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**Guidelines for designing and managing multiple uses of
water systems in rural areas of Colombia**

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Rural water supply systems in Colombia are planned considering typical urban water uses, ignoring that rural inhabitants use water for domestic and small-scale productive activities, particularly irrigation of small plots (less than 6400 m²) and keeping animals - 20 chickens, 5 pigs, 1 or 2 cows. These activities provide monthly income, in some cases around 590 US\$/month, that contributes to family basic needs and sustainability of water supply systems. These benefits are possible by supplying around 213 lpcd for multiple uses. This quantity is slightly higher than the 100-150 liters per capita per day (lpcd) established by Colombian regulation. Allowing multiple uses of water and its benefits requires planning of systems including a variety of water sources (surface water, groundwater, rainwater, fog water and even grey and wastewater), considering technological alternatives to match supply and demand, and implementing managerial strategies to ensure equity and sustainability.

Introduction

In Colombia (South America), 30% of the population live in rural areas, and from those, 73% have productive activities household based (DANE, 2005). Research in Valle del Cauca Department indicates that around 80% of rural people engage in productive activities that depend on water: 84% of households have cropped areas less than one hectare, 54% have chicken, 25% pigs, 19% cows and 8% horses. Families usually have less than five pigs (69%), cows (61%), and horses (98%), except for chicken where families can have around 20 (62%). These activities can provide an estimated family income in the bracket of US\$ 7.8 – 590 per month (Cinara, 2007). However, in this country, water supply systems are designed using an urban approach. Colombian legal frameworks recognize the use of water for domestic, commercial and industrial activities, including luxury uses that “better-off” people have (i.e. car-washing, washing machines). In contrast, uses that support livelihoods are not allowed. For this reason, Cinara Institute – Universidad del Valle (Cali, Colombia) with funds from the Challenge Program on Water and Food (CPWF) and the Colombian Institute of Science and Technology (Colciencias) has from 2004 been developing guidelines for planning MUS systems. The guidelines are based on a series of principles that promote technical, environmental and financial sustainability and offer solutions targeting the poor.

Planning of multiple uses of water systems

Multiple uses of water supply systems (MUS) are intended to provide water for domestic and small-scale productive activities that are common in rural areas and depend on multiple sources of water. The principles suggested for planning water systems under a MUS approach are discussed below.

Principle 1: Include an approach on poverty reduction and gender

Two main considerations facilitate to achieve this principle:

Establish household socioeconomic conditions: In Colombia, the most widely used methods to establish household socioeconomic conditions are the Unsatisfied Basic Needs Method (UBN), Quality of Life Index (QLI) and Poverty Line (PL). The UBN method considers someone poor if he/she does not have access to

house or sanitation or education or income. The QLI includes indicators of health, family life, community life, material welfare, political stability, job security, climate, geography, gender equity, etc. The PL considers the income level required for a basic family basket and categorizes people as indigent or poor. In Colombia, for 2007, a family with four members was poor with a monthly income less than US\$454.5 and indigent with a monthly income less than US\$181.8 (DNP, 2007).

Introduce gender perspective in all stages of the Project Cycle: men and women relate to water in different ways. In some rural areas of Colombia women are responsible for chicken (78%) and pigs (47%) while men work in crops and keep major animals like horses and cows (Cinara, 2007). This differentiation can be considered identifying people's livelihoods according to gender, including its implications in the technical design, implementation, resources management and monitoring.

Principle 2: Promote equitable access to water for all activities

Water demand estimation based on the multiple uses of water of rural families: water demand for domestic activities in rural areas in Valle del Cauca appears in a range of 73-142 lpcd, while water for productive uses can increase the demand to 213 lpcd. A rural family has from one to five cows, pigs or horses, around 20 chicken and usually less than 1 hectare (Cinara, 2007). Water consumption from animals and crops is influenced by multiple factors. Therefore, this demand should be introduced in the allocation for design and can be estimated by using different techniques: surveys, water consumption monitoring in households, workshops, interviews, focal groups, observation, etc.

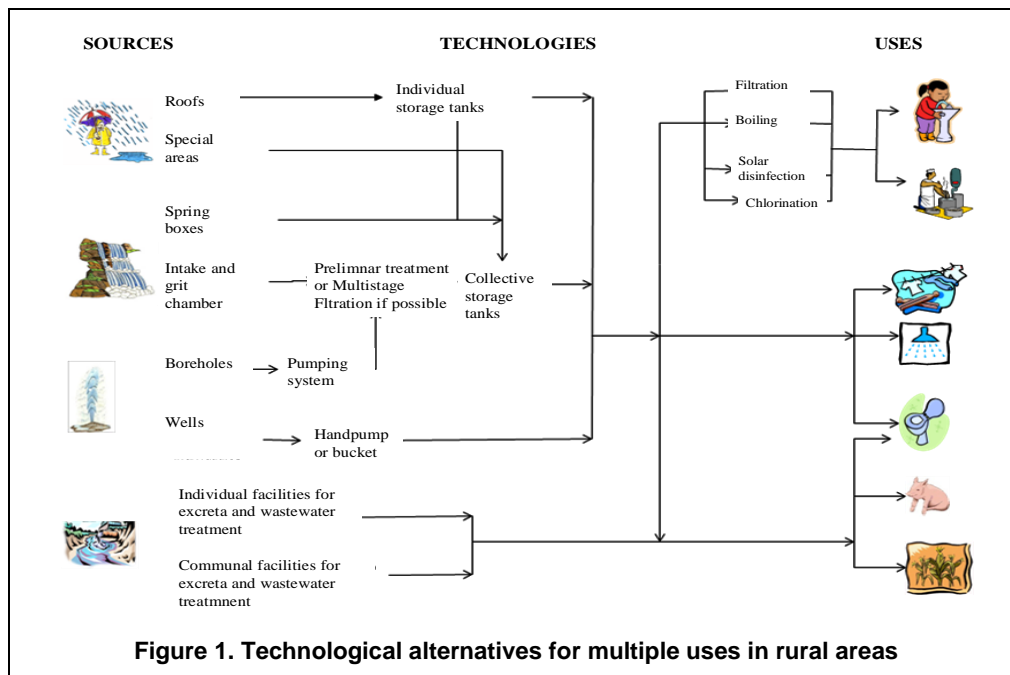
Ensure equitable access: Research in Colombia (Domínguez, 2010) also found that when systems are used for multiple purposes but designed for single uses, usually the better off in those communities undertake infrastructure investments as household storage, leading to service intermittence that can threaten access to water for those that are not able to build such infrastructure. For that reason, a system allowing for MUS must clearly identify all users and their particular water demands and establish an organization capable to enforce rules that allow access to all users and provide equal benefits for the different customer categories.

