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ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN IMPLEMENTATION OF THE UPPER MEFOU WATERSHED IN CAMEROON

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ABSTRACT

Despite the support of environmental management laws in Cameroon, implementation of the impacts assessment results remains low. Studies carried out at the catchments and treatment stations to sustain the quality and quantity of water resources mostly neglected the watershed that is the potential source of pollution and reduction in the water supply. This phenomenon is worst in urban and semi-urban areas where environmental conditions are rapidly deteriorating due to unplanned urbanization partly linked to demographic pressure. The ESMP aims to fully secure the immediate protection perimeter by constructing a fence of about 30 km. The promoter recruited a support structure responsible for achieving the above objectives. The implementation effectively began in 2012 with activities like sensitization, inventories (agriculture, land, housing, etc.), boundary markers and creation of a database managed as geographic information system. From inventories and mapping, different types of vegetation in the Upper Watershed were identified. A tree nursery consisting of local forest species made it easy to plant over 3000 individuals in vulnerable areas. Traditional latrines were destroyed and replaced with biological latrines offered freely to populations. A nursery and primary school was opened with about 100 pupils in the first year. Local residents had training on cooperatives to increase their revenues and on livestock in order to divert activities on the bed and waterways surrounding. Results showed that promoter reduced significantly operating costs when stakeholders feel involved in the project. CAMWATER has profited from this experience to create two additional units which provide and promote green jobs.

Keywords: Camwater, catchment, stakeholders, Yaounde, environmental laws, protection perimeters.

1.   Introduction

The availability and quality of surface water on the planet is influenced by human activities. To ensure his biological needs, human beings often occupy the vicinity of water sources. Thus, during land use, the various anthropogenic activities applied at the catchment areas have diverse consequences both on water quality, as well as his socio-economical activities (Bunea *et al.*, 2010; Torok *et al.*, 2011; Weidema, 2011). One of the most common pollution of surface waters is the gradual enrichment in nutrients and organic matter that are the origin of eutrophication (Benchea *et al.*, 2011; Dehbi *et al.*, 2007; Petrisor *et al.*, 2010). Usually, to sustain the supply of drinking water in quality and quantity, it appears indispensable to implement a protection policy of water used in catchments through the establishment of protection perimeters (PP).

More than simple contours, the PP are among the fitting out measures of territory, the most appropriate for the protection of drinking water. Everywhere like in Cameroon, the law defines three types of perimeters: the immediate PP (IPP) includes the most constraining conditions; in order to avoid deterioration of installations and dumping of pollutants substances in the proximity

of water supply, no activities other than those relative to exploitation and installations upkeep are authorized (Garouni and Merzouk, 2004). The near PP (NPP) is implemented to protect catchments against migration of pollutants substances (Djemin, 2009). The easements imposed inside this perimeter, concern all activities likely to destroy water quality. Its area is determined according to the slope of watershed (Lallemand-Barres and Roux, 1989). The distant PP corresponds to an area or the whole watershed that supply the catchment which is elaborated in order to protect reservoir against persistent pollutants (Garouni and Merzouk, 2006).

Despite the support of environmental management laws in Cameroon, implementation of the impacts assessment results remains low. Studies carried out at the catchments and treatment stations to sustain the quality and quantity of water resources mostly neglected the watershed that is the potential source of pollution and reduction in the water supply. This phenomenon is worst in urban and semi-urban areas where environmental conditions are rapidly deteriorating due to unplanned urbanization partly linked to demographic pressure. Unfortunately in Cameroon, very few surface water used as potable water catchments have gotten a protection perimeter. As far as this policy is concerned, the Mefou Lake appears as a pilot project. Created in 1969 the Mefou dam was abandoned for more than a decade before being reactivated by the Government in 2011 through international investment funds. The rehabilitation of the Mefou dam affected mainly periurban and rural population (about 10 000 inhabitants) established in both sides of the lake.

The Mefou Lake water catchment is potentially threatened by human activities along its watershed. The clearing of the water surroundings for agricultural purpose and the progressive extension of urban areas due to demographic pressure combined with anarchic urbanization in Yaounde, the capital of the country constituted the main factors of water degradation. Quantity and quality of Mefou reservoir could be deteriorating due to pollutants thrown by populations which are increasingly growing on the watershed. Therefore, protection of this reservoir is imperative due to its sensitive nature to exploitation and pollution. The Cameroon water utilities corporation (CAMWATER), the public promoter of potable water supply in the country, recruited a support structure called Technical Assistance Unit (TAU) to implement the environmental and social management plan (ESMP) of the rehabilitation of the Mefou dam with the aim to fully secure the immediate protection perimeter by building a fence of about 30 km. The main objective of this study is to show how an independent structure, constituted by scientists, conducted the implementation of an ESMP with success by establishing three protection perimeters around the Mefou reservoir in order to ensure the quality and quantity of water.

