PD-AAM-860 631-0012 42

ISN 29932

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

1. TRANSACTION CODE: A (A ADD, C CHANGE, D DELETE)

PP

2. DOCUMENT CODE: 3

3. COUNTRY/ENTITY: CAMEROON

4. DOCUMENT REVISION NUMBER:

5. PROJECT NUMBER (7 digits): 631-0012

6. BUREAU/OFFICE: A. SYMBOL: AFR; B. CODE: 06

7. PROJECT TITLE (Maximum 40 characters): MANDARA MOUNTAINS WATER RESOURCES

8. ESTIMATED FY OF PROJECT COMPLETION: 84

9. ESTIMATED DATE OF OBLIGATION: A. INITIAL FY 79; B. QUARTER 2 (Enter 1, 2, 3 or 4); C. FINAL FY 83

10. ESTIMATED COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY 1979 B. FX	C. L/C	D. TOTAL	LIFE OF PROJECT E. FX	F. L/C	G. TOTAL
AID APPROPRIATED TOTAL	872	69	1,000	3,690	2,966	6,656
(GRANT)	(872)	(69)	(1,000)	(3,690)	(2,966)	(6,656)
(LOAN)	( )	( )	( )	( )	( )	( )
OTHER U.S. 1.						
OTHER U.S. 2.						
HOST COUNTRY	-	323	323	-	2,599	2,599
OTHER DONOR(S) IBRD	168	-	168	1,036	97	1,133
TOTALS	1,040	392	1,491	4,726	5,662	10,388

11. PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	D. LOAN	E. 1ST FY 79 F. GRANT	G. LOAN	H. 2ND FY 80 I. GRANT	J. LOAN	K. 3RD FY 81 L. GRANT	M. LOAN
(1)	FN	201	252	1,000		1,000		1,544	
(2)									
(3)									
(4)									
TOTALS				1,000		1,000		1,544	

A. APPROPRIATION	N. 4TH FY 82 O. GRANT	P. LOAN	Q. 5TH FY 83 R. GRANT	S. LOAN	LIFE OF PROJECT T. GRANT	U. LOAN
(1) FN	1,507		1,605		6,656	
(2)						
(3)						
(4)						
TOTALS	1,507		1,605		6,656	

12. IN-DEPTH EVALUATION SCHEDULED: MM 11 YY 81

13. DATA CHANGE INDICATOR: WERE CHANGES MADE IN THE PID FACESHEET DATA, BLOCKS 12, 13, 14 OR 15 OR IN PRP FACESHEET DATA, BLOCK 12? IF YES, ATTACH CHANGED PID FACESHEET.

PRM:JBWoods [signature]
AGR:MHFord [signature]

1 (1 = NO, 2 = YES) HNP:DWPalmer [signature] CONT:OKShannon

14. ORIGINATING OFFICE CLEARANCE

SIGNATURE: [signature]

TITLE: FREDERICK E. GILBERT
ACTING DIRECTOR

DATE SIGNED: MM 10 DD 07 YY 75

15. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM DD YY

AID 1330-6 (3-76)

MANDARA MOUNTAINS WATER RESOURCES

PROJECT PAPER

Table of Contents

Facesheet - i
Table of Contents - ii
Maps and Tables - iii
Project Design Personnel - iv

I. DESCRIPTION OF THE PROJECT
A. Project Profile - 1
B. Project Background - 3
C. Project Beneficiaries - 6
D. Complementary Activities - 6

II. PROJECT ANALYSIS
A. Economic Analysis - 9
B. Social Soundness Analysis - - - - - - - - - - - - - - - - - - - 12
C. Technical Feasibility - 16
D. Administrative Feasibility - - - - - - - - - - - - - - - - - - 18
E. Environmental Concerns - 19

