ENVIRONMENTAL IMPACT STUDY FOR THE RUMICHACA – PASTO DUAL CARRIAGEWAY ROAD PROJECT, PEDREGAL – CATAMBUCO SPAN, UF. 4 ANDUF. 5.1., CONCESSION CONTRACT UNDER SCHEME APP NO. 15 OF 2015

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CHAPTER 9. Environmental management zoning

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TABLE OF CONTENTS

INDEX OF TABLES

INDEX OF FIGURES

9. Environmental Zoning

9.1. Introduction

The Environmental Management Zoning is the result of interrelating the sensitivity biotic, abiotic and socio-economic zoning of the area, vis-à-vis the environmental assessment of the activities to be carried out in the project area (functional units 4 and 5.1), by determining the possible intervention levels.

Likewise, Chapter 8: Environmental Assessment defines project activities with the potential of generating critical severe and moderate environmental impacts.

So in order to define project's Environmental Management Zoning, based on the analysis of these two aspects to pinpoint the areas where project interventions will occur and that require special measures, very restrictive measures (geotechnical works), compensation measures (reforestations, isolations), or medium and low restriction measures where environmental management measures will be implemented..

This is how this analysis becomes the starting point to formulate the environmental management plan of the project, in order to prevent, mitigate, control, restore and compensate identified impacts that could arise in development hereof.

9.1. Methodology

The methodology to analyze and list the environmental zoning of the area of influence of the project and impact evaluation consisted in developing two main steps:

a) Review the areas with different abiotic, biotic and socio-economic sensitivities taking into account the project activities that generate potential critical, severe and moderate impacts during the construction phase, the operation phase or during the two project implementation phases, in order to establish the desired environmental management category. The criteria used for this purpose were legal, social and ecological.

b) Identify and review areas with environmental risk characteristics, taking into account project activities that generate potential severe, moderate and high impacts during the construction and operation phases in order to establish the recommended environmental management category.

Having identified and qualified the areas under different types of management, these were subdivided into management units based on the major attributes characterizing them, and then define the restrictive measures or practices to be implemented for each project activity in terms of potential severe and moderately high impacts during the project phases. The classification used met the terms of reference for Environmental Impact studies for Construction of Road Projects, stipulated by the MADS in Resolution 751 of 2015.

Each management unit was analyzed in a qualitative and quantitative manner, using geographical information systems where the units are classified into the following areas:

- Exclusion Areas.
- Intervention with restrictions areas.
- Intervention areas.

9.2.1 Exclusion Areas

Are the areas that cannot be intervened by project activities. The exclusion criterion is considered to be related to legal criteria, environmental vulnerability and functionality of the area, and with the nature of special regime areas.

9.2.2 Areas of intervention with restriction

These are areas where special management and restrictions must be considered in line with project activities and phases and with the environmental vulnerability of the area. Degrees and types of restrictions and conditions thereof must be established. Three categories (high, medium, and low) must be presented.

9.2.3 Free intervention areas

These are areas where the project can be developed with environmental management according to the activities.

Table 9.1 shows environmental management zoning classification, including all restrictions.

Table 9.1 Environmental management zoning classification

RESTRICTION	SYSTEM	PARAMETER	HIERARCHICAL CLASSIFICATION
EXCLUSION	Control areas	Riparian corridor	30 meters corridor. Article 83 of Decree 2811 (18/12/1974); Article 3 of Decree 1449 (27/06/1977). Fountainheads, corridors Article 45
HIGH RESTRICTION	Control areas	EOT conservation areas	Area of natural forest conservation, water protection areas, environmental recovery areas and forest development areas, soil conservation and ecological restoration areas and integrated management district area for future declaration process
	Control areas	Riparian corridor	Bodies of water with their respective corridor, where drainage works must be built (box culverts and sewage (bridges, artificial lentic type water bodies that will be intervened because they are in road construction strip and its lateral safety zone
	Environment characteristics	Wooded covers, rivers	Dense forests, secondary or transitional vegetation and shrubs
		High slopes	>100%, 50 - 100%
		Risk/Erosion	High risk/Slight to severe threat

	Socio-economic dimension	Housing	Presence
		Production associated infrastructure (Roads, paths, water holes, sugar press, warehouse), Utilities infrastructure (counties aqueduct, power, sewer)	Intersection
		Areas with high archeologic potential	Requires implementing measures (surveys, archeological recovery and/or monitoring)so the project can be built
MEDIUM RESTRICTION	Environment characteristics	Soil cover	Wooded pastures
		Moderate slopes	30 - 50%
		Risk/Erosion	Low risk/Slight to severe threat
	Socio-economic dimension	Areas with medium and low archeological potential	Requires implementing measures (surveys, archeological recovery and/or monitoring)so the project can be built
LOW RESTRICTION	Environment characteristics	Soil cover	Urban areas, road and rail networks and associated terrains, denuded and degraded land, clean pastures
		Moderate to low slopes	0 – 30 %
		Risk/Erosion	No risk/Moderate to severe threat

