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ILLUSTRATIONS

TABLES

6 SOCIAL AND ENVIRONMENTAL IMPACT EVALUATION

The social and environmental impact evaluation is an instrument or tool of a preventive nature, focused on identifying in advance the social and environmental implications or consequences that may be caused by the execution and functioning of any human activity. Its purpose is to establish the preventive, corrective and control measures that can make possible the activity development without harming the environment and society (Arboleda, 2008).

The following describes the methodology used and the results obtained from the identification and evaluation of social and environmental impact for the mining project "El Pescado" in concession 5969.

6.1 METHODOLOGY

The methodology used to identify and evaluate impact is based on Conesa (1997), for the determination of environmental importance (hereafter IA), and on ECOPETROL S. A. (Delgado, 2012) for probability determination of occurrence and environmental significance.

6.1.1 IMPACT IDENTIFICATION

The identification of impact was made through the construction of a matrix, configured in its columns with the project activities that can impact, classified by stages. In the rows, there is the set of components classified by social and environmental media, plus the associated impact through interactions or intersections of columns and rows (See Table 6-1).

Table 6-1. Sample impact identification matrix

MATRIZ DE IDENTIFICACIÓN		SIN/CON PROYECTO											
		ETAPA	ETAPA 1			ETAPA 2				ETAPA 3	ETAPA 4		
MEDIO	COMPONENTE	IMPACTOS / ACTIVIDAD	Actividad 1	Actividad 2	Actividad 3	Actividad 4	Actividad 5	Actividad 6	Actividad 7	Actividad 8	Actividad 9	Actividad 10	Actividad 11
ABIÓTICO	Componente 1	Impacto 1			1	2	3		4				5
		Impacto 2						6					
		Impacto 3								7			
	Componente 2	Impacto 4								8			
		Impacto 5						9					
	Componente 3	Impacto 6			10	11	12				13		14
		Impacto 7				15	16		17				
BIÓTICO	Componente 4	Impacto 8			18	19	20		21		22		23
	Componente 5	Impacto 9	24	25	26	27	28	29	30			31	32
	Componente 6	Impacto 10			33		34		35				36
	Componente 7	Impacto 11								37			
	Componente 8	Impacto 12			38	39	40		51				42
SOCIO-ECONÓMICO Y CULTURAL	Componente 9	Impacto 13							43				
	Componente 10	Impacto 14			44								45
	Componente 11	Impacto 15	46									47	48

Interacción

Source: INGEX, 2016.

These interactions or intersections corresponding to the identification of impact can happen in the following combinations:

- Intersection or interaction of different activities associated with one (1) component.
- Intersection or interaction of one (1) activity on different components.
- Intersection or interaction of one (1) activity presented in several stages of the project, on the same (1) component. However, this does not mean that different impact are presented by this activity on the same component, but the temporal variation impact according to the activity presented in the different stages of the project.

Therefore, the number of interactions does not always correspond to the total impact.

The previous cases of interactions or intersections are considered to determine the total amount of impact and construction of Environmental Management Plan (PMA by its initials in Spanish)

6.1.2 IMPACT EVALUATION

In accordance with the methodologies of Conesa (1997) and ECOPETROL (Delgado, 2012), the impact evaluation was carried out on each interaction or impact identified through the assignment of variables, as it described in the following numerals of eight (8) parameters for the IA calculation and the probability of occurrence to determine the SA.

The assignment of variables or parameters in each interaction or impact assessment is supported by the justification or technical support according to the professional expert of the elaborated component in the LBSA (See Table 6-2 and Annex 6.1.).

Table 6-2. Support table or example justification for assigning impact assessment parameters.

ETAPA	Sin proyecto	**ACTIVIDAD**	Ganadería	**MEDIO**	Abiotico
COMPONENTE	Agua	**IMPACTO**	Alteración de la calidad fisicoquímica y microbiológica del agua		
DESCRIPCIÓN DEL IMPACTO	Producción de excretas por Bovinos :Deterioro de la calidad del agua a partir del aumento de nutrientes, de solidos suspendidos, grasas y aceites, y patógenos			**CALIFICACIÓN SIGNIFICANCIA AMBIENTAL (CSA)**	**BAJA**

CALIFICACIÓN Y JUSTIFICACIÓN		
CRITERIO	**VALOR**	**JUSTIFICACIÓN**
CARÁCTER (C)	-	El sentido de cambio ambiental generado por la acción es negativo.
MAGNITUD (Ma)	2	Cambian algunas caracteristicas del agua
EXTENSIÓN (E)	2	En los elementos del componente físico, cuando hay alteración de este, nunca se da afectación puntual por lo menos es local, dado que son flujos donde al darse contaminación puntal se presenta dispersión de contaminantes hacia otra áreas.
MOMENTO (Mo)	8	La alteración de este parámetro se presenta una vez inicia la actividad.
DURACIÓN (D)	1	El impacto es fugaz puesto que es un sistema lótico
PERIODICIDAD (Pe)	1	El fenómeno es ocasional y depende de diferentes factores
REVERSIBILIDAD (Rev)	1	La alteración se recupera con el cese de la actividad.
RECUPERABILIDAD (Rec)	1	La alteración puede recuperarse mediante la aplicación de las medidas de manejo propuestas.

IMPORTANCIA AMBIENTAL (IA)	16	**PROBABILIDAD DE OCURRENCIA (Po)**	8
ESCALA DE CONSECUENSIAS (EC)	2	**SIGNIFICANCIA AMBIENTAL (SA)**	28
IMPACTO ACUMULATIVO	NO	**DESCRIPCIÓN DEL IMPACTO ACUMULATIVO**	
IMPACTOS SECUNDARIOS	SI	**DESCRIPCIÓN DE LOS IMPACTOS SECUNDARIOS**	Aumento de nutrientes (fosforo, nitrogeno y potasio), grasas y aceites, generando eutrofización , además de un aumento en los solidos suspendidos totales
ESTRATEGIAS DE ACCIÓN	N/A		
TENDENCIA DEL IMPACTO DESPUÉS DE LA APLICACIÓN DE LA(S) MEDIDA(S) DE MANEJO	N/A		

Source: INGEX, 2016.

6.1.2.1 Character (c)

This defines the sense of social or environmental change. It can be positive (+), when the impact generated has a beneficial effect or negative (-), when the impact generates a harmful effect.

6.1.2.2 Magnitude (ma)

It corresponds to the alteration degree or the change produced on a specific element, as a consequence of the development of an activity or process, evaluating the severity scale (See Table 6-3).

Table 6-3. Magnitude Range

MAGNITUDE RANGES (SEVERITY - INTENSITY)		
RATING	**SCALE**	**SIGNIFICANCE**
LOW	1	The alteration of the impacted element is minimal.
MEDIUM	2	Some characteristics of the impacted element changed.
HIGH	3	The main characteristics of the impacted element change.
VERY HIGH	4	There is a total loss of the impacted element.

Source: CONESA, 1997.

6.1.2.3 Extension (e)

It refers to the extension of impact effects (see Table 6-4).

Table 6-4. Extension Range

EXTENSION RANGES (AREA OF INFLUENCE)		
RATING	**SCALE**	**SIGNIFICANCE**
PUNCTUAL	**1**	From a biophysical point of view, the area affected is limited to the area intervened by a specific activity. From a socio-economic point of view, the impact is manifested at the level of family units.
LOCAL	**2**	From a biophysical point of view, the affected area involves the entire unit of the evaluated element that was intervened. From a socio-economic point of view, the effect is manifested at the level of the minimum territorial unit (Vereda).
EXTENSIVE	**9**	From a biophysical point of view, the affected area exceeds the intervened characterization unit, transcending more units that were not the object of intervention. From a socio-economic point of view, the impact goes beyond the minimum territorial unit. It is considered that sheltering more than one minimum territorial unit is an extensive extension.

Source: CONESA, 1997.

6.1.2.4 Moment (mo)

The impact manifestation is defined from the time that elapses between the start of the action and the appearance of the effect on the element (see Table 6-5).

