15 A PARTICIPATIVE APPRAISAL OF THE WATER SITUATION IN A COLOMBIAN MICRO-CATCHMENT

Mario Pérez[1], Stef Smits[2], Alberto Benavides and Silena Vargas[3]

Cinara (Instituto de Investigación y Desarrollo en Agua Potable, Saneamiento Básico y Conservación del Recurso Hídrico), Universidad del Valle, Cali, Colombia (stefsmits@hotmail.com)

Summary

Although Colombia is rich in water resources, scarcity increasingly affects water supply in various regions of the country. This is mainly a scarcity of adequate water quality. This is also the situation in the Department of the Valle del Cauca. The environmental authority of this Department (CVC) has contracted Cinara to contribute to resolving water use problems in a specific micro-catchment and at the same time to develop methodologies that allow the replication of the work in other areas under jurisdiction of the CVC. The area selected for this project is the 'Ambichinte' micro-catchment located on the western slopes of the Andes, in the Municipality of Dagua.

This paper presents both the methodology and results of the first phase; a participative appraisal of the water situation in the micro-catchment. The appraisal was done with the participation of both the community and institutions. It looked at the impact of water in all its aspects on the lives of people in the catchment, and drew out gender and poverty differences. Besides, the appraisal has tried to identify the demand and value people have for management and protection of the micro-watershed and for access to water for both domestic and productive uses. The demand was assessed by a Willingness To Pay (WTP) study in combination with the collection of other demand indicators.

The micro-catchment is approximately 13 km^2 and is inhabited by about 5,600 persons, living in 5 communities. Until the 1970s this was an area of in-migration and colonization from other parts of the country. From then on, it became popular as a weekend retreat for rich people from Cali. These migration patterns have resulted in fractured and individualistic communities with little social cohesion, and a wide range of wealth strata.

This individualism is reflected in the high demand for private water supplies, a challenge taken up by the institutions in charge of issuing water use concessions and investments in water supply infrastructure. The result is a patchwork of overlapping systems, individual and communal, made possible by the easy availability of water. Today, there are 7 gravity-fed community-managed systems supplying drinking water to the 5 different communities, as well as a large number of individual systems and some smaller communal systems.

However, none of the systems delivers water of adequate quality, due to lack of treatment facilities. The economies of scale necessary to make treatment affordable are not met by these fragmented small scale systems. As a reaction to this lack of quality, a large percentage of the inhabitants use alternative water sources, such as springs, bottled water and other water supply systems. This implies extra costs, which affects especially the poorest. These therefore express a strong demand to improve the water supply and are willing to pay an increased tariff to cover operation and maintenance costs of improved water supply.

In addition to domestic household use, water is also used for productive uses such as irrigation, poultry and pig rearing, fishing ponds and recreational purposes (watering of gardens and swimming pools). These uses make up to about a fifth of all water consumption in the area and contribute directly to the economic wellbeing of more than 25% of the population. The vast majority of those that now use water for such purposes are willing to pay to maintain their access to this water, women even more than men. Improvements in water supply should therefore both provide water of adequate quality and of sufficient quantity for productive use. Various technological options for that exist, but require a more in-depth cost-benefit analysis.

[1] Mario Pérez is an economist (MSc) and works as lecturer and researcher at Cinara (Instituto de Investigación y Desarrollo en Agua Potable, Saneamiento Básico y Conservación del Recurso Hídrico) at the Universidad del Valle, Cali, Colombia.
[2] Stef Smits is an agricultural engineer (MSc) and employed as Junior Professional Officer at IRC International Water and Sanitation Centre, Delft, the Netherlands. In this function he is currently working at Cinara.
[3] Alberto Benavides and Silena Vargas have a degree in Sanitary Engineering (BSc) and Social Sciences (BSc) respectively and are both working at Cinara as development workers and researchers.

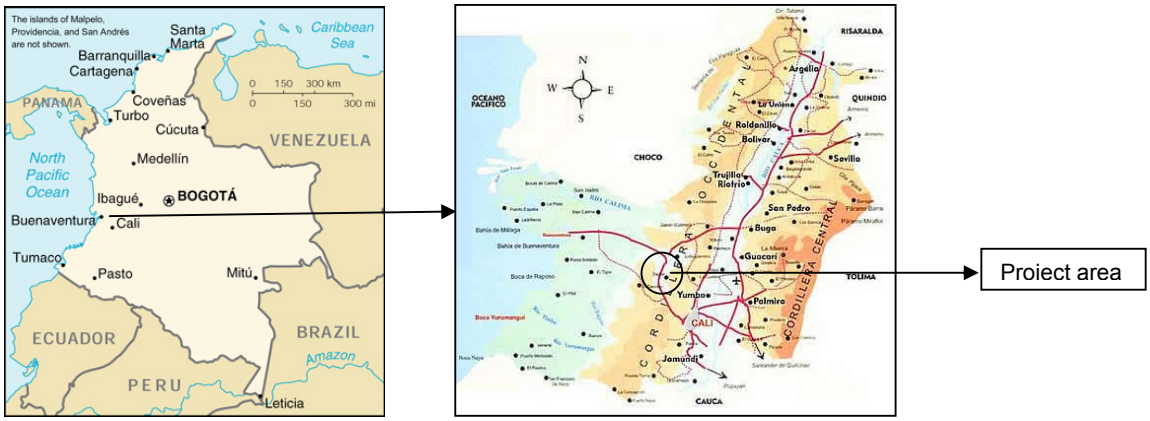
Multiple use water supply systems can contribute to the fighting of poverty by both addressing health improvement and increased production and income. This paper shows a case which is thought to be "typical" for the Andean environment and some of the issues involved in multiple use systems, notably the balancing between water quality and quantity and how water resources management is related to that. Although the practice is not new, little work has been done on these kinds of systems in terms of policies, design and management. Therefore, it is recommended to advocate the recognition of multiple use systems; further investigate the social and economic importance of productive water use; identify and test possible technological solutions for multiple use systems; strengthen community organizations responsible for the administration of multiple use water supply systems and develop forms of water resources management that are more responsive to people's livelihood needs.

15.1 Introduction

15.1.1 Country information

Colombia is located in the north-west of South America and has an area of 1,138,914 km^2 and a population of 44 million persons. It is a middle income country, having a GDP per capita of US$6,248 (ppp) and its Human Development Index is 0.772, occupying the 68th position (UNDP, 2002). Despite this relatively high position, nearly 40% of the population continue to have an income of less than US$ 2 per day (UNDP, 2002). Another important characteristic of the country is its high degree of urbanisation. About 71% of the people live in urban areas, and the remaining 29% in rural areas. On the other hand, more than 80% of the 1,072 municipalities in the country have less than 12,500 inhabitants.