Source (Géminis Consultores Ambientales, 2016)

9.3. Analysis results

9.3.1 Abiotic environment management zoning

As shown in Table 9.2, the area of influence of the abiotic environment is divided into *exclusion* zones with an area of 342.18 hectares (17.70%), *high restrictions* zones with an area of 140.02 hectares (7.24%); *medium restriction zones* with an extension

of 975.95 hectares (50.47%); in areas with *low restrictions* with an area of 102.99 hectares (5.33%) and in *intervention* areas with an extension of 372.45 hec (19.26%).

Table 9.2 Abiotic environment management zoning

ABIOTIC ENVIRONMENT MANAGEMENT ZONING	AREA OF INFLUENCE (HEC)	%
Exclusion	342,18	17,70
High restriction	140,02	7,24
Medium restriction	975,95	50,47
Low restriction	102,99	5,33
Intervention	372,45	19,26

Source (Géminis Consultores Ambientales, 2016)

Figure 9-1 and Figure 9-2 show the results obtained for the project's abiotic environment management zoning.

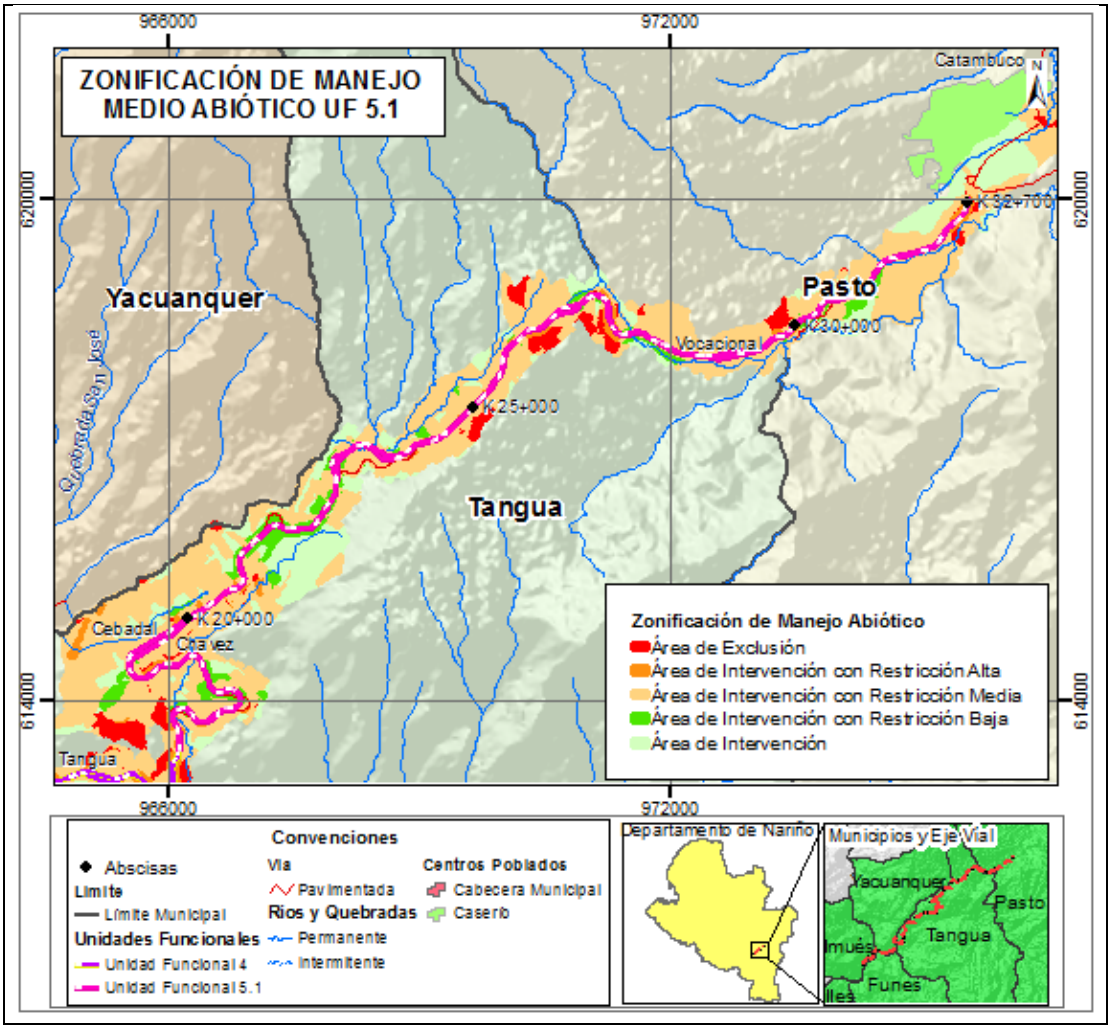

Figure 9-1 Abiotic environment management zoning UF 5.1

Source: (Géminis Consultores Ambientales, 2016)