Table 6-5 Moment Ranges

MOMENT RANGES		
RATING	**SCALE**	**SIGNIFICANCE**
LONG TERM	**1**	The impact takes more than five (5) years after the start of the activity.
MEDIUM TERM	**2**	The impact is manifested between one (1) to five (5) years, after the start of the activity.
SHORT TERM	**4**	The impact is manifested in less than one (1) year, after the activity has started.
IMMEDIATELY	**8**	The impact is presented once the activity begins.

Source: CONESA, 1997.

6.1.2.5 Length (l)

It refers to the amount of time the impact will theoretically remain since its appearance. The impact frequency of occurrence is not taken into account, it is considered as if it occurred once (See Table 6-6).

Table 6-6. Length ranges.

LENGTH RANGES (TIME/FREQUENCY)		
RATING	**SCALE**	**SIGNIFICANCE**
BRIEF	**1**	If the impact persists for one (1) to three (3) years.
TEMPORARY	**2**	If the impact persists for one (1) to three (3) years.
PERSISTENT	**4**	If the impact persists for four (4) to 10 years.
PERMANENT	**8**	If the impact persists for an indefinite period of time or longer than 10 years.

Source: CONESA, 1997.

6.1.2.6 Periodicity (pe)

It refers to the manifestation period of the effect (s) generated by the impact (s) during the development of the generating activity (See Table 6-7).

Table 6-7. Periodicity Ranges

PERIODICITY RANGES		
RATING	**SCALE**	**SIGNIFICANCE**
IRREGULAR	**1**	The effect manifested sporadically, during the time in which the activity is developed.
PERIDICAL	**2**	The effect is manifested cyclically during the activity development.
CONTINUOS	**4**	The effect is manifested regularly during the activity execution.

Source: CONESA, 1997.

6.1.2.7 Reversibility (rev)

This corresponds to the recovery possibility of the element's initial conditions (after carrying out an activity) through natural processes, once the impact generating activity is stopped (See Table 6-8).

Table 6-8. Reversibility Ranges

REVERSIBILITY RANGES (TOLERANCE – ASSIMILATION)		
RATING	**SCALE**	**SIGNIFICADO**
IMMEDIATE	**1**	The conditions of the affected element are recovered with the activity termination.
REVERSIBLE	**2**	The alteration may be assimilated in a short, medium or long term, according to the ecological specific conditions of succession and self-purification of the environment.
IRREVERSIBLE	**4**	It supposes the impossibility or extreme difficulty of returning to the natural conditions prior to the development of the activity.

Source: CONESA, 1997.

6.1.2.8 Recovery (rec)

It refers to the possibility of returning the affected element to its initial conditions (previous development of an activity), through human intervention (application of management measures) (See Table 6-9).

Table 6-9. Recovery Ranges

RECOVERY RANGES (TIME)		
RATING	**SCALE**	**SIGNIFICANCE**
RECOVERABLE	**1**	Alteration can be eliminated by applying corrective measures.
MODERATE	**2**	The damage caused can be clearly mitigated through the application of the proposed management measures.
IRRETRIEVABLE	**4**	The damage caused is impossible to recover.

Source: CONESA, 1997.

6.1.2.9 Environmental Importance (ei)

The impact environmental importance is determined by summing the ratings given to each of the above eight (8) parameters: Magnitude (Ma), Extension (E), Moment (Mo), Length(D), Periodicity (Pe), Reversibility (Rev) and Recovery (Rec), as presented in the following equation:

$$EI = (C \pm) Ma+E+Mo+L+Pe+Rev+Rec)$$

Once all parameters have been qualified and the EI is calculated. It is located in **Table 6-10**, according to the ranges of importance between 11 and 52, and scale of consequences between 1 and 5. Thus obtaining the level of importance (Irrelevant, moderate, relevant, serious and critical) of the interaction, both for negative and positive impact, the level of importance is realized for two scenarios: with a project and without a mining project.

Table 6-10. Importance level

IMPORTANCE	CONSEQUENCES SCALE	IMPORTANCE LEVEL (Negative impact)	IMPORTANCE LEVEL (Positive impact)
11-12	**1**	Irrelevant	Irrelevant
13-22	**2**	Moderate	Moderate
23-32	**3**	Relevant	Relevant
33-42	**4**	Severe	Severe
43-52	**5**	Critical	Critical

Source: CONESA, 1997.

6.1.2.10 Occurrence probability (op)

Once the impact importance level has been determined, the probability of interactions occurring is established. This variable is the most relevant in the impact assessment of the ES. The probability of occurrence was rated according to **Table 6-11** on a scale of A to E, where A represents low probability or almost impossible to occur, and E refers to the impact occurrence at a high level of certainty.

Table 6-11. Occurrence probability

PROBABILITY	DEFINITION
A	Practically impossible to happen.
B	Unlikely to happen.
C	It may happen.
D	Most likely to happen.
E	It will happen with a high level of certainty.

Source: ECOPETROL - Delgado, 2012.

6.1.2.11 Environmental Significance (es)

The result obtained from the EI of the impact, depending on the probability of occurrence, gives the final assessment of the evaluation of each environmental impact, i.e. the ES, variable between meanings ranging from low, medium, high to very high.

To obtain the ES for each impact, the importance level and/or consequence scale are placed in the rows and intercepted with the probability of occurrence, obtaining an ES in the intercepted cell. This is true for both negative and positive impact (see Table 6-12 or Table 6-13).

Table 6-12. Environmental Significance for Negative Impact

CONSECUENCES		OCURRENCE PROBABILITY				
IMPORTANCE LEVEL (+/-)	EC*	A	B	C	D	E
Critical	5	Medium	Medium	High	High	Very High
Severe	4	Medium	Medium	Medium	High	High
Relevant	3	Low	Medium	Medium	Medium	High
Moderate	2	Low	Low	Medium	Medium	Medium
Irrelevant	1	Low	Low	Low	Medium	Medium

Source: ECOPETROL - Delgado, 2012.

Table 6-13 Environmental Significance for Positive Impact

CONSECUENCES		OCURRENCE PROBABILITY				
IMPORTANCE LEVEL (+/-)	EC*	A	B	C	D	E
Critical	5	Medium	Medium	High	High	Very High
Severe	4	Medium	Medium	Medium	High	High
Relevant	3	Low	Medium	Medium	Medium	High
Moderate	2	Low	Low	Medium	Medium	Medium
Irrelevant	1	Low	Low	Low	Medium	Medium

Source: ECOPETROL - Delgado, 2012.

6.2 RESULTS

6.2.1 IDENTIFICATION AND IMPACT EVALUATION

Following is the identification impact evaluation for the scenarios with and without a project, based on the justification or technical support of the professional's expert who elaborate the components of the LBSA (See **Table 6-2** and **Annex 6.1**, as mentioned in the methodology.

6.2.1.1 Scenery without Project

6.2.1.1.1 Impact Generating Activities

The activities currently being developed in the project's area by local communities, may be generating impact in the area of direct and indirect influence, before initiating the development of the project (see **Illustration 6-1**). These are described in detail below, based on what was evidenced during the LBSA field phase.

