

- The white oter (Aonyx Sp) Contributes to diminish catches while eating fishes caught by the nets, lines and barriers;
- The less performing smoke system requires an important use of wood. The use of "choker" oven would contribute to preserve destruction of the forest. This equipment uses less wood for a better yield as compared to the traditional tray.

1.6 HUNTING

Hunting is the real economic activity for the population of the study zone as it gives animal proteins in food and financial income, not negligible.

1.6.1 Forest Fauna

The savage fauna is diversified and very abundant. Field investigations carried out besides the hunters plus the data of the literature, serve to draw up a list of the species found in the study region as described in Annex I of the general study and in the Appendices of this Annex III.

This fauna is dangerously on the decline now due to an intensive disorganized hunting. Many species of animals have disappeared (leopard, hylochere, faux gival, chives...) whereas others are about to disappear (gorilla, chimpanzee, panther, elephant, crocodile). All the peasants agree on the fact that their booty decreases year after year.

It should be noted lastly that the activity of catching parrots which was quite intensive about a year ago has just disappeared due to environmental protection associations which are against these practices and which have been informed by many Air companies of their refusal to transport these birds.

1.6.2 Types of Hunting

Hunting is mainly men's activity. It is done either with guns or with traps.

1.6.2.1 Gun hunting

It is generally done with caliber 12 guns. According to the Ma'an Control Post, there are 23 guns in perfect condition in the zone. The species that are specifically hunted by these arms are those that go from tree to tree and which are difficult to be trapped through other hunting methods.

Investigation reveals that the quotas are as follows:

- 15 mandrills killed per year per gun;
- 4 gorillas killed per year and gun;
- 2 chimpanzee killed per year by gun;
- 2 monkeys killed per gun each week throughout the year.

In average, two boxes of cartridges, that's 50 cartridges are used every year by each hunter.

This type of hunting is practiced all year long and the game killed is generally sold after removal of the four legs that represent 80% of the volume; the rest is for self-consumption.

It should be noted that scarcity of munitions has as direct consequence the intensification of trap hunting.

1.6.2.2 Trap Hunting

It is by far the most popular means of hunting. Many types of traps can be distinguished:

- aerial neck traps for monkeys and squirrels;
- Land snare for rodents and small carnivorous;
- Land foot traps for cephalophers;
- Pole-ax trap (Ekoumou) for rats and aulacoels (hedgehog).

Apart from this last type that uses local vegetal materials, the other traps are fabricated iron cables that resist bad weather.

This means of hunting is mainly practiced during the rainy season when the animals leave the marshy areas in quest of dry zones. But when it rains much (October and half of November) the catches are not so good thus the best hunting period is; Mid - March - April - half June and September - half November and half December making five months in the year. The rest of the year is reserved for "subsistence" hunting along the stream when animals come to drink water. The most frequently captured games by this type of hunting are the blue cephalophus locally called hares, yellow back cephalophus, with a black dorsal band and antelopes, "Artherure" called porcupine and aulacod (locally called hedgehog). The other types of animals are caught by chance and often rarely.

i) Categories of hunters

With regard to the duration of hunting, a classification of the hunters of the region can be done in two categories: the "small" hunters and the "big" hunters (or professionals).

The first category, small hunters, who are more of farmers and visit their traps two to three times a week: these are small hunters who have about 50 to 100 traps over a portion of about 5 kilometers around the villages. Besides them, we have the "big" hunters who go into the forest to spend one to two weeks and come back to the village during week-end to sell their game and acquire food. They go beyond 10 kilometers from the village and set more than two hundred traps; this could fetch them about a minimum of 28 games per week composed of 7 hares, 5 porcupines, 3 antelopes, 3 hedgehogs, 5 rats and 2 pangolins. As for bush pig a number of 7 per year is estimated. For small hunters, the estimate is 5 games per week composed of 2 hares, 2 porcupines, 2 pangolins, 2 rats and 2 antelopes per week.

During the dry season (dead season) the number of games killed per week per hunter is estimated at 4: 1 hare, 1 porcupine and 2 rats. It is at this time that crocodile is hunted with a ratio of 3 crocodiles per year per hunter.

ii) Number of hunters

According to the results of field surveys in October 1992, there were 11 "big hunters" and 90 "small hunters", i.e. 101 hunters in total. The distribution of hunters by village is shown in a table in the Appendices.

1.6.3 Estimate of Species Annually Hunted

Taking into consideration all the components and standards mentioned above, it is estimated that the total number of animals slaughtered each year in the project area amounts to 36,750, with a total living weight of 181 tons or 78 tons equivalent in carcass. A table giving the number of slaughtered animals by species and type is given in the Appendices.

1.6.4 Marketing and Revenues

1.6.4.1 Destination, marketing channels and prices

The games captured are either consumed, or sold in big centers of Nyabessan, Ma'an or Ebolowa and to passers-by.

The percentages of self-consumed or sold games depend on the mode of hunting, type of hunter, and species hunted. Thus,

- for big hunters using a gun, 80% of the produce is sold and 20% self-consumed, including rare species;
- for big hunters using traps, and a gun from time to time, 60% is sold 40% self-consumed, including the species hunted in the area;
 - for small hunters, 90% is self-consumed and 10% sold, including the species the most common;
 - during the dead season, 60% is for self-consumption and 40% for sale.

It is estimated that about 115 tons are self-consumed, which represents a living weight of 72 kg per person per year or 197 g per day.

With regard to marketing, the prices are determined by many parameters:

- the volume of demand and supply;
- the buying place (the prices increase in proportion to the distance from the study area);
- the origin of the buyer (strangers buy a little higher prices)

The marketing channels are often modified and hindered by control agents who most often seize the games to sell them by auction. The prices vary between 800 F.CFA and 3,000 F.CFA by piece of smoked game depending on the selling location and the species sold. Detailed prices are given in the Appendix on Hunting. These prices may vary by one to three times if the game is sold near to the large city.

1.6.4.2 Estimate of revenues from hunting

The estimate of revenues from hunting was based on the following elements:

- Category of hunters;
 - Prices used for evaluation are those applied in Nyabessan.
 - All the rats are consumed while all the crocodiles are sold alive.

The revenue of a big hunter having a gun is 460,000 F.CFA per year; that of a big hunter without a gun is 260,000 F.CFA/year; and that of small hunters is 70,000 F.CFA/year.

The detailed calculation of revenues of various categories of hunters is shown in the Appendix on Hunting.

1.6.5 Damage to Crops

Crops planted in the forest are frequently devastated by wild animals. Gorillas, chimpanzees and monkeys are devastating specialists for cacao, maize and bananas, while artherures and hedgehogs and bush pigs destroy cassava in the fallow.

In conclusion, hunting is one of the most important activities of the inhabitants of the region; game is the only product whose demand is certain and has an agreeable taste. However, intensive poaching causes a decrease in this source year by year. The enforcement of law is quite difficult and more efficient measures should be found to keep the animals from disappearance but, at the same time, without "starving" the inhabitants.

1.7 FORESTRY EXPLOITATION

1.7.1 Traditional Exploitation

The inhabitants of the zone of study utilize freely the forestry products available for many purposes as follows:

1.7.1.1 Construction

Traditionally houses are constructed either with rammed earth or with wood. In the first case, only the structures and door frames require this material. Stretched thatch roofs are giving way bit by bit to corrugated iron sheet. As far as the framing structure proper is concerned, the original material seems to be rachis of raffia leaves (*raphia monbuttorum*). For more sophisticated structures, poles got from the forest are used. Young trees with a diameter of 10 cm or less are selected for this purpose. The species the most durable are used. The following are given priority:

- *Hallea ciliata*
- *Uapaca togoensis*
- *Trema orientalis*

1.7.1.2 Firewood

Cooking is directly done on fire wood. The following types of woods are mainly used:

- Akom
- Asseng
- Akak
- Ebebeng
- Oyang

1.7.1.3 Alimentation and pharmacopoeia

Like elsewhere in Cameroon local cooking and pharmacopoeia require the use of available vegetal resources: leaves, flowers, fruits, tree barks, saps are used as the case may be. We can cite the fruits of Ndo'o as well as those of Amvout or Tom, Ngale and Afan. The bark of Ekouk helps to fight against fever.

1.7.2 Mechanized Farming

It is practiced with the help of chain saws (5 in all for the project zone). Trees are felled and cut up on the spot by sawyers. The products obtained are lathes, planks and rafters which are more and more utilized in homework and furniture in the villages. The main trees used are:

- Abang
- Olom
- Ekouk
- Odjom

It should be noted that SONEL also used the services of sawyers in particular when it built a small bridge (over Nkoremba going to Aloum 1) to provide access to the villages located on the right bank of the Ntem river and for the construction of its camp.

1.7.3 Industrial Exploitation

In spite of its richness in construction wood, the forest is not exploited for industrial purpose in the study area. The Campo forestry company which is nearby, has no direct influence. It should be noted that a forestry development plan was formulated by ONADEF (National Office of Forestry Development). The plan aims at dividing the zone into forest reserve area, forest protection area, development area and agro-forestry area.

A inventory of the forestry resources of South-Cameroon (1983) has permitted to classify the trees of the region under five main groups which are:

- A: Species with high commercial value
- B: Species commonly available
- C: Species irregularly available
- D: Species sporadically available
- E: Species locally abundant but less popular

1.8 OTHER ECONOMIC ACTIVITIES

1.8.1 Tourism

At first sight, tourism in the study zone is reduced to only one activity today: - Visiting the Memve Ele waterfalls. The promotion of this unique natural touristic product is obstructed by the enclavement of the region and lack of infrastructure and accommodation facilities like hotels and restaurants.

After the construction of the dam and related structures, two other touristic activities could be introduced: Sports fishing and visit of fauna reserves. These new activities would contribute to the development of tourism in the area and the promotion of handicraft production, provided that private developers are interested and invest in this sector.

1.8.2 Handicraft

Presently, traditional and modern handicraft in the zone of Nyabessan exists in the form of a well mastered technique by the inhabitants.

This is why we can find: baskets, stools and beds made out of bamboo, mortars and pestle, spoons and plates in wood, mats, canoes, tom-toms and drums, balafons fabricated by the inhabitants themselves. Because of a lack of consumption market for these art objects, and the non valorization of traditional cultures, handicraftsmen produce these objects only in limited quantity for self-use or as gifts.

1.8.3 Picking

The rich equatorial forest of the study zone still constitutes an important reserve for picking for the population. Many products can still be gathered from trees, from the soil and even from the rivers. These are:

- fruits such as EVOUHE, ATOTA, EKOUA, EKONG, MVOU from trees;
- at least 3 kinds edible mushrooms from the soil; and

- small aquatic snails from the rivers.

However, the impact of activities surveyed in this sector is small, both from the viewpoint of population's alimentation and income resource.

1.8.4 Commerce

About thirty years ago, this zone used to be a linking commercial center for Equatorial Guinea and South Cameroon. But today there is a striking decline due to its enclavement and its far distance from the main transport axes and consumption centers (Ebolowa, Ambam, Gabon). Today exchange activities are limited to a small commerce which has been boosted by the STS's construction site, the installation of SONEL Camp, and the road repair works. This small commerce somehow manages to survive while waiting for the start of the dam works.

This commerce is done simultaneously in the villages through two channels:

- street stalls or bars;
- periodic markets of Nyabessan, in the formal channel;
- mobile sellers and shops or bars (kitchen), in the informal channel.

It is through these channels that they the people purchase the products of primary necessity for their family as well as the equipment and inputs for production.

It is only at Nyabessan that all the forms of formal channel are found; that is, shops and bars - there are 5 in all; on the contrary the whole zone is dotted with shops and bars in the informal channel, as almost every bar sells at least beer or Arki. A few mobile sellers and "bayam selam" are also found in the whole area during the dry season.

On the other hand, many family heads in Nyabessan say they get their products mainly from Ebolowa and at times from Ambam, which is the new chief town of the department. Many women also say they sell their foodstuffs directly at Ebolowa, as well as the hunting and fishing products in spite of the high transport cost, poor condition of roads, and frequent checks by tourism agencies and water and forest agencies. These exchanges constitute an important support to the families and are analyzed in the chapter on revenues.

1.9. ALIMENTATION AND AGRO-ALIMENTATION BALANCE OF THE POPULATION

The populations of the project zone have an alimentation in which products from the river, forest and cultivated land play some major roles.

- River products are constituted by fish consumed, fresh or smoked, and fished traditionally by a large number of family heads. During field investigations some families told that they, from time to time, consume smoked (Bifaga and cod) or fresh sea fish occasionally bought from town.
- Forest products comprise various games killed on caught, which constitute the essential protein source in the alimentation, and picking products (natural palm nuts, mushrooms, almonds, various leaves) used in sauces.
- Cultivated land products are mainly cassava which is eaten fresh or processed in sticks and whose leaves are also consumed like vegetable. Other products are, in order of quantity consumed: plantain, cocoyam, sweet potato and yam. The grains of cucumber and peanuts as well as locally produced onions are used in sauces.

In addition to these local products, the Mvaye and Ntoumou populations regularly buy rice (very appreciated), beef, refined oils.

The food of these population is consequently very varied considering the richness of the area: meat stew, fish stew, and vegetable provide proteins, accompanied by glucids through cassava, cocoyam or plantain and lipids through palm nuts, groundnuts or ground cucumber.

The populations of the zone consequently enjoy a very good quality of alimentation based on a varied production drawn from the area. The ration in calories had been estimated by ORSTOM-MESIRES (the nutritional situation of Cameroon according to the most recent epidemiological investigations and Alimentation and Health of the Forestry Populations of South-Cameroon 1989) at 1,950 kcal/day. These studies also indicated that consumption of animal products is about 200 - 250 g/day per capita, which is very high.

Consequently the populations of the zone are more and more affected in their alimentation by a decrease in games as a result of over-exploitation (see Chapter on Hunting, Item 1.7.) and the reinforcement of the hunting regulations.

1.10 COMPOSITION OF REVENUES BY ACTIVITY

1.10.1 Activities of the Population

The area subject to the impact of the dam covers almost solely the people engaged in supplementary rural activities such as: agriculture, hunting, fishing, stock farming, picking, tree cutting. Besides, a number of civil servants, government officials or other "confessional" agents, who most often live in the study area, are also doing these activities as an additional supporting source.

Agro-economic investigations carried out in the zone have helped to establish the typology of the family heads. The typological characteristics are described in the chapters related to sectorial activities and to revenues.

i) Planter

His main activity is cacao farming but due to the fall in price of his product, he somehow neglects this activity and diversifies his income resources through picking, hunting and fishing to which he pays more and more time through a rational organization of his time. This category of head of family is predominant in the zone where cacao plantation has played a central role in the socio-economic activity for more than 50 years.

ii) Hunter-fisherman

Although he has a cacao farm, this type of family head spends most of his time on these two activities which he carries out according to the seasons. Cacao farming is becoming a secondary activity to him and its exploitation generally inherited is often abandoned or hardly maintained.

iii) Professional hunter (or fisherman)

He takes up this business very young and spends his time exclusively on that throughout the year. Although their number is not great for now, this category of heads of families could have an increasing number with the improvement upon communications roads and the come back of certain youths noticed in some villages.

iv) Female farmer, family head

Most often unmarried mother, divorcee or widow, this category of head of family depends mainly on foodstuff agriculture from which she has most part of her income but also on some secondary activities which are not negligible:

- the sale of beer, palm wine or alcohol drawn from palm wine or from corn (odontol)
- the marketing of foodstuff and/or game animals in town.

Some of these women have cacao farms inherited from their father and which they maintain on behalf of their brothers who are absent in the village.

v) Public servants and other employees in the area

They mostly live in the project area and work either in the sector of public or "confessional" education or in the health sector, but rarely in the agricultural development sector. For this reason, these public servants and employees are sometimes mixed up with farmers, hunters and fishermen because they are engaged in the same activities as these people.

1.10.2 Marketing and Agricultural Incomes

There is a need to make a distinction between the main cash crop product, which is cacao, and other products (agricultural and picking products) to better understand the problem of marketing in the area.

1.10.2.1 Cacao

Before the 1988/89 campaign season, commercialization was organized. Companies like farmers cooperatives were in charge of purchasing cacao at a price fixed by the state from farmers with money that was given to the farmer in advance by recognized buyers. This made the farmers to manage and commercialize their product locally. This system functioned simultaneously with another called "coxage", a clandestine buying of cacao from farmers at a non controlled price.

Since the 1989/90 cacao season, the Cameroon Government has liberalized the marketing of cacao in the whole country (any cacao buyer can buy cacao from any peasant on the basis of a reference price fixed by the Government but which the buyer is not obliged to respect).

Meanwhile, the price of cacao has fallen to about half, from 420 F/kg for grade II and I in 1988/89, to 210 F/kg in 1990/91 and the basic cooperative bodies have been pushed out of the commercialization of cacao due to feeble financial capacity and management of UCA Sud (Union for Agricultural Cooperatives of the South Province) that had replaced SOCODER.