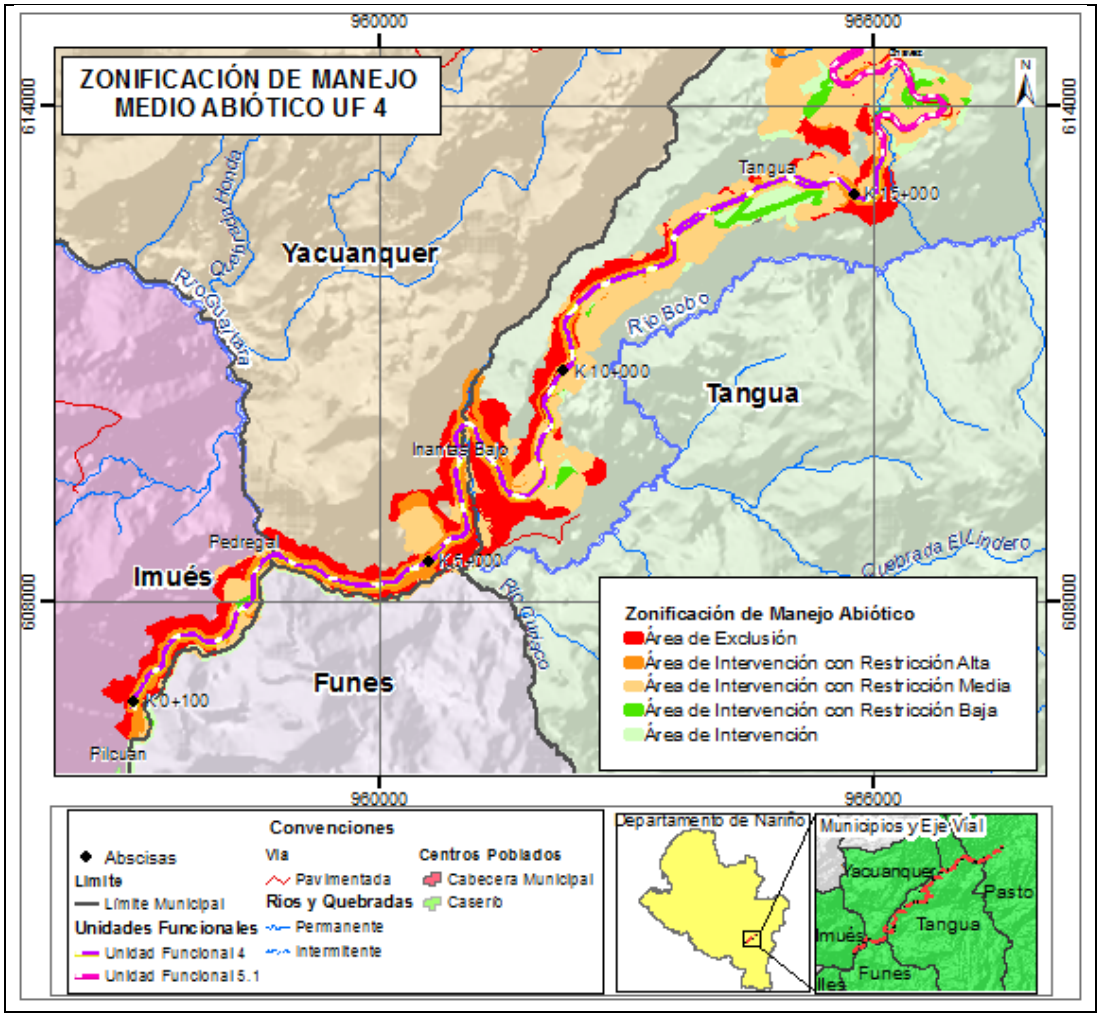

Figure 9-2 Abiotic environment management zoning UF 4

Source: (Géminis Consultores Ambientales, 2016)

9.3.2 Biotic environment zoning

The biotic environment of the area of influence is divided into *exclusion* zones with an area of 224.94 hectares (11.63%) *high restrictions* zones with an area of 149.71 hectares (7.74%); *medium restriction zones* with an extension of 378.66 hectares (19.58%); *low restrictions zones* with an area of 899.42 hectares

(46.51%) and *intervention zones* with an area of 280.87 hectares (14.53%), as shown in Table 9.3.