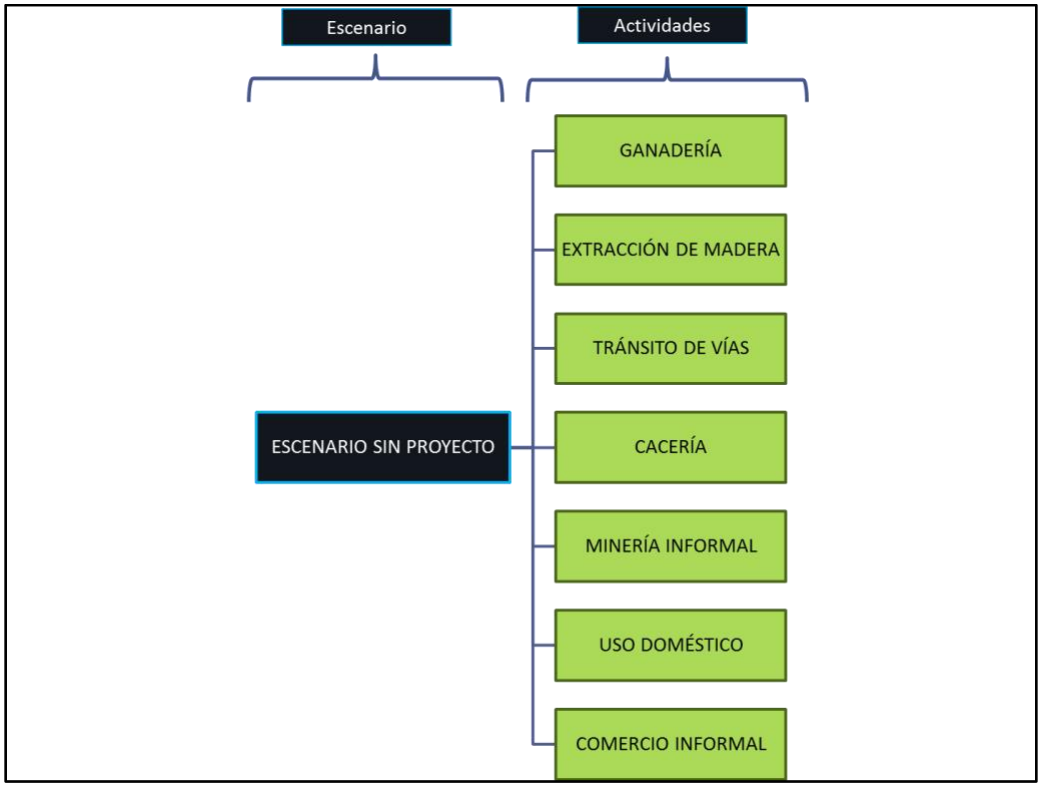

Illustration 6-1 Impacting activities by communities in the area, before initiating project development.
Source: INGEX, 2016.

6.2.1.1.1.1 Livestock Farming

Livestock farming is an economic activity, which consists of raising all the animal species that can be domesticated for production purposes.

In Segovia, livestock farming has the largest production area, due to the natural conditions of this municipality, which have determined the development of this economic activity throughout its history (Land Use Planning – PBOT by its initials in Spanish, Development Plan, etc.).

In the area of study, in accordance with the LBSA lifting, livestock farming is applicable, mainly in the production of animals to obtain meat and derivatives such as milk and leather (See Illustration 6-2). Therefore, for the impact identification in the scenario without project, the means and components that are currently impacted by this activity were analyzed.

Illustration 6-2. Evidence of the development of livestock activity in the study area.
Source: INGEX, 2015.

6.2.1.1.1.2 Timber extraction

According to the study " State of Knowledge of the Northeast Wild Flora, Magdalena Medio and Bajo Cauca Antioqueño, carried out by CORANTIOQUIA in 2009", the natural forests of the study area are under intense pressure due to the expansion of the agricultural frontier, mainly for the establishment of pastures and illicit cultivation, for timber extraction and illegal mining.

Starting from the previous source and field verification during the LBSA data collection, timber extraction is identified as an activity developed in the study area (see Illustration 6-3) which generates impact on the abiotic, biotic and socioeconomic environments.

Illustration 6-3. Evidence of the development of timber extraction activity for the finding of trails and paths for transportation and movement of the material extracted in the study area.
Source: INGEX, 2015.

Some of the most commonly extracted species in the area, for purposes such as combustion element, construction of structures and rafts, are presented below in Table 6-14 and Illustration 6-4.

Table 6-14. Species mainly extracted from the project's area of influence

Scientific Name	Common Name	Principal use
Xylopia frutescens	Escubillo	Firewood
Lacmellea floribunda	Costillo de res	Firewood
Jessenia polycarca	Palma Mil Pesos	Roof wood
Jacaranda copaia (Aubl.) D. Don	Chingalé	Construction Timber
Jacaranda mimosifolia	Gualanday	Construction Timber
Ochroma lagopus	Balso	Floating rafts wood
Dacryodes colombiana Cuatrec	Anime	Construction Timber
Hymenaea courbaril Linneaus	Algarrobo	Construction Timber
Caryocar glabrum	Cagüí	Construction Timber
Calophyllum mariae Planch. & Triana	Aceite María	Construction Timber
Clathrotropis brunnea Amshoff	Sapán	Construction Timber
Ormosia paraense	Chocho	Craft wood
Humiriastrum procerum (Little) Cuatr.	Chanúl	Construction Timber.
Vismia baccifera (L.) Triana & Planch.	Carate	Firewood
Aniba sp	Canelo	Construction Timber
Caryodaphnopsis cogolloi	Yambé	Construction Timber
Nectandra lanceolata	Laurel Amarillo	Construction Timber
Cariniana pyriformis	Abarco	Construction Timber
Lecythis mesophylla	Coco cristal	Construction Timber
Lagerstroemia sp	Carbonero	Construction Timber
Huberodendron patinoi Cuatrec	Volador	Construction Timber
Cedrela odorata	Cedro	Construction Timber
Virola flexuosa	Soto	Construction Timber
Mincuartia guianensis	Punte e candado	Construction Timber
Coccoloba uvifera	Buche e pava	Construction Timber
Chrysophyillum cainito	Caimo	Construction Timber

Source: INGEX, 2015.

Illustration 6-4. Xylopia frutescens (Left), Chrysophyillum cainito (Right).
Source: INGEX, 2015.

6.2.1.1.1.3 Road Transit

Traffic on existing access roads also impact the abiotic, biotic and socio-economic environments (see Illustration 6-5).

Illustration 6-5. Access road to the existing project.
Source: INGEX, 2015.

6.2.1.1.1.4 Hunting

Hunting is defined as the activity of persecution or persistent harassment of someone or something. In this case, this activity was identified as the capture, destruction or collection of wild species for commercial purposes or for personal consume, risking the biodiversity of the place.

Among the species hunted mainly for meat purposes are the common bale (Agouti paca) (See Illustration 6-6) and the ñeque or guatín (Dasyprocta cf punctata), in the case of accidental hunting, felines, mainly jaguars and pumas (Onca Panther and Puma concolor, respectively).

Illustration 6-6. Common Paca (Agouti paca)
Source: INGEX, 2015.

6.2.1.1.1.5 Illegal Mining

Illegal mining is carried out in prohibited areas such as riverbanks, lagoons, basin headwaters and buffer zones of protected natural areas, which do not comply with the requirements of administrative, technical, social and environmental law.

Illegal and informal mining was identified in the study area (see Illustration 6-7), which generates indiscriminately impact on biotic, abiotic and socio-economic environments.

Illustration 6-7. Evidence of illegal and/or informal mining work in the study area.
Source: INGEX, 2015.

6.2.1.1.1.6 Domestic Hydric use

This activity refers specifically to the demand; use and exploitation of water resources at domestic level in the communities, altering water availability for other consumers and the physical-chemical quality of the resource (see Illustration 6-8).

Illustration 6-8. Settled population in the study area.
Source: INGEX, 2015.

6.2.1.1.1.7 Informal Trade

The informal economy or irregular economy refers to an activity that is hidden only for reasons of tax avoidance or administrative controls (e.g. undeclared domestic work, spontaneous street selling, or undervaluation of the price recorded in a property sale).

There are several causes that generate this type of trade in the study area, such as the high unemployment rate in the municipality, lack of opportunities and lack of attention to the agricultural sector (Lithuania, 2012).

In the scenario analysis without a project, informal trade was identified as an activity generating impact mainly on the socioeconomic environment due to the high number of people who carry out this activity for their economic livelihoods.

6.2.1.1.2 Identification and evaluation of impact

The above activities are presented below, components or means, and associated impact identified and supported by the evaluations calculated (see Table 6-15).