Principle 3: Use different sources of water

The demand of water for drinking purposes is only between 4-6 lpcd (Howard & Bartram, 2003). Colombian laws however indicate that all the water provided from a water supply system should be potable and establish as the main source surface and groundwater and prioritizes the design of centralized systems (Mindesarrollo, 2000). However, nowadays, more frequently, water supply systems cannot satisfy people's demands due to the insufficient quantity/quality of water available from traditional sources. Therefore, to satisfy the full range of people's needs, systems must include the use of multiple sources from the planning stage. This requires *assessment of water availability in quantity and quality* from surface, groundwater, rainwater, fog water and even grey and wastewater, depending on the quality and quantity required for the intended activities. It provides accurate information for planning, matching supply and demand. The *risks associated with quality according to intended uses* should be estimated, the Water Safety Plans approach (WHO, 2005) can be followed. Once the potential uses of each source are identified, it is suggested to prioritize with the community the uses allocated to the different sources and plan according to this prioritization.

Principle 4: Consider different technological alternatives

To provide around 213 lpcd for multiple uses from multiple sources, different technological alternatives that match supply and demand can be considered. Treatment selection depends on water quality, uses and costs. The options include from centralized treatment of all the water to be supplied before the distribution network and the provision of drinking water for all uses, to the distribution of raw water and treatment at the household level of the water required for drinking and cooking. Alternative selection should be carried out ensuring informed community participation. Figure 1 presents potential sources, uses and treatment requirements.



Principle 5: To introduce cleaner production strategies

The cleaner production (CP) concept can be applied in water supply systems from abstraction to consumption in order to maximize the resource for a wider range of uses. *CP strategies can be considered at the household level for domestic uses, and for small-scale productive activities such as pigs and cows rearing, and water balances can be used for deciding crops to be introduced.* Assessment of water availability should include treated wastewater, according to the type of crops and water quality restrictions. *CP strategies can be implemented at the collective system as well.* Activities include measurement, detection and repairing of leakages; reduction in infiltration losses; installation of float valves in storage tanks; asset management, pressure control and regular monitoring to evaluate performance and infrastructure condition.

Principle 6: Establish an organization for managing the multiple uses of water system

Organizational structure: In Colombia, organized communities are usually in charge of water provision in rural areas. The most common structure is the Nonprofit Community Organization, which have managerial and financial independence, with a non-defined period. Customers are the members and everyone has the same rights and obligations.

In the case of MUS, The organization in charge should provide the service and facilitate people's livelihoods. Aspects that should be considered are the infrastructure features and capacity, water provision costs, deep knowledge of people's livelihoods, and available water. The organization should be integrated according to people's livelihoods and it is suggested that the Directive Board has one representative from each productive sector in the settlement, ensuring a decision making process that considers everybody's interests. Furthermore, a productive advisor can guide families to improve the use of water for their small-scale productive activities. The system rules, besides including the aspects of a domestic system should establish which uses of water are allowed and the scale; pipe diameters, quantity of users that can be attended under a certain service level; allowed size for household storage tanks, regulation of water for irrigation purposes, and conflict resolution mechanisms.

Tariffs: In Colombia, the legal framework establishes the methodology for tariff calculation, based on consumption obtained from household meters. However, the quality of water and intermittence in many rural services frequently cause problems in meters. For this reason, for MUS, the charge of the service can be established according to type and scale of productive activities at the household. To do this, the total costs of running the system should be established and distributed among the activities of the users considering their scales. Flat tariffs should be avoided. For instance, it is not equitable to charge the same price to those that have two pigs and to those that have 20 pigs. The ranges of magnitudes can be defined with the community.

Conclusions

In Colombia, the use of water for small-scale productive activities in rural areas is restricted, creating a barrier for the people to develop their livelihoods. This situation contributes to unemployment and migration to cities. Therefore, planning of rural water supply systems considering multiple uses requires introducing water requirements for domestic and small scale productive activities that are income generating, contribute to poverty alleviation and cost recovery in service provision. The proposal includes multiple sources as consideration of water availability for planning, in contrast to the approach of Colombian legal frameworks that prioritize the use of surface water, ignoring the potential of other sources to complement traditional options and reduce pressure over groundwater and surface water. It is also suggested that water should be provided for each activity according to quality and quantity requirements and based on this criteria, undertake source selection. Consideration of different technological alternatives to match multiple uses and multiple sources is also suggested.

Systems should be managed by organizations intended to provide the service for all uses and users. Interests of the different categories of users should be taken into account and families should receive support to improve the use of water for domestic and small-scale productive activities. Besides, a tariff system which does not rely exclusively on meters, but that contributes to equity is also proposed. This system is based on the scale and type of productive activities and the charge should be calculated taking into account the total costs that should be assumed by the organization in charge of service provision.

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