III. FINANCIAL PLAN - 22

IV. IMPLEMENTATION PLAN - 26

V. EVALUATION - 28

VI. CONDITIONS, COVENANTS AND NEGOTIATING STATUS - - - - - - - - - - 29

ANNEXES

A. PID Approval Cable - 30

B. Technical Details
1. Equipment List Estimate - 39
2. Dam Characteristics - 44

C. Log Frame - 50

D. Statutory Criteria Checklist - - - - - - - - - - - - - - - - - - 51

E. 611 (a) and (e) Certification - - - - - - - - - - - - - - - - - - 56

F. Cameroon Request for Assistance - - - - - - - - - - - - - - - - - 58

H. Initial Environmental Examination - - - - - - - - - - - - - - - - 61

I. Draft Authorization - 77

MAPS AND TABLES

		Page
Map 1	LOCATION OF DAM SITES	2
Map 2	LOCATION OF HEALTH UNITS	4
Table 1	COST OF WATER PER CUBIC METER DURING 20 YEAR PERIOD	10
Table 2	SUMMARY COST ESTIMATE AND FINANCIAL PLAN	23
Table 3	PROJECTION OF EXPENDITURES BY FISCAL YEAR	24
Table 4	NUMBER OF FAMILIES SERVED BY EACH DAM SITE	44
Table 5	RAINFALL AND DRINKING WATER	45
Table 6	DIMENSIONS AND CHARACTERISTICS OF EACH DAM SITE	46
Table 7	TOTAL DAM CAPACITY AND AMOUNT OF SEDIMENT DEPOSITED AFTER 30 YEARS	47
Table 8	LABOR REQUIREMENTS FOR CONSTRUCTION OF 10 m^3 OF FINISHED RUBBLE MASONRY	48
Table 9	LABOR REQUIREMENTS	49

PROJECT DESIGN PERSONNEL

1. Project Design and Coordination

   Marcel Ngue, Program Design Assistant, USAID/Yaounde

   Eric Witt, Agricultural Economist, USAID/Yaounde

2. Economic Baseline Study

   Bureau d'Etudes pour le Developpement Integre, Yaounde

   Martin Eketi, Director

3. Engineering Analysis

   John Benoit, General Engineering Advisor, REDSO/WA, Abidjan

   George Thompson, General Engineering Advisor, REDSO/WA, Abidjan

4. Environmental Health Team

   Mamadou Ali, Assistant Medical Entomologist, ONAREST, Kumba

   Dr. Same Ekobo, Director of Parasitology, University Center for the Health Sciences (CUSS), Yaounde

   Peter Enyong, Medical Entomologist, ONAREST, Kumba

   Douglas Palmer, Public Health Specialist, USAID/Yaounde

   Dr. C. Ripert, Professor of Parasitology, CUSS, Yaounde

5. Social Soundness Analysis

   Dr. Mona Fikry, Anthropologist, Consultant to USAID/Yaounde

   Francois Tchala-Abina, Lecturer in Rural Sociology, Ecole Nationale Superieure Agronomique, Yaounde

---

NOTE: Studies are available for review in Office of AFR/DR/CAWARAP

I. DESCRIPTION OF THE PROJECT

A. PROJECT PROFILE

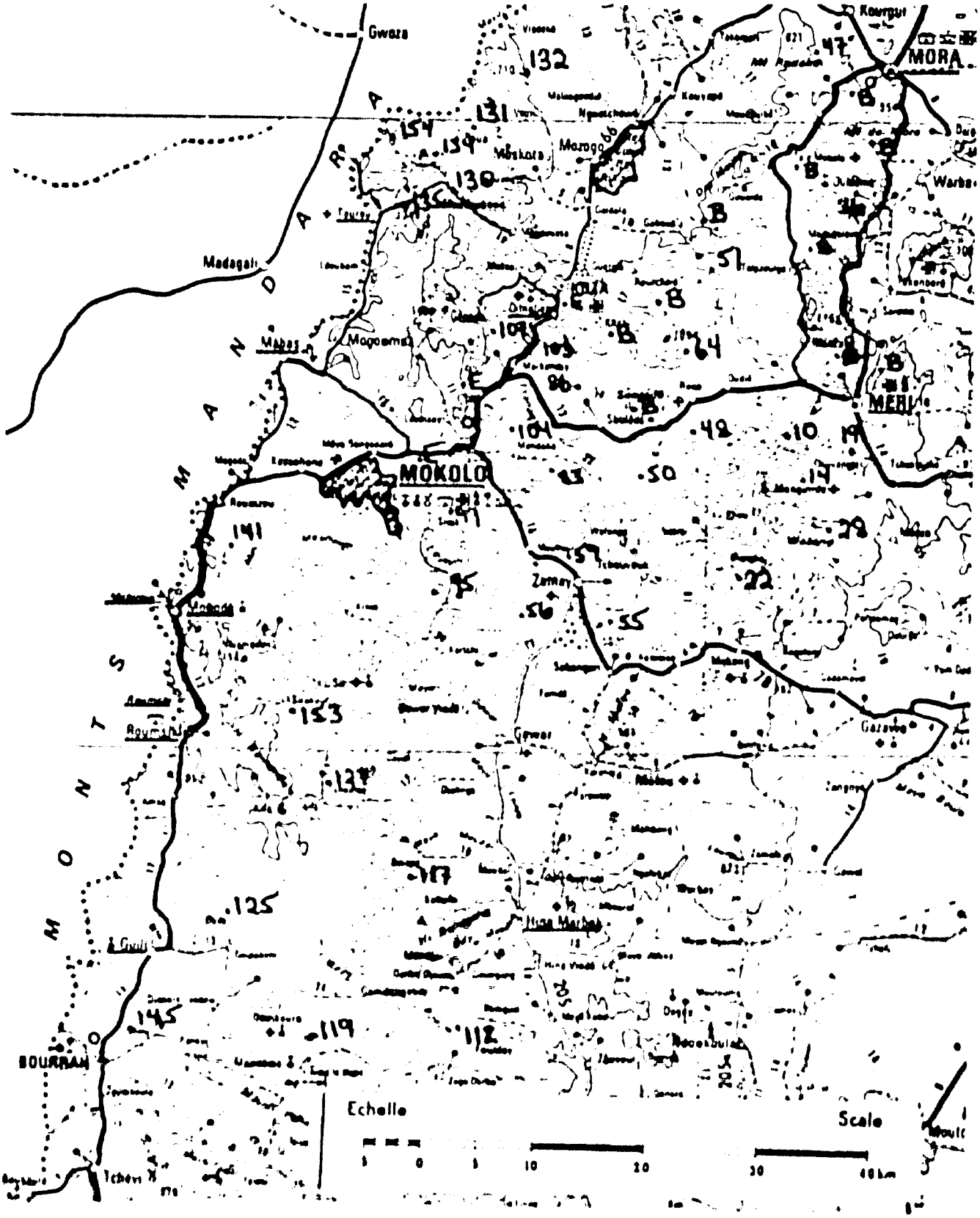
The Mandara Mountains Water Resources project will consist of the construction of 35 water catchment dams in the Mandara Mountains region of North Cameroon (see Map 1).