The combination of these two effects: liberalization of cacao business and the decline in price has decreased the average revenue per family-home for more than 50% as seen in the following filed investigations results:

Cacao Season	1988/89	1998/90	1990/91
Revenue (average) per family-farmer	164,209	77,887	59,780

Source: SEDA survey on 50 family heads.

This drastic fall in revenue is alleviated by the commercialization of all the agricultural products, in particular food crops, which has increased owing to the installation of companies involved in the study on the dam, and which is a domain almost exclusively reserved for women.

1.10.2.2 Marketing of other products

The populations in the study zone have always practiced farming at a subsistence level because as they live in an enclosed zone, all their products are mostly self-consumed. The very few sales that take place was done on the village spots and concerned almost exclusively cucumber sold to intermediary merchants (bayam sellam) who came time and again, or sold at Ebolowa or Ambam when the women could find transport means, but with the uplifting of Ebolowa to a provincial chief town, on the one hand, and the execution of various studies on the dam, on the other hand, these agricultural and picking products are more in demand. Consequently farmers find more and more buyers in their village, at Nyabessan center, as well as among the employees of companies entrusted with the dam studies, and also the "bayam sellam" from Ebolowa. Ambam, Ma'an and even from Equatorial Guinea in quest of supplies. The monetary incomes from the sales of agricultural products in 1991 are shown in the table of agricultural monetary income calculated in the section on production.

The table below gives some details on the sales and the ratios of family producers/sellers in the area:

Type of Products	Average Income per Family (FCFA)	Ratios of Family Producers/Sellers (%)
Cassava - Fresh	131.700	33
- Dried	30.000	2
Plantain	80.309	51
Cucumber	38.188	51
Groundnuts	28.146	47
Sweet potato	10.500	6
Yam	10.900	10
Cocoyam	77.429	14
Fruits	9.375	8
Palm oil	58.137	49

Source: SEDA Survey

It must however be underlined here that not all food producing families sell their product because many are still producing for self-consumption. The above table therefore shows the percentages of incomes by product by family groups that produce and sell the food crops to get the average incomes.

In the calculation of monetary income for the project area as mentioned in the following section, the values of respective species cultivated in the area as well as those of other activities (handicraft, small commerce, public service) are evaluated.

It is to be noted that the income from food crops is mainly the women's business; it accounts now for 65% of the total income of a family.

1.10.3 Overall Evaluation of Income in the Study Area

This evaluation can be made by two approaches: One focused on production and the other on employment. For a more viable calculation of incomes, however, the production approach is applied.

The results of calculation of total production and monetary income by this approach are detailed in the following table.

Agricultural Production and Incomes

Components	Production Volume (Ton)	Unit Value (1000 F)	Gross Product Value (million F)	Intermediate consumption coefficient (%)	Net Product Value (million F)	Percentage of Net Marketed Product	Agricult. Monetary Income (million F)
Cacao	41	200	9.0	10	8.2	100	8.2
Groundnuts	199	200	39.8	20	31.8	60	19.1
Maize	16	25	0.4	20	0.3	0	-
Squash	249	250	62.2	20	46.7	60	28.0
Cocoyam	62	25	1.6	25	1.5	0	-
Plantain	774	100	77.4	5	73.6	60	44.1
Cassava	831	50	41.6	5	39.5	10	3.9
Other food crops	66	50	3.3	5	3.1	0	-
Palm oil	14,600 lit.	200	2.9	5	2.9	0	-
Banana	43	50	2.1	0	2.0	0	-
Mango	87	50	4.3	5	4.3	0	-
Avocado - Citrus fruits	61	50	2.6	0	2.6	0	-
sago and other fruits	100	25	2.5	0	2.5	0	-
Sheep	300 kg	550	0.2	0	0.2	0	-
Goats	300 kg	350	0.2	0	0.2	0	-
Pigs	6	550	3.3	0	3.3	0	-
Fowl	900 kg	1,000	0.9	0	0.9	0	-
Palm wine	64,000 lit.	100	6.4	0	6.4	20	13.0
					230.0	104.6	

Therefore, the net value of agricultural production would be CFA.F 819,000 per family per year on an average and the monetary agricultural income would be CFA.F 372,000 per family per year.

It is to be noted that the share of cacao plantation in agricultural production is very small (less than 8% of monetary agricultural income) while food crops contribute the major part to the monetary income.

Accordingly, taking into account all the economic activities in the whole project area, the local production and income are estimated as shown in the following table.

	Net Total Production Value		Monetary Income from Monetized Production	
	million CFA.F	%	million CFA.F	%
PRIMARY SECTOR	286	94.1	124.7	87.4
- Agriculture	230	75.7	104.6	73.3
- Hunting	25	8.2	11.4	8.0
- Fishing	11	3.6	8.7	6.1
- Forest exploitation and picking	20	6.6	-	-
TERTIARY SECTOR (Added values)	18	5.9	18.0	12.6
- Handicraft, commerce, tourism	6	2.0	6.0	4.2
- Administration (salary of public servants and equivalent)	12	39.0	12.0	8.4
	304	100.0	142.7	100.0

The net value of total annual production would be CFA.F 304 million, i.e. CFA.F 190,000 per capita, and the monetary income would be CFA.F 508,000 on an average per family per year (CFA.F 42,300/month).

The results given in the above two tables indicate that the total value of self-consumption would be CFA.F 126.7 million (CFA.F 217 per capita per day, which would nearly equal to the absolute poverty level in Cameroon).

This overall income is used specifically to cover numerous basic needs. According to the surveys, the most important needs are the following:

Items	Percentage in Relation to Annual Average Expenses
Primary schooling	5%
Secondary schooling	23%
Food and clothing	30%
Presents	17%
Health	11%
Miscellaneous	12%
Savings	2%

The saving capacity in the project area is very low, and even negative if we actually take into account all the items of expense of families, because, according to the agro-economic survey (50 questionnaires), their expenses have always been ill-managed. This poor saving reflects the social conditions observed as follows:

- i) High number of youths who come to live in the village due to a lack of means to continue their studies;
- ii) Absence of new houses made of corrugated iron sheet in the area;
- iii) Excessive number of premature young mothers.

1.11 Constraints and Advantages Related to the Socio-economic Environment

The main socio-demographic constraints are due to the following characteristics of "demographic and socio-political depression" of the project area:

- Ageing of farm heads;
- Rural exodus of the young and active work force (both male and female);
- A large number of children under 15 years being taken care by aged persons;
- A large number of unmarried mothers often at an early age;
- A low land occupation rate;
- Poor socio-political and community structuration;
- Present low income of families.

The main advantage of the area is the availability of land in a very flexible land system where the women are very active but the youths are poorly integrated. This quasi-unlimited land availability constitutes an important advantage for the Memve Ele Project in the aspect of resettlement of the populations:

- the coming back to the zone of many young people expecting to get job under the project;
- the possibilities of diversifying the highly supplementary rural activities which provide substantial income all year long: picking, production of wine, hunting, fishing.

**II. CONSEQUENCES OF WATER FILLING
- EVALUATION OF IMPACTS
AND DAMAGE**

II. CONSEQUENCES OF WATER FILLING- EVALUATION OF IMPACTS AND DAMAGE

2.1 FEATURES AND ROLE OF THE DAM

According to the results of the project optimization study conducted by JICA, the following project features were retained:

The dam to be constructed on the Ntem river will be of run-of-river type and consist of the following structures:

- a dam downstream of Nyabessan, having a length of 1,850 m and a maximum height of 20 m; the dam crest will be at El. 393 m;
- an inlet canal of about 2.5 km long;
- the power station will be equipped with 4 units of 50.6 MW each;
- the energy produced will be transmitted to Yaoundé through a 250 km long transmission line connected to the national power network;
- the reservoir will have a gross storage capacity of 130 million m³, of which 19 million m³ will be available for power generation.

The impact analysis was carried out on the basis of the following alternatives:

- Maximum alternative: Evaluation of crops cultivated below El. 400 m and human establishments located at El. 405 m along the Ntem river and its tributaries. The area covered by the reservoir created on the three rivers would be 7,600 ha, i.e. 76 km²;
- Medium alternative: Evaluation of crops cultivated below El. 395 m and human establishments located at El. 398 m along the Ntem river only. The area covered by the reservoir created on the Ntem river would be 2,800 ha, i.e. 28 km²;
- Main alternative: Evaluation of crops cultivated at El. 392 m and houses located at El. 395 m on the Ntem river. The area covered by the reservoir would be 1,900 ha, i.e. 19 km². This was retained as the optimum alternative in JICA study.

2.2 IMPACTS ON HYDROBIOLOGY, VEGETATION AND FAUNA

2.2.1 Expected Changes in Hydrobiology

After the reservoir water filling decay of the organic matter will lead to a sensitive modification of different parameters of the quality of the waters. The latter depends largely on the rate of renewing the reservoir. For one year, this rate is expressed by the relation of annual average inputs (AAI) over the capacity of the reservoir (CR):

$$\text{Rate of renewal} = \text{AAI/CR.}$$

When this rate is low and thus the storage time being important, there is possibility of stratification of the mass of water. The nutrients remain at the bottom with risks that the plants be deeply rooted in less profound areas, anoxic as well as the proliferation of mosquitoes.

The global results of the decay of the organic matter will produce methane gas in final stage, as well as sulfurated hydrogen, carbon dioxide and ammonia. After complete consumption of the existing dissolved oxygen, the PH will be stabilized at the neutral value (6,3 - 7).

Since dissolved oxygen is the vital parameter in water, a particular attention should be given to its follow-up.

i) In the reservoir

During the first months (about six months), a rapid fall of the value in dissolved oxygen will be noticed, notably in the deep layers where the anaerobic conditions (0 mg/l) could be attained. This situation could persist more or less briefly (1 year roughly) depending on the rate of renewal of the water. At the level of upper layers where renewal is fast, correct values (about 4 mg/l) compatible with aquatic life will be found within a reasonable time. Consequently the plankton and the fish will inhabit only the first oxygenated meters of the anoxic epilimnion.

ii) Downstream

Because of the existence of a series of natural falls on the Natem, through some 50 kilometers that permit the stirring of the masses of water, the low content in dissolved oxygen in the outlet of the dam should rapidly have a normal value (3 - 4 mg/l) in the first kilometers downstream. These are the only worries to be reckoned with for fishing concerning modification of seasonal floods to which many species of fish have adapted themselves as well as the fishermen.

The natural limit created by the series of falls prevents any migration of fish throughout the river, thus there will be no change in the ichthyological fauna. Thus, it is not necessary to provide fish passages.

2.2.2 General Impact on the Vegetation

All the tall trees with more than 40cm will remain partly when the reservoir will be full and will cause a serious problem to the navigation on water surface and the quality of water. In fact, these trees that will continue their vegetative cycles for some years will bring along a very important mass of organic matters to the reservoir; and the decay of these matters will be a pest to the development of fish even if the plankton would have increased. This phenomenon has been observed in the Maga, Mbakaou and Mapé reservoirs which were filled respectively 11, 21 and 7 years ago. In each of these stretches of water, the submerged trees exist in the form of stumps erected either above water surface, or under in a way that any navigation becomes particularly delicate if not dangerous.

2.2.3 Impacts on the Fauna

2.2.3.1 Reptiles and Amphibious

Considering the nature of the structure, the following effects might occur in the reservoir area:

- An exodus of adult individuals and an eventual overpopulation in the outlying areas;
- Vulnerability of the next generation in all forms: egg laying, larvas, juveniles.

- Several types of reaction of species:

- The species exploiting the banks are able to swim; they will escape the traps on islands, will follow the rising of the waters but will provide a surplus in the area of hills. The disappearance of a kilometer measuring of the banks, a biotope whose impotence in forestry ecosystem is after forgotten of this farm. The rising of waters will dispose of the pool zones situated behind the high slopes: the layer ground for many species will disappear and it is less probable that the next marling zone will suit them.
- The species of soil and litter their majority being underground, burrowing and very small, are not susceptible to swim for long. Many of them may be drowned during launching and will attract predators. lost layings.
- Certain treed welling species of the company will migrate progressively with biological deterioration of their support but others with flight reflex is to hide in the leafy vault, will live and will be trapper notably in the rapidly formed islands. Part of the faun capable of swimming and to pass through the vault will migrate along the periphery of the inundated zone.
- Predators will benefit from the windfall when the animals escape from the rising of the waters and later on when the density of the preys will be high in the periphery. Their number will increase especially as those like the poisonous snakes of the Type which are ovoviparous do not loose their investment of reproduction in the year of lanching.

2.2.3.2 Mammals and birds

If at first sigh inundation does not seem to present any immediate danger for birds, bats and aguatic mammals which can evade water, the situation is different in reality. Since evasion cannot be done most often in phase, maammals and most birds will be concentrated on small islands where they will be particularly menaced by predators.

2.3 GENERAL IMPACTS ON HUMAN ESTABLISHMENTS

2.3.1 Degree of Impact on Rural Space

The rural space here means the villagers' land consisting of many farms organized as follows:

- houses arranged in family concessions along the paths;
- fiels or home gardens around or behind the houses;
- cacao farms behind or not so far from the houses;
- food crops fields and follow land at a farther distance from the houses; these places are also the areas of hunting by traps of the owners;
- the primary forest which is a commonly exploited domain of hunting and picking for all the riverside dwellers without distinction.

The systems of exploitation and the putting into value of the land have been described in the stock diagnosis. The impact on housing and exploitations are respectively analyzed in the present chapter and in item 2.4.

In proportion to the extent of damage caused to the various human establishments in the zone, the soils can be classified into three types

Type 1 - Very important or major impacts: total destruction of land eventually leading to a resettlement of farmers;

Type 2 - Mean impact: partial or minor destruction of houses and/or farmlands requiring a partial resettlement of farmers and/or houses;

Type 3 - Minor impact: destruction of part of the farms without affecting the houses.

2.3.2 Types and Standards of Houses

The houses in the project area are classified into 5 categories according to the construction materials used and the type of use of the houses:

- Type 1 corresponds to a concrete house with its walls in cement blocks and the roof in aluminium or corrugated iron sheet;
- Type 2 is a house either made of mud or dried bricks or planks and covered with aluminium or corrugated iron sheet;
- Type 3 is a house made of mud or planks covered with a raffia mat roof;
- Type 4 is a warehouse or drying room without walls, covered with aluminium or corrugated iron sheet;
- Type 5 is a warehouse or drying room without walls, with a raffia mat roof.

Types 1, 2 and 3 serve as dwelling houses while types 4 and 5 are shelters used only during the day. There are no breeding houses.

Each monogamic family has 3 houses on average:

- 1 type-2 house for the family's living;
- 1 type-2 or type-3 house as kitchen;
- 1 type-4 or type-5 house (as drying room or warehouse).

In polygamic families, each wife has a kitchen.

2.3.3 Farming Standards

According to the survey results, the average number of cacao plantations per planter is 1.9. In some villages or hamlets, some planters have 2 or 3 planted parcels, one of which being old (more than 40 years) and 1 or 2 being planted with regenerated or recent cacao trees (5 to 20 years). Most of the plantations however are more than 15 years old.

The average area per farmer or planter is 1.32 ha, i.e. 0.75 ha on average per cacao plantation. The average number of cacao trees per hectare is 2,650.

The average area per food crops farmer is 0.61 ha. As each woman may cultivate 2 to 3 parcels a year, the total average area of food crops per year is 1.2 - 1.8 ha.

The average farming area of a monogamic family therefore ranges from 2.5 ha to 3.1 ha according to the importance given to food crops in the farming system.

2.4 DAM'S IMPACTS BY SECTOR ACCORDING TO THE RESERVOIR WATER LEVEL

2.4.1 Maximum WL Alternative

2.4.1.1 Vegetation

At the maximum water level, the reservoir area will be 7,600 ha, of which 6,600 ha of forest will be submerged. Taking into account the ratios of tree species existing in the area - 23 trees of high commercial value species (diameter larger than 40 cm, Group B+C) per ha and 126 trees of currently marketed species (diameter larger than 40 cm, Group B) per ha - and considering that 1/5 of the submerged area has good species in forests that are less degraded by clearing, it is estimated that 30,000 trees of Group A and 166,000 trees of Group B will be submerged and thus destroyed. In addition to these, there are also many tree species of common use (fire wood, framework, handicraft, etc.).

Other estimates were made based on operation records of the Campo Forest Development Company, applying the following rates:

- Category A: 2 trees/ha;
- Category B - C: 5 trees/ha;
- Volume of construction wood and fire wood: 1,000 m³/ha.

The above estimates show that 13,200 trees of category A, 33,000 trees of category B+C and 6,600 m³ of construction and fire wood will be lost.

2.4.1.2 Villages and populations affected

According to field investigations and based on STS surveys, the villages situated below El. 397.5 m are subject to submergence by the reservoir. SEDA carried out evaluations based on El. 405 m for houses and 400 m for crops in order to provide a sufficient margin of security for the riverside populations.