Table 9.3 Biotic environment management zoning

BIOTIC ENVIRONMENT MANAGEMENT ZONING	AREA OF INFLUENCE (HEC)	%
Exclusion	224,94	11,63
High restriction	149,71	7,74
Medium restriction	378,66	19,58
Low restriction	899,42	46,51
Intervention	280,87	14,53
TOTAL	**1933,6**	100,00

Source: (Géminis Consultores Ambientales, 2016)

Figure 9-3 and Figure 9-4 show the results obtained for the project's biotic environment management zoning.

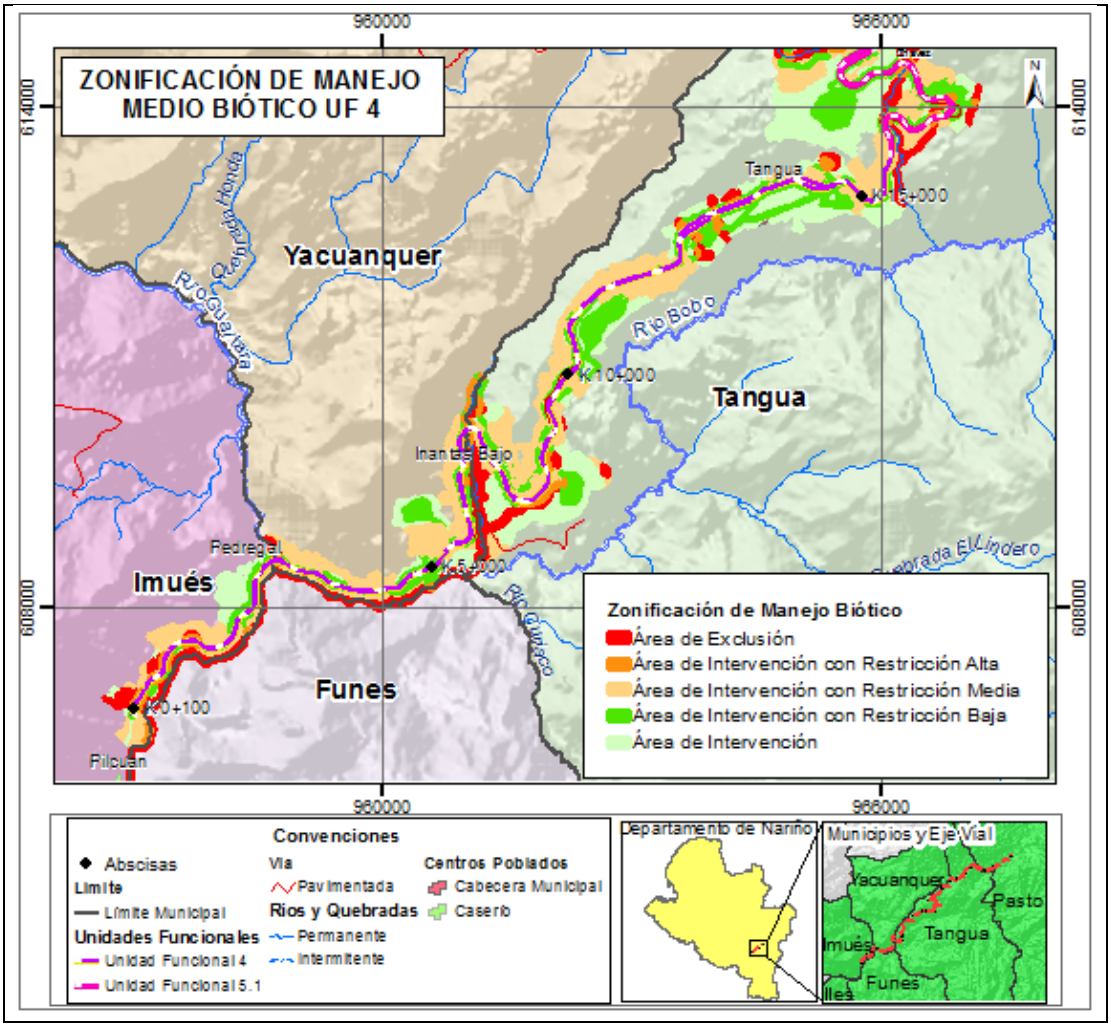

Figure 9-3 Biotic environment management zoning UF 4

Source: (Géminis Consultores Ambientales, 2016)