Figure 1: Location of the project area



Colombia is well endowed with fresh water resources. On average some 57,000 m^3 per capita per year are available (FAO, 2001), which is one of the highest availabilities in the world. However, a large part of this is needed to maintain ecological functions and the areas with highest water availability are the least populated. The valleys of the Cauca and Magdalena rivers, in which 80% of the population is located, have a water availability which ranges from being just sufficient to slightly below current demands (Ministerio del Medio Ambiente, 1998). Currently most water use is from surface sources, which are characterised by high sediment contents and bacteriological contamination. This problem is increasing due to processes such as deforestation and disposal of untreated wastewater. The national water resources study indicates that this contamination is leading to a problem of scarcity of water of adequate quality (IDEAM, 2000).

While the coverage in water supply in urban areas is 89%, it is only 45% in the rural areas, leading to an average national coverage of about 76% (Mindesarrollo/Findeter-Univalle-Cinara- 1998). Although these figures for coverage are quite high, the number of water supply systems that deliver water of good quality is low. Most water supply systems are piped networks relying on surface water sources and suffer from the above-mentioned quality problems. Drinking water treatment is therefore necessary in most cases, but only 33% of small towns and communities have such facilities, often in bad condition. Taking into account the water quality criteria, the coverage of water supply provision is only 10% in the rural areas and 62% in urban areas (Visscher, 1997). The scarcity of water of adequate quality is thus directly

affecting water supply. The number of municipalities experiencing absolute water scarcity is still small (IDEAM, 2000), but expected to rise under current demographic trends, with the northern and central Cauca valley and the eastern Andean range being most affected.

The national coverage for sewerage is 62% (Mindesarrollo/Findeter-Univalle/Cinara, 1998), whilst for the rural areas this is only 30% (García Vargas, 2001). Only about 7% of the wastewater is treated to some degree before discharging it back into water bodies (FAO, 2001), contributing to the aforementioned problem of scarcity of water of adequate quality.

Utility provision has been decentralised since the beginning of the 1990s. This means that the municipalities are responsible for water supply and sanitation, which may be provided directly by the municipality, by "mixed" companies (i.e. public and private), by private companies or by community-based organizations. National level institutions are responsible for regulation and control functions (García Vargas, 2001). Responsibility for water resources administration lies with so-called Regional Autonomous Corporations. There are 34 Corporations in the country and their administrative boundaries largely coincide with Departmental boundaries, although some of them have their jurisdiction over watersheds.

15.1.2 Project background

In the Department of the Valle del Cauca, most of the water resources problems mentioned above are increasingly affecting water supply and sanitation services. These services are in turn having an impact on the water resources of downstream uses. In many cases, the low water quality supplied leads to water-related illnesses, like diarrhoea and skin infections[4]. Dealing with this situation of water (quality) scarcity asks for new management approaches. Therefore, the Regional Autonomous Corporation of the Valle del Cauca (CVC) has proposed a project in a micro-catchment with “typical” problems, such as reduced water availability in the dry season, deforestation, increasing demand, pollution from domestic wastewater disposal and little interest from the community in the environmental situation. The project was required not only to contribute to resolving the water-related problems in this area, but also to generate methodologies for intervention in other areas under the jurisdiction of the CVC, with similar conditions. It has contracted the institute Cinara (Instituto de Investigación y Desarrollo en Agua Potable, Saneamiento Básico y Conservación del Recurso Hídrico) at the Universidad del Valle, to lead this process and design and develop the necessary methodologies. At the moment of writing the project has just finished the first phase, which was a participative appraisal. Although the project has not started its intervention phase, the experiences to date are presented here. The findings that are presented are thought to be typical for many Andean communities and might reorient water resources management and interventions in water supply in the Andean region.

15.1.3 Area description

The area in which this project is being carried out is called the Ambichinte micro-catchment, located entirely within the Municipality of Dagua, some 30 km from the city of Cali. This micro-catchment is located on the western slopes of the Andes at an altitude of in between 1,300 and 2,000 m above sea level. The area of the micro-catchment is 13 km^2.

In this area we find 5 communities, that all belong to a *corregimiento*[5], called Borrero Ayerbe. These communities are called Km 26, Chipre (Km 27), Km 28, Km 30 and El Vergel. As the names suggest, these are merely localities spread out along a road and boundaries between them are sometimes difficult to establish (Figure 2). The village of Km 30 is the main village of the *corregimiento*. Besides, there are three *parcelaciones* (kind of rural compounds), called Ambichinte, La Floresta y El Ensueño.

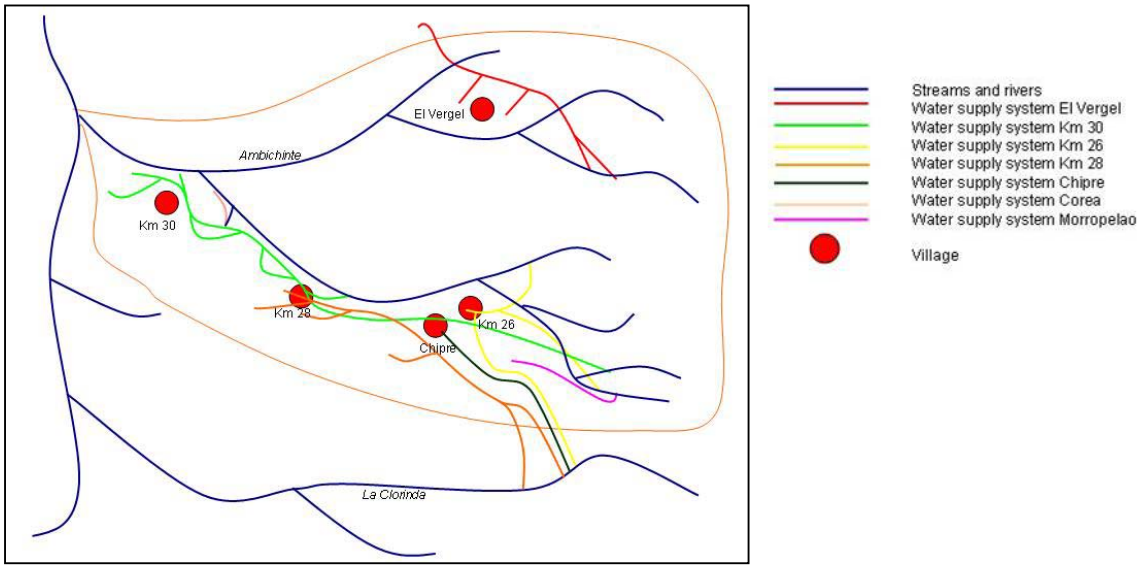
The number of houses in the area is 1,368. There are 5,600 permanent inhabitants. Km 30 is the largest community having 3,656 inhabitants. The others all have some 500, except for Chipre which only has 12 families. During weekends and holidays, many people from Cali come here for recreational purposes. Besides, many inhabitants during weekdays work and stay in Cali, and in the weekends come back to the area. This leads to an estimation of another 6,000 temporal inhabitants.

[4] In 1999 diarrhoeal diseases were the second death cause among children under 5 years in Colombia with a rate of 28.2 and diseases like cholera and typhus are still endemic in some areas (Ministerio de Salud-OPS, 2000).
[5] A corregimiento, best translated as bailiwick, is an administrative unit, one level below the municipality. It has some financial autonomy. One corregimiento usually comprises various veredas, or neighbourhoods.