The villages that would be decamped are located essentially at the right bank of the Nyabessam-AKOM with the two access roads leading from Nyabessan to Ndjo'oyop 1 and 2, depending on Nyabessan at the crossing of NJO'O on the 2 banks, and at Nkolessong hamlet depending on Nyabessan at the crossing of Ntem.

On the left bank, only the Aloum I village sustains immediate impact of the dam and would be decamped for security sake, since it will be surrounded by the curve 400 m.

Hamlets affected in different degrees are listed in the 3rd degree chieftainries of Nyabessan, ABEM, NTEBEZOK, ALEN 2, MELEN 2 NHEMEYONG and NSEBITO in the MVAYE-WEST cantons where only the chieftainries of AKOM, TOM and ASSENG do not sustain any compensatory prejudice on the one hand and that of ALOUM I in the bending canton of NTEM or the 3rd degree chieftainries of MELEN 2 AND AYAMA'ANG concentrating the majority of the populations are safe on the other hand.

The list of hamlets and villages affected is given in the Appendices.

The affected villages count 162 homes with 1,023 persons, that's 83.1% of the inhabitants of the MVAYE-EAST canton, and 11 homes with 55 resident people, that is 17.6% of the Canton Ntounou Ntem bend. Properties of 67.4% of the population of the impact zone of the dam will be affected at various degrees.

In the maximum water level alternative, 63 families (i.e. 36%) consisting of 373 inhabitants in the impact area will mainly suffer extensive damage both to their houses and their crops, in 18 hamlets belonging to 8 administrative villages; 14 of these hamlets will have to be completely relocated. More than a half (52%) of the 173 families will suffer damage only to part of their crops and only 12% of the families will not suffer any damage.

2.4.1.3 Houses affected at El. 405 m

- 4 houses of type 1 with a total area of 647 m²;
- 86 houses of type 2 with a total area of 5,597 m²;
- 44 houses of type 3 with a total area of 1,658 m²;
- 6 houses of type 4 with a total area of 97 m²;
- 7 houses of type 5 with a total area of 113 m².

2.4.1.4 Cacao plantations affected

a) According to STS's survey:

STS has classified the surveyed plantations into 4 types without giving specific details on each owner:

- Maintained young plantations of less than 5 years;
- Non maintained young plantations of less than 5 years;
- Maintained old plantations of more than 5 years;
- Non maintained old plantations of more than 5 years.

SEDA conducted a planimetric survey of these plantations and their distribution in the hamlets and villages in the impact area. The details on plantation areas by type and distribution by human establishment are given in the Appendices.

The planimetric survey result indicates that the 51 cacao plantations surveyed have a total area of 52.7 ha.

b) According to SEDA's survey:

A systematic survey of the plantations affected indicates that they have a total area of 53.2 ha covering 141,178 trees in 96 plantations belonging to 82 owners.

The cacao plantations affected are divided into 2 types:

- The plantations that will be completely submerged and surely destroyed within the first year;
- The plantations that are located at an elevation around 400 m. The water table will be so near to the surface that it can asphyxiate the trees 4 or 5 years after the water filling of the reservoir. In such a case, the plantations will be in a condition of marginal exploitation.

Taking into consideration the standards set forth by decree for compensation, according to which a maximum of 1,600 trees are compensable per hectare, the total number of cacao trees to be compensated is 85,120.

2.4.1.5 Food crops affected

a) According to STS's survey:

STS classified the food crop fields into 5 categories:

- 1st year squash (including a small area of maize, according to the survey);
- 2nd year groundnuts (including maize and young plants of long cycle cultivation, according to the survey);
- 3rd year cassava (including some area of plantain and cocoyam, according to the survey).

The non individualized surveyed areas amount to 88.1 ha covering 125 parcels.

b) According to SEDA's survey:

The food crop areas and number of plants subject to submersion are shown in details in the Appendices by species, location, alternative and type of human establishments affected (the physical evaluation by km² and by tree was adopted in order to facilitate application of the decreed compensations in the monetary evaluation).

In the case of the maximum water level alternative, the results are as follows:

Species	Human Establishments			
	Type 1	Type 2	Type 3	Type 4
Groundnuts, maize, cucumber (equivalent density) in m ²	651,067	222,735	90,245	964,047
Plantain trees	14,413	4,933	1,999	21,345
Cassava trees	10,346	3,540	1,436	15,322
Cocoyam trees	162	55	23	240
Other crops trees	162	116	48	326

2.4.1.6 Impacts on infrastructures and facilities

The results of field surveys combined with the data shown on available maps have enabled to identify numerous impacts on access infrastructures and socio-collective facilities as follows:

a) Impacts on roads and river crossing structures

By drawing the contour line 405 m on a 1:10,000 scale map, it was found that the following road sections and footpaths will be affected.

- On the right bank of the Ntem river:
 - ABEM EKOETE-ABEM EFON: 0.5 km at contour line 403 m;;
 - ABEM BENDAMBA - ABEM NKOLMELONGO: 0.92 km at contour line 390 m;
 - NTEBEZOK - ABEM ABETE: 0.85 at contour line 400 m;;
 - ALEN II - MELEN I: 1 km at contour line 393 m;
 - NHEMEYONG - NHEMEYONG AKAK: 0.20 km at contour line 400 m;
 - NEMEYOUNG MACEDOINE - ALEN II: 1.1 km at contour line 393 m;

- ABANGSI - NSEBITO: 0.650 km at contour line 393 m;
- NYABESSAN - NJO'OYOP: 0.6 km at contour line 390 m.
- On the left bank of the Ntem river:
 - The footpath NTEM - ALOUM I.

b) Impact on schools and chapels

Only the school at NEMEYONG is found below El. 405 m. The affected chapels are those at NEMEYONG (2), NTEBEZOK, NSEBITO BETHEL, EFON and that under construction at ALOUM I at this elevation.

At elevation 400 m and 395 m none socio-education or religious facilities will be affected.

c) Impact on the wells

Seven wells are found below El. 405 m in the following localities: ABEN-NKOLMELONGO, ABEM-MELONGO (1), ALEN II (1), NEMEYONG (2), NSEBITO (2).

In whatever alternative, it is recommended to reconstruct these wells in order to ensure the welfare of the population.

2.4.2 Mean WL Alternative

2.4.2.1 Impact on the vegetation

In this alternative, the reservoir will cover an area of 2,800 ha, out of which 2,100 ha of forests with 9,600 group A trees and 51,600 group B+C trees would be affected. An estimate based on the data of the Campo Forest Development Company indicates that 4,200 group A trees, 10,500 group B+C trees and 2,100 m³ of construction and fire wood will be affected.

2.4.2.2 Villages and population affected

In this alternative, all the Nkolessong will be affected.

The human establishments of type 2 include: Abem Melongo and Nkomelongo, Melen 1 and Nhemeyong 4.

Those of type 3 include all the other hamlets located on the right bank of the Ntem river on Nyabessan - Ma'an road and the Aloum village on the left bank. Thirteen families consisting of 77 inhabitants in 5 hamlets belonging to 4 administrative villages will suffer substantial damage. Only one hamlet (Nkolessong) would have to be completely relocated.

2.4.2.3 Houses affected

- 23 houses of type 2 with total area of 2,047 m²;
- 4 houses of type 3 with a total area of 168 m²;
- 4 houses of type 4 with a total area of 74 m².

2.4.2.4 Farms affected

a) Cacao plantations affected

- According to STS's survey:

The area of cacao plantations is 33.4 ha covering the 27 parcels surveyed.

- According to SEDA's survey:

The systematic survey conducted by SEDA gives an equivalent area of 35.9 ha covering 28 plantations with 57,440 trees, owned by 18 planters.

According to the compensation standards, all the 57,440 trees will be compensated.

b) Food crops affected

- According to STS's survey:

The non individualized planimetric areas are 75.5 ha.

- According to SEDA's survey:

Species	Human Establishments			
	Type 1	Type 2	Type 3	Type 4
Groundnuts, maize, cucumber (equivalent density) in m2	50,162	431,387	454,800	936,348
Plantain trees	2,107	6,743	14,106	27,956
Cassava trees	6,047	19,349	54,825	80,221
Cocoyam trees	69	220	623	912
Other crops trees	69	221	627	917

2.4.2.5 Impact on infrastructures and facilities

At this elevation, only the following roads and crossing paths will be affected:

- Abem Bendamba - Abem Nkolmelongo: 0.5 km at contour line 390 m;
- Ntebezok - Abem Abate: 0.25 km at contour line 400 m;
- Alen II - Melen I: 0.61 km at contour line 393 m;
- Abang S1 - Nsebito: 0.11 km at contour line 395 m;
- Ndjo'op - Nabessan: 0.60 km at contour line 390 m.

2.4.3 Main Alternative (395 m)

2.4.3.1 Vegetation

At elevation 395 m the reservoir will cover an area of 1,900 ha including 1,200 ha of forest. This would submerge 5,500 group A trees and 29,500 groups B trees. Calculated on another assumption, the figures are 2,400 group A trees, 6,000 group B+C trees and 1,200 m³ of construction and fire wood.

2.4.3.2 Human establishments

a) Villages and population affected

In this alternative, none human establishment of type 1 will be affected even though Nkolessong is very near to the reservoir. All the other hamlets on the right bank and Aloum on the left bank are of type 3.

b) Houses affected at El. 395 m

- 8 houses of type 2 with a total area of 549 m²;
- 1 house of type 3 with an area of 40 m².

2.4.3.3 Farms affected

a) Cacao plantations

- According to STS's survey:

The area of affected cacao plantations is 15.2 ha covering 7 parcels.

- According to SEDA's survey:

At El. 395 m the area surveyed is 18.5 ha covering 8 plantations with 29,600 trees, owned by 8 planters.

According to the compensation standards, all the 29,600 trees will be compensated.

b) Food crops

- According to STS's survey:

The affected area is 38.5 ha.

The details of measured areas by type of crop and by village are given in the Appendices.

- According to SEDA's survey:

Species	Human Establishments			
	Type 1	Type 2	Type 3	Type 4
Groundnuts, maize, cucumber (equivalent density) in m2	0	0	538,401	538,401
Plantain trees	0	0	22,518	22,518
Cassava trees	0	0	64,902	64,902
Cocoyam trees	0	0	738	738
Other crops trees	0	0	741	741

2.4.3.4 Impact on infrastructures and facilities

The following road sections will be affected:

- Abem Bendamba - Abem Nkolmelongo: 0.18 km at contour line 390m;
- Alen II - Melen I: 0.35 km at contour line 393 m;
- Abang SI - Nsebito: 0.11 at contour line 393 m;
- Ndjo'op - Nyabessan: 0.35 km at contour line 390m.

2.4.3.5 River crossing ways

At any alternative water level of the reservoir, the distance between the two banks of the Ntem river at the present Nkolessong crossing point is about 2 km. Considering the long distance from Nyabessan or Aloum to the dam embankment which will serve as a crossing road for pedestrians and vehicles (about 15 km), the river crossing will continue to be made at Nkolessong. It is recommended to provide a motor canoe for crossing the Ntem river at this point.

2.4.4 Summary

The human establishments and farms affected in each respective alternative are summarized below.

2.4.4.1 Human establishments

The human establishments that will be affected by the reservoir are as follows:

Alternative	Number of hamlets	Number of hamlets to be relocated	Number of families	Number of inhabitants	Number of houses
Maximum WL	18	14	63	373	147
Mean WL	5	1	13	77	31
Low WL	1	0	5	30	9

2.4.4.2 Summary of areas affected by alternative

i) According to STS's survey

The total submersible areas by alternative are as follows:

Crops	El. 400 m	El. 395 m	El. 392 m
Cacao plantations	52.7 ha	33.4 ha	15.2 ha
Food crops	88.1 ha	70.5 ha	38.5 ha
Total	140.8 ha	103.9 ha	53.7 ha

ii) According to SEDA's survey

Crops	El. 400 m	El. 395 m	El. 392 m
Cacao plantations	53.2 ha	35.9 ha	18.5 ha
Food crops (equivalent density)	96.4 ha	65.3 ha	53.8 ha
Total	149.6 ha	100.9 ha	72.3 ha

iii) In the case of food crops

The areas of food crops given in the above tables are the cultivated areas at the time of surveys. However, according to the result of diagnosis, each family harvests 3 times a year. Therefore, for estimating the food crop farms of 1 to 3 years old that are under production, the above areas should be multiplied by three. Thus, the food crop areas in the maximum, mean and low water level alternatives become 264.3 ha, 311.5 ha and 115.5 ha respectively, based on the result STS's survey.

iv) Fruit trees in home gardens

The number of fruit trees recorded in the cacao plantations and around the houses is shown below:

Fruit trees	El. 400 m	El. 395 m	El. 392 m
Palm tree	1,220	980	530
Avocado tree	214	44	17
Banana tree	1,997	412	159
Coconut tree	32	7	3
Citrus tree	133	28	11
Kola tree	44	9	4
Guava tree	-	-	-
Mango tree	196	41	16
Sago tree	139	29	11

v) Conclusion

With regard to cacao plantations, there is some coherence between the data of STS and those of SEDA, since SEDA has added the plantations omitted in STS's survey. On the other hand, however, there is a big difference in the areas of food crop farms estimated by STS and SEDA, due to the different method of calculation used by SEDA for El. 395 m and El. 392 m.

2.5 IMPACTS ON OTHER ACTIVITIES

2.5.1 Fishing

After the reservoir, there will be an increase in productivity thus a revival of the fishing activity with an increase in the number of fishermen either by reconversion (seasonal fishermen into permanent fishermen), or by migration of fishermen from the coast (Kribi) and/or from Equatorial Guinea. The natural fishing potential is estimated at 50 kg of fish per hectare.

Depending on the alternative adopted, the following incremental potential can be expected one year after the water filling of the reservoir:

Alternative	Additional water area (ha)	Additional fishing potential (ton)
Maximum water	6,600	330
Mean water level	2,100	105
Low water level	1,200	60

In fact, fishing occupies a place of choice in the peasant production system in the study zone. The typology of activities defined above has enabled us to calculate the annual production costs of a fisherman as well as incomes from the sales of fish. The condition of fishermen before and after water filling of the reservoir is described in detail in the Appendices.

Presently the production charges are estimated at 36.280 F essentially representing production means (canoe and engines) and transport fare to reach Ebolowa or Kribi to acquire the different tools. After the water filling these charges will be close to 40,000 F/fisherman/year. The slight increase (3,720 F) is due to the introduction of fishing permit (3,000 F/year) and of the production tax (720 F/kg).

Revenues before launching are calculated from a commercialized production estimated at 600 kg per fisherman and per year. Considering the assumption that the number of fishermen would increase to reach about 100, the potential annual production per fisherman will be in the order of 1,000 kg. With an average price of 500 F/kg, the revenue of the fisherman could be multiplied by 2.5 passing from 217,000 F to 530,000 F globally. Thus, the revenues of the fish component of the impact zone could therefore pass from 12.30 million to more than 50 million CFA.F per year.

2.5.2 Impact on Forest and Hunting

The dam construction works and water filling of the reservoir will lead to an increase in population (arrival of immigrants, new national and international fishermen) with their demand for land for their village and for agriculture (clearing), construction wood, services, fire and gamble. This would more and more reduce the vital space and will represent a constant danger for the animals. The restrictions to the movements of the fauna will bring about some inconveniences to the hunters and even to the population who may face a serious problem, that of lack of animal proteins. Firstly, (from one to two years after the launching of the dam), hunting will be productive; since the animals will be concentrated in the small islands of the reservoir and neighbouring forest. Later on, when piscicultural exploitation will be profitable, getting the animals will be more and more problematic. Hunters will cover long distances on the mountains in quest of animals whose prices will be relentlessly on increase.

In fact this pressure will become unbearable for the local resources near the area because the creation of the reservoir will cause a definitive loss of cynegetic resources estimated in volume and in value as follows:

Alternative	Volume of disappeared games (ton)	Value (CFA.F million)
Maximum water level	39.6	5.5
Mean water level	12.6	1.7
Low water level	7.2	1.0

Thus, there is reason to fear that hunting which is quite beneficial now be relegated to a secondary place.

2.6 INDUCED EFFECTS

2.6.1 Expectations and Needs of the Populations

Results of the field investigations show that the populations are conscious of the damage that will be caused by the construction of the dam on their lands. However most of them rather expect something good and a revival of the economy of their region which has been forgotten for long.

2.6.1.1 Availability of lands - land problems

The farmers investigated declare that they have enough land to boost their production in case of loss of their land. On the territory of their tribe-chieftainry, they think they will face no major problem to be accepted by their brothers in case of re-installation near other clans that will remain on the spot more so because there is an imbrication without any major consequence in hamlets belonging to different clans at present. Traditional authorities wish however, that a sensitization campaign be carried out by the administrative authorities and that the zones of rehousing camps be identified for each hamlet with their eventual collaboration.

2.6.1.2 Relocation of farms and houses

(i) The preoccupations of the farmers mainly concerns the relocation of their cacao farms which constitute for them an appreciable source of revenues despite the fall in the purchase prices, because they are sentimentally attached to it.