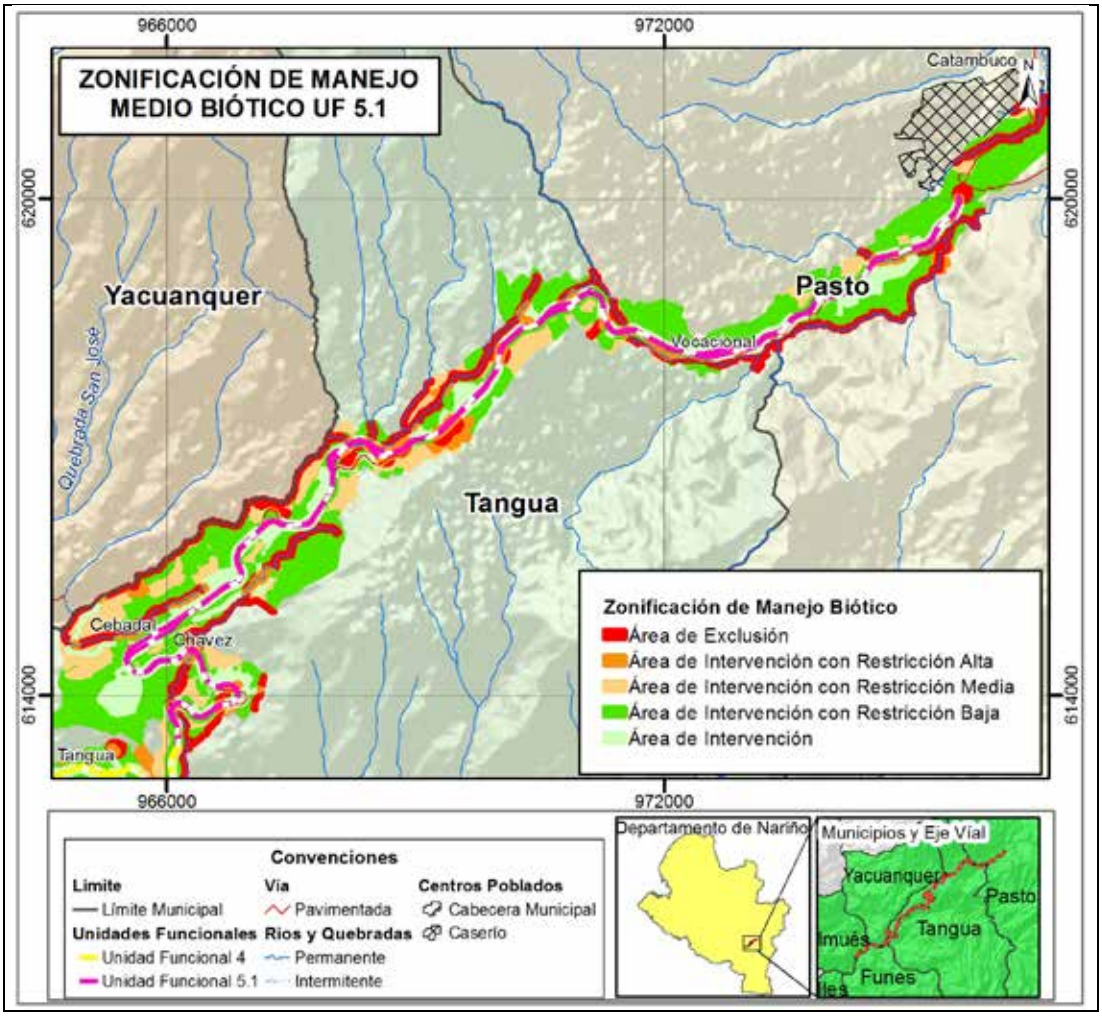

Figure 9-4 Biotic environment management zoning UF 5.1

Source: (Géminis Consultores Ambientales, 2016)

9.3.3 Socio-economic environment management zoning

The socio-economic environment of the area of influence as is shown in Table 9.4 is divided into *exclusion* zones with an extension of 146.95 hectares (7.60%), *high restriction* zones with an area of 106.65 hectares (5.52%); *medium restriction zones* with an extension of 629.59 hectares (32.56%); in zones with *low restrictions* with an area

of 147.10 hectares (7.61%); and in *intervention areas* with an extension of 903.31 hectares (46.72%).

Table 9.4 Socio-economic management environmental zoning

SOCIO-ECONOMIC MANAGEMENT ENVIRONMENTAL ZONING	AREA OF INFLUENCE	%
Exclusion	146,95	7,60
High restriction	106,65	5,52
Medium restriction	629,59	32,56
Low restriction	147,10	7,61
Intervention	903,31	46,72
TOTAL	**1933,6**	100,00

Source (Géminis Consultores Ambientales, 2016)

Figure 9-5 shows results obtained for the socio-economic environment management zoning for the project.