15.2 Methodology

For the identification of the current situation, a participative appraisal has been carried out. An integrated approach was followed, in which land and water resources in the micro-catchment and linkages between them have formed the main axis of research. This included the management of the resources itself, as well as its use for domestic, productive and recreational purposes and the management of wastewater. The appraisal included data collection on technical, environmental, organizational, economic and social aspects, including people's perception and valuation of water resources and their use (see below). In this, a gender and poverty focusedfocused approach was applied, addressing both men and women and different wealth categories specifically in the various activities. Data collected have been disaggregated according to gender, wealth status and also by locality.

Figure 2: Map of the area with the water supply infrastructure. (Source: Univalle/Cinara-CVC, 2002)



In the various activities of the appraisal, different key stakeholders in the catchment participated: male and female community members and leaders, members of the community water supply organizations, operators of the community water supply systems, local youth and institutions (the CVC, the municipality and a community ecological corporation).

Activities included workshops and technical visits to the micro-catchment and the water and sanitation infrastructure with those persons. A range of participatory techniques including social mapping, Venn diagrams, daily routine diagrams, transect walks, and key informant interviews with a range of community and institutional stakeholders were used to characterize the water supply situation and general characteristics of the area. In addition to this, a thorough review of secondary data sources, especially the review of hydro-meteorological data of the area, and relevant literature was carried out. A detailed survey was held among 101 households to find out about the water supply and use at household level.

15.2.1 Valuing water – a willingness to pay survey

To complement the qualitative data about people's perception and demand for water supply services and water resources management with quantitative data, a willingness to pay (WTP) survey was carried out, using the Contingent Valuation Method (CVM). In general, WTP surveys aim to uncover users' preferences for a proposed change in a service, and what they would be willing to pay for it (EC, 1998) or receive for as compensation for loosing access to a service or resource (Rojas Padilla *et al*., 1998). The CVM is so called because their replies are 'contingent' on the description of the (usually) hypothetical change in a service (EC, 1998). Concrete examples of the use of WTP include the identification of people's readiness to contribute to the construction of a specific project or to its Operation and Maintenance (O&M) costs. In the Ambichinte case, the survey aimed to obtain insight in people's demand for improved water resources management, for improved drinking water supply and for access to water for productive uses

The survey consisted of some 35 questions (see Appendix 1, for the complete survey form). These included the direct WTP questions, as well as questions on the socio-economic situation of the household, actual water use in their households, the actual spending on water and their perception of the water resources management and water supply. The data were disaggregated by the different socio-economic strata, by gender and by village. The three main WTP questions were posed in a bidding way:

- Would you be willing to pay a monthly amount of $X for the implementation of such activities for the improvement and guarantee of the quantity and quality of the water in the streams and rivers that pass your locality?
- Would you be willing to pay an *additional* monthly tariff of $ X for the improvement of your main water supply system, that provides you a service with the aforementioned characteristics of a good service quality?
- Would you be willing to pay an *additional* monthly tariff of $X order to have sufficient water of the adequate quality for your productive and recreational uses, on top of the additional tariff mentioned for domestic purposes?

The starting amount of $X was chosen at random. After each of these questions the maximum amounts of money people would be willing to pay were asked. For the first question, a logistical model was used to determine the DAP and statistics. Based on the maximum amounts people were willing to pay only descriptive statistics were determined. More details of the statistics used can be found in Parra (2002).

On basis of the earlier mentioned survey among 101 households, a first impression was obtained of the variability of incomes in the zone. This variability formed one of the inputs for the determination of the sample size for the WTP. To do this, a random sampling estimation method was used, with confidence limits of 95%. For this level of confidence, 299 households were selected. In practice, we were able to visit 357 households (26% of the houses in the area). Depending on who was present, both men (166) and women (191) were interviewed. The WTP was done by high school students, who had received training for this.

In general, using WTP surveys for water is considered controversial (EC, 1998). For example, respondents might show 'strategic behaviour', whilst wishing to have the service, they can either exaggerate or understate the amount they are willing to pay (EC, 1998). In addition to this standard drawback, it was noticed that some people found it difficult to express their demands in monetary terms and had difficulties in separating their readiness to contribute to water resources management from a contribution to improved water supply, as they related improved catchment management directly to improved water supply in their homes. Finally, people were not very eager to answer questions on their socio-economic situation, like income and expenditures, For these reasons, the exact outcomes of a WTP should not be used directly for interventions like tariff adjustments. Rather they give a first estimation of people's valuation of a certain service. Besides, results of the WTP have been complemented and cross-checked with other data, such as people's actual spending on water services and have the people compare these with their spending on other services, like electricity, telephone or cable television, if they have these services.

15.3 Results

15.3.1 Socio-economic situation

In Colombia various poverty definitions are in use. The first one is that of unmet basic needs. Due to the complexity of determining this indicator, it has not been used in this work. Another way to describe poverty is by means of stratification. All households in Colombia, by law, have to be stratified into socio-economic classes, ranging from 1 (poorest) to 6 (richest). By law, tariffs for public services and also taxes are to be based on these strata so utility companies, including community-managed service providers, should apply the stratification in their tariffs. However, each household's stratum is determined on the basis of the conditions of the homestead and its surroundings. Determining these is difficult and many community-based service providers do not apply stratification in their tariffs. The third criterion for defining poverty is the one based on income. There is a legally established minimum salary, which at the moment of carrying out the appraisal (July 2002), amounted to the equivalent of US$ 124. Most people express their wealth status in terms of their stratum (if they know) or in terms of a number of minimum salaries.

The area in general can be characterized as poor: 25% of the households receive less than half the minimum salary, and 50% between half and one minimum salary. Only 8% of the households earn more

than 2 minimum salaries. Most houses belong to strata 1 or 2. However, there are also many weekend houses belonging to of rich people from Cali, all belonging to stratum 6. Due to the guerrilla activities many of these houses are not visited anymore and it has been difficult to contact these people in the survey and the WTP study, so this stratum is not so well represented in the socio-economic data.

The variety of wealth classes is the result of historical migration patterns. Until the 1970s, it was an area of colonization by smallholder farmers. Social cohesion was limited, as people came from different parts of the country. From then on, the area became popular with wealthy people from Cali, including drug lords. These built individual homesteads and did not integrate in community life. This process has lead to further individualisation of the communities. Community organizations are weak and do not have much legitimacy among the inhabitants.

Although stratum and income situation give a good idea of the poverty situation, the research showed that it is important to consider whether a family has an urban or a rural livelihood strategy. The inhabitants of Km 30, the main village, have an urban orientation. Only a small percentage of its inhabitants get their main income from agriculture-related activities, and they show strong migration patterns towards Cali. The other communities are more dispersed and agriculture has a more important role. In these more rural settings, many gain their main income from working as caretaker at the weekend houses, where they have in addition small vegetable gardens, animals or fish ponds. Although the entire zone is considered a rural area, in reality it is a hybrid society, with both urban and rural livelihood strategies (for some indicators see Table 1). This is an important note as it is reflected in water use and the value people give to water.