The purpose of the project is to increase the availability of drinking water during the ninemonth long dry season when surface water supplies and nearby wells dry up. During the latter part of the dry season women are walking seven to ten kilometers one way to collect water for their families' needs. Temperatures reach a maximum of 110°F. during this period.

The dams will be gravity over-spill structures of rubble filled concrete. Their height will range from 4.5m to 10m and they will have a storage capacity ranging from 18,000m^3 to 108,000m^3. The basic width would be equal to the height of the dam and both the upstream and downstream faces of the dam will be sloped. An additional concrete lip will be constructed on the downstream slope of the dam to lead over-flowing water or seepage away from the dam. One or two water distribution points (these water points will look like wells) will be built downstream of each dam. The water points will be connected to the reservoir by pipes. Water will be filtered between the reservoir and water point. Water levels in the reservoir and water point will be equal. Thornbushes and/or cacti will be planted above the upper reaches of the reservoir high water mark to prevent people and animals from entering the water.

Construction of the dams would be undertaken over a four year period with four dams being constructed during the first construction year and 31 dams being constructed during the following three years. The first project year would be devoted to logistics. The dams will be constructed by four construction teams. Each team will consist of an engineer, a supervisory staff, skilled laborers, and unskilled laborers. The source of the unskilled labor would be from the people in the area to be served by the dam. The supervisory engineers would be from a general engineering construction firm, experienced at construction in this type of region, that will obtain the engineering contract under normal AID contracting procedures.

There is a small dam at Djingliya which was built by Genie Rural during the past four years. It has served as a prototype for the members of the design team and has given the Mission ideas on ways to proceed with the project. The Djingliya dam's downstream face is designed in the form of a staircase. During the rainy season, this has proved to be an excellent breeding place for black flies. The project will assist in the engineering redesign of this dam to minimize the negative health implications of it. This will include the smoothing of the downstream dam face, the construction of a concrete lip at the downstream base to lead run-off water further away from the site, and construction of a culvert under the road. The road is 100m downstream of the dam and has blocked the run-off water from the dam, which has resulted in a marshy area between the dam and the road during the rainy season.