Their wishes are:

- A substantial compensation for the affected farms;
 - Felling of trees for new land parcels by SONEC or the project authority or, if necessary, supply of chain saws to the resettled families;
 - Supply of selected seedlings considering the difficulties to rapidly set up nurseries.
- ii) Concerning housing, their needs are:
- Rapid and timely payment of related compensations
 - Making available materials (corrugated iron sheet and cement) in the zone for purchase;

- Preparation of land areas destined to receive the houses of the resettled people (parcelling out of land)
- Assistance, if possible, to set up improved or modern houses made of earth blocks or concrete blocks.

2.6.1.3 Needs in infrastructures and equipment

The people investigated expect an improvement in their lifestyle from the project, notably:

- Access paths to new lands and to rehousing sites;
- Parcelling of rehousing sites
- Construction of wells with pumps;
- Construction of schools with lasting/final materials.

Meanwhile very few are those families who would be willing to bring any contribution be it material or financial, since community achievements are up to now virtually inexistent in the zone.

2.6.1.4 Specific needs of women

Women's preoccupations concern:

- i) The compensation of their food crop farms;
- ii) Credit or assistance for tree felling which constitute the main handicap to the development of food crops on larger areas;
- iii) Training on modern farming technique and guidance by the agricultural agencies related to the food crop production sector which is being neglected;
- iv) Supply of improved or selected materials, in particular tubers (cassava, yams, sweet potatoes);
- v) Protection against devastating crops predators (big monkeys).

2.6.1.5 Reactions towards the new populations' contributions

Those investigated people are conscious that works related to the dam will bring about an important contribution by the immigrated populations in the zone; they have already had some experience through survey and experimental works led by STS and SONEL. They wish that job opportunities be offered to the youths who have come back in large numbers to the villages, with the hope of an imminent launching of activities. This will help stabilize them and develop the villages.

They are conscious that the population's contribution will bring about additional effort on their part in the production but they are worried for not being able to respond conveniently if their farms are inundated. Moreover, there will be a serious problem of accommodation for the new comers in the villages.

The integration of the villagers and even strangers (fishermen) will be easy if they respect each other and the local customs and if traditional authorities are associated by the project authority or SONEL and sufficiently kept informed of the developments.

2.6.1.6 Attitude of the youths with regard to agricultural activities

The youth people in the area are interested in particular in a remunerated activity which they have already experienced from the preliminary works carried out by STS and SONEL. Many stake their hope and future in the resumption or start of the dam construction works; they are not concerned at all with the agricultural activities or hunting; and fishing is just a palliative for them during this waiting period.

It is feared that, in spite of the expected incomes from agriculture thanks to the arrival of immigrated people, the youths' attitude would persist and rural exodus will recontinue after the completion of construction works.

2.6.2 Effects at the Level of Production Activities and Incomes

The agricultural production potential will sustain within two to three years a fall in the cultivated areas estimated at:

- 53 ha for cacao trees in the maximum water level alternative, corresponding to 15 tons in production of the 96 more or less maintained plantations; and 18.5 ha in the El. 392 m alternative, i.e. a potential production of 5 tons. Given the increasing disaffection of the population for this crop, the restoration of this potential will take at least 5 years if a vigorous promotion is carried out. In the case this crop production is not strongly promoted, it is feared that very few farmers would actively resume its cultivation.
- about 96 ha of food crops cultivated generally in mixed farming system will be affected at El. 400 m. At El. 392 m, only an area of about

This production potential could be rapidly re-established in 2 or 3 years and increased in the perspective of an important population increase with a strong promotion and supply of inputs.

The potential in palm oil tree situated in the exploited lands and susceptible of being flooded will also be seriously decreased and will oblige the decamped populations to a difficult bonding in vegetal oils for 2 to 3 years while awaiting the putting into value of the new lands. The deficit can be assessed at 40 l/year/home that's 3,000 l/year for the entire decamped populations. The revenues incurred from the exploitation of palm wine, that is 60,000 F CFA/year/home will break off or will drop equally for at least 2 years, equally for the partially or totally affected villages or those to decamp. Meanwhile abundance in natural palms is favourable factor in the zone if the exploitation new pal farms will not lead to conflicts and a foreseeable pressure. In this assumption, the introduction of selected varieties will be necessary in the agricultural component.

As for picking of forest products (mushrooms, almonds, various vegetables) for supplement feeding, the potential will remain very important because of the abundance of reserves which will remain intact and which will be well exploited by the affected populations during the transitional and re-installation period.

2.6.3 Induced effects at the level of human establishments

2.6.3.1 Relocation of houses

This constitutes the most important effect in view of the number of people to be resettled in any alternative.

This will bring about a remarkable perturbation of the layout of the present rural space through:

- The inflation of the population of certain villages in which the decamped people will install live first, while awaiting the construction of their houses on the new sites in case of no intensive framework towards the re-installation movement;
- The final installation of very old decamped people or those who desire less to go far from their former lands;
- And especially an important increase in the population of Nyabessan which will become an important pre-urban center.

In this context and to avoid any side-slip of often noticed in this type of operation, it is advisable to strongly take care of it through:

- an effective control by the administrative and traditional authorities;
- an improved operation on housing to be initiated and be followed within the framework of a specific project (mud blocs, environmental hygiene and latrine etc.).
- A summary urban development plan of Nyabessan to be established by the Maan Council with determination of large spaces or parcelling to be given for infrastructures and collective equipment to the nearby decamped people and eventually to allogenes.

2.6.3.2 Contributions of the new population

It is difficult at this present level of the evaluation studies to determine the contribution of seasonal and permanent migrates induced by the construction of the dam and new activities or those that will develop following its construction. It is probable that works will require at least 1,000 permanent employees for the various enterprises, that is about 2,500 persons including the families and traders who will be attracted for at least two years. Moreso, fishing activities will attract in average term at least 100 fishermen with their families/

It is thus evident that the population of the influence zone of the dam will double very rapidly to attain about 5,000 inhabitants during construction years and will become stabilized at 3,500 - 4,000 inhabitants after launching.

In this perspective, the negative effects related to the decrease in cultivated lands in foodstuffs will be quite sensitive to the level of alimentation of this important population which the local productions will hardly satisfy. It is evident that supplies to these new populations should be from large areas stretches right up to the AMBAM road and Kribi. This will constitute a competition for the towns of Kribi and the agro-industries (HEVECAM and SOCAPALM), fortunately have a foodstuff program in their plantations, and especially for the exportation of food towards Gabon. This contribution of the population will constitute a stimulation for the

fast re-establishment of local potential of food production and will lead to a modification of feeding habits in which the following items will intervene:

- Cereals (rice, maize and wheat flour) to respond to the immediate needs for food;
- Refined oils;
- sea fish;
- Cattle meat with the risk however, of pressure on the fauna resources in the zone.

The decamped population will benefit during the bonding period (2 years) from a PAM ratio, supply for the migrants will be ensured either by private traders, or through canteens whose managementship will be administered by the various enterprises as it appears difficult, considering the low commercial level of the region, for an organized circuit to be set up immediately to satisfy workers' demand.

Finally, installation of the different sites will take into account the low local potential in housing for the numerous workers and be judiciously carried out with regard to the spacious needs for the local populations, Nyabessan hoping to be at the center of numerous demands for these different sites; whereby there is need for a summary plan for the putting into use the space of the village and eventually of neighbouring hamlets to set up immediately with Administrative and Municipal Authorities before the start of various construction works at the sites.

**III. EVALUATION AND PROGRAMMING
OF COMPENSATORY MEASURES
AND SUPPORTING PROJECTS**

III. VALUATION AND PROGRAMMING OF COMPENSATORY MEASURES AND SUPPORTING PROJECTS

3.1 BASIC PRINCIPLES, STANDARDS, CRITERIA AND OBJECTIVES

3.1.1 Basic Principles

In the analysis of the needs of the populations and the induced effects of the dam, the following orientations and objectives can be retained for the various compensatory measures:

3.1.1.1 Sociological aspect: Respect of ethnic and clan links and in particular the willingness of the population in resettlement

Clan links must be taken into account and especially ethnic links in the rehousing of the populations. Rehousing sites must thus be very near the former villages with which the decamped people will preserve on the contrary, it will be difficult for the NTOUMOU of ALOUM I to accept being displaced in the right bank on the MVAYE territory.

3.1.1.2 Human establishments: Setting up modern housing

The construction of a modern housing on the parcelled sites must permit to give an open air aspect to a region called up to know a fast development with the construction of the dam. A specific framework operation of this reconstruction seems to be indicated, become a short term administrative and commercial important centre with development services.

3.1.1.3 Compensations: Exceeding classical norms

The populations are insisting on cash payment compensation of all their wealth including food crops. The objectives of compensations will be to permit production potential rapidly considering the low revenues and saving capacity of these population and especially their individualism and the setting up of projects. That is why the classical norms for compensation fixed by official texts are less adapted if we need to attain a real rapid reestablishment of the socio-economic balance of the region and redeem a production value for a population which rapidly grow.

3.1.1.4 Supporting projects and programs: Restoration and development of the economic potential through a strong framework

The projects and sectorial programs should consequently aim at rapidly re-establishing the production potential of the zone and at permitting its fast development to partially or fully respond to the demand in basic food products that will generate the construction works of the dam.

These projects and program must take into account:

- The period of bonding from 2 to 3 years linked to the loss of their houses and farms through part of the population of the zone; whereby there is need for an adapted food program;
- the present low framework of production sectors which does not give room for hope of a re-establishment and a development of economic potential if things remain in state. Things will not evolve, consequently in a positive manner, except the projects and programs

proposed, benefit from a structured framework, adapted and willingly associating to the need, technical services competence, the NGO and missionary works;

- the weakness of the capacities of organization of the population which necessitate dynamism in the framework of the various projects and programs notably through:
 - the training of women groups as well as men's group for community works and eventually of cooperative structures;
 - Supply of intakes and inputs adapted and highly productive;
 - the sensitization and training on the improvement of the lifestyle and environmental protection.

3.1.2 Standards of Compensation

3.1.2.1 Standards of compensation for houses

For each type of house, a cost for a m2 has been estimated and goes thus:

- Type 1 (block house): 50,000 F CFA distributed thus:
 - big work: 52%
 - openings and framings: 8%
 - internal and external coatings: 13%
 - (Pavement and covering) of floor: 10%
 - ceiling: 6%
 - Painting: 11%
- Type 2 (mud block house, dried bricks or in planks with a roof of aluminium or galvanized zincs): 13,500 F CFA distributed as follows:
 - big work and openings : 50%
 - Internal and external coatings: 17%
 - floor: 12%
 - Ceilings: 11%
 - Painting: 10%
- Type 3 (mud block house or in planks with mat roof): 2,500 F CFA
- Type 4 (shelter, drying ground with zinc roof): 2,200 F CFA
- Type 5 (shelter, drying ground with mat roof): 800 F CFA

3.1.2.2 Standards of compensation for food crops

In principle, the standards to be applied are those stipulated in Ministerial Decree No.58 of August 13, 1981 as described in the Appendices. This decree determines the compensation amount to be paid for crops and fruit trees in cases of resettlement of the population or damage of properties due to public purposes. The crops to be compensated are classified as follows:

- Annual crops (leguminous, cereals, tubers)

- Fruits (banana, pineapple, etc.)
- Perennial crops (citrus trees and income generating crops)
- Industrial crops or cash crops (cacao, oil palm tree, coconut tree in the area)

They are also classified into 2 categories: Young crops and adult crops.

The cash crops are however classified into 3 categories by age.

The standards decided by competent authorities after an analysis of production costs are fair in general, considering the present decline of cash crop prices as well as production costs.

However, some procedures and conditions should be taken into consideration with regard to the compensation for food crops and fruit trees.

For the food crop producing farmers, it should be noted that the shortage of products for consumption must be compensated. Therefore, the project authority should, as a compensation, provide food to the resettled population for 2 years in order to allow them to re-establish the equilibrium in their production system in the new farming areas or relocation areas. Thus, for this study, the standards applied by international organizations for these types of affected populations are referred to for the transitional period.

As to fruit trees, which are perennial crops, the compensation will include two parts: A cash amount and the supply of slips of improved varieties produced by nurseries that will be installed using part of the compensation amount.

3.1.2.3 Compensation for the population

The affected population will suffer, for the first 2 to 3 years after the reservoir water filling, an imbalance due to the loss of food production potential. This needs a period of 20 months for recovering. Accordingly, before water filling, it is necessary to mobilize the population to cultivate the first food crops around their new resettlement sites so as not to interrupt their dietary habits which mainly depend on starchy foods and vegetables.

Before their food crops production fully recovers, a food ration in the form of "Food for Work" will be provided by the project authority instead of paying them a great part of compensations for their food crops.

The food ration will be limited to short-term stockable and non perishable products, consisting of the following per person:

- 400 g of cereals (rice)
- 30 g of canned meat or fish
- 40 g of palm oil
- 20 g of sugar

3.1.2.4 Standards of compensation of churches

There are no norms for the edification of churches. They will thus be indemnified based on their construction estimates. The simplicity of their architecture and the material used have permit to classify churches in one or the other of categories of houses.

In this way, the church at MEMEYONG, 251 m², is the Type 1 with its m² cost maintained, referring on the more important big works, the related costs to coating, ceiling and painting.

The two EFON churches, 118 m² and 156 m², and that of NSEBITO BETHEL, 57 m², are the Type 2, whereas that of NTEBEZOK, 31 m² is the Type 4.

3.1.3 Criteria for the Choice of Rehousing Sites

Rehousing of the affected population by the dam will be done taking into account the various criteria linked to physical, economic, human and infrastructure environment.

3.2.3.1 Criteria linked to physical environment

These are mainly pedological criteria in direct relation with the use of land. The map of physical constraints precisely brings them out.

i) Survey and landscape

The accidental zones situated in the WEST of NTEM are hardly exploitable by the peasants and these lands have not been retained for rehousing but could better serve for fauna reserve (the World Bank Consultants on Faun prefer to establish reserve on forestry massifs).

ii) Accessibility:

The lands situated south of the zone are "blocked" by a heavily marshy zone constituted by the arms of the Ntem and its tributaries. These lands have not been retained for rehousing. To ease disenclavement of the zone, SONEL promises to build a dike-bridge to connect Nyabessan.

iii) Inundation:

All the lands situated below elevation 400 m are susceptible of being flooded thus excluded for rehousing.

iv) The lands

Land assessment has been done in chapter 1.2.4. The pedological characteristics which have direct impact over the use of lands, thus over rehousing which have permitted to retain certain zones are outlined as follows:

- topograpy: slopes between 0 and 8% are more advisable for farming.
- the depth of the soil or more exactly the volume of the soil which can be explored by the roots ; this useful depth must be at least equal to 125cm;
- the presence of gravels or other obstacles that can limit the useful depth or the penetration of water or of the roots. This soils with a volume of rough element not above 15% in the first 90cm are preferable ;
- the depth of the underground water level and its inference over the volume of the useful soil on the one hand, appreciation of the useful soil on the one hand, appreciation of moist that rise through capillarity in the profile on the other hand. The soils presenting a good drainage with ground water situated above 150 centimeters are the best.

3.1.3.2 Socio-economic criteria

Orientations and sociological criteria are presented in 2.6.4.1. This involves essentially the clamic and ethnic affinities in the two tribes of the region and the respect for the present administrative organization in the restructuring of space. Under this well be treated the criteria related to production :

i) Distance house-farms

The foreman has as primary concern to leave the populations near their zones of farming which for the most part will be safe from flooding. Investigation shows a distance of 1 to 1km, from house to foodcrop farm whereas the cocoa farm is situated just near the house. The fraction of the population whose crops will not be affected, especially income generating crops, will be rehoused very near these crops. The completely decamped villages will be rehoused on new sites.

ii) Taking into account the Peasants' experience

In chapter 1.2.6, the trees that are indicators of the fertility in the zone according to the peasants are presented.

The location of these trees in the virgin forest is done by the hunters who know the forest very well and canvass it day in day out. It is also they who know the sources of drinkable water and all the necessary structures for the creation of new villages.

Finally, the majority of the villages situated along the Nyabessan-Ma'an road come from the zone situated at the right bank of NDJO'O (NDJO'O AYAT) and most of them would wish to go back to their lands which according to them were more fertile than the present once they occupy.

iii) Average areas per home :

The average necessary area for a family to develop its crops is assessed at 8ha including fallows. The village space taken into account.

3.1.3.3 Criteria related to infrastructure and equipment

i) Average areas for housing and constraints:

Investigation carried out on housing has permitted to note that a space of 800m² averagely is occupied by only one family. More so, high slope lands are to be avoided.