Table 1: Socio-economic characteristics of the communities

Indicador	*El Vergel*	*Km 26*	*Chipre*[6]	*Km 28*	*Km 30*	*Average total*
Number of persons per household	3.4	4.8	3.8	4.3	3.7	4.0
Average family income (US$/month)	161	84	116	125	135	131
Average area of homesteads (m^2)	1,222	155	501	959	424	585
% of persons that own their house	48.8	73.5	31.3	46.3	70.0	63.3
% of population in agriculture	10.3	24.2		10.0	4.2	8.1
% of population working as caretakers of holiday houses	28.2	15.2		32.0	6.2	14

Source: Univalle/Cinara-CVC, 2002

With respect to the gender situation, 25% of the households were headed by women. Households are generally small (average of 4 persons) and normally consist of husband, wife and their children. Sometimes, other relatives like brothers or sisters live in the same house as well. Especially in Km 30, a large percentage of the men work in Cali during weekdays and come to the community only at weekends. Most women work as housewives, only a few doing remunerated work. Participation of men and women in the boards of the community water supply organisations is not equal. Of the 7 water supply systems, only 5 have a steering committee. In Km 30, the largest community, 4 men and 3 women form this committee, and women occupy the positions of president and administrator. In the other committees women occupy only a quarter of the available positions, but often the leading positions of president or vice-president.

15.3.2 Water resources management

The effective annual rainfall in the catchment is estimated[7] being 1,078 mm and the reference evaporation 882mm (Sarmiento, 2001). There are two “dry” and two “wet” periods, but even the dry periods have still at least on average a rainfall of about 60 mm/month. In the dry months, potential evapotranspiration is higher than rainfall for the main crops such as coffee and plantain, but as these are deep rooting crops, stored soil moisture might provide part of the deficit. However, crops like vegetables and beans *do* experience water stress when it does not rain for some two weeks in the dry period.

Water is available in the form of various small streams and springs (La Clorinda, La Clorindita, La Mina, Peña Alegría and Ambichinte) that form together the Ambichinte river. No discharge measurements of

[6] As the population of Chipre is very small, data on the economic activities of its inhabitants are included in the statistics of Km 28.
[7] This is the best estimate, drawn from a water balance study by the CVC. But some doubts exist on the quality of the meteorological data. In the catchment there is no meteorological station and data have been used from a station nearby but in another catchment, with quite a different micro-climate.

this river exist. Based on land use types and typical run-off rates, average total surface run-off in the catchment has been estimated to be the equivalent of 260 l/s (Sarmiento, 2001). On groundwater no data exist and at the moment groundwater is not being used in the area.

Although flows diminish in summer, these are just sufficient for the existing demands for domestic use in the zone. Table 2 shows availability of water in the wet and dry season at some of the intakes during the wet season. As can be seen, at some points even in the wet season all available water is captured, whilst at other points there is more availability also during the dry months. It is also noted that, for example in the upper reach of the Ambichinte, nearly all water is captured, but that the flow recuperates rapidly due to the contribution of various small streams. At some points there are conflicts over water, eg, near one of the intakes of the water supply system of El Vergel, an individual user takes water from the stream with a hose, leaving the small intake dry. Another important remark to make here is that large amounts of water (between 30 and 40% of the water taken in) are lost in the transport and distribution systems.

Table 2: Impact of water extraction for domestic use

Water supply system	Location of intake	Flow in stream in wet season (l/s)	Flow in stream in dry season (l/s)	Amount taken in during wet season (l/s)
Km 30	Ambichinte upper reach	11	5.5	10
Km 30	Ambichinte middle reach	83	33	25
Corea	Spring Ambichinte	3.8	3.8	3.5
Km 26, Km 27 and Km 28	La Clorinda	25	8	25
Km 28	La Clorindita middle reach	36	18	18
El Vergel	La Mina upper reach	0.5	n.a.	0.5
El Vergel	La Mina lower reach	3.3	n.a.	3.3

Source: Univalle/Cinara-CVC, 2002

There are signs of degradation, but not to a disastrous extent. Housing development is considered the main problem affecting water resources, as this has led to deforestation and especially to disposal of untreated wastewater. This is especially the case in the middle reaches. For example, the water supply system of El Vergel has one of its intakes just below a group of houses that have their septic tanks close to the stream. The sewage system of Km 30 also disposes directly into the lower part of the micro-catchment, without any treatment. Finally, a large part of the contamination is due to pig farms, which discharge their wastewater directly into the streams without treatment.

Many people have never been in the area where the water sources are and do not know well the situation of the micro-catchment. Neither do they know the activities of the CVC or other institutions in catchment management, although the CVC in particular has undertaken some actions like reforestation and control of some of the wastewater flows. Considering that it is a rural area, one would expect more knowledge and interest of the people in their direct environment. On the other hand, there is some willingness to pay to improve the conditions of the micro-catchment, although this is the entire responsibility of the CVC and people contribute to this already through payment of taxes. It appears that the inhabitants of Km 28 are the ones who are most aware of the situation and most interested in contributing to its improvement. There is a significant trend suggesting that the lower strata are less willing to pay for this improvement than the higher strata. Lack of money is the main reason for the ones that are not willing to pay. Also noteworthy is that men show a slightly higher average maximum WTP than women (0.79 US$/month and 0.66 US$/month), but this difference was not statistically significant..

The administration of the water resources is the responsibility of the CVC and done by a system of water use concessions. For a concession for domestic use, the fee is 0.44 US$ per month. According to the rules of the CVC, the fee depends on the size of the assigned flow, but actually all pay the same fee, although their flow sizes differ. Concessions for other uses have hardly been issued in the area. The issuing of concessions has been done without clear criteria and planning, as the potential of this management instrument has not been fully recognized. Due to the weakness of community organisations and the migration patterns, many persons in the region have tried to resolve their water supply in an individual way and so there have been many fragmented demands for concessions. These nearly always have been issued. Nowadays, there are a large number of individual or very small group-wise water supply systems (on average 6 houses per concession issued), having various problems, as will be explained below. The registration of the concessions is deficient. Nearly half of the concession owners

have not paid their user fees for more than 3 months. There is hardly any monitoring of whether the quantities used coincide with the licensed abstraction.

Table 3: Perception of the community of the micro-catchment

Community	El Vergel	Km. 26	Chipre	Km. 28	Km. 30	Average total
% of population that has ever visited the water source in the catchment area	26.8	47.2	50	68.3	36.5	40.7
% of population that considers the catchment in bad conditions	70.0	43.3	100	100	96.2	80.3
% of population that is aware of any catchment management activities being developed by the environmental authority or any other institution	22.0	17.7	13.3	31.7	19.4	20.7
WTP for improved catchment management and protection[8] (US$/month)	0.61	0.68	0.82	0.94	0.70	0.72

Source: Univalle/Cinara-CVC, 2002

The root-causes for the deficient water resources planning and administration are probably two-fold. On the one hand, the relatively high water availability never has given rise to the need for this. Anyone could simply take what he/she wanted; there was always more than enough. Apparently, under current conditions this way of management is no longer a valid option. The second reason for deficient water resources planning and administration has to do with problems in inter-institutional coordination. The CVC (water resources administration) and the different divisions at municipal level responsible for investments of water use infrastructure, such as the Health Secretary and Agricultural Secretary do not develop their plans together nor do they combine forces. Besides, these often also have internal subdivisions, for example in “social” and “technical”, in “water resources” and “water use” directions and coordination between these sometimes is deficient.