Table 6-15. Sample impact identification matrix. Scenario without project

MATRIZ DE IDENTIFICACIÓN		SIN PROYECTO							
Medio	Componente	Impactos / Actividad	Ganadería	Extracción de madera	Tránsito de vías	Cacería	Minería informal	Uso doméstico	Comercio informal
ABIÓTICO	Aguas superficiales	Cambio en el caudal disponible del recurso (oferta hídrica)	MEDIA					MEDIA	
		Sedimentación en cuerpos de agua					MEDIA		
		Alteración de la calidad fisicoquímica y microbiológica del agua	BAJA		BAJA		MEDIA	BAJA	
	Atmósfera (Aire/Ruido)	Cambio en la concentración de material particulado, gases y vapores en el aire			BAJA				
		Cambio en los niveles de presión sonora		BAJA	BAJA		BAJA		
	Suelo	Cambio en el Uso del Suelo	MEDIA	ALTA			ALTA		
		Alteración en las Propiedades Fisicoquímicas y Biológicas del suelo	BAJA				MEDIA		
	Geomorfología/Geotecnia	Fenómenos de Remoción en Masa/Formación de Fenómenos de Remoción en Masa					MEDIA		
		Procesos Erosivos	MEDIA						
BIÓTICO	Flora	Modificación de las coberturas vegetales	ALTA	ALTA	ALTA				
		Fragmentación de Ecosistemas	ALTA		ALTA	ALTA			
		Pérdida de Biodiversidad florística	MEDIA				MEDIA		
		Alteración en las especies de flora por el uso excesivo de herbicidas	MEDIA						
		Alteración en las comunidades de especies en peligro, en peligro crítico o vulnerable.		ALTA					
		Cambios en la oferta de biomasa y carbono.		MEDIA					
		Cambios en el micro-clima.		ALTA					
		Alteración en el funcionamiento de los estomas de las plantas.			MEDIA				
	Fauna	Pérdida de Biodiversidad faunística	MEDIA			ALTA			
		Desplazamiento de fauna	ALTA	ALTA	ALTA		ALTA		
		Alteraciones en el habitat y microhabitat		ALTA			ALTA		
		Atropellamiento de fauna			MEDIA				
		Alteraciones en redes troficas				MEDIA			
		Afectacion en la fauna asociada a cuerpos de agua					ALTA		
SOCIO-ECONÓMICO Y CULTURAL	Dimensión Demográfica	Variación en la distribución y ubicación de la población	ALTA				ALTA		
		Aumento en el transito de población por los accesos vias y caminos		MEDIA					
		Alto nivel de ocupación de personas género masculino		MEDIA					
		Alteraciones en las dinámicas del poblamiento			MEDIA				
	Dimensión Espacial	Aumento de programas de extensión rural	ALTA						
		Incremento en el nivel de asociación y agremiación	ALTA						
		Incremento en la demanda de ocupación de medios de transporte e infraestructura vial	ALTA	MEDIA	MEDIA		MEDIA		MEDIA
		Modificación en la estructura del paisaje	MEDIA	MEDIA		BAJA	BAJA		
	Dimensión Económica	Mayor generación de empleo	MEDIA	MEDIA	BAJA		BAJA		
		Alteraciones el la comercialización de las especies silvestres				MEDIA			
	Dimensión Cultural	Generación de costumbres y modismos en la actividad ganadera	ALTA				ALTA		
		Incremento del uso de la madera como material de combustión		MEDIA					
		Acceso a servicios y programas de intercambio cultural y deportivo			BAJA				
		Tipo de construcción		MEDIA					
	Dimensión Politico organizativa	Incremento en la adquisición de la propiedad	MEDIA						
	Tendencias de desarrollo	Incremento en el fortalecimiento económico	ALTA				ALTA		MEDIA
		Fortalecimiento del desarrollo economico integral		MEDIA	MEDIA				

Source: INGEX, 2016.

6.2.1.1.3 Analysis and interpretation of impact evaluation impact

The analysis and interpretation of the evaluation results is presented below.

6.2.1.1.3.1 Abiotic Environment

In the abiotic environment, three (3) impact (34%) were identified on the surface water component, two (2) impact (22%) on the atmospheric component, two (2) impact (22%) on the soil and two (2) impact (22%) on the geomorphology and geotechnical component (see Illustration 6 9). The total number of interactions is eighteen (18), eight (8) correspond to an average negative HS (44.44%), eight (8) to low negative HS (44.44%) and two (2) to high negative HS (11.1%). There are no positive interactions for the identified impact on the abiotic environment (see **Illustration 6-10).**

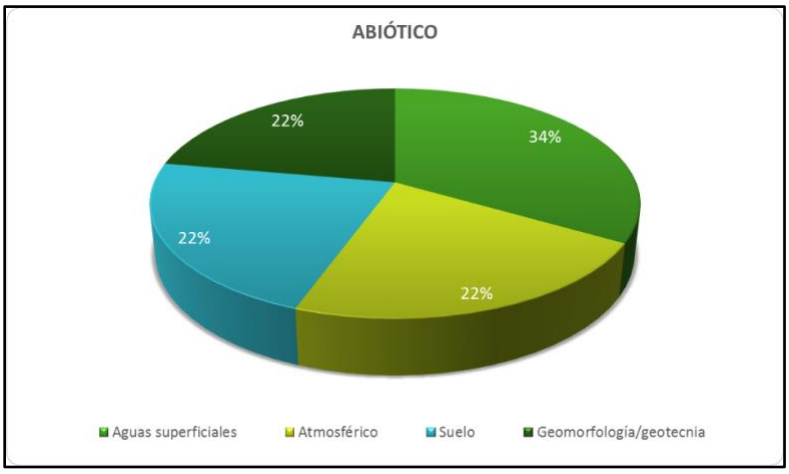

Illustration 6-9. Percentage distribution of impact on the abiotic environment
Source INGEX, 2016.

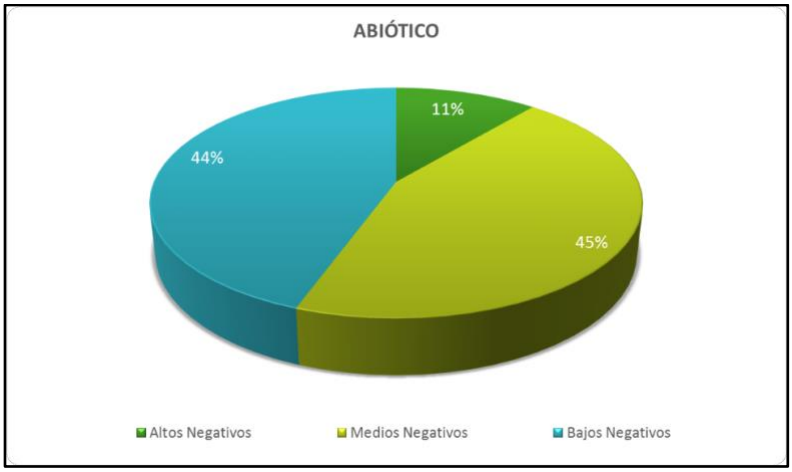

Illustration 6-10. Percentage distribution of impact on the abiotic environment
Source: INGEX, 2016.

In accordance with the foregoing, it is identified that the component on which the greatest number of impact fall is the surface waters of the area. These effects are mainly due to the execution of livestock, informal mining and domestic water use activities. It is important to mention that even though this component presents the greatest number of impact, the interactions identified did not exceed an average environmental significance; what happened with the soil component, which obtained high ES ratings for land use change for timber extraction and informal mining activities.

6.2.1.1.3.2 Biotic Environment

Eight (8) impact (57%) on the flora component and six (6) impact (43%) on the fauna component were identified. The total number of interactions is twenty-four (24); where sixteen (16) correspond to a high negative ES (67%) and eight (8) mean negative ES (33%). There are no positive impact and interactions. (See Illustration 6-12).