Consequently, each reception zone must reserve at least 1,000m² to all families without dispersing the houses. Moreover, the zone must be with slight slope so that construction techniques known to the populations be preserved.

ii) Water supply :

For the population of this zone, the fetch because streams and wells are at a near distance from the houses. Thus rehousing zones should be at the proximity of streams and rivers, or should be where a geological layer has an exploitable water by the wells. According the diagnostic record, the zone is potentially rich in water but this is no factor to limit the choice of zones.

iii) Means of settlement and collection :

Reception sites will inevitably be linked to the Nyabessan-Ma'an main road through colonizing roads. It is necessary to minimize as much as possible the cost resulting from their construction. For this, their itinerary must permit to excite the zones requiring costly construction works and be as brief as possible.

iv) Collective equipment

It would be desirable that location of the new sites be such that the decamped population continue to exploit the some collective equipment as well as those that have remain in their former place. This means therefore that the distance should be reasonable to be done on foot.

3.1.3.4 Organization of rehousing

1) Programming the operations

Rehousing should be organized in a rational manner so that the food production potential of the population be partly re-established before the launching of the dam. This supposes therefore a consequent programming linking SONEL and the administrative and traditional authorities in the selling up so that the affected population be safe from any need and surprise noticed on the sites of the same type of works.

Meanwhile, all necessary measures will be taken so that the decamped population rebuild on the new sites with their collaboration, Thus the program for the operations will go as follows :

i-1) Before the filling of the dam and at the same time during the works, to benefit from the services of the firms in charge of works :

- a) access roads to the rehousing sites of NHEMEYONG-NORTH in the case of maximum and mean water level alternative;
- b) the choice of sites for the various villages and hamlets and the clearing out of the platforms to receive the houses following a village space type organization outline of to be drawn up with the populations ;
- c) socio-educative equipment and water supply
- d) operations for compensation on crops and housing ;
- e) reconstruction of houses and weeding for the first food portions ;

i-2) 1st year of filling the dam

- a) Supply of a supporting food ration
- b) Letting up various development actions

ii) Compensations

Compensations will be done in conformity with organizational and institutional measures presented hereabove. It is certain that before the construction of the dam, new houses will be constructed while new parcels of crops will be created. It will be appropriate to take a certain number of conservatory measures in the light of compensations clarity :

- To stop the construction of new houses in the zone of safety of the dam (elevations 400 and 405 which must be rematerialized around the villages);
- To stop any new creation of food crops or everlasting crops below elevation 398 or 400 m before the filling of the dam.

3.1.4 Objectives of Measures and Projects

Reminder on the objectives compensatory measures and valorization and accompaniment projects should aim, as stated in the preceding chapter, at:

- Re-establishing the production potential and life style of the affected population within some convenable date lines after the launching of the dam.
- Substantially increase food crops in the zone to respond to the foreseeable contribution of a large new comers population;
- Develop the fishing potential that will increase with the reservoir lake and consequently care for the local and new producers;
- Protect the environment and faun potential of the region which is already highly engaged by the riverside dwellers and that may sustain a rapid degradation with the growth of the population.
- Increase the population's revenue through diversification of their activities in the light of the economic crisis on cocoa.
- Sensitize, train, responsabilize and care for the local producers in order to attain a mastery of the modern systems of putting into value their lands, compatible with the present strategy of environmental protection, to obtain their full participation and contribution to sectorial projects.

3.2 Monetary Evaluation of Compensations

Compensations constitute the first compensatory measures to be taken before the launching of the dam which will permit the concerned populations to re-establish their level of life and their protection potential in the earliest convenient times. Indemnification must be inscribed as the objective of a just remuneration of wealth destroyed by the dam and whose evaluation of quantities had been made in chapter 2 taking into account the texts in force.

The following remarks should be made for the case of maximum water level alternative (400 and 405 m):

- The distance of houses at high water points have not been considered. This safety distance from all points of view is generally held at 2 km. The taking into consideration of this constraint would have led to the decampment of all the villages from NYABESSAN to AKOM.
- The stage hydrograph 405 splits up certain villages into two: on the one hand a zone to be decamped and on the other hand a non affected zone. At the moment of compensation, respect of this limit, which will be imaginary by the time of registering the wealth systematically, will lead unavoidably to certain tensions. The latter will be more pronounced than the indemnified persons will live in the village.

In the mean and optimum alternatives, the impact will be very weak on human establishments, and the compensations will be subject to milder pressures.

3.2.1 Compensation for Houses

Calculated from the areas of each type of houses indicated in Chapter 2 and detailed by hamlet in the Appendices, and from the unit prices in m² mentioned hereabove, the amount of compensation for houses in the respective alternatives is shown in the table below:

Alternative	Compensation for houses (CFA.F million)					Total
	Type 1	Type 2	Type 3	Type 4	Type 5	
Maximum water level	32.35	75.57	4.15	0.21	0.090	112.37
Mean water level	0	27.65	0.42	0.16	0	28.23
Main alternative	0	7.42	0.1	0	0	7.51

3.2.2 Compensation for Crops

3.2.2.1 Amount of compensation for fruit trees

Almost all trees are over 8 years old and located in cacao plantations and around the houses. The estimated amounts of compensation for these trees by alternative are as follows:

Alternative	Amount of compensation (CFA.F million)
Maximum water level	0.28
Mean water level	0.6
Low water level (Main alternative)	0.2

3.2.2.2 Amount of compensation for cacao plantations

Based on three categories of age and data by village as described in the Appendices, the amounts of compensation for cacao plantations by alternative are as follows:

It is to be noted that the number of compensable trees is not the same as that recorded during the field survey, because of the application of the conditions stipulated in the decree referred to Chapter 2 and shown in the Appendices.

Reservoir Water Level	Amount of compensation by age (CFA.F million)			Total
	5 years	5 - 15 yr.	Over 15 yr	
Maximum	2.304	20.640	80.942	103.886
Mean	0	17.520	54.930	72.450
Low (Main)	0	1.920	34.020	35.940

3.2.2.3 Amount of compensation for food crops

Food crops can be compensated only in the case that the farmers are evacuated suddenly without having the time to harvest their crops. Therefore, in the case of this project where the dam construction will last for more than 2 years, the annual crops will not be compensated

because farmers will have sufficient time to harvest them, provided that necessary conservatory measures are taken timely by the authorities. However, the amounts of compensation for food crops are estimated based both on the food demand of the affected population in accordance with the basic principles mentioned at the beginning of this chapter, and on the loss of crops in submerged fields. The amounts calculated by alternative are given below:

Alternative	Compensation for loss of food crops for 20 months (CFA.F million)	Amount of compensation to be paid in the form of ration during 3-year recovery period (CFA.F million)
Maximum water level	64.8	54.7
Mean water level	52.0	44.9
Main alternative	28.4	24.0

As discussed above, a part of these compensations should be paid in the form of food rations directly in the first year and the remainder (equivalent to CFA.F 316,000 per affected family) be paid in cash in many times in the 2nd year after seeing signs of reconstitution of the food potential in the "3 fields" system practiced by working women.

3.2.2.4 Summary of compensations for crops

Alternative	Amount of compensation (CFA.F million)			
	Cacao plant.	Food crops	Fruit trees	Total
Maximum	103.886	64.68	2.8	171.486
Mean	72.450	52.0	0.6	72.450
Low (Main alternative)	35.940	28.4	0.2	35.940

3.2.3 Reconstruction of School

3.2.3.1 At maximum water level

According to the result of diagnosis, only the school at MEMEYONG will be affected. This school is built with temporary materials. But it would be recommended to compensate it in accordance with the standards set forth by the Ministry of Education in order to build final buildings equipped with adequate didactic equipment. The credit usually offered by the Ministry of Education for the construction of normal classroom (9m x 14m) with doors is 4 million F CFA.

The cost of an equipped classroom goes thus:

- local construction: 4 million F CFA.
- 22 table-benches: $22 \times 15,000 = 330,000$ F CFA
- office: 20,000 F CFA.

A complete school of two buildings for 6 classrooms therefore will cost 26,220,000 F CFA.

3.2.3.2 At mean and low water levels

No school will be affected in this case.

3.2.4 Compensation for Churches

3.2.4.1 At maximum water level

The evaluation of each of the 5 churches has permitted to obtain the following costs:

- NEMEYONG church: $251 \text{ m}^2 \times 50,000 = 12.55$ million F CFA.
- EFON churches: $(118 + 156) \times 13,500 = 3.679$ million F CFA.
- NSEBITO BETHEL: $57 \times 13,500 = 769,500$ F CFA
- NTEBEZOK: $31 \times 2,200 = 68,200$ F CFA

Thus, the total sum amounts to 17.0667 million F CFA.

3.2.4.2 At mean and low water level

No church will be affected in this case.

3.2.5 Reconstruction of Wells

3.2.5.1 At maximum water level

It has been noted that 7 wells are affected in the villages of ABEM - NKOLMELONGO, ABEM - MELONGO, ALEN II - I, NEMEYONG and NSEBITO. Improvement upon the life of the populations being the rule, these sky open wells will be replaced by pipe wells in the whole of their depth and equipped with SWN pumps with manual motility.

The cost of a piped well, equipped with pump is 2,5 million F CFA, the 7 wells will cost 17.5 millions F CFA.

3.2.5.2 At mean and low water levels

Three well will be affected. Their compensation amount would be 7.5 million F CFA.

It is however recommended that all important villages where wells will be affected at the maximum water level be provided with well equipped with pumps.

3.2.6 Reconstruction of Provincial Road (D41)

3.2.6.1 At maximum water level

This work consists in raising the surface level of the sections affected at El. 405 m. It is assumed the longitudinal profil of the road e raised to El. 400 m. This assumption is justified by the height of spillway that does not go above 399.5m. This leads to 44,400m³ of embankment for a total distance of 3.5km for a 5m large road.

This cost for a m³ embankment being at 1,800 F CFA, compensation will amount to 79.92 million F CFA.

3.2.6.2 At mean water level

The longitudinal profil is assumed to be raised to El. 397 m. The cost will be 52,695,000 F CFA for a road section of 2.07 km long, 5 m wide with an embankment volume of 29,275 m³.

3.2.6.3 At low water level (Main Alternative)

The longitudinal profil is assumed to be raised to El. 392 m. This will result in a cost of 16,650,000 F CFA for a road section of 0.88 km long, 5 m wide with an embankment volume of 9,250 m³.

3.2.7 Organizational and Institutional Measures

3.2.7.1 Study on wealth counting

SONEL must see into it that a consultant carries out a systematic counting of private wealth as well as collective wealth situated below elevation 405 or any other elevation when the final characteristics of the dam and its functioning will be known.

Epidemiological constraints will equally be taken into consideration. The Consultant will, to this effect, establish individual files for all the affected families.

Each file will comprise of :

- an exact identification of the beneficiary(ies);
- an exhaustive description of the affected wealth (houses and/or crops);
- location of the wealth
- detailed assessment of the wealth.

The cost of such a study would be in the vicinity of 15 millions. Its execution will require the intervention of a Rural Engineer for supervision, a Higher Technician for rural engineering for the survey of farms, an Agricultural Technician for the counting of the plants and a Building Technician for the description of the houses.

3.2.7.2 Local Commission for Compensation

A local commission for compensation will be created, composed of SONEL, the District Offices, the Mayor, traditional Authorities and Delegates from MINAGRI (Ministry of Agriculture), MINEPIA (Ministry of Fishing and Animal Husbandry) and MINUH (Ministry of Town Planning and Housing).

The role of this local commission will be:

- to verify on the spot the conformity of the files previously established by the consultant;
- to proceed to the evaluations of wealth;
- to establish the states of payment;
- to transmit these states for payment at SONEL
- to give cheques to the beneficiaries
- to organize payment days with the bank.

It is recommended that SONEL issues, together with a bank that is ready to carry out payments in the field, individual cheques corresponding to the amount to be paid to each beneficiary. These cheques will be handed to the beneficiaries through the intervention of the local commission.

The operation expenses of this commission amount to 2,000,000 F CFA for various missions.

3.2.7.3 Mixed Commission for Report

Experience has shown that there always exists claims during compensation. These complaints generally come from the populations involved or not in the compensations. A commission composed of MINPAT (Ministry of Regional Development), MINAGRI (Agriculture), MINMEE (Mines, Water and Energy), SONEL, Traditional and local Authorities, must also be set up. This commission will have as main task, to see that the compensation operations be done within the norms of the law in force. The commission will ensure liaison between the local Commission and the population. It endeavors to solve the various conflicts during and after compensation operations.

Interventions of this commission on the field will be punctual and will require a budget of 1.2 millions F CFA.

3.2.7.4 Construction of school and wells

The project authority will organize and manage all the works related to the construction of the school affected in the maximum alternative, with eventual assistance of the people concerned.

The construction of wells would be entrusted to CEDAC of Sangmelima, since they have the competence and necessary equipment, payments being done by SONEL. CEDAC whose zone of intervention does not affect this district will act in the light of a private firm. Its work will be supervised by SONEL and the project authority.

3.2.7.5 Works on the embankment of road canals

This work is the responsibility of a Civil Engineering Company. They will also have the task of constructing new communication roads. The embankment cost adopted is closely linked to this condition in a bid to sustain just once the installation expenses of the site of the firm.

3.3 REHOUSING

3.3.1 Location of Reception Sites

3.3.1.1 Maximum WL Alternative (El. 405 m)

With regard to the criteria and orientations outline above, three main sites have been retain to receive the villages and hamlets to be decamped completely or partially.

i) The Aloum I Site *Canton bend of Ntem, left bank)

It will be located across the work on a path to be created which will link it to MELEN and AYA' AMANG. Potential for this site is limited in terms of good land considering the present low density. It will receive ALOUM I, seat of the 2nd degree chiefdom, a village essentially inhabited by the ESSAMANGONE clan on the path at the crossing of the dam.

ii) Nyabessan

Nyabessan possesses enough space to receive a more important population that could develop its crops towards the Ndjo'o ; Consequently, a site to be created at Nyabessan after the school on the path leading towards the Ndjo'o will receive the hamlets of NKOLOSSONG and Ndjo'o YOP 1+2. Although the inhabitants of NKOLOSSONG are of the NTOUMOU tribe and have shown the interest in joining their brothers in the left bank of the Ntem in case of decampment, this solution has been held for purpose of preserving the established administrative situation and with the aim of uplifting Nyabessan to an administrative center with a more assorted population.

iii) The NHEMEYONG NORTH Site

With an area of 1,000 ha, this site constitutes the most important site for rehousing and for settlement of new lands. It offers many advantages outline above :

- a large availability in good quality land (see pedological reconnaissance) and an acceptable topography ;
- Extension possibilities right bank of the Ndjo'o (NGO'O YAT) with which the population maintain old affectionate links (localisation of their former villages before 1940 ;
- Farness from the risky zone constituted by the reservoir lake.

This site will receive the hamlets of the following villages :

- Abem : Bedemba, Melongo, NKolmelongo and Abem2, making up 15 families ;
- ALEN 2 : Alen 2.2, 3 families ;
- NHEMEYONG : Nhemeyong 4 (Macedonia) 6 families ;
- NSEBITO : Efon, Bettel and Nsebito (Ntebezok) that is 9 homes making a total of 33 families requiring a total farming area of 181 ha.

iv) Secondary sites

These are sites situated in villages on which houses of the decamped dependent population will be re-established. These sites do not require an important investment like in case of main sites for the creation of platform by SONEL. These concern the hamlets of the following villages :

- MELEN I : NLOZOK
- NTEBEZOK : NTEBEZOK
- NHEMEYONG : Nhemeyong

involving 11 families and requiring a farming area of 18 ha.

3.3.1.2 Mean WL Alternative (400 m)

At this elevation, the site at Nhemeyong North will be used only for development of new lands.

The site at Nyabessan will accommodate the inhabitants from Nkolessong.

Other resettled inhabitants will be kept in their village for the reconstruction of their houses.

3.3.1.3 Main Alternative (395 m)

The site at Nhemeyong North will remain a potential area for expansion of crops.

The site at Nyabessan will receive inhabitants from Nkolessong in the case this hamlet is evacuated for health and safety reasons as recommended in Chapter 2. This case however is not taken into consideration in the evaluations.

3.2.3 **Cost of Infrastructures and Accompaniment Equipment**

3.3.2.1 General principles

Following the reference terms, it is particularly recommended to study "the needs for rural paths for the enclaved villages and for future rehousing zones". It is in this light that it is proposed that " apart from the road linking the new site of NHEMEYONG-NORTH to the secondary D41 road, paths be open in series along the left bank, thanks to the possibilities henceforth given by the existence of the dam to cross the Ntem with civil engineering engines.

The roads will have a hold of 12m for a pavement of 5m. The cross profile will be in roof will crossing slopes of 3% and lateral gaps of 1.50m wide and 0.40m deep. Their layout will follow the lines of the crest to minimize embankments. Their cost is around 8 million FCFA/km. This cost embodies the primary study done by contract adjudicator company, cleaning, embankment, putting into form, realization of trenches and divergents, construction of small sewage works (channel) and passage (culvert). This cost may be reduced to half, i.e. 4 million F CFA as retained in the evaluations.