15.3.3 Water supply

The number of houses in the area is 1,368. There are 5,600 permanent inhabitants. Km 30 is the largest community having 3,656 inhabitants. The others all have some 500, except for Chipre which only has 12 families. During weekends and holidays, many people from Cali come here for recreational purposes. Besides, many inhabitants during weekdays work and stay in Cali, and in the weekends come back to the area. This leads to an estimation of another 6,000 temporary inhabitants.

In a relatively small area there are 7 large water supply systems, serving the 5 communities. Next to these there are two supply systems that get water from other micro-catchments and serve some areas within the Ambichinte catchment. As if this were not enough, the *parcelaciones* have their own water supply, as do many individuals. This means that there has been a huge combined investment in water supply infrastructure. As can also be seen the water supply networks are like a spider web and there are sometimes 3 or 4 pipelines running parallel, which means that relatively large investments must have been made in the past. On the other hand, only Km 30 has treatment facilities, however these do not function adequately. Water quality tests taken in all systems showed heavy Fecal Coliform contamination. So, despite the investments in water supply infrastructure, none of them delivers water of adequate quality.

Many people are aware of the low water quality supplied; only 25% of the population considers the quality good. In order to overcome this problem about 37% of the population uses alternative sources of supply, like springs, bottled water or another water supply system. These alternative sources are then used for drinking and cooking, while the main system is used for washing, showering and productive uses. This indicates that the main reason for accessing alternative sources has to do with the water quality criterion. To a minor extent, people have access to two supply systems to guarantee supply at all times.

The costs associated with having access to these various sources are high. Those that use the alternative source, spend on average US$2.90 each month on this, in addition to travel time to get this water. The average tariff people pay for the main water supply system is US$1.64. These data show that there is a large demand for good quality water. This demand is also expressed in the willingness to pay

[8] See Annex 1 for the description used in the WTP questionnaire on which activities are understood by this.

an additional tariff over and above the tariff paid at the moment in order to get a good water supply service from the main water supply system. A good water supply service is understood as a continuous service of sufficient quantity and quality and with an adequate administration. For most people the main improvements that can be made in the service are water quality and the administration. The vast majority (94%) of the interviewees is content with continuity and quantity of supply. In the community meetings, water quality was also considered the main point for improvement.

It is striking to note that actual spending on alternative sources is higher than on the main water supply system and also higher than the actual price plus an additional tariff people are willing to pay. A reason for that can be that many people are not aware about the total monthly costs they make on these additional sources, as these are small amounts every time one buys bottled water or gets water at a spring, but the total costs are high. Looking at the sum of the actual spending and the WTP for the additional tariff, these are in the same order of magnitude as the actual spending on the alternative sources. The actual spending can thus be considered a first indicator of people's demand. On the other hand, actually 39% of the population is spending on alternative sources; while in the WTP 90% are willing to spend an additional amount on improved water supply.

Both the actual spending, on alternative water sources and the WTP for tariff increases for improved water supply, vary between the different communities and between the different wealth classes (see Table 4). There is a significant trend that the higher wealth classes are actually spending more and are also willing to contribute more to improved water supply, as might be expected. The WTP for improved water supply did not differ significantly between men and women. It should also be noted that the standard deviations are very high, so within wealth classes WTP's are very heterogeneous.

Table 4: Actual spending and WTP on water supply for different wealth classes

Income class	Actual spending on tariff of the main water supply system (US$/month)	Actual spending on alternative sources (US$/month)	WTP for an *additional* tariff for improved water supply (US$/month)	Standard deviation of WTP
< 0.5 minimum salary[9]	1.31	2.71	0.71	0.59
0.5 - 1 minimum salary	1.76	2.36	0.97	0.79
1 - 1.5 minimum salaries	1.53	4.02	0.98	0.62
1.5 - 2 minimum salaries	1.86	3.07	0.93	0.68
2 - 2.5 minimum salaries	2.20	2.40	1.47	1.45
2.5 - 3 minimum salaries	2.40	3.19	1.11	0.61
3 - 5 minimum salaries	3.51	4.32	1.07	0.69
> 5 minimum salaries	1.94	4.06	1.14	0.67

Source: Univalle/Cinara – CVC, 2002

When comparing the actual spending on water supply with people's capacity to pay, it is noted that those having an income of less than half a minimum salary (26% of the population) spend on average 4% of their income on the main water supply system. Taking into account that many of them also use alternative sources, their total spending on adequate water can be as high as 12% of their income. Internationally, it is recommended that spending on water supply should not exceed 3% of people's income (Bolt and Fonseca, 2001). If tariffs were to increase according to the WTP, expressed by the various wealth classes, still the poorest would spend up to 6.5% of their income on water. Considering the mixed composition of the various communities, in Km 26 the actual tariffs are already more than 3% of the average income (5.0 %). Those that do not use the alternative sources for drinking water pay a high cost for that. According to the registers of the Municipal Hospital, intestinal parasites formed the fifth cause of morbidity in 2001. Medics reported that diarrhoeal diseases and skin infections are among the most common illnesses in the region.

Concluding, it can be said that there exists a clear demand for drinking water of adequate quality. People are apparently willing to pay for this, even if this will amount to a relatively large percentage of their family budget. Due to the history of the villages and the migration patterns, resulting in weak community organizations, this individual demand had not been translated in a collective demand. The institutions have given a response to these individual demands by issuing individual concessions and investing in an uncoordinated way in water supply. However, these investments have not been able to solve the water supply problem, nor people's poverty.

[9] The minimum salary at the moment of doing the research amounted US$ 124 per month.

15.3.4 Water use

In the study area, water is not only used for domestic purposes, but also for productive and recreational purposes. For these uses no separate or adapted infrastructure exists. Use is made of the drinking water supply infrastructure, so in fact these can be considered multiple use water supply systems. The amounts involved in the different uses have been estimated at household level:

Table 5: Water consumption for various uses

Use	Percentage of households	Estimate of consumption (l/household/day)	Percentage of total water consumption (%)
All domestic uses (drinking, cooking, washing, sanitation, cleaning)	100%	600	80
Irrigation	25%	471	16
Watering of animals (does not include fishing ponds	15%	77	1.5
Small enterprises	n.a.	n.a.	n.a.
Swimming pools	8%	214	2.2
Sub-total of productive and recreational uses[10]		146	20
Total water consumption		746	

Source: Univalle/Cinara-CVC, 2002

It is estimated that the per capita consumption for 'domestic' purposes (drinking, washing, cooking, cleaning and, sanitation) is about 150 l/person/day, which corresponds to 600 l/household/day, considering an average of 4 persons per household.