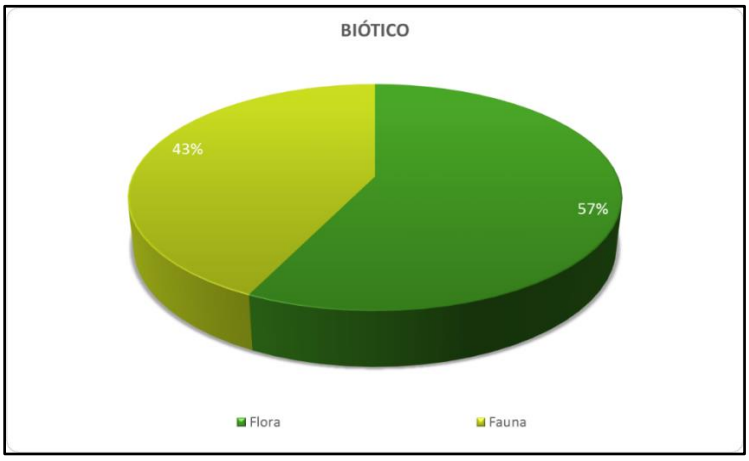

Illustration 6-11. Percentage distribution of impact on the biotic environment.
Source: INGEX, 2016.

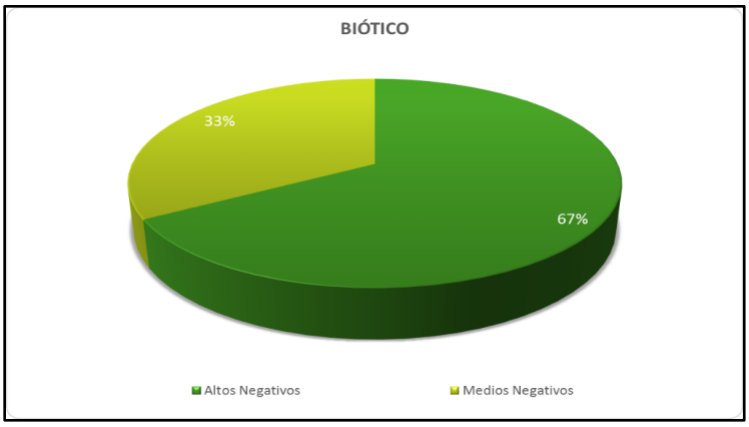

Illustration 6-12. Percentage distribution of impact on the biotic environment.
Source: INGEX, 2016.

The biotic environment is mainly impacted by livestock activities, timber extraction, road traffic, hunting and informal mining, in which flora the component with the greatest number of impact is generated by these activities. The "modification of vegetation cover" and "ecosystem fragmentation" was the impact that received the greatest number of interactions with high environmental significance and timber extraction activity was the activity that generated the greatest number of impact on the flora component.

On the other hand, for the fauna component, it was identified that "Fauna displacement" is the impact that arises during the execution of a greater number of activities. Informal mining is the activity developed in the region which generates more impact on this component, by affecting fauna associated with water bodies, alteration and displacement in habitat and microhabitat.

6.2.1.1.3.3 Socio-Economic and Cultural Environment

In the project scenario, 17 impacts were identified for the socioeconomic environment, 4 impacts for the demographic dimension (23%), 4 impacts for the spatial dimension (23%), 2 impacts for the economic dimension (12%), 4 impacts for the cultural dimension (24%), 1 impact for the organizational political dimension (6%) and 2 for development trends (12%). (See Illustration 6-13)

The total number of interactions is thirty-two (32), where two (2) correspond to a low negative ES (6.3%), six (6) medium negative ES (18.8%), three (3) low positive ES (9.4%), twelve (12) an average positive ES (37.5%) and nine (9) interactions obtained a high positive ES (28.1%) (See Illustration 6-14).

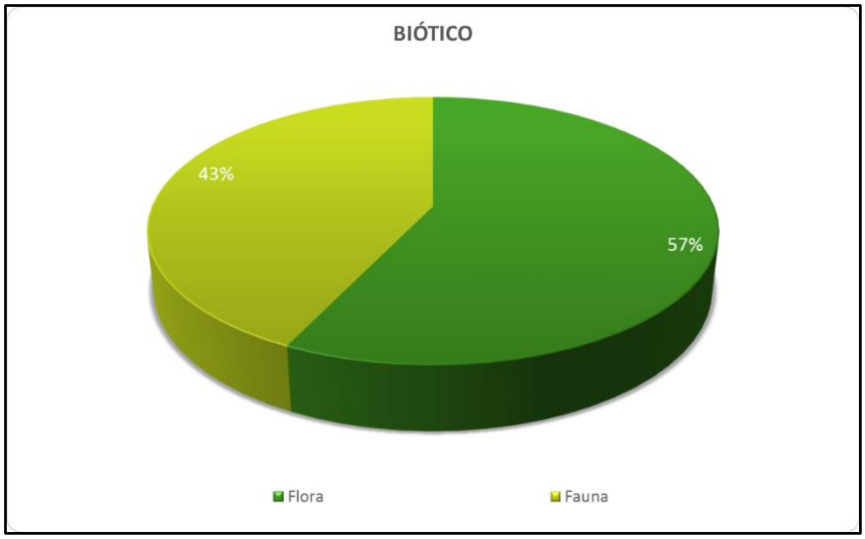

Illustration 6-13. Percentage distribution of impact on the socio-economic environment.
Source: INGEX, 2016.

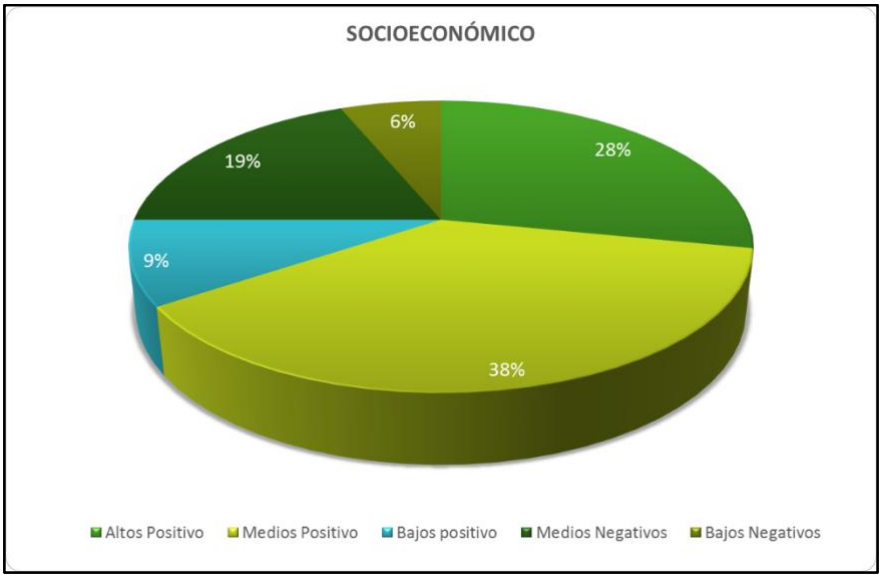

Illustration 6-14 Percentage distribution of impact on the socio-economic environment.
Source: INGEX, 2016.

According with the above, it is identified that in the project's area of influence, livestock, timber extraction, road traffic, hunting, informal mining, and informal trade activities mostly generated positive impact and interactions, thus affirming the need to implement these activities for the economic livelihoods of the region's families.

The most significant impact of these activities is the generation of employment, followed by an increase in economic strengthening and the rising for transportation occupancy.
Negative interactions are generated mainly by the modification of the landscape as a consequence of the opening of roads, pastures and areas for livestock, the construction or establishment of infrastructures for the development of mining and the transportation of extracted wood.

The activity generating most interactions on the dimensions of the socioeconomic environment was livestock farming with a total of 6 high positive interactions, 2 medium positive and 1 medium negative.

6.2.1.2 Scenery with project

6.2.1.2.1 Impact generating Activities

The project activities that may generate impact in the area of influence are presented by stages in Illustration 6 15 according to Chapter 2. Project description.