2.   Material and methods
2.1. Study site
Located in the western peri-urban of Yaounde, the Centre Region of Cameroon, the Mefou Upper Watershed lies between the southern dense equatorial rainforest and the central forest region within latitudes 3°33' to 3°59' N and longitudes 11°22' to 11°39' E (see Figure 1). It has an estimated surface area of about 9,528 km^2 entirely on a plateau with rolling mountains at altitudes of about 800 m reaching maximum peaks at occasional massif of 1300 m. The predominant vegetation is rainforest. Several small streams are found within the upper watershed and some drain into the Mefou and eventually into Nyong River. The climate is of the equatorial type with four distinct seasons including two dry seasons (December to March and July to August) and two rainy seasons (March to July and September to October). The estimated average annual rainfall is about 1600 mm with a recorded maximum just above 2000 mm and minimum about 1100 mm (Ndam-Ngoupayou *et al.*, 2007). The mean monthly temperature is about 25 °C and annual potential evapotranspiration is estimated to be between 1200 mm and 1300 mm.
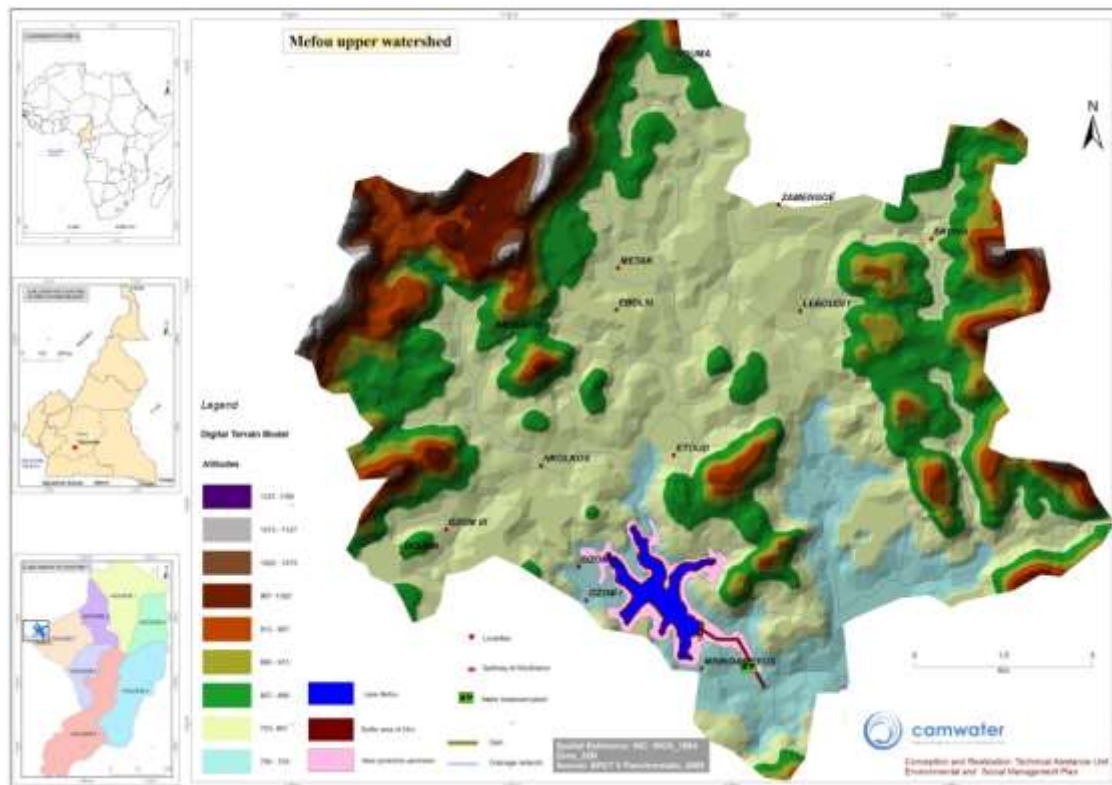
Figure 1: Location of the study area.

2.2. Methods

2.2.1. Awareness initiatives

The sensitization was to meet with the administrative authorities and the chiefs of the various villages. Meetings were then held in all villages with local populations. Leaflets produced were distributed to populations with explanations in local languages. Local consultative committees were set up in each locality.