The paths of settlement for the new farm lands are large servitudes of less than 4m and simply realized by chain saw clearing. Their cost is 60 CFA/m², that is 240,000 FCFA/km. For construction of improved and better cleared paths of the same type, the cost will become twofold, i.e. 500,000 F CFA/km.

House construction techniques require a plattened emplacement. Since houses would be set out along the new roads, during their construction, platforms destined to receive houses will be realized. A space of 1000m² for the house and yard will be provided for each home. The works will consist of deforestation and cleaning. 30cm thickness. The unit costs are estimated at 60 FCFA/m² for deforestation and 590 FCFA for 1m³ of earth removed. The making up of 1m² of plate-form would give 237 FCFA.

3.3.2.2 In maximum WL alternative

i) For the Aloum I new site

- Paths :

- Improved access path of 4 km long: 2 million F CFA;
- Resettlement path of 2.5 km long: 0.7 million F CFA

Total cost amounts to 2.7 million F CFA.

- Land preparation for construction of houses

$$15 \times 1,000 = 15,000\text{km}^2$$

$$\text{Cost: } 237 \times 15,000 = 3,555,000 \text{ FCFA}$$

- School with a complete cycle situated at MELEN : 26,220,000FCFA

- Equipped wells with pump : 1 x 2.5 million FCFA.

ii) For the Nyabessan site

- Resettlement path to Ndjo'o: 3 km
Its cost will be $(3 \times 240,000) = 720,000$ FCFA
- Land preparation for houses for 8 families: 8,000 m²
Cost: $(8,000 \times 237) = 1,896,000$ FCFA

iii) For the Nhemeyong North site

- Road and paths:
 - NHEMEYONG-NORTH - Secondary road D41 : 6km.
The cost of this resettlement road is 24 million FCFA.
 - Path for collection and inland service: 5km
Cost: 1.2 million FCFA.
- Plat-form for housing of 50 families : 0,000 m²
Cost: $(40,000 \times 237) = 9.48$ million FCFA
- Complete cycle school : 26,220,000 FCFA
- 1 well : 2.5 millions

iv) Total Amount for Rehousing

The whole rehousing exercise requires the sum of 100.59 million FCFA broken down as follows :

Items	Sites			Total
	Aloum1 bis	Nyabessan	North Nhemeyong	
Roads and paths	2.7	0.72	25.2	28.62
Land preparation for housing	3.555	1.896	9.48	14.926
School	26.22	-	26.22	52.44
Wells2.5	-	2.5	5.0	
Total	34.975	2.616	63.4	100.59

3.3.2.3 In mean WL alternative

i) For the Nyabessan site

- Resettlement path to Ndjo'o: 3 km
Its cost will be $(3 \times 240,000) = 720,000$ FCFA
- Land preparation for houses for 4 families: 4,000 m²
Cost: $(4,000 \times 237) = 948,000$ FCFA

ii) For the North Nhemeyong site

- Road and paths:

- North Nhemeyong - Provincial Road D41: 6 km
The cost of this resettlement road will be 24 million FCFA
- Path for collection: 5km
This path will cost 1.2 million FCFA

iii) Summary

The relocation of houses will cost 25.2 million FCFA for the North Nhemeyong site and 1.668 million FCFA for the Nyabessan site, i.e. a total of 26.87 million FCFA.

3.3.2.4 In low WL alternative (main alternative)

i) For the North Nhemeyong site

One resettlement path of 6 km long will be constructed to the site identified above for expansion of crops. Its cost is estimated at 3.0 million FCFA.

3.3.2.5 Comparison of cost of houses relocation by alternative

The costs of relocation including land preparation for construction of houses, roads and paths, restoration of infrastructures and socio-collective facilities by alternative are as follows (in million FCFA):

Alternative	Aloum I bis	Nyabessan	North Nhemeyong	Total
Maximum WL	34.975	2.616	63.4	100.59
Mean WL	-	1.668	25.2	26.87
Low (Main alternative)	-	-	3.0	3.0

3.3.2.6 Motor boat

In any alternative, a 10-seat motor boat should be provided at the crossing point between Nkolessong and the left bank of the Ntem river toward Aloum. The cost of this boat is estimated as follows:

- Manufacture: 50,000 FCFA
- Engine: 300,000 FCFA
- Total: 350,000 FCFA

- Maintenance: borne by the project authority
- Operation: paid by users through collection of toll charge.

3.3.3 Development Infrastructures and Equipment in the Area

Other infrastructures and equipment required for smooth development of the project impact area as a whole in the medium and long terms are described below. It is recommended that local agencies concerned take necessary measures, in coordination with the project executing agency (SONEL), for their planning timely with the execution of the works.

3.3.3.1 Schools

Apart from the school in Nyabessan which needs some repairs, all the other schools are built in temporal materials. Improvement upon the localities passes through the construction of a school in each of the following areas : ALEN II, TOM, MVILIMENGALE, NKOMEYOS, AYA' AMANG.

The 5 schools will amount to 131,10 million FCFA to which 2 million will be added to renew the school at Nyabessan. Their construction will be undertaken by the missionary organizations and by the Ministry of National Education; their cost is not included in the project cost.

3.3.3.2 Water supply

Talks held with the population and the visit of the wells permitted us to note that these wells were not everlasting. Those wells that were dry required renewal through deepening them and putting of flag stone. Wells dry in marshes should be replaced by more profound once dry in the yard of the village. All the well will be equipped with manual pumps.

Thus 6 wells will be renewed (Nyabessan, Nsebito and Ntebezok, Akom and Tom (2)) and 1 well will be dug at Melen.

Since the re-establishment of the wells is estimated at 2 millions, the total amount to be provided is 14.5 millions FCFA; this cost is to be borne by the project authority.

3.3.3.3 Dispensary of Nyabessan - Health actions

The building of the Nyabessan developed health Centre is becoming ramshackle. Works consist of doing some painting, some walls and the roof. The of these works is estimated in Annex 2.

3.3.3.4 Costs Infrastructures in the zone

Additional infrastructures for the improvement upon education and water supply amount to 145,600,000 FCFA, of which 14,500,000 FCFA will be borne by the project authority for general improvement of the drinking water supply system in the impact area.

3.4 ACCOMPANIMENT PROJECTS

3.4.1 Development Projects underway

A number of identified, studied or underway projects at the level of national or regional dimension, are susceptible of integrating or serving as vector to actions and analyzed programs within the framework of the present study. These projects concern especially sectors of territorial and rural development.

3.4.1.1 SODECAO

The new Cocoa development Authority (SODECAO) financed by the World Bank for a period of 5 years (1990-95) represented at the level of the region (districts of AMBAM and MA'AN) by the district technical team.

This team comprises of 4 members : 2 agricultural technicians, 1 specialist in commercialization and 1 specialist in training. This team is to help the state to disengage itself

progressively from this sector and assist Producers to organize themselves. Concretely, the team helps the farmers in the following operations :

- Commercialization of cocoa
- Supply of intakes
- Training of the necessary drivers against anticapside ;
- Promotion of saving spirit against the different expenses ;
- Catering for food production, breeding and the management of constituted savings accounts
- Follow-up of training seminars with the assistance of Non Governmental Organizations (NGO).

To attain these objectives and work efficiently producers are grouped under teams (50 teams of 20 persons averagely). The whole of this constitutes UGPAMO, Federation Organization des paysans d' AMBAM, having a total of 820 men and 1000 women.

3.4.1.2 FIMAC

Set up within the framework of "GRAND PROJECT FOR FOOD SAFETY," financed by the World Bank in 1991, FIMAC is line with awarding credit destined to finance community projects presented by the groups of 5 to 20 members living in the unformed rural zones. These groups must be presented by a supporting structure and be of a productive nature. Supporting structures are local services related to MINASCOF, MINAGRI, MINEPIA or NGO, (Ministry of social and women affairs, Ministry of agriculture, Ministry of fishery and Animal Industries, or Non Governmental Organization), religious bodies or charity organizations.

Micro-projects must be simple and technically masterable by the groups that do not receive money in cash, but finance of equipment destined to their realization of the following type :

- Equipment of food community forms and gardening ;
- Breeding material, fishing materials, pisciculture and agricultural materials.
- Small storage stores, processing or conditioning;
- Small rural markets ;
- Slaughterhouses and vaccination parcs.
- Construction of low bottoms or water points for agropastoral use.

Beneficiaries must contribute in cash or in kind in all cases for 30% to 40% of the total cost of the project and receive an adequate training whose cost must be included in that of the project.

The reimbursement of funds by the groups must permit to reconstitute it, this is why their recovering is confided to local structures and institutions to which they belong.

The setting up of FIMAC in the project zone will have a short term confrontation to the inexistence of community structures already noted above. This is why the constitution of groups which is a prerequisite seems to be a priority in the perspective for revival and for the development of food production and pisciculture. An attempt is underway for the constitution of fishermen groups and the diverse local technical services are already sensitized and trained

for the FIMAC mechanisms ; But they lack the means, the profiles and the adequate number for sensitization of producers in that line.

3.4.1.3 The Project of putting into Value the AMBAM region

This project is in line with the policy of developing the border zones as stated in the Vth development plan of the MINPAT (Ministry of Plan and Territorial development) and which aims at equipping border regions with infrastructures, equipment and agropastoral development projects that will enable them play an important economic transit role and a role of linking neighbouring Countries.

The project was studied in 1986 and Comprises of numerous economic components whose realization has not held due to the economic Statement and the fall in the activities of the organs concerned, like SODECAO.

The only concrete achievements so far one :

- The densification of the administrative framework notably the creation of the Valley of Ntem division which covers the project zone ;
- The construction of a border grouping market, and also for collection and transit in the South of AMBAM destined for agricultural products with destination to Gabon and Equatorial Guinea.

3.4.1.4 UCA-SOUTH (Union for Agricultural Cooperations of the South)

Having benefited from logistic structures for its launching from the ex-ONCPB (national Produce Marketing Board), UCA presently suffers from a slow-down notably in activities related to the poor sales of products and lack of liquidity in the face of competition among Licensed buyers to intervene everywhere since the liberalization of the coffee/cocoa and who have logistic and financial means.

The three basic structures (Cooperative Centres) with elected bureau in the zone are no longer functional since three years whereas they started to play an important role in the training of peasants and cooperative movement groups and modern technical acquisition. Their remobilization around certain themes framing with the above outline general objectives would be envisaged.

3.4.1.5 Missionaries and NGO works

The zone disposes many competitive Christian and antagonistic churches with their actions limited for now at the construction of churches and at the organization of believers. No remarkable action has been noticed in the domain of development whereas the AMBAM region benefits from well organized production sectors notably through CEPAR, (Centre for Promotion and Rural Assistance) of EPC (Presbyterian Community Church) which for years, is developing guide-actions for agro-pastoral.

For now, no NGO intervenes in the zone whereas their combined actions with those of the missionaries would have permitted to develop community spirit which is a failure here.

In conclusion, the project zone does not receive any remarkable feedbacks from the above described projects, at least presently. In mid term, only FIMAC and SODECAO could be operational with condition that community structures develop rapidly.

3.4.2 Implementation of an Agricultural Development Program

Production systems of this zone comprises of many identified constraints in chapt 1. Construction of the dam will intensity these constraints and even create new once (demographic pressure leading to large deforestation) ; thus the only way to stamp them out would be to apply other production techniques and more other efficient technologies.

Commercialization and production care which are essential for the intensification of production should be added to that component.

The agricultural development component can be implemented within the framework of P.N.F.V.A. (National Program of Agricultural Training and Extension Services) under the Ministry of Agriculture, which should pay a particular attention right now to this area by strengthening its services through local extension agencies. However, this program, which is financed by the World Bank, will expire in 1995. Therefore, in accordance with the planning for construction of the project, it is necessary to find out a way to implement the above mentioned measures adequately.

3.4.2.1 Improvement upon production systems

i) Cacao System

This system has as main constraints the ageing of trees, the poor shading, lack of labour, the decline in productivity and soil fertility and commercialization difficulty.

Actions that can be envisaged are :

- Utilization of multiple purpose trees (fruit trees, palm oil tree etc...) for cocoa shading ;
- Utilization of covering leguminous plants in the newly created farms to fight against erosion and harmful herbs (Cajanus Cajar seems to do well for ecology) ;
- Production of shade tolerating plants like cocoyams and bananas ;
- Supply of modern intakes especially in vegetal material ; hybrid pods ;
- Commercialization
- Agricultural farm research These actions can be grouped in 2 parts :
 - Short term :
 - # research of the utilization of improved varieties set up by the research
 - # intensive introduction of fruit trees and food crop in the young cacao farms to increase the fields ;
 - # improving commercialization
 - A long term research on the production systems using improving leguminous plants and dealing on ;
 - # the identification of the adapted species in the region ;
 - # Optimal densities in associations cacao/food crops/fruit crops ;
 - # the effect of covering plants on production and the fertility of the soil.

ii) Food Crop Systems

The main seasons for the utilization of fallow in this region seem to include the follow facts :

- the forest is quite vast and there is no need to preserve it ;
- There is the tendency to transfer as many fallows as possible to one's descendants before one's death ; it is a pride ;
- The cleared lands (fallows) are the property of the worker as well as all the fruit trees (palm tree, Kola nut tree, *Iurugia gabonensis*) which are found there and which are an important source of income ;
- Peasants do not know the damages they cause through deforestation and erosion. In addition, this system has the constraint of the decline of fertility, source of production decline which must be increase with the growth of the population.

Improvement of this system depends on many actions :

- a) Increase in soil fertility. This result can be obtained by introducing improving trees and bushes to rapid growth that can cover the soil right from the first year. These are leguminous like *Calliandra calothyrsus*, *Gliricidia sepium* and *Flanemgia congesta* which had been tested with success in this ecology. These trees and bushes can be planted in line (corridor crops) or scattered (improved fallow). They can be used as life supports by squash (cucumber) and yams. They are thereafter pruned during crop seasons and the seeds are incorporated in the soil to improve upon fertility.
- b) the use of highly productive ameliorated varieties must be a priority.
- c) the introduction of new tools which can decrease the difficulty of certain manual works (felling, evacuation of the production).
- d) Organization of the commercialization of food products
- e) Research on the different production system that can bring about a lasting development in the region. This action can be undertaken in long term and for three years.

iii) The system of home garden

These garden are often very small, not quite diversified and their development is perturbed by domestic animals which damage the crops.

Through these gardens, the intensification of agricultural and animal production should be envisaged. This will intervene through the following actions :

- the introduction of quickset hedge planted around houses and gardens and sewing as enclosure and as food for the animals ;
- the enlargement of the size of these gardens which at present is reduced to a few fruit trees and vegetables ;
- the planting of many crops and in a stratified manner (crops and trees grouped in the farm by decreasing order).

Plants that will be found here must be for all usages : food, kitchen, tool, medicine, animal food. Research component will consist of the study optimal association of these diverse plants.

3.4.2.2 Commercialization of production

Actions to be undertaken in this domain concern :

For cocoa production :

- the valorization of existing cooperative centers in each village and their reduction in a center per group. for food crops :
- development of the periodical market at Nyabessan
- Favour the opening of a sale center of agricultural and fishing material. This center should be a private initiative and the constituted group to which belongs the promoter will only endorse it to obtain credit (FIMAC or others).

3.4.2.3 Guidance for Production

This passes through the creation of small groups of at least 25 persons and constituted by members living side by side and carrying out the same activities. Preferably these members will come from the same village or very close villages. The formation off the following groups can be envisaged :

Villages or hamlets	number of families	number of groups
Nyabessan	25	1
Abem	23	1
Ntebezok + Alen II	11 + 10	1
Melen I	16	1
Nhemeyong	23	1
Nsebito	54	2
Tom	24	1
Akom + Asseng	8 + 11	1
Aloum I	11	1
Melen II	22	1
Aya'amang	31	2
Ebenmeyong	12	1
Total		14

These groups must be guided by two technicians of agriculture, the first in charge of the EBENMEYONG, AYA'AMANG, MELEN II, ALOUM I, NYABESSAN and ABEM zone. The second, from NTEBEZOK to ASSENG. The delegate of the Ma'an district is in charge with the supervision in relation with the light guiding structure proposed further.

The guiding consists mainly of :

- assistance for commercialization
- assistance in the supply of modern intakes ;
- caring for the production (food crops, cacao and the creation of diverse nurseries) ;
- assistance in the creation and management of a savings bank immediately compensations are paid ;
- favour access to credit and other assistance for the acquisition of onerous material (chain saw, rickshaw ...).