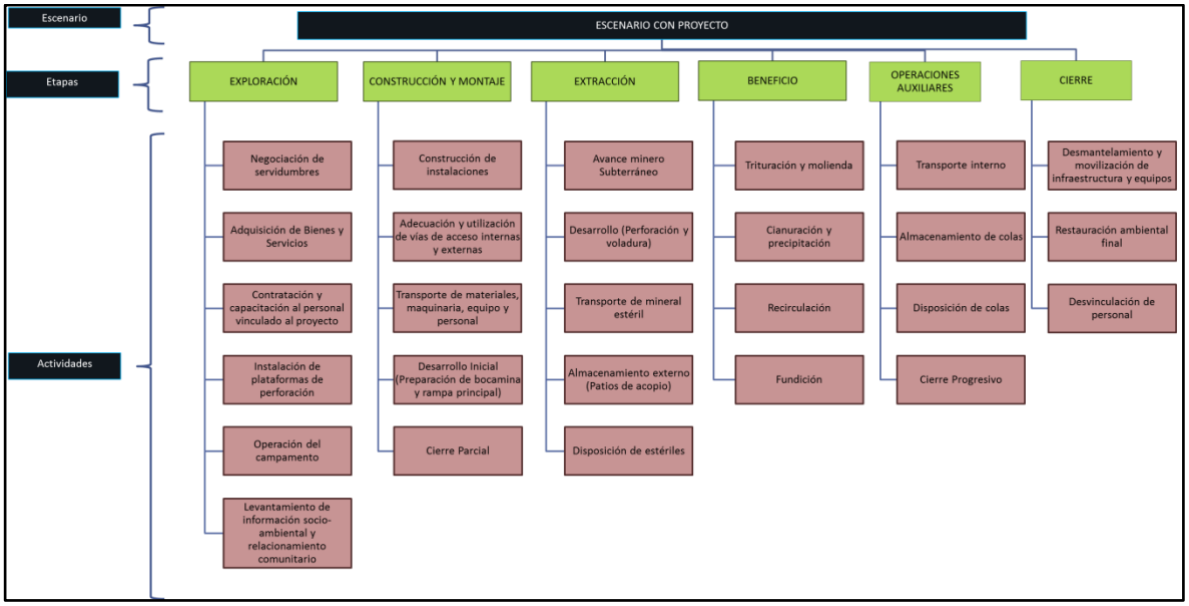

Illustration 6-15. Impacting activities by project stages.
Source: INGEX, 2016.

6.2.1.2.2 Identification and Impact Evaluation

The previous activities, components or environment, and associated impact identified and supported by the calculated evaluations are presented below (See Table 6-16).

Table 6-16. Impact Evaluation matrix, scenario with project.

MATRIZ DE IDENTIFICACIÓN		CON PROYECTO																																		
		Etapa	Exploración Exploración 2003 - 2005						Construcción y montaje Mes 1 - Mes 2					Explotación																					Cierre Año 12 - Año 14		
														Extracción Año 1 - Año 13					Beneficio Año 1 - Año 13				Operaciones auxiliares Año 1 - Año 13													
MEDIO	Componente	Impactos / Actividad	Negociación de servidumbres	Adquisición de Bienes y Servicios	Contratación y capacitación al personal vinculado al proyecto	Instalación de plataformas de perforación	Operación del campamento	Levantamiento de información socioambiental y relacionamiento	Construcción de instalaciones	Adecuación y utilización de vías de acceso internas y externas	Transporte de materiales, maquinaria, equipo y personal	Desarrollo Inicial (Preparación de bocamina y rampa principal)	Cierre Parcial	Avance minero-Subterraneo	Desarrollo (Perforación y voladura)	Transporte de mineral estéril	Almacenamiento externo (Relleno de escombro)	Disposición de estériles	Trituración y molienda	Clasificación y precipitación	Recirculación	Fundición	Transporte interno	Almacenamiento de colas	Disposición de colas	Cierre Progresivo	Desmantelamiento y movilización de infraestructura y equipos	Restauración ambiental final	Desvinculación de personal
ABIÓTICO	Aguas superficiales	Cambio en el caudal disponible del recurso [oferta hídrica]				BAJA	MEDIA		BAJA				MEDIA		MEDIA				MEDIA	MEDIA	MEDIA						MEDIA			
		Sedimentación en cuerpos de agua				BAJA											BAJA							BAJA						
		Afectación de la calidad fisicoquímica y microbiológica del agua				BAJA	MEDIA			BAJA							BAJA		MEDIA	MEDIA				BAJA						
	Atmósfera (Aire/Ruido)	Cambio en la concentración de material particulado, gases y vapores en el aire							BAJA	BAJA	BAJA	BAJA			BAJA	BAJA	BAJA	BAJA					BAJA	BAJA	BAJA		BAJA		
		Cambio en los niveles de presión sonora				BAJA	BAJA		BAJA	BAJA	BAJA	BAJA		BAJA	BAJA	BAJA	BAJA		BAJA				BAJA						
	Suelo	Cambio en el Uso del Suelo				MEDIA			MEDIA																					
		Afectación en las Propiedades Fisicoquímicas y Biológicas del suelo							ALTA								BAJA							BAJA	BAJA				
	Geomorfología/Geotecnia	Generación de fenomenos de remoción en masa/Generación estabilidad de taludes							BAJA	BAJA				MEDIA	MEDIA														
		Cambio en la Unidad Geomorfologica/Generación estabilidad de taludes				MEDIA	ALTA		ALTA	ALTA		ALTA	ALTA				ALTA	ALTA					ALTA	ALTA	ALTA		ALTA		
BIÓTICO	Flora	Modificación de las coberturas vegetales				MEDIA	ALTA					ALTA																	
		Fragmentación de ecosistemas					ALTA																						
		Pérdida de Biodiversidad florística				ALTA																							
		Afectación en el crecimiento de las comunidades floristicas y deterioro fitosanitario.							ALTA	ALTA																			
		Sucesión vegetal.											ALTA													ALTA			
		Recuperación en la dinámica poblacional.											ALTA																
		Restauración ecológica.																								ALTA		ALTA	
		Cambios en el micro-habitat y demás características del bosque.											ALTA																
		Afectación en el funcionamiento de los estomas de las plantas.							MEDIA	MEDIA	MEDIA	MEDIA											MEDIA	BAJA	BAJA				
	Fauna	Desplazamiento de fauna				MEDIA	MEDIA		ALTA	ALTA		MEDIA		MEDIA	MEDIA											MEDIA			
		Ahuyentamiento de fauna						MEDIA																					
		Afectaciones en el habitat y microhabitat							ALTA								MEDIA	MEDIA											
		Afectacion en los parametros comportamentales													MEDIA									MEDIA	MEDIA		MEDIA		
		Atropellamiento de fauna								MEDIA	MEDIA					MEDIA							MEDIA						
		Manipulación de fauna silvestre						MEDIA																					
		Recuperación en la dinámica comunidad biótica											MEDIA														MEDIA		MEDIA	
SOCIO-ECONÓMICO Y CULTURAL	Dimensión Demográfica	Variación en la distribución y ubicación de la población		ALTA																							ALTA			ALTA
		Alto nivel de ocupación de personas																												
		Afectaciones en las dinámicas del poblamiento										ALTA	ALTA																	
	Dimensión Espacial	Mayor demanda de los servicios públicos y sociales		MEDIA		ALTA		ALTA	ALTA																		MEDIA			
		Incremento en la demanda de ocupación de predios de transporte e infraestructura vial		ALTA		ALTA	ALTA																							
		Ocupación de infraestructura y espacios locativos									ALTA		ALTA																	
		Modificación en la estructura del paisaje				ALTA			ALTA	ALTA	ALTA	ALTA	ALTA		ALTA	ALTA	ALTA	ALTA	ALTA					ALTA			ALTA	ALTA		
	Dimensión Económicas	Generación de empleo.		ALTA	ALTA	ALTA	ALTA	ALTA	ALTA	ALTA	ALTA	ALTA	ALTA	ALTA	ALTA	ALTA	ALTA	ALTA	ALTA	ALTA	ALTA	ALTA	ALTA	ALTA			ALTA	ALTA		
		Cambio del ingreso percápita de los propietarios contratistas	MEDIA																											
		Cambio en la demanda y oferta de productos, bienes y servicios							ALTA	ALTA		ALTA	ALTA																	MEDIA
		Disminución del empleo																									ALTA			ALTA
		Aumento en la inversión social		ALTA				ALTA																				ALTA		
	Dimensión Cultural	Modificación de los habitos y de las practicas culturales de la informalidad en los desempeños de la función minera.			ALTA																									
		Incremento de la integración comunitaria local y regional						ALTA																						
		Incremento en la transmisión de conocimientos						ALTA																						
		Inserción de procesos tecnológicos													ALTA															
	Dimensión Político Organizativa	Fortalecimiento del relacionamiento institucional y comunitario											ALTA														ALTA			
		Atención en la participación sectorial						ALTA																						
	Tendencias de desarrollo	Incremento en el fortalecimiento económico		ALTA					ALTA																					ALTA
		Cambios en las dinámicas de vida												ALTA																
		Fortalecimiento del desarrollo economico integral															ALTA													
	Arqueología	Afectación del patrimonio Arqueológico							BAJA			BAJA		BAJA	BAJA															

