774	19.95
SU1	31	50	48	42	32	50	40	48		30	48											25				32	32	46	523	35.47
SU2	36	50	42	40	50	33	49	52		39	34					40		48	44	32		46				32	38	46	715	48.49
SU3	14	19	28	40	29	33	32	40		39	32					34		48	34	32									440	11.34
SU4	14							49		34	32										36		36	26					213	0.00
SU5	3			29	34	34	29	32		40	38	31	33								46		30	26					402	0.00
SU6	4	19	30	29	48	33	34	48		48	36	31	39								46								441	11.37
SU7	3	19	42	34	44	33	48	52		42	29																		343	8.84
AG1	71	36	42	48	34	33	44	52	39	40	32	31	39			30		36	32	38									606	29.59
AG2	63	42	26	44	28	33	34	30	34	49	32	31	34			32		36	32	36									553	31.50
AG3	24			34	38	48	30	38	40						30	38		36	38	46									416	0.00
AG4	55						38	38	48	52	32	34	40	33	32	31		36	36	46	46	46	30	26	38	38	38	46	804	0.00
AG5	7											30	44								46	46	29	26	38	36	38	46	379	0.00
FA1	29	62	26	28	39	44	36	39		48	32																		354	29.77
FA2	11					34					32																		66	0.00
FA3	18					30					32											38				46	34	46	226	0.00
FA4	8					38					32														46				116	0.00
FA5	2	40	39	38	46	46	42	39		52	48											48				46	46	46	576	31.25
VEG1	16	49	40			29	48																						166	11.03
VEG2	27	35	40			32	48															34				46	46	46	327	15.52
VEG3	21	52	39			29	49																						169	11.92
VEG4	6	50	50			50	50																						200	13.56
PA1	27					39																32				46	38	46	201	0.00
PA2	16					39	32	34		34	48											32				38	46	46	349	0.00
PA3	9	34	50	39	50	34	32	40		30	34										48	38				38	32	46	545	25.13
SOC1	19							48		38	32											36				38	36	46	274	0.00
SOC2	32	32	34	34	40		27	42	42	30	32			39		27		36	39	34									488	21.18
SOC3	32							40		32	38	32	44		31		29				34	36	35	26		46	48	46	517	0.00
SOC4	35	26	32	34	42		30	49	40	29	36	38	32	39	27	33	32	39	34	32	32								656	23.14
SOC5	2	48	26	42	42		30	32	49	32	29	31	38	34	33	34	26	39	40	32									637	41.47
SOC6	2							48		32	32							34	48	38		46	40	46		46	31	46	487	0.00
SOC7	4							44		36	32				39		48				32	32	42	46		38	32	46	467	0.00
SOC8	4							34		29	32	27	31								38	38	34	46		36	46	46	437	0.00
Ii	737	682	634	603	645	806	844	1059	330	958	930	289	343	178	226	333	135	436	417	400	366	598	242	322	122	646	633	736		
I_{RI}		17289	15613	16735	15598	19277	21571	25097	13160	22936	20150	8812.6	10217	6136.8	6607	12625	2281.6	15298	13982	14576	6421.9	12422	3803	6493	4702	13384	13809	15586.7		

V.5 Delimitation of the Area of Influence

The assessment process of the impacts that may be caused by the execution of the Proyecto Hidroeléctrico Veracruz, through the adaptation, construction and operation activities, was made without yet considering the application of prevention, mitigation restoration or compensation measures proposed in the following chapter 6: Environmental Handling Plan.

In this regard it is very important to highlight that the area of the location will be constructed on a zone partially modified by the activities developed by the inhabitants of the region, transforming the natural vegetation to include agriculture and coffee growing activities. It is also important to highlight that notwithstanding the trifle with which this assessment was prepared, the hydroelectric project to be constructed mainly in the municipalities of Zongolica, is not comparable to another of the country's big hydroelectric projects, and apart from that, it is an important project, both regionally and locally that deserves that its construction process is careful with the surroundings intended to be utilized.