3.2.4 Financial Evaluation of the components

The expenses that these exploitations will sustain are in categories :

- Expenses on investment
- Expenses on running cost

Expenses on investment include :

- buildings and equipment
- fencing ;
- agricultural tool
- research and study allowances
- vegetal material and various equipment Expenses for running cost concern :
- Expenses engaged for annual intakes
- Expenses on labour
- Various transport

In the present evaluation, all the most onerous expenses to which the peasants cannot stand through own present means and which may obstruct the smooth going of agricultural development will be taken into account.

i) Equipment

- 1 all weather vehicle which will ensure not only the coordination of the operation but also the transportation of intakes (vegetal materials and others) from the producing zones to the project zone. Later on, this vehicle will be transferred to the Ma'an agriculture Delegation. Since the Delegate is the homologue of the chief technician (Volunteer) (cf 3.7 structure of the project).
- 2 motorcycles for the basic care-takers for 600,000 per moto, that is 1,200,000FCFA.
- fuel expenses : 1,000F/day
- Maintenance : 10,000F/month

Total : $40,000F \times 12 \times 2 = 960,000F$ for expenses on annual functioning

ii) Onerous tool

- 1 chain saw per group to assist the families to prepare the land, that's 14 chain saws at 285,000F CFA that's 3,990,000FCFA.
- 1 rickshaw per group that's 14 in all at 64,000F each, total 896,000 FCFA.

iii) Cost of minor material to create nurseries Number of hectares

Number of hectares: 337

Materials	Nmbr. per total population	Quantity	Total unit Price (FCFA)	Total Price (FCFA)
Plastic sachets	1,700	91,000	6	550,800
Water cans	2	108	7,500	810,000
Wheel barrow	1	54	16,300	880,200
Pickaxe	1	54	3,500	75,600
Dibber	1	54	1,400	275,400
Matchets	3	162	1,700	1,718,700
Shovel	1	54	1,400	75,600
Rake	1	54	1,400	75,600
Files	3	162	1,350	218,7
Action against pesticides			15,000 (per ha)	810,000
Total				3,969,900
				rounded to 3,961,000

iv) Cost of acquisition of vegetal material

Crops	Areas cultivated in ha	Quantity in ha	Total quantity	Unit cost including transport	Total cost
Cocoa	54 h	60 cab.	3,240	50	162,000
Maize	990 h	35 kg/ha	34,650	100	3,465,000
Cassava	6 h	10,000 bou	60,000 bou	15	900,000
Sweet Potato	1 h	30,000 bou	30,000 bou	12	300,000
Banana	3,180 p			75	238,500
Pineapple	4,770 p			50	238,500
Mangos	318 P			1,000	318,000
Pear	636 p			1,000	636,000
Plum	636 p			1,000	636,000
Mandarine	318 p			1,200	381,600
Orange	636 p			1,200	763,200
Pomelo	318 p			1,200	381,600
Guaver	636 p			1,200	763,200
Pawpaw	1,590 p			800	508,800
Palm tree	2,862 p			1,500	4,293,000
Total					12,794,400

Remark:

Crops taken into account are those will low varieties. Quantities consider losses (10% for fruit trees) calculations of the areas to be cultivated is done in the following way :

- maize : 324 homes cultivating 6.10m² each with 2.5% in maize every cycle (2 cycles)

- for fruit crops, the norms of an anchard of hut that produces nutritive fruits all year long.

Specie	Number	Area occupied by tree	Total area
Mango tree	1	100	100
Pear tree	2	50	100
Mandarine	1	50	50
Plum tree	1	100	100
Orange tree	2	36	72
Pomelo	1	50	50
Guaver	2	36	72
Pawpaw	5	6	30
Banana	10	6	60
Pine apple	15	1	15
Palm tree	9	72	648

Total area: 649 m2 for fruit trees

648 m2 for palm trees

v) Studies and research

It is recommended that the studies, which have already yielded some results, be continued under the usual programs of MINREST (Ministry of Scientific and Technical Research) by the Nkoemvone research station.

Summary of costs of the agriculture component:

Development Activities	Cost of implement per year (1,000 FCFA)					Total
	1	2	3	4	5	
Additional personnel (2 extension workers)	2,040	2,040	2,040	2,040	2,040	10,200
Equipment						1,200
- Motorbikes	1,200	-	-			4,800
- Operation	960	960	960			
Farm equipment						3,990
- Chain-saw	3,990	-	-			896
- "Porte-tout"	-	896	-			
Vegetal materials	12,974	-	-			12,974
Total	23,085	1,856	960	2,040	2,040	38,021

The project authority will bear the cost for additional personnel (2 staff) and extension equipment, totalling 4,200,000 FCFA for the 1st year and 3,000,000 FCFA for the 2nd year. The remaining cost under this program will be borne by the farmers in the framework of restoration and development of their farms.

3.4.2.5 Establishment of a collective nursery farm as a compensatory measure

The numbers of cacao plants required for restoration of the affected cacao plantations are as follows:

- 91,800 trees for the maximum water level alternative
- 20,400 trees for the mean water level alternative
- 8,500 trees for the main alternative

A nursery farm will be established and managed by an agent of MINAGRI to satisfy the demands in cacao plants as well as improved fruit plants (citrus tree, mango tree, oil palm tree, banana tree, etc.). The costs related to the nursery farm by alternative are as follows:

Alternative	Total number of plants per year	Number of improved fruit plants	Number of improved oil palm plants	Total area of nursery farm	Total cost per year (FCFA million)
Maximum	100,000	7,200	1,000	1,000	1.3
Mean	26,000	4,600	1,000	260	0.8
Main	14,000	4,500	1,000	140	0.8

3.4.3 Fish Component

3.3.3.1 Introduction

Works to be done at the project site which will be open by the future reservoir will considerably disturb the area and fishing activities (reduction of rate of dissolved oxygen, flooding of forestry galleries, immigration of fishermen ...). In order to withstand the new situation, it will be imperative to undertake actions aiming at adapting with the circumstances while preserving the balance in the milieu. These actions would therefore aim at developing this activity to respond to the foreseeable needs of a fast growing population around.

The above mentioned actions will be possible only if the following measures are implemented:

- Control of fishing activities;
- Non motorization of boats because of the limited area of the reservoir:
 - 7,600 ha for the maximum alternative
 - 2,800 ha for the mean alternative
 - 1,900 ha for the main alternative
- Delimitation of nursery areas where fishing is prohibited;
- Use of wide-mesh nets (4 or 5 fingers);
- More or less regular stocking of the reservoir in proportion to the condition of exploitation of fish stock.

Other factors might also help to increase the income of fishermen, namely the following:

- The demand and supply law resulting in the increase in fish price. In fact, the opening of the area thanks to the construction of the reservoir will attract more potential buyers of fishing products (merchants, SONEL officials, etc.);

- The ease of supply of inputs such as nets, hooks, ropes, etc. at the site if a fishing center is created in the area.

3.3.3.2 Construction of fishing corridors and piscicultural sites

i) Maximum alternative

The felling of trees (deforestation) in view of opening fishing corridors will immediately interest the upper zone of the dam here and there from the minor bed of the rivers (Ntem, Biwome and Ndyo'o) ; villages and hamlets will be linked to fishing corridors by canoes of about 20 meters large. These spaces will cover an area. The upper part of Ndjo'o as well as a "tongue" of the NTEM will be worked up (systematic grubbing) for eventual aquatic sites (cage aquaculture, big 4).

The filling of the reservoir will submerge vegetation covering almost 3,500 ha which will be refuge ground for ichthyological fauna. This flood zone will also play and especially a major role of supplying many species. These combined effects will contribute to increase productivity of the reservoir.

Deforestation costs on corridors for fishing and aquacultural sites are estimated at:

$$\frac{6,600 \text{ ha} \times 50,000}{5} = 66,000,000 \text{ FCFA.}$$

ii) Mean alternative

The reservoir would cover an area of 2,800 ha including 2,100 ha of vegetation. The construction of fishing corridors will cost:

$$\frac{2,100 \text{ ha} \times 50,000}{5} = 21,000,000 \text{ FCFA.}$$

iii) Main alternative

The area covered by the reservoir will be 1,900 ha including 1,200 ha of vegetation. The construction cost of fishing corridors will be:

$$\frac{1,200 \text{ ha} \times 50,000}{5} = 12,000,000 \text{ FCFA}$$

The construction of fishing corridors can be entrusted on a contractual basis to farmers who use chain-saws in order to avoid land scraping and systematic elimination of deep vegetation by the use of heavy machinery; this helped to preserve the areas for reproduction and feeding of fish. On the other hand, the use of heavy machinery will be three times as expensive as hand felling for each alternative. The tree fellers can receive large income due to the commercial value of trees and the large wood requirements as a result of resettlement and increase of resident population.

3.4.3.3 Fish stocking in the reservoir

i) Justification and standards

Successive perturbations to the construction of the dam are likely to bring about scarcity in some species. To cover up this gap, it is necessary to envisage alevinage of the reservoir immediately after filling. Three species that are well known for their ability of adapting to artificial African lakes can be retained. These are :

- *Oreochromis niloticus* (Tilapia)

The flesh of this specie is appreciated and it has a rapid (300g/an) growth in the natural conditions of the artificial lakes. The alevins (young fish) are available in aquacultural centers of MINEPIA (Ministry of Husbandry, fishing and Animal Industry) for sales to fish breeders. Supply could be done from Taounde, since the center in Ebolowa is not yet functional.

- *Clarias Lazera*

This specie has the same characteristics in growth like the number I nilotica with which it is after associated in polyculture. Orders for alevins will be made at the MINEPIA (Ministry) stations of the West and North-West Provinces where hatching center of this specie

- *Heterotis niloticus*

Its growth is fast like that of the first two species. But young *Heterotis* are not available in stations. They are caught in nature. Avelinage can also be done from adult fishes that will be caught in the Nyong river (around Mbalmayo) and introduce in the reservoir. Teaching is based on the biotic load of the reservoir from which the annual production potential of the fish is known. In tropical lakes, the average value is generally 50kgs/ha/year; we can retain that figure for the present study. To attain it, the rates of fish stocking presented in table 6 could be used. However, this table also gives the weight of the alevins per specie, their number and their tonnage as well as the corresponding cost bearing in mind that an alevin of *Tilapia* costs 20F, whereas that of *Clarias* and *Heterotis* costs 50F each. To calculate the tonnage of alevins pumped it, the rate of mortality of 30% and 20% have been taken account respectively for *Tilapia* and *Clarias* on the one hand and for *Heterotis* on the other. This rate was increased with the number of alevins required for the stretch of the reservoir, that's 52,000 ha. The value of the rate of mortality considered for the two first species is explained by the distance of supply centers.

Fish stocking will be chosen at the MINEPIA or at the Ministry in charge of research. This will necessitate the intervention of an experienced staff for one month. Expenses related to that are estimated at 2.23 million FCFA.

ii) Maximum alternative

Fish stocking will take place in each of the three rivers (Ntem, Biwome, Ndjo'o) in areas where there are no fishing corridors. In order to avoid loss of fish during the opening of the dam, it is recommended to install fixed bars (meshes de 30mm width) at the level of the gates. Modalities and cost of fish stocking in the reservoir (7,600 ha) are shown in the following table (excluding consulting charge):

	Rate of stocking	Number of alevins	Weight	Cost (x1,000 F)
Tilapia (10g)	100/ha	988,000	9.88	19,760
Hegerotis (50g)	2/ha	18,240	0.912	912
Clarias	2/ha	19,760	0.988	988
Sub-total (A)		714,000	11.78	21,660
Contingencies (10% A)				2,170
Total			11.78	23,830

iii) Mean alternative

Fish stocking will be carried out only in the Ntem river at locations where there are no fishing corridors. Modes and costs of fish stocking in the reservoir (2,800 ha) are shown in the following table (excluding consulting charge):

	Rate of stocking	Number of alevins	Weight	Cost (x1,000 F)
Tilapia (10g)	100/ha	364,000	3.64	7,280
Hegerotis (50g)	2/ha	6,720	0.336	336
Clarias	2/ha	7,280	0.364	364
Sub-total (A)		378,000	4.34	7,980
Contingencies (10% A)				800
Total			4.34	8,780

iv) Main alternative

Fish stocking will be carried out only in the Ntem river at locations where there are no fishing corridors. Modes and costs of fish stocking in the reservoir (1,900 ha) are shown in the following table (excluding consulting charge):

	Rate of stocking	Number of alevins	Weight	Cost (x1,000 F)
Tilapia (10g)	100/ha	247,000	2.47	4,940
Hegerotis (50g)	2/ha	4,560	0.228	228
Clarias	2/ha	4,940	0.247	247
Sub-total (A)		256,500	2.495	5,415
Contingencies (10% A)				540
Total				5,955

3.3.3.4 Construction of a fishing center and a fishing station

i) Missions:

Two main missions will be assigned to the fishing station and/or fishing center:

- Collection of statistics for a better follow-up of lake exploitation
- Guidance for fishermen

The 2nd item will be done at many levels:

- Sensitize the fishermen on the rules and control the application. These measures concern the respect for the use of the authorized meshes, respect for the prohibition of fishing in cantonment zones, the control of the fishing effort by giving out fishing permits.
- Sensitize the fishermen on the utilization of more performing fishing techniques and smoking (chorkor)

- Assist the fishermen to organize themselves into groups or cooperatives, the only means through which they can benefit from the intervention of financing bodies like "La Caisse de Developpement de La Pêche Maintime (CDPM) or " Le programme de financement d' Investissement de Micro-Realisations.Agricoles et Communantaries (FIMAC). For a sound organization, the training of fishermen is necessary. This can be done through courses organized by MINEPIA. Expenses for this short term training (3 months) organized every 2 or 3 years are incurred by MINEPIA. Another Conger training course is given at the National Piscicultural Centre at Fouban. The (fisherman) student bears the expenditures.

It should be recommended that fishing center be constructed before filling the dam or immediately after. It will be placed under the MINEPIA and must be directed by an experience fishing technician.

ii) Location:

The most suitable location for this center is NSEBITO where there is a large number of fishermen. Nyabessan will accommodate a less important structure (fishing post) of the same type, directed by a fishing instructor (MINEPIA). The center and the fishing post will be built in the rehousing zones of the population. If the population are displace in relation to their present villages, it will be necessary to construct a road linking them to the wharfs. For the center, a land of about 1 ha in necessary. For the post 2,000 m² will suffice.

iii) Costs and programming

The cost of the fishing station to be constructed before water filling of the reservoir is 9.3 million FCFA. This cost will be borne by the project authority. MINEPIA will assign a qualified monitor to the station.

The cost of the fishing center is 15.7 million FCFA in the maximum water level alternative only.

The construction and operation of the center will be undertaken by MINEPIA within the framework of its traditional activities. It is recommended that this Ministry be informed of this plan immediately so that it can integrate it in its medium term programs.

Detailed costs of these facilities are shown in the Appendices.

3.4.3.5 Research - multi-disciplinary development

i) Missions

Seven main missions can be retained:

- Health and nutrition of the population
- A follow-up of the physico-chemical characteristics of reservoir waters
- limnology
- the biological and dynamic study of the main species exploited in view of defining a rational managing plan for the resources of the reservoir ;
- an attempt of breeding certain endogeneous species ;
- a support for researches in flora, vegetation, fauna.
- a support to structures of the MINEPIA and SONEL

ii) Construction of a multi-disciplinary research unit

The research unit could be constructed at Nsebito not far from the site arrange for pisciculture. It will be placed under the tutelage of the ministry in charge of research and will be exploited jointly by the three institutes mentioned above.

Construction should take place be the filling of the dam or during the two years after.

iii) Staff

The staff will be Cameroonian and eventual Japanese. Some researchers and technicians will live on the spot. Others would make periodic missions.

3.4.3.6 Construction of wharves

To ease the movements of canoes, two main wharfs will be constructed at Nsebito (1) and at Nyabessan (1). Secondary wharfs will be provided at Abem, Ntebezok and Alen II. In order to avoid mud problems during rainy season, a reinforced concrete slip way of 50m/10m will be constructed at the wharfs of Nsebito and Nyabessan.

The cost of a wharf of 50m x 1m x 0.3m is 4,124,400 F.CFA broken down as follows :

- Cleaning : $51m \times 11m \times 2,000F \times 0.2m = 224,400F$
- Reinforced concrete : $50m \times 10m \times 0.3m \times 26,000F = 3,900,000F.CFA.$

Thus for the 2 whares, the cost will be 8,248,800 FCFA.

3.4.3.7 Development of sites for fishermen villages

Experience in the past showed that this type of dam always attracts many fishermen who often remain outside the aboriginal collectivities. It is judged necessary to provide some specific infrastructures for the fishermen villages as follows:

- prepared lands for villages;
- wells equipped with pumps
- access paths and a school, if possible.

The sites will be located in the hamlets near Nyabessan and Nsebito and each fisherman will have a prepared land area of 500 m². The costs per alternative are as follows:

Alternative	Forecast number of fishermen	Estimated costs of village infrastructures (FCFA million)
Maximum	285	66
Mean	105	39.8
Main	70	36

3.4.3.8 Other facilities

i) Fish conservation

After the filling of the dam, daily production by alternative in the impact zone will be as follows:

- 2.5 tons for the maximum alternative in the three rivers;

- 1 ton for the mean alternative on the Ntem river, without taking into account its 2 tributaries;
- 0.95 ton for the main alternative on the Ntem river.

If it is estimated that half of this production could be frozen and stored during about 10 days before being taken to commercial centers, we can envisage the construction of a cold store with a capacity of 12 tons at the estimated cost of 15 millions. The setting up of such a structure can come during the second year after the filling of the dam and only in the case of adoption of the maximum alternative.