Source: INGEX, 2016

6.2.1.2.3 Analysis and interpretation of impact evaluation

The analysis and interpretation of the evaluation results is presented below.

6.2.1.2.3.1 Abiotic Environment

In the abiotic environment project with scenario, three (3) impact (34%) on the surface water component, two (2) impact (22%) on the atmospheric component, two (2) impact (22%) on the soil component, and two (2) impact (22%) on the geomorphology and geotechnical component were identified. (See Illustration 6 9). A total of 65 interactions were obtained, of these interactions, 11 obtained a HIGH Negative SA (17%), 12 obtained a MEDIA Negative SA (18%), 39 interactions obtained a LOW Negative SA (60%), and 3 interactions obtained a MEDIA Positive SA.

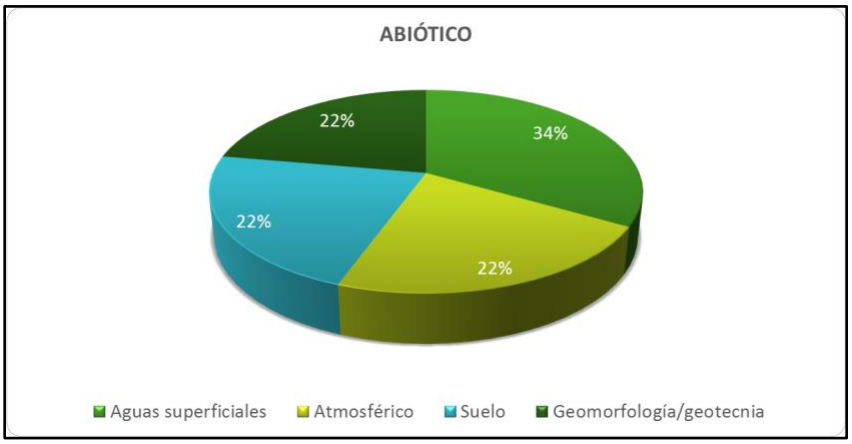

Illustration 6-16 Percentage distribution of impact on the abiotic environment.
Source: INGEX, 2016.

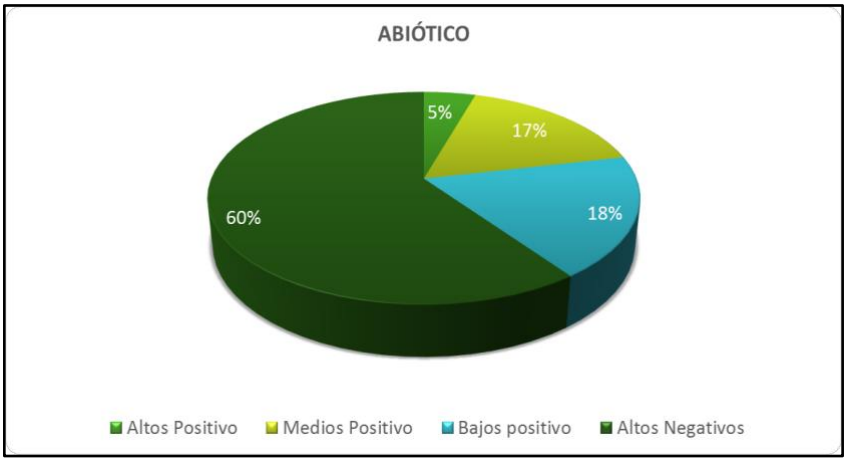

Illustration 6-17. Percentage distribution of interactions identified for the abiotic environment in the project scenario.
Source: INGEX, 2016.

In accordance with the above, the component in which a greater number of interactions were identified is the atmospheric component, i.e. it is more impacted throughout the development of each stage of the project. These interactions had low environmental significance.

On the other hand, the component was assessed with high environmental significance is geomorphology/geotechnology, specifically for the impact "Change in the Geomorphological Unit" in the exploration, construction, assembly, extraction and auxiliary operations stages.

The stages in which the most impacting activities are developed are the construction facilities, road adaptation, material transportation, the initial development, construction, assembly, mining progress, development, external storage and disposal of tailings in the extraction stage.

6.2.1.2.3.2 Biotic Environment

In the scenario project for biotic environment, 9 impact on the flora component (56%) and 7 impact on the fauna component (44%) were identified. (See Illustration 6 18). A total of 44 interactions were obtained, of these interactions, 10 obtained a HIGH Negative (23%) environmental significance, 24 MEDIUM Negative significance. (55%), 2 interactions obtained a LOW Negative ES (4%), 5 a HIGH Positive ES (11%) and 3 a MEDIA Positive ES (7%). See **Illustration 6-19**.

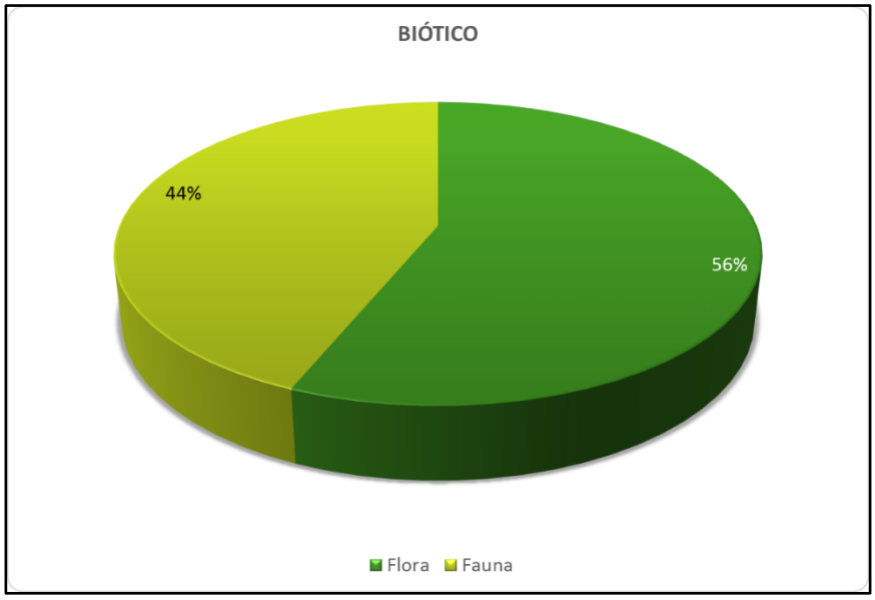

Illustration 6-18. Percentage distribution of impact on the biological environment.
Source: INGEX, 2016.