2.2.2. Demarcation of protection perimeters

The delimitation of the IPP involves several partners. The operations were carried out in connection with the technical services of the State which are those authorized to perform certain tasks (e.g. the boundary line or the evaluation of assets for the payment of compensation). The topography around the catchment area is not uniform in order to use a single distance. The principle of water protection against runoff from neighboring ecosystems and differential erosion was adopted. A transect from 3 to 5 meters wide was opened at the top of the peaks around the lake to materialize this limit. About 200 boundary-stones georeferenced with the GPS were planted. Information boards which include the existing legislation were also planted to limit intrusion within the prohibited area. Biological, land, agricultural and real estate inventories were performed. All field data were integrated into GIS ArcGIS 10.1 software activated with a panchromatic SPOT 5 image and one of Google Earth. Different garbage deposits were identified. Samples of raw water and their analyses *in situ* and in laboratories permitted to set the state of the resource at the beginning of the project and monitor its progress.

2.2.3. Implementation of accompanying social measures

A socioeconomic survey was carried out in three localities (Minkoameyos, Ozom I and Etoud) surrounding the Lake Mefou. Questionnaires, interviews and discussions were conducted on households, focus groups and individuals in the localities around the Mefou reservoir to investigate the basic problems that originated from the dam. Target resource persons were adults, family heads and members of communities whose land was affected by the rehabilitation of the dam.

3. Results and discussions
3.1. Catchment area protection
After several sensitization meetings with the population on the relevance of measures to protect catchments of potable water, the three protection zones have been demarcated. Data from the GIS estimated the IPP at 1727 km² and the NPP at 5746 km². Boundary stones were placed along the edge of the immediate PP. This boundary is regularly maintained by local residents. All lands or plots of the populations were identified and mapped (see Figure 2). Awareness had the main positive impact of the full involvement of local communities in the implementation of the ESMP.
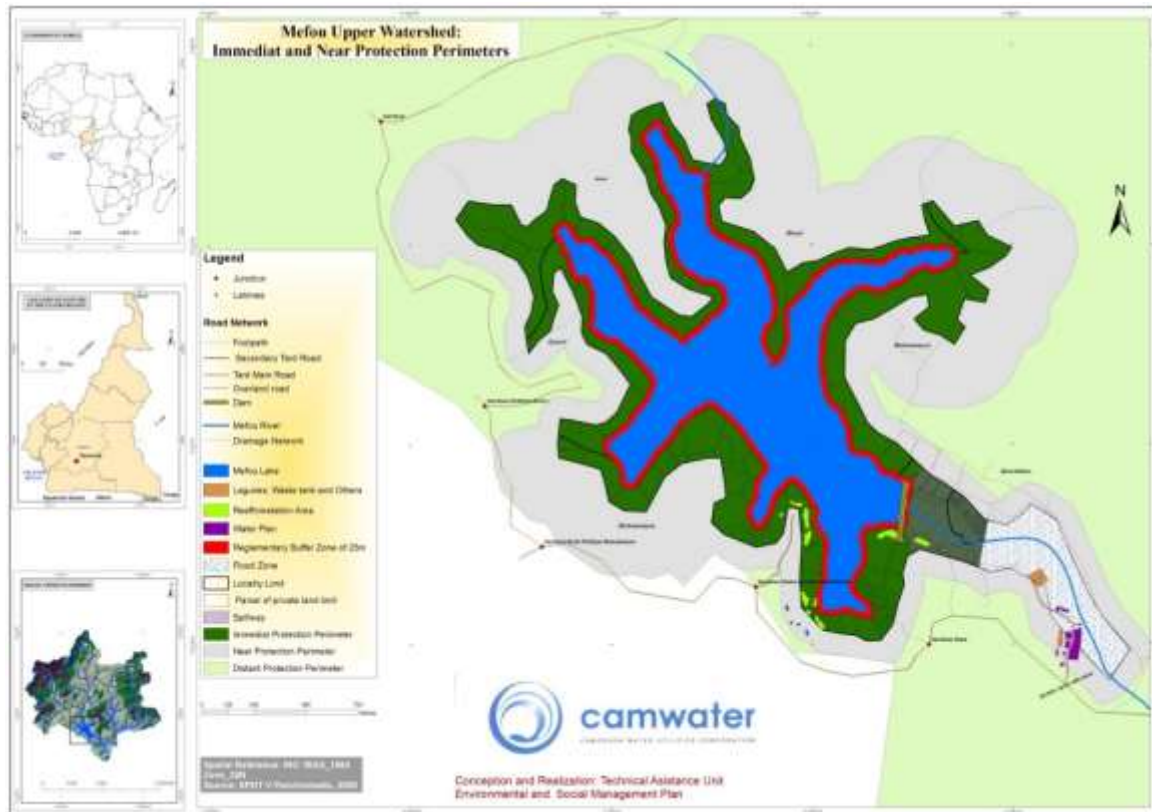