Moreover, the fishing center will contribute to the extension of improved techniques for fish smoking.

ii) Selling alls

Before the filling of the dam, it is necessary to construct a hall for fresh fish at the level of each main wharf. These fishing structures. They will be placed under the responsibility of the local authorities (Maan municipality) or under the fishermen cooperative. The construction cost is estimated at 1.32 million francs broken down as follows :

Place	Area (m ²)	Unit Price (F)	Construction Cost (F)
Nsebito	40	20,000	800,000
Nyabessan	20	20,000	400,000
Hazards			120,000
Total			1,320,000

3.4.3.9 Summary and programming of the costs of fishing component

It is our wish that operations related to fishing component be realized before and during the first two years filling. The following map indicates the locations of various fishing development sites and the costs by alternative are summarized in the following table:

Summary of costs of fishing component

Items	Cost (FCFA million)		
	Maximum Altern.	Mean Altern.	Main Altern
1. Construction of fishing corridors	p.m.	p.m	p.m
2. Fish stocking in reservoir	23,830	8,780	5,955
3. Fishing control station	9,300	9,300	9,300
4. Construction of fishing center	15,675	15,675	15,675
5. Construction of wharves	8,249	8,249	8,249
6. Cold storage facility	15,000	-	-
7. Selling halls	1,320	1,320	1,320
8. Sites for fishermen villages	66,000	39,800	36,000
Total	139,374	83,124	76,499

3.4.4 In The Hunting and Forest Sectors

3.4.4.1 Hunting sector

In order to avoid the systematic disappearance of the fauna, a certain number of measures must be taken, the most important are :

- Sensitization and education of the population :
- Cutting out and delimitation of the zone in specialized areas ;
- Reinforcement of control in hunting
- Hunting before the filling of the dam

A certain number of necessary studies for the knowledge of the population is also preconized.

i) Sensitization and education of the population :

During investigation, it was discovered that the inhabitants of the region do not perceive the good intention behind the control exercise on hunting, more so, they consider the region as a patrimony handed down to them by their ancestors; thus they are surprised for being prohibited from exploiting this sector even when the exploitation is anarchic. There is need therefore for a sound sensitization (through radio, village meetings ...) to show :

- the merits of the period of dead hunting which is mainly instituted for the reproduction of animals;
- intensification of hunting done by means of arms of the vegetal origins (clubbing trap, lances, spears ...) and the progressive abandonment of arms destroyers (guns, cables ...).
- The necessity to preserve scarce species to promote tourism in the area.

ii) Delimitations of specialized areas in the zone

Very rapidly, the zone should be delimited and the protected areas be known by all. These areas will of course be chosen in agreement between the Hunting authorities, the traditional authorities and the users (hunters). The limits will be natural limits (rivers, hills, natural residence of scarce species)

At the end, limits of villages and crop perimeters will be fixed in the zone where hunting is authorized and the protected areas where hunting is prohibited.

iii) Control of hunting

The number of staff controlling hunting should be increased. For now, it is limited to two guards based at Maan and whose main activity seems to be the seizure of animals in public transport vehicles. It will be judicious for these guards to live at the entrance of the protected areas to effectively watch the zone and apply the law.

According to the authorities in place, two control posts are enough : each post would comprise of at least two persons.

These persons would be recruited among the native of the forestry zones.

- Two motorcycles (1 per post) to go round the protected areas. As for arms, (guns and ammunitions) and uniforms, the state is already ensuring the supply.

iv). Animal beating

Before the filling of the dam, it is advisable to do some hunting in the open air to disperse the animal and make them retreat in order to avoid loss through drawing of the many species that swim poorly. This noise can also be done by beating the drums for many days and almost regularly to driver away the troops at a long distance.

v). Accompaniment studies

Studies can be carried out during the filling of the reservoir. Three types of studies seem important :

- Study of the behavior, movements and the future of individuals emigrating spontaneously or arctically displaced (by radio-tracking) ;
- A precised inventory of the species and their population densities during the reservoir filling. The present study (two weeks of field investigation) has imposed a qualitative approach, even though efforts are made to quality certain results obtained through declarations during the numerous interviews carried out besides the inhabitants of the zone.

These studies will be conducted within the framework of research programs of MINREST if a coordination is made with other research institutes (such as ORSTOM) for their planning and integration in the budget of this Ministry.

3.4.4.2 Forestry Sector

i) Studies and reconnaissances

General knowledge of the flora and the vegetation of the entire region will be necessary to follow up the evolution of riverside ecosystems during and after the filling of the dam.

Perspectives of botanic studies are as follows :

- A study on the vegetation of the "flooded" zone as an ecological unit with particular function ;
- Inventory of the thick forests
- A particular stress will be put on eventual biological invasions which could effect the dam zone. Modifications of the hydrological region and the local microclimate which could favour the development of "pests".

These studies could be carried out by researchers of the National Herbal on of the faculty of Sciences, University of Yaounde.

The cost of scientific inventories of fauna and flora will be financed by the project authority from the item of compensatory measures up to the limit of 24 million FCFA, i.e. 12 man-months of researcher.

ii) Protection of forest in relation to the high monetary value of submersible species

Immediately the project is retained, the beneficiary, that is SONEL must inform the Ministry of Environment and Forests through correspondence with a precised map limiting the whole zone which is liable to flooding.

The Ministry, through its external services based in the locality will proceed with a forestry inventory liable to interest any forestry exploiter. The latter, at the request of the Ministry, will proceed to a cutting called "saving" of all the commercial trees found in the zone.

A rough estimation was made on the number of trees by category. Their monetary values by alternative are shown below:

- Maximum alternative:

- Species of type A: 4,735,332,000 FCFA
- Species of type B+C: 6,115,306,000 FCFA

- Mean alternative:

- Species of type A: 1,372,446,000 FCFA
- Species of type B: 2,115,144,000 FCFA

- Main alternative:

- Species of type A: 937,500,000 FCFA
- Species of type B: 165,479,000 FCFA

The above estimated figures are not different from those calculated in Annex I and summarized in the following table in which fire wood is taken into account.

However, since the reservoir areas are already known, it is possible to estimate the completed submerged forest areas and the volume of construction and fire wood from the data obtained from the Campo Forest Development Company, as detailed in Annex I on overall study.

	Total sub-merged forest area	Number of category A species (Ø > 40 cm)	Number of category B species (Ø > 40 cm)	Volume of construction and fire wood (1,000 m3)	Net value of lost wood (FCFA million)
Main	1,200	2,400	6,000	1,200	2,638
Mean	2,100	4,200	10,500	2,100	4,967
Maximum	6,600	13,200	33,000	6,600	15,609

3.4.5 Preservation of Memve Ele Site and Related Tourist Projects

Considering the tourist potential and landscape of the exceptional site of the Memve Ele falls, it is strongly recommended that part of this site be preserved by maintaining a minimum flow in both the north canals in any alternative. The technical details of this measure are given in Annex I.

The maintenance of the site will enable to create income-generating projects under the initiative and financing by the private sector.

These projects concern the enhancement of tourism and related sectors with the construction of the dam and induced activities and the foreseeable demographic boom !

- Hotel and/or reception centers at Nyabessan and at Meyo-Ntem near Melen ;
- Bars and Restaurants
- Hardwares stores for building materials
- Transport means (Truck and cars) etc.

3.4.6 Obstacles of short term integration of the programmes in the projects and institutions

Analysis of sectional programmes liable to enable a fast development of the region to respond to the general or specific objectives as defined, clearly brings out a remarkable institutional weakness at as levels.

- Insufficiency of care-taking staff at the level of the zone ;
- Lack of logistic means ;
- Sluggish intervention of SOECAO that concentrates its actions for now at AMBAM region

This is why the programmes assessed above will be realized with difficulty within the time limit through traditional structures if a decision to realize the work at short or medium term came in. In effect, certain programs like the rehousing, require a global and integrated approach that necessitates a qualified staff over a brief period for a safe output of the operations, whereas other programs (agricultural, fishing, forestry programme) require an intense work over a long period which could be done by the local staff supported by research but endowed with important means and incentives.

- for the entire operations linked directly to the renovation of like style, to the reestablishment and to the potential development of production, an impetus must be given through a light coordinating structure so that their programming be respected over a short period.

3.4.7 Program framing structure for rehousing and enhancement of production

3.4.7.1 Justification and role

The weakness (handicap) of the institutional traditional framework in the zone justifies that, the fast realization of the operations linked to rehousing, a light structure of coordination and framework be set up with the following tasks :

- ensure the relationship and contacts between the various intervening parties and SONEL.
- the setting up of housing (installation of villages, improvement upon housing and like style at the sites ...) in relation with administrative and traditional authorities ;
- Organization and training of producers in the impact zone of the dam (formation of groups, sensitization of the women, animation, cooperative movement) in relation with the services of MINAGRI (Ministry of Agriculture) MINASCOF (ministry of social and women's affairs) and SODECAO and, missionary undertakings.
- Extension of modern farm techniques and of selected seedlings in relation with research ;

- The search for micro-realization financing of the groups formed ;
- Primary health actions (health house, village pharmacies, etc), in relation with the local health services.

This structure must not be substituted to the local technical services, but must rather give a decisive impetus to the enhancement programmes for production activities in the zone while closely associating them to their execution and while using their competences so that they ensure their follow-up (long and short term) without difficulties.

3.4.7.2 Composition of the Structure-profile of the Animators

i) Composition and origin of the staff

The structure will be composed of two (2) persons detached to the project zone by a N.G.O or a volunteer institution with which the project owner (SONEL) will sign a convention for the period of their intervention .

- A coordinator-animator for a two year period.
- An assistant for a one year period.

ii) Profiles

a) The coordinator must have the profile of an agronomist or an economist and competence in :

- Secretariat and writing of assessment reports ;
- projects management
- Assessment and putting into action of projects
- Extension of modern techniques
- Organization and direction of peasants

He must be young (less than 30 years) and have the ability of contact and work with partners in development.

b) The assistant must have a solid training in rural development on in community development because his task will essentially be :

- The leading of reconstruction works of the villages
- The hygiene of the milieu
- The infrastructures and community equipment
- The training of women and group animation

A woman profile is recommended for this second post.

3.3.7.3 Costs

The necessary costs of running the structure are 37,94 FCFA and comprises of :

- payment of 2 volunteers for a period of (2 and 1 year)
- Lodging with equipment and functioning;
- Secretariat and animation costs;

- An old wheather double cabin vehicle with running cost (eventually given by SONEL) and broken down as follow :

The cost are broken down in the Appendices.

3.5 SUMMARY OF COSTS AND PLANNING OF COMPENSATORY MEASURES AND ACTIONS LINKED TO THE PROJECT

3.5.1 Distribution of Costs by Alternative

The costs of compensatory measures and supporting projects evaluated above are distributed by alternative as follows:

- Maximum alternative: 827,420,000 FCFA
- Mean alternative: 470,300,000 FCFA
- Main alternative: 322,520,000 FCFA

The distribution by component is shown in the following table in million FCFA and in percentage.

Components Programmes	Years					Total	Remarks
	-1	0	1	2	3		
I. Compensations	15.00	497.40				512.40	
1.1 Housing		112.37				112.37	SONEL
1.2. Cocoa Farms		172.39				172.39	
1.3. Fruit Trees		6.17				6.17	
1.4. Food Crop		63.96				63.96	
1.5. Schools		26.22				26.22	Tacheron
1.6. Churches		17.07				17.07	CEDAC
1.7. Wells		17.50				17.50	
1.8. Road		79.92				79.92	Societe TP
1.9. Study	15.00					15.00	Bureau Etude
1.20. Commissions		1.80				1.80	
II. Rehousing		225.38				225.38	
2.1. Roads		150.64				150.64	Societe TP
2.2. School		52.44				52.44	Tacheron
2.3. Wells		5.00				5.00	CEDAC
2.4. Platforms		17.30				17.30	Societe TP
III. Infrastructures in the zone		158.60				158.60	
3.1. Schools		131.10				131.10	Tacheron
3.2. Wells		14.50				14.50	CEDAC
3.3. Dispensaries		13.00				13.00	MINSANTE
IV. Agric. Dev.		51.18	11.18	10.54	2.16	75.06	
4.1. Equipment			2.16	2.16	2.16	6.48	DAA + Structur
4.2. Agric. Tool		28.71	0.90			29.61	DAA + Structur
4.3. Vegetal Material		13.82				13.82	DAA + Structur
4.4. Studies/Research		8.65	8.13	8.38		25.15	IRA/ICRAF
V. Fishing	0.00	136.895	19.85	86.02	12.00	255.83	
5.1. Construction of Passages		86.70				86.70	MINEPIA/ MESI
5.2. Allevinage of lake							MESIRES/ IRZ
5.3. Construction Research Unit				86.02		86.02	
5.4. Wharfs		51.25				51.25	
5.5. Cold Stores					12.00	12.00	Prive
5.6. Selling Halls			1.32			1.32	Communes
VI. Forest-Hunting	5.00	11.00	13.16	6.96	0.96	37.08	
6.1. Equipment			2.16	0.96	0.96	4.08	
6.2. Studies/Research	5.00	11.00	11.00	6.00		33.00	MESIRES
VII. supporting Structure			25.50	12.40	0.00	37.90	ONG ou Organ de Volontair
7.1. Staff			14.40	7.20		21.60	
7.2. Lodging			2.00	1.20		3.20	
7.3. Secretary's Office/ Livelihood			1.20	0.60		1.80	
7.4. Vehicle			6.90	2.40		9.30	
7.5. Miscellaneous			1.00	1.00		2.00	
Total	20.00	1,081.52	69.69	115.92	15.12	1,302.24	

Compensation and rehousing components absorb more than 56% of the costs whereas those linked to revenue generating activities (agriculture, fishing) represent 25.4% of the costs. Fishing, a sector in which everything must be done and which can have great studies, comprising of the most important investments. The re-establishment of agricultural production potential will require a bit of money; this is why a particular attention must be placed on its being set up.

3.5.2 Programming of Actions

The majority of actions representing 83% of the costs of programs is concentrated in the year 0 preceeding the filling of the dam. Though the supporting structure was programmed in the year 1 of the dam filling, it is highly wished that it be in place at least 3 months before the filling of the dam for a better coordination of its operations with the project owner and the other intervening parties. To this end, it is wished that the firm to supply volunteers or consultants be contracted in year 1 of the achievement of the work so as to attain the results of the convention within the fine limit.

BIBLIOGRAPHIE

- 1 - JICA (1991) Rapport préliminaire d'analyse de l'état initial de l'environnement. Recommandations et spécifications pour la suite de l'étude d'impact.
- 2 - SEDA-MINPAT (1986) Rapport de mise en valeur de la région d'AMBAM. 200pp.
- 3 - TONYE J. et AL (1987) Description des systèmes d'utilisation des terres dans la zone forestière du CAMEROUN. Revue Sciences et Techniques du MESIRES pp 31-43.
- 4 - SEDA-MINPAT (1986) Conséquences de la mise en eau du barrage de la MAPE. Etude de recasement des populations. 160 pp.
- 5 - DOUNIAS (1991) Pratique agroforestière des agriculteurs de la réserve de CAMPO. Actes du séminaire régional : gestion des ressources et des réserves de la biosphère et éducation relative à l'environnement, SANGMELIMA 1991 - pp. 198-210.
- 6 - LEFLAIDEUR A et AL (1981) Modèle 3C - CAMEROUN - CENTRE - SUD -CACAO culture ou simulation du comportement agro-économique des petits paysans de la zone forestière camerounaise quand ils choisissent leur système de cultures. IRAT MONT PELLIER - PARIS 240 pp.
- 7 - IRA (1990) Fiches techniques des cultures MINREST YAOUNDE 100 pp.
- 8 - DEPIERRE D. VIVIEN J. (1992) Mammifères sauvages du CAMEROUN-OFFICE NATIONAL DES FORETS BVD. de Constance 77 300 FONTAINEBEAU. 250 p.
- 9 - DJINDE MC (1991) La méthode de "D & D". Agroforesterie - Planification - Diagnostic - Enquête. ICRAF BVD. des NATIONS UNIES 30677, NAIROBI, (KENYA).
- 10 - ANONYME (1986) Projets des exploitations agricoles de moyenne importance EAMI - Manuel d'évaluation MINAGRI YAOUNDE
- 11 - MUTSAERS (1977) Les cultures fruitiers. ENSA NKOLBISSON 43 pp.
- 12 - ANONYME (1987) Recensement agricole 1984 - résultats au niveau national. MINAGRI-YAOUNDE.
- 13 - THIRAKUL S. et AL (1983) Manuel de Dendrologie CENA DEFOR - ACIDI YAOUNDE.
- 14 - HALNORTH (TH.) Dilles (H) (1985) Mammifères d'Afrique et de MADAGASCAR, DELACHAUX et NIESTLE - NEUCHATEL - PARIS.