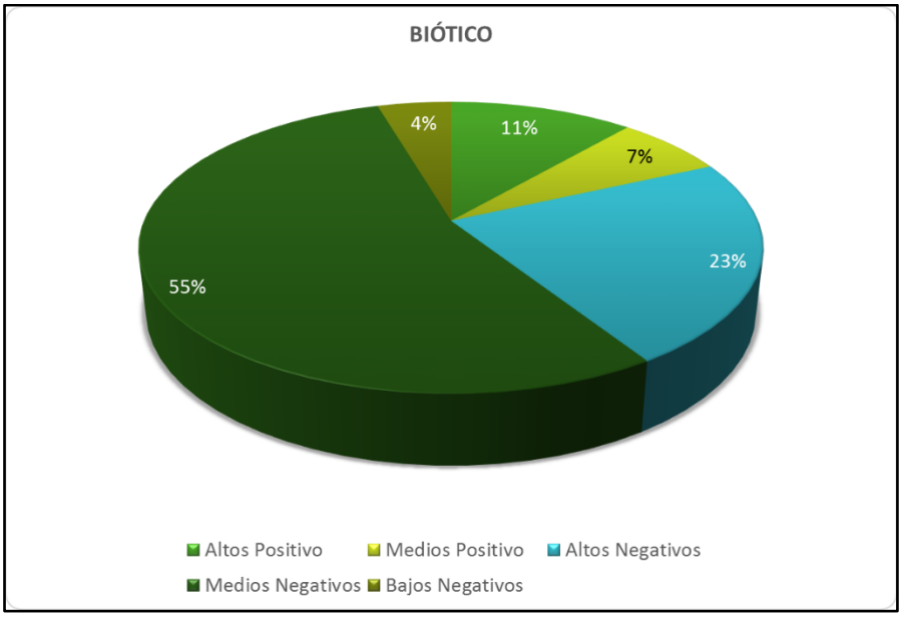

Illustration 6-19. Percentage distribution of interactions identified for the biotic environment in the project scenario.
Source: INGEX, 2016.

The biotic environment has more interactions with negative medium ratings. Flora is the component on which most impact is produced.

The fauna displacement is the impact that most affects the activities execution in each stage. The construction and assembly stage is the one that generates the greatest number of interactions on the fauna and flora components.
This environment presents positive interactions due to the execution activities such as partial and progressive closure in the construction, assembly and auxiliary operations stages, increasing plant succession, recovery in the population dynamics and ecological restoration.

6.2.1.2.3.3 Socio-economic and cultural Environment

In the project with scenario, 22 impact for the socioeconomic environment were identified, 2 impact for the demographic dimension (9%), 4 impact for the spatial dimension (19%), 5 impact for the economic dimension (24%), 4 impact for the cultural dimension (19%), 2 impact for the organizational political dimension (10%), 3 for development trends (14%) and an impact for the archaeological component (5%). (See Illustration 6 20). A total of 81 interactions were obtained; from these interactions, 56 obtained a HIGH (69%) positive environmental significance, 5 a MEDIUM positive significance. (6%), 15 a Negative HIGH (19%) significance, 1 interaction a Negative MEDIA (1%) significance and 4 interactions obtained a Negative LOW (5%) environmental significance. See Illustration 6-21.

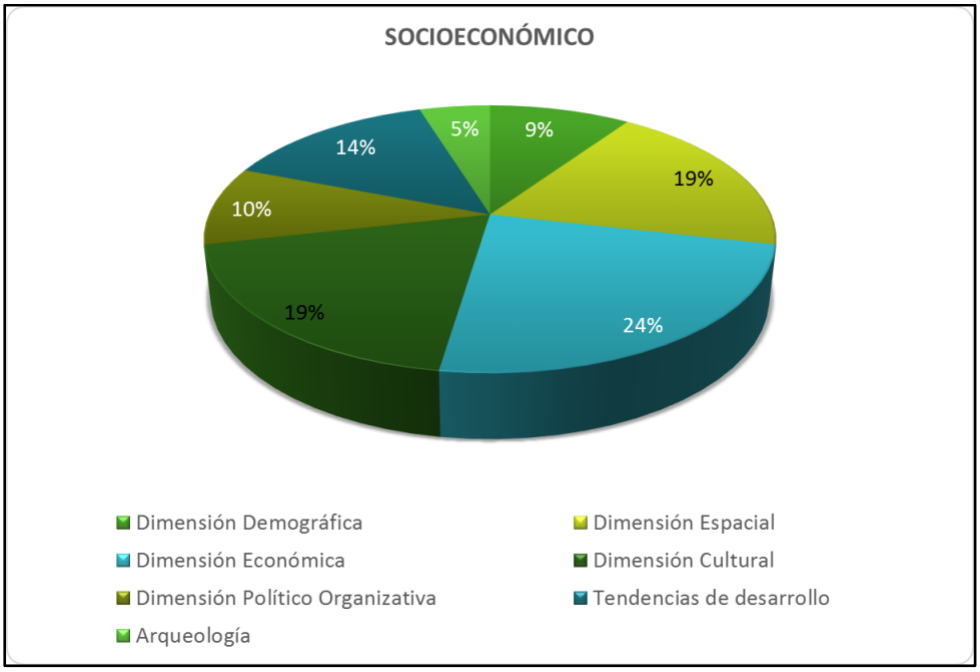

Illustration 6-20. Percentage distribution of impact on the socio-economic environment.
Fuente: INGEX, 2016.

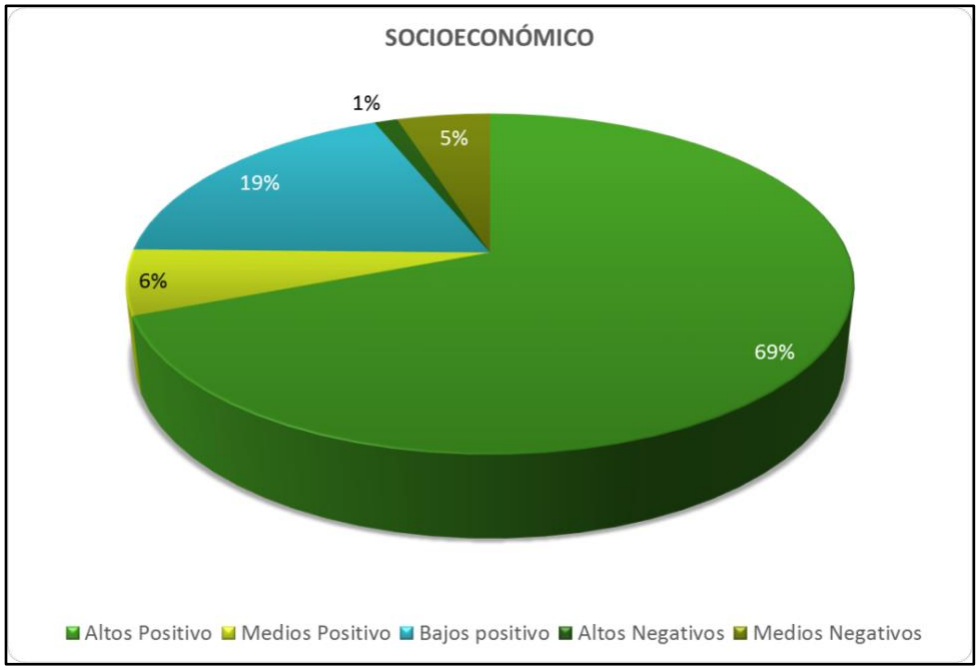

Illustration 6-21. Percentage distribution of interactions identified for the socio-economic environment in the project scenario.
Source: INGEX, 2016.

According to the above, it is concluded that the development of the mining project in the area of influence generates more interactions with high positive ratings than negative, specifically those identified for the "employment generation" impact, with this positive effect occurring during the development of all stages.

The negative interactions identified for this environment are mainly generated by the landscape modification as a result of the execution of activities in the construction and extraction stages. There are interactions related to the closure of the project due to the disconnection of staff and changes in capital inflows by the contractor owners. Similarly, the stage with the greatest number of interactions generating impact on the dimensions of the environment is the construction and assembly stage. For all significant impact, management measures are applied.