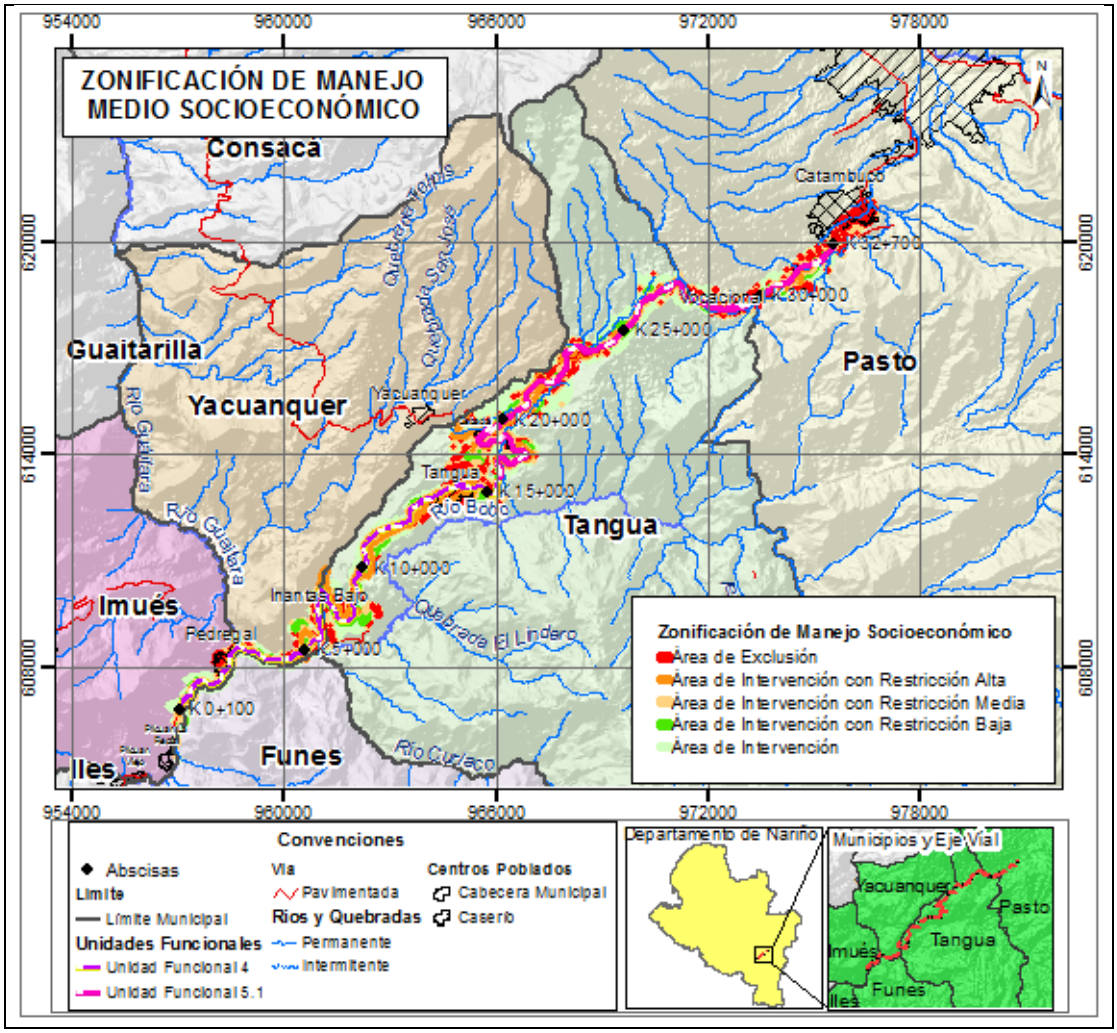

Figure 9-5 Socio-economic management environmental zoning

Source: (Géminis Consultores Ambientales, 2016)

9.3.4 Total management zoning

The area of influence is divided into *exclusion* zones with an extension of 151.11 ha (7.82%), *high restriction zones* with an area of 113.21 hectares (5.86%); *medium restriction* zones with an extension of 575.64 hectares (29.77%); in areas with *low*

restrictions with an extension of 796.20 hectares (41.18); and in *intervention areas* with an extension of 297.42 hectares (15.38%), as shown in Table 9.5.

Table 9.5 Total management environmental zoning

TOTAL MANAGEMENT ENVIRONMENTAL ZONING	AREA OF INFLUENCE	%
Exclusion	151,11	7,82
High restriction	113,21	5,86
Medium restriction	575,64	29,77
Low restriction	796,20	41,18
Intervention	297,42	15,38
TOTAL	**1933,6**	100,00

Fuente (Géminis Consultores Ambientales, 2016)

Figure 9-6 and Figure 9-7 show the results obtained for the total environment management zoning for the project.