Irrigation is practiced in 25% of the households. Most of this is vegetable gardening on small plots (on average 386 m^2, with more than half of them less than 75 m^2) plots. Only in a few cases people irrigate larger terrains (about 0.6 ha) with crops, such as beans, as all other major crops (coffee, plantain and cassava) are rainfed. The vegetables are normally sold on the market and not used for home-consumption. An important percentage of water use for irrigation comes from the watering of the large gardens of the weekend houses. This is not direct production, but water has an important economic impact here. Those with weekend retreats come to the area especially for the green environment, of which nice gardens form an important component. Having water for these contributes to the tourist development of the zone. On the basis of cropping patterns, cropped areas and irrigation practices, average water consumption for irrigation has been estimated at 471 l/household per day in the dry period. Of course, the exact amount used in a household depends on crop, size of the terrain irrigated and irrigation practices.

Water is used for watering animals in 15% of the households. There is a large diversity of animal rearing activities. There are some very large pig and poultry farms, but the majority of the families have only a few animals, such as chickens, pigs or cows. In addition, there are a number of fish ponds that are at times fed by water from the water supply systems. Water consumption in households with animals is on average 77 l/day. Here it is interesting to note that the larger pig and poultry farms have their own drinking water treatment facilities, as the owners consider the risks of the low water quality too high for their farms.

Next to the irrigation of large gardens, water use for swimming pools is an important recreational use of water in the zone (which contributes to its economic development). Some 8% of the houses have swimming pools. Assuming that they change the water entirely once per year, this implies a daily consumption of 214 l. In Km 30 water is also used in small enterprises such as shops, restaurants and bakeries. The amounts used in these could not be estimated.

Considering all these amounts used, and the number of families using water for productive and recreational uses, an estimated 20% of water consumption in the area is for productive use, with irrigation being the most important of these, both in amounts used and in numbers of households engaged in it.

Due to time limitations, the income generated by water in the various uses has not been determined. Especially for the recreational uses, this was considered difficult as water contributes indirectly to the

[10] This is the consumption taken as an average for all households, whether they use water for productive uses or not.

economy of the area, through its contribution to the value of housing conditions and not to direct production. The WTP study should give an indication of this value, and also for the other productive uses.

People were asked how much they would be willing to pay in order to have access to water for productive uses. This question was only put to those who already have productive uses, and so did not try to determine the demand for further development of productive uses. As water is still quite readily accessible, it was assumed that the existing demand is nearly fully met. The WTP study showed that 80% of the current users are willing to pay to maintain their access to productive uses. Those that were not willing to pay had economic difficulties to pay more or considered that the water supply tariff should include water for productive uses. The average monthly amount people are willing to pay is US$ 0.73, but with a very high standard deviation of US$ 0.71, which shows a very heterogeneous demand. Again, a slight trend was noticed that the poorest are willing to pay less than the better off. However, as only existing users were interviewed, the sample was smaller and larger standard deviations were observed. More pronounced, but not significant, was the fact that women are willing to pay 16% more for access to productive uses than men (US$ 0.79 per month and 0.68 US$ per month respectively). A possible explanation for this is that men are migrating more than women, leaving the latter with the daily production activities. Therefore, women are probably the ones that receive more benefits from water for productive uses.

Ambichinte is probably not an exception with respect to the characteristics of multiple uses of water. In La Castilla, a rural community located half way between Cali and Ambichinte, the inhabitants are refusing a drinking water treatment plant the Municipal Health Secretary is building. They fear the chlorine that will be applied will damage the vegetables and herbs they grow. Besides, the Municipal Health Secretary forbids irrigation, as it is considered a waste to use treated water for irrigation. A user's reaction to this was, "A farmer has his animals and his plants and these also need water. Then some people from the city come and say we shouldn't." A combined effort between the Municipal Health Secretary, the Municipal Agricultural Secretary and the CVC could lead to a solution in which both drinking water needs and irrigation needs are met. Still, this inter-institutional coordination and cooperation is difficult to attain. This and other cases show that more attention should be given to the issue of multiple use in Colombia. It is thought the data obtained in this research are quite "typical" for the Valle del Cauca and probably many more regions in Colombia. Similar cases are common in other Andean countries such as Bolivia (see for example Camacho, 2002). Still, these situations are often not officially recognized, nor do institutions know how to deal with them. This and other studies can be useful in showing the order of magnitude of multiple use of water and in advocating the need to recognize this situation. A next step will be the identification and testing of solutions that will allow both the provision of adequate drinking water and water for productive uses.

15.4 Conclusions and recommendations

With respect to the methodology, the main lesson learned is that a WTP study can be useful in understanding users' demands for and valuing of water. Still, its use also has various drawbacks and should therefore never be used on its own, but its results should be complemented and cross-checked with other data, like for example, people's actual spending on alternative sources of water.

The study showed that people in the zone have a marked demand for drinking water of good quality. This was especially shown through the fact that a large percentage of the inhabitants spend a relatively large amount of money and time on getting water from alternative sources, like springs and bottled water. These types of alternative source suggest that the main reason for using them is water quality. The vast majority of the people consider the quality supplied by their main systems deficient while they are satisfied with the quantities supplied.

Although strong individual demands for drinking water supply were identified, these have not been translated in collective demands. The history, migration patterns and different cultural patterns (rural and urban) of the communities in the Ambichinte catchment are to a large extent due to this. Collective systems have an advantage in the possibility to provide a better quality service (especially in terms of water quality) than individual systems, due to the economies of scale in water treatment. Still, the institutions have given individual responses to these individual demands. A very large number of concessions have been issued for individual supply systems or for small groups of houses. The relatively high water availability also permitted this in former days, but nowadays, the availability is just enough to meet demands, although efficiency of water use is low.

Despite the investments made, the actual water supply does not meet drinking water quality criteria. This affects directly on the poverty situation in the area, as many people have to pay large amounts for alternative sources of safe water, the poorest even up to 12% of their income. Besides, water-related diseases are still an important cause of morbidity.

Also, a strong demand exists for water for productive and recreational purposes. These account at the moment for some 20% of total water consumption in the area and are of importance for more than 25% of the households. Especially, women show a high demand for having access to water for vegetable gardening and for animal husbandry.

The main challenge is thus to find a solution that guarantees water of adequate quality at an affordable price, whilst at the same time providing water for productive and recreational purposes. A first option could be the amalgamation of the existing systems and having a collective treatment system. In this way economies of scale are generated. However, this option might affect the possibilities for the multiple use of water. Experiences in other communities show that these reject treatment systems when this affects the water for productive uses. One could therefore also think of a water supply system providing water of low quality for bulk domestic uses, such as washing, cleaning and productive uses. Alternative sources such as springs could then be further exploited for drinking water provision. A third option can be to have an amalgamated water supply system, in which part of the water is treated to drinking water conditions and in which another part is used for purposes that do not require these quality standards. This solution would require two parallel distribution systems, which would raise the costs of such a solution. It requires a more detailed analysis of each option in terms of its technical, economical and environmental feasibility, including a cost-benefit analysis of providing water for productive use as well. At the moment of writing, the communities, government institutions and Cinara are in a process of identifying possible solutions, so for each a further analysis can be made.