Figure 2: Mefou Lake Protection Perimeters

The realization of the Mefou ESMP activities took into account the most important factors which are legislation and regulations in force, the requirements of funders seen in the compensation of all the people whose property has been respondents and the social responsibility of CAMWATER. The active participation of the population contributes to the achievement of several objectives (O'Faircheallaig, 2006). Through consultations, many conflicts were avoided between the people and companies on one hand and on the other with CAMWATER. Despite sporadic reactions of some activists, the collaboration between TAU and the populations is perfectly maintained. The establishment of this structure has facilitated the implementation of the Mefou ESMP in that it indicates almost everywhere that; where the State is committed to managing environmental issues alone, it happens more often to a loss of confidence of the people in institutions and leaders (André *et al.*, 2010).

Several worries of the population have been met including the construction of a bridge over the spillway that allows them to cross safely. Local people have been given priority in the recruitment of unskilled labor in the construction of the water treatment station, rehabilitation of the dam and pipe laying. The satellite image and field observations show that the area is booming with human activities. The census shows a dichotomy between suburban and rural areas. Food crops plantation on one hand, home gardens and fallow while secondary species of semi-deciduous forest are dominant in rural areas.

3.2. Protection of the resource

The vulnerable areas caused either by natural phenomena or by human activities have been re-afforested. Three thousand plants consisting only of local forest species were planted. A collaboration agreement was established with the Ministry of Forestry and Wildlife to support this activity. This re-afforestation contributes in the protection against erosion, prevents sedimentation of the lake and promotes the retention of a large number of pollutants. To sustain the potential of drinking water supply, weeding the lake and its tributaries is performed regularly to avoid the threat of colonization by invasive aquatic plants (*Polygonum acuminatum* Kunth and *Nymphaea lotus* L.).

The observations and the results of socio-economic surveys revealed several sanitation problems in the immediate surroundings of the abstraction point. Sensitization on the household waste management, construction of latrines and biological toilets for the benefit of the populations in the near PP are measures to limit pollution of the lake water and the risk of diseases. Regular monitoring of the quality of raw water and treated water (physico-chemical analyzes, bacteriological and parasitological) are involved in the supervision of the resource. Despite the recurring presence of coliforms in raw water, almost all the results of the different evaluated parameters comply with the WHO standards.

3.3. Social measures

The inventory of assets implicated in the IPP concerns about 1000 individuals. The Cameroonian regulation provides three types of compensation: land, housing and crops. The evaluation of all expropriations to indemnify is around two billion CFA francs (about € 3,000,000). The action plan of this ESMP included several incentive measures for the development of the whole Mefou High Drainage Basin. Despite the limiting factor that is always limited financial resources, the extension of the drinking water system was conducted in the suburban area of the project. Drillings are being constructed to ensure the supply of potable water to rural areas. Roads are regularly maintained to avoid the isolation of the rural part. Electrification studies of the whole area have been completed and will be presented to target councils. Two schools were created and opened in Etoud, a village in the rural area whose nearest school was about 5 km.

Training seminars are regularly offered to the populations of the ESMP area. They were trained in poultry farming, fish breeding, the mushroom-growing, the snail farming, livestock farming (large rodents, e.g. hedgehog), sustainable agriculture and the management of community assets. Particular emphasis is placed on creating income generating activities. The management model adopted in the cooperation with the competent state services for sustainability is the formation of cooperatives. These structures receive management and public subsidies.

As in most developing countries, the main difficulty encountered in the implementation of this ESMP is the poor mobilization of financial resources (Benabides, 2011). The incivility often due to the selfishness of certain individuals is also a threat to the adherence of the population. The construction of houses in the IPP after the assessment of the property is a delicate social problem since most often significant resources are committed to this work.

4. Conclusion

The implementation of the Mefou ESMP is actually devoted into four major dimensions: environmental (preservation and improvement of ecosystems, biodiversity conservation, rational management of natural resources, etc.), social (promoting the living standards of the population), economic (creation of income generating activities in the fight against poverty) and governance (effective implementation of the legislation). The social measures to the benefit of the populations have improved the image of the promoter. The results of this recruited structure have motivated CAMWATER to create two similar units for the sustainable management of the two main catchments of the country.

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