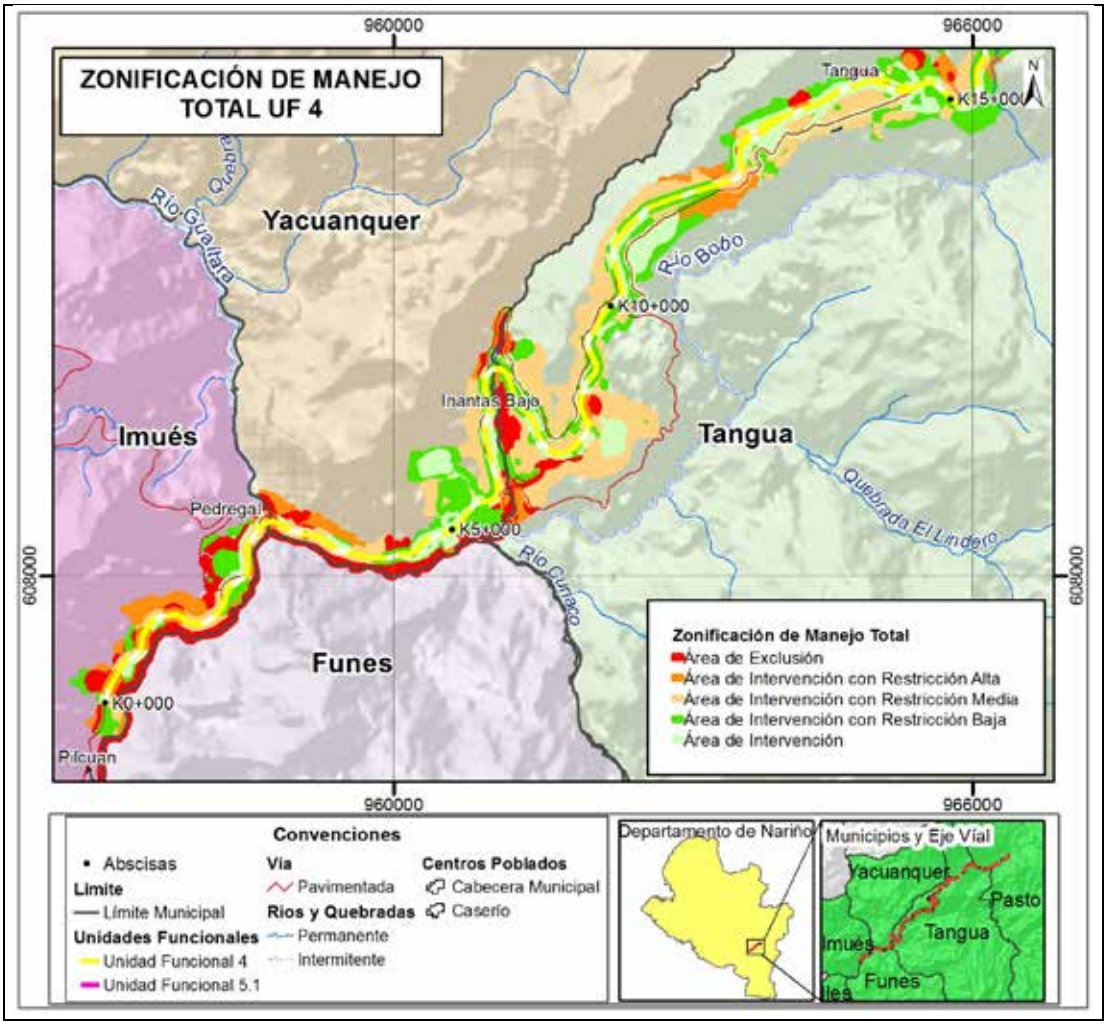

Figure 9-6 Total management zoning UF 4

Source: (Géminis Consultores Ambientales, 2016)