Generally speaking, the supply of water can contribute to fighting poverty, as it might address health improvement and increased production and income. Multiple use systems can kill both birds with one stone. This paper has shown a case which is thought to be “typical” for the Andean environment and some of the issues involved in multiple use systems, notably the balancing between water quality and quantity and the way this is related to water resources management. Although the practice is not new, little work has been done on these kinds of systems in terms of policies, design and management. Therefore, the following general recommendations are made:

- To advocate the recognition of multiple use systems. It is felt that in Colombia, and probably other Andean countries, the importance of multiple use of water has not been recognized sufficiently or is even officially denied. A first step to improve people’s realities is to recognize their reality.
- To further investigate the social and economic importance of productive water use. This is needed in order to be able to justify (or not) investments in multiple use systems.
- To identify and test possible technological solutions for multiple use systems. As shown in the case study, various technological options exist for multiple use systems. Well-documented experiences of these systems in the Andean context do not exist.
- To strengthen community organizations responsible for the administration of multiple use water supply systems. Managing a multiple use system is in some aspects different from managing drinking water systems. Community organizations need to be strengthened to assume new responsibilities.
- Develop forms of water resources management that are more responsive to people’s livelihood needs. The study shows that water resources administration should promote solutions that allow generating some economies of scale and so contribute to reducing people’s expenditure on water. Besides, it should allow people to have concessions for both domestic and productive demands. This will also require joint planning and coordination between institutions responsible for water resources management and for water use.

15.5 References

Bolt, E. and Fonseca,C. (2001). ‘Keep It Working; A field manual to support community management of rural water supplies. *In IRC Technical Paper Series* 36, Delft, The Netherlands, IRC.

Camacho, A. (2002). *Estudio de Caso sobre el Sistema de Agua Potable y Saneamiento Villa Serrano*. Paper presented at the workshop on a strategic approach for integrated water resources development and management, 12-14 November, 2002, La Paz, Bolivia

EC (1998). *Towards sustainable water resources management; a strategic approach.* European Commission, Luxembourg

FAO (2001). *AQUASTAT- database*. www.fao.org/ag/AGL/aglw/aquastat/colombia/colombia.htm

García Vargas, M. (2001). *Community Partnership; an Option for Improving Water Supply Services in Rural Areas*. Paper presented at the IRC Conference "From System to Service; Scaling up Community Management", 12-13 December, 2001. The Hague, The Netherlands.

IDEAM (2000). *Estudio Nacional del Agua.* Santa Fé de Bogotá, Colombia, Ministerio del Medio Ambiente, Instituto de Hidrología, Meteorología y Estudios Ambientales.

Mindesarrollo/Findeter - UnivalleCinara (1998). *Servicios Sostenibles de Agua y Saneamiento: Marco Conceptual*. Bogotá, Colombia, Ministerio de Desarrollo Económico.

Ministerio del Medio Ambiente (1998). *Políticas Ambientales de Colombia.*. Santa Fé de Bogotá, Colombia, Ministerio del Medio Ambiente – Consejo Nacional Ambiental.

Ministerio de Salud – OPS (2000) *Indicadores de Salud 2000.* Santa Fé de Bogotá, Colombia, Ministerio de Salud – Organización Panamericana de Salud.

Parra, A. (2002). *Plan de Muestreo y Estimación de la Disponibilidad a Pagar por la Protección de la Microcuenca Ambichinte, el Mejoramiento del Servicio de Agua para Consumo Humano y Usos Productivos.*, Santiago de Cali, Colombia, Cinara.

Rojas Padilla, J, Pérez Rincón, M. and Peña Varón, M (1998) *La Valoración Contingente: una Alternativa para Determinar la Viabilidad Financiera de Proyectos de Tratamiento de Aguas Residuales en Zonas Rurales de Países Tropicales*. Paper presented at Agua 1998, Cali, Colombia, Cinara.

Sarmiento, A.L. (2001). *Balances Oferta-Demanda de Agua en la Unidad de Manejo de Cuencas Alto Daga-Restrepo-La Cumbre.* Santiago de Cali, Colombia, CVC-Dirección Regional Pacífico-Grupo de Recursos Hídricos.

UNDP (2002). *Human Development Report.* New York, USA, United Nations Development Programme.

Univalle/Cinara-CVC (2002). *Informe de diagnóstico participativo de la situación de los Sistemas de abastecimiento de agua y saneamiento en la microcuenca de Ambichinte (Dagua).* Cali, Colombia, Cinara.

Visscher, J.T. (ed.)(1997) 'Technology Transfer in the Water Supply and Sanitation Sector: A Learning Experience from Colombia'. In *IRC Technical Paper Series* 32. The Hague, The Netherlands, IRC and Santiago de Cali, Colombia, Cinara.

World Bank (1993*).* 'The demand for water in rural areas: determinants and policy implications'. *The World Bank Research Observer*, Vol. 8, no.1 p. 47-70

15.6 Appendix 1: Survey form of the WTP study

Part 1. Introduction to the survey

Good morning / good afternoon,

My name is……..and I am part of the group of community students, that are at the moment working for the Institute Cinara of the Universidad del Valle.
Cinara at the moment is working together with the Corporación Autónoma Regional del Valle del Cauca – CVC on a project to improve water resources management and water and sanitation services in the Ambichinte micro-catchment. For this reason we would like to hear your opinion about this topic and ask you some questions that will take between 20-30 minutes. We appreciate your collaboration.
We remind you that the information you provide is confidential and that there are no good or bad answers. So, please, feel free to speak openly.

Locality
Homestead Number.
Date / / 2002

Start time of interview AM / PM End time of interview AM / PM
Interview is: Complete ☐ Incomplete ☐