The matrix involved 999 interactions from which 398 were impacts identified through this technique. Those impacts considered as negative were 222, from which 70% will be present in the project's preparation and construction and correspond to the affectation caused on the environmental factors: land, fauna and atmosphere. In this project it is evident that the number of positive impacts is from the percentage point of view lower than the negative ones (17% of the interactions) considering the conservative vision for the utilization of the use of land and infrastructure works in favor of the protection of the water resource, land and air. The foregoing, notwithstanding the removal of a vegetal coverage that has an environmental service as air depurator, wind, silencer, and shelter of the solar radiation, had indirect repercussion on the fauna effects in the place.

Upon the construction of the importance matrix and the obtainment of the calculations, it is observed that the activity that provides the greater impacts (positive and negative) is the construction and the most affected environmental factor is related to the affectation to the vegetation and atmospheric contamination and the most benefited one is the socio-economic in the local economy and employment aspects. The project's care to give a potential future use to the zone is highlighted, notwithstanding the affectation and even the same supplementary hydraulic works, which were assessed as positive. The negative effect is due to the works and activities demanded by the construction of the project, where noise, machinery, moving of materials, gas emissions and particles are involved. The socio-economic factor is integrated to the environmental handling, by considering again an activity in the site with a greater sense of social and environmental responsibility.

Considering the land characteristics and its topography, the water resource is considered important as long as there are no contributions of the process residual liquids. Thus, the platforms and avoiding uncontrolled discharges, will be protection strategies.

The interactions activity/environment would be classified, as shown in Table V.11.

TABLE V.11. INTERACTION ESTIMATED VALUE.

ENVIRONMENTAL FACTOR	ESTIMATED VALUE
Vegetation	23
Land	21
Water	18
Fauna	10
Atmosphere	9
Landscape	9
Socio-economic	9

From the preceding table, we observe that the most involved environmental factor is the vegetation, both in works and/or activities that affect it negatively and positively, as well as its synergisms with factors such as fauna, water and land. The vegetation reports high importance values within the process of land preparation due to the removal thereof. Then, the legal vocation of the land productive utilization must be respected and the fact that the assessments due to the ecologic interrelations or the presence of phenomenon such as the barrier effect, border effects, shifting of species, sensitization of possible reproduction and feeding zones do not occur, due to the presence of species cataloged as protected or endemic.

The atmosphere factor has a punctual and temporary synergism with the fauna and water. This factor would have its main impacts in the construction stage and would cease as soon as this stage is completed, even though they continue being significant negative impacts. In the operation stage there will be an alteration by the mobilization of vehicles which are almost all new and that therefore it is assumed that their contributions due to noise and contaminating gases are minimum, which is not the case of the zonal vehicular increase generated due to the improvement of the internal roads.

In respect to water and lad, these are always fragile resources within a project, but the infrastructure works allow to protect them from a greater contamination and deterioration. Even though the environmental factor corresponding to water had an estimated value of 18 and its main impacts are of negative nature, they become indirect in their majority in respect to the dam's preparation and construction works. Directly, this resource is in relation with the increase of the flows required in order for the hydroelectric project to achieve its purpose.

Very integrated to the impact on land, are the modifications of the landscape units, that intend to organize the different elements and give an objective use to the surroundings, in such case the impacts are positive. The landscape is an important factor, because it uniforms the regional development of the municipality, and grants the sense of respect to the activities around it. Notwithstanding the civil works in their preliminary phases (land moving, surface intercepted by laying of cables and the tunnel), provoke changes in the different landscape units, these may be highly beneficial in the organization of the landscape integral handling units.

Based on the project's integral assessment, it is acknowledged that its implementation is recommendable because of the cost-benefit it represents. The foregoing is based on the fact that the area on which it is intended to be developed has been impacted by antique activities; while currently the main deterioration activity is sustained in the lack of economic development options.

In conclusion, the project is ecologically respectful and environmentally viable within the framework of a local sustainable development, generating and maintaining a local, regional and national economic distribution, result of the future hydroelectric functioning. The operations do not imply great headings in the alteration of the ecologic balance and/or contributions of emissions or pouring that might exceed the maximum permissible limits, and in all cases, the negative impacts identified, are susceptible of being mitigated in their majority, through preventive, mitigation and/or compensation practices.