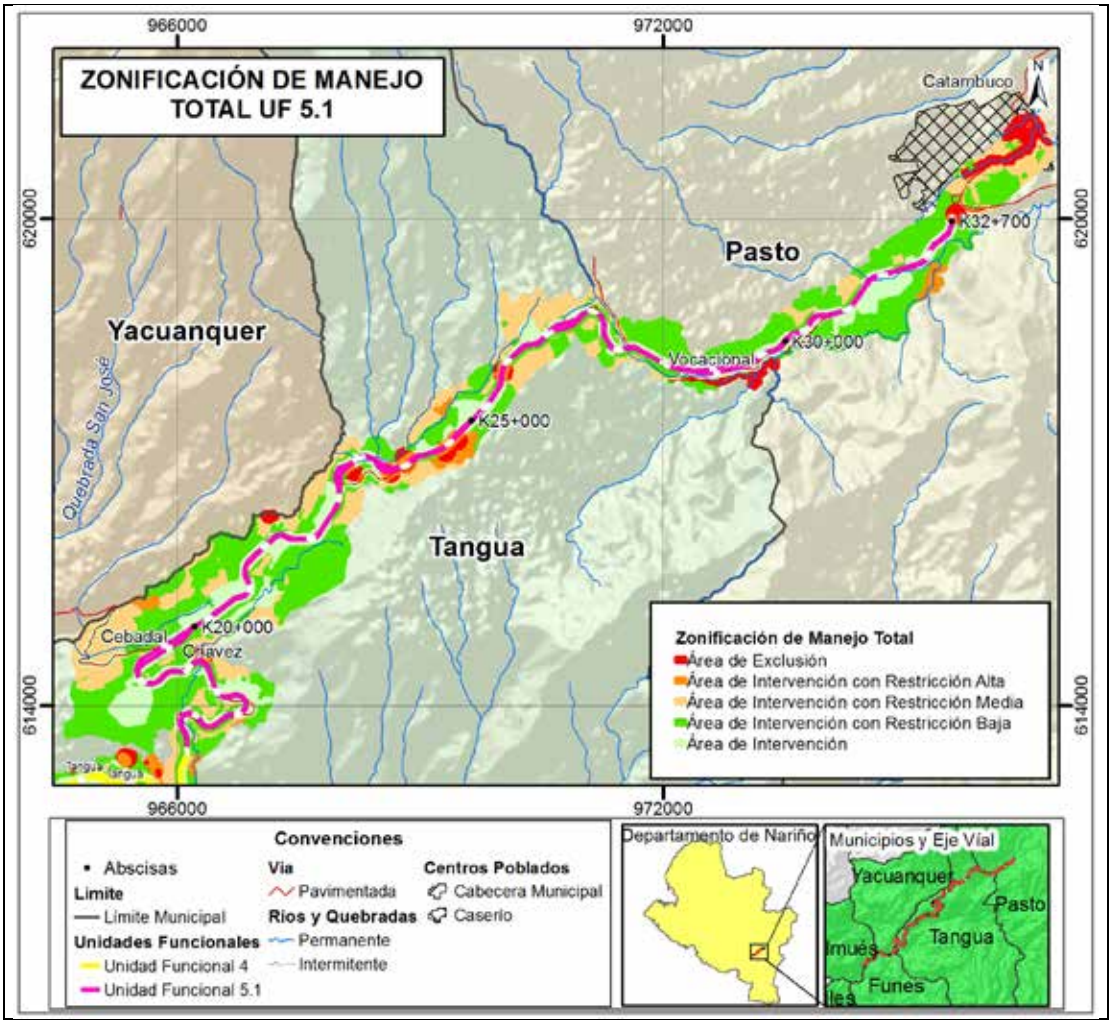

Figure 9-7 Total management zoning UF 5.1

Source: (Géminis Consultores Ambientales, 2016)

Follows some basic types of precautionary measures and correct environmental management that should be taken into consideration during any project activity in the high, medium or low restriction areas.

9.4 Management of determined areas

9.4.1 Exclusion

According to the results obtained from the total environmental zoning, the areas with restriction for project any intervention are defined including the riparian corridors valued as **areas of high sensitivity**, which are areas of exclusion for any project intervention; by law waterways and water should be protected.

Follows environmental management measures:

In accordance with current environmental regulations, these are forests and fountainheads protection areas. The project's layout does not provide for the intervention of any protected area; however, it will impact wooded areas reason why a forest use permit must be requested and therefore compensation must be made, according to the guidelines of the Manual for Compensation Allocation for Biodiversity Losses.

Listed below are the environmental management measures:

The project's layout will indirectly affect this type of areas reason why the forest use permit must be foremost requested (Article 5 of Decree 1791 of 4 October 1996). Likewise, actions to reduce vegetation cover impacts, loss of ecosystem connectivity must be considered as well as preventing deterioration of the landscape quality; for such end the following measures should be implemented: Restrict unnecessary vegetation cutting outside the maximum strip established for vegetation cutting, building drains to maintain the exchange of surface waters.

In accordance with current environmental regulations, no works can be made in a strip of 30 meters from river banks. In the event a work must be carried out, to ensure water flow continuity, not cause river bank instability and not pollute the water.

Spacing of the different elements (housing) is punctual and their intervention is possible by implementing environmental and social management measures; avoid affecting them and ensure that their social function is not altered. The current project must negotiate affected property and compensate for relocation; actions that

must be specified in the Social Management Plan. Compensation must seek the same or better conditions found prior to the intervention and will be made with compensation factors according to social vulnerabilities, established by the INCO.

9.4.2 Restrictive measures

These correspond to moderately sensitive environmental areas, which by their nature may be less susceptible to deterioration, and therefore can be intervened by project activities. Notwithstanding the aforesaid, management measures contained in the Environmental Management Plan must always be considered, apply for forest use permits with compensation measures and environmentally educate the communities.

9.4.3 Low restrictions

Depending on the type of soil where the intervention is made, recommended management according to the specific type of use must be followed. Implementing prevention, mitigation, control and recovery measures.

Implement environmental and social management measures to prevent, control, mitigate, recover and compensate for the environmental and social impacts that may be generated with project development.

Social compensation programs and management of the organic layer, plant grass and landscape management: plant grass or implement ecological restoration measures in denuded land.

In addition, Environmental Management Plan programs and charts must be developed (see Chapter 11.1.1) proposed in this study to prevent, mitigate and/or compensate for the impacts arising from the construction and operation of the project.