Part 2

1. Name and surname:
2. Are you the head of household?
YES ☐ (if yes, then go to question 4) NO ☐ (if no, go to question 3)
3. What is your kinship with the head of household?
Spouse ☐ Son/daughter ☐ Brother/sister) ☐ Other ☐, which?
4. Sex of the interviewee: Male ☐ Female ☐
5. What is your age?
6. Until what grade did you study?
☐ Did not study
☐ Primary school Complete ☐ Incomplete ☐ years
☐ Secondary Complete ☐ Incomplete ☐ years
☐ "Technical school" Complete ☐ Incomplete ☐ years/semesters
☐ University Complete ☐ Incomplete ☐ years/semesters
7. Are you employed at the moment?
YES ☐ (if YES go to question 9) NO ☐ (if NO go to question 8)
8. How long have you been without employment? years/months
9. What is your main job at the moment?
☐ Agricultural labourer ☐ Construction labourer
☐ Teacher or civil servant ☐ Merchant
☐ Subsistence farmer ☐ Large scale farmer
☐ Caretaker at weekend retreat ☐ Domestic help
☐ Housewife/man ☐ Other, which?
10 Are you a permanent resident in the locality?
YES ☐ NO ☐
11. Do you own the homestead you live in?
YES ☐ NO ☐
12. What is the total size of the terrain, in which the homestead is located? m^2/ha/*"plazas"*
13. Do you own any animals like cows, pigs, chickens or horses?
YES ☐ How many?_____
NO ☐
14. How many persons in the household receive monthly incomes? _____
15. In which range does the monthly income of the household fit?
☐ Less than $155,000 (less than half a Legal Minimum Salary, LMS)
☐ Between $155,000 and $310,000 (between 0.5 and 1 LMS)
☐ Between $310,000 and $465,000 (between 1 and 1.5 LMS)
☐ Between $465,000 and $620,000 (between 1.5 and 2 LMS)
☐ Between $620,000 and $775,000 (between 2 and 2.5 LMS)
☐ Between $775,000 and $930,000 (between 2.5 and 3 LMS)
☐ Between $930,000 and $1,550,000 (between 3 and 5 SMLV)
☐ More than $1,550,000 (more than 5 LMS)
16. Which is the approximate value of the monthly expenditures of the households? $
17. What is the average monthly tariff you pay for:
Electricity $ Stratum
Water supply $ Stratum

Telephone $ Stratum
Cable TV $
Concesión of the CVC $
18. Total number of persons in the household:
Total number of male adults
Total number of female adults
Total number of children (up to 12 years)
19 During holidays and weekends, how many extra persons visit your house?

Part 3. Valuation of the micro-catchment

20. Have you ever visited on of the following streams or rivers: Ambichinte, Peña Alegría, La Clorinda, La Clorindita, La Mina or any of the other streams that pass through your locality for recreation, fishing or other activities?
YES☐ (if yes go to question 21) NO ☐ (if no go to question 22)
21. Do you consider the actual state of these streams and rivers in terms of water quantity and quality is:
Good ☐ Reasonable ☐ Bad ☐
22. Are you aware of any of the activities the CVC is actually carrying out for the protection and management of these water sources?
YES ☐ can you name any? _____NO ☐
23 Do you know of any other organization that is engaged in activities for the protection and management of these water sources?_____

Introduction I

In general, the quantity and quality of the water in rivers and streams can be improved and guaranteed through activities such as reforestation, erosion control, wastewater treatment, environmental education and regulation of water use by means of concessions, as well as many other activities. Based on this:
24 Would you be willing to pay a monthly amount of $_____ for the implementation of such activities for the improvement and guarantee of the quantity and quality of the water in the streams and rivers that pass your locality?
YES ☐ (if YES, go to question 26)NO ☐ (if NO, go to question 25)
25. Why would you not be willing to pay?
☐ A governmental entity should do such activities anyway
☐ Economical reasons
☐ It does not interest me
☐ There are no water quantity and quality problems
☐ Other, which?
26. What would be the maximum amount of money you would be willing to pay monthly for the implementation of activities for the improvement and guarantee of the quantity and quality of the water in the streams and rivers that pass your locality? $_____
27 Which institution, do you think, would be the most adequate one to receive this money and implement actions and activities for the improvement and guarantee of water quantity and quality?
☐ CVC
☐ Municipality
☐ An NGO
☐ The community water supply organization
☐ Other, which?

Part 4. Valuation of the improvement of the water supply system and productive uses of water

28. Which is the main water supply system in this house?
☐ Water supply system Km 30 ☐ Water supply system El Vergel
☐ Water supply system Km 28 ☐ Water supply system Korea
☐ Water supply system Km 27 (Chipre) ☐ Other, which?
☐ Water supply system Km 26
29. Water quality can be expressed through its colour, taste, smell, degree of pollution and turbidity. Taking into account these characteristics, please qualify the quality of the water you receive through this supply system on a scale from 1 to 5, 1 being very low and 5 being very high
☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
30 Could you please qualify the quality of the administration and management of your main water supply system on a scale from 1 to 5, 1 being very low and 5 being very high
☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
31. Do you actually use water from an additional source?
YES ☐ (if YES, go to question 32) NO ☐ (if NO, go to Introduction II)
32. Please indicate the source and use of the additional sources of water
☐ Other water supply system for:
☐ Drinking and cooking ☐ Other domestic uses ☐ Productive uses

☐ Spring for:
☐ Drinking and cooking ☐ Other domestic uses ☐ Productive uses

☐ Rain water for:
☐ Drinking and cooking ☐ Other domestic uses ☐ Productive uses

☐ Bottled water for:
☐ Drinking and cooking ☐ Other domestic uses ☐ Productive uses

33. If you have indicated that your additional water source is an other water supply system, please indicate which one:

☐ Water supply system Km 30
☐ Water supply system Km 28
☐ Water supply system Km 27 (Chipre)
☐ Water supply system Km 26
☐ Water supply system El Vergel
☐ Water supply system Korea
☐ Other, which?

34. Can you indicate the money and time you spend monthly in obtaining water from these additional sources?
Monthly value$_____ hours/month_____

Introduction II

In general, a good water supply service is considered to supply water in a continuous way, in sufficient quantity and quality for domestic uses such as drinking, cooking, washing clothes and plates, personal hygiene and cleaning of the house. A good service also includes an adequate administration, operation, maintenance and attention to the user; besides it needs to generate sufficient funds for repairs, extension of the system and covering the costs of legalisations and the use concession of the CVC. Based on this:

35. Would you be willing to pay an additional monthly tariff of $_____for the improvement of your main water supply system, that provides you a service with the aforementioned characteristics?
YES ☐ (if YES, go to question 37) NO ☐ (if NO, go to question 36)

36. Why would you not be willing to pay?
☐ The actual service is satisfactory
☐ Economical reasons
☐ It does not interest me
☐ A government entity should pay for this
☐ Other, which?

37. What would be the maximum additional monthly tariff, you would be willing to pay for a water supply service for domestic purposes with the aforementioned characteristics? $_____

38. Do you actually use water for productive and recreational purposes such as: irrigation of crops, catering of animals, cleansing of pig stalls, irrigation of large medium sized gardens or swimming pools?
YES ☐ (if yes, go to question 39) NO ☐ (end of the questionnaire, thank you very much for your time and attention)

39 Would you be willing to pay an additional monthly tariff of $_____ in order to have sufficient water of adequate quality for your productive and recreational uses, on top of the additional tariff mentioned for domestic purposes?
YES ☐ (if YES, go to question 41) NO ☐ (if NO, go to question 40)

40. Why would you not be willing to pay?
☐ The actual service is satisfactory
☐ It should be included in the tariff for domestic purposes
☐ Economical reasons
☐ A government entity should pay for this
☐ Other, which?

41 What would be the maximum additional tariff you would be willing to pay for a service that permits you to have sufficient water of the adequate quality for your productive and recreational uses, on top of the additional tariff mentioned for domestic? $_____

End of the questionnaire.
Thank you very much for your time and attention

Observations_____