MAP 1. LOCATION OF DAM SITES

B = World Bank-funded sites

E = Existing dams

Numbers = Proposed AID-funded sites

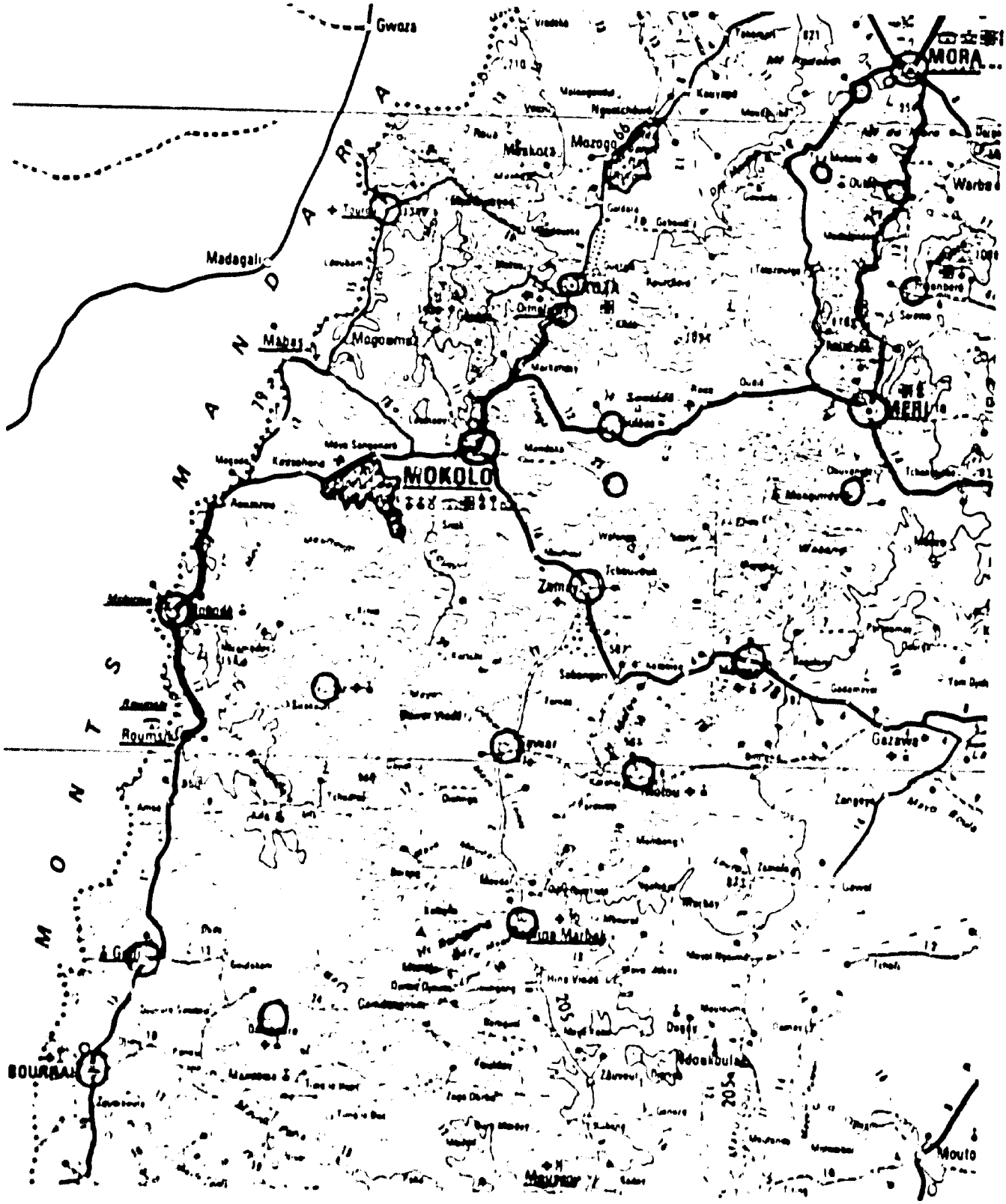
Two community development agents will work with each construction team. One will be responsible for arranging for people to work at the dam site. The other will begin a program of health education activities. This will be an important component of the project. During the project it will be necessary to collect health statistics from the 23 hospitals and dispensaries in the project area (see Map 2). Baseline health statistics have been collected and are part of the environmental health report. Health education activities in the areas of the dam sites will include the planting of the thornbush and/or cacti barriers to the reservoirs, the construction of pit latrines downstream of the dam sites, and discussions of the relationships between health and water. There are three dams in the project area--two at Mokolo and one at Djingliya. An additional 45 dams will be constructed in the next five years (10 by the World Bank and 35 by AID). The finished dams will be visited semi-annually to inspect for entomological samples, aquatic growth, standing puddles of water downstream of the dam, the thornbush and cactus barriers, and the use of the water by the residents of the area. The community development agents will be assisted by Peace Corps volunteers with public health backgrounds. These monitoring/education activities will go on throughout the year. There will also be at least two visits per year by the staff of the Ministry of Health and the University Center for the Health Sciences (CUSS) to inspect the dams and health care facilities in the area.

In addition to these health activities, there will be nutrition surveillance activities. The National Nutrition Survey, prepared by UCLA in September 1978, indicated some deficiencies in the project area. A sample of 1,000-2,000 children up to age five will be surveyed. Dispensary personnel, the community development agents and Peace Corps volunteers will be trained to administer two tests. One test will utilize paper arm bands to measure arm circumference and will give an indication of nutrition variations. The other test will utilize temperature strips that are applied to a child's forehead and the results will provide an index of acute infection. Personnel from the Ministry of Health and CUSS who participated in Cameroon's nutrition survey will train the aforementioned personnel. The results of the nutrition surveillance will be analyzed in relation to the national data now available and provide baseline data to complementary activities that may be undertaken in the area.

B. PROJECT BACKGROUND

The mountains of the region rise to a height of 1400m and are formed from old pre-cambrian rocks of the basement complex. Geologically they are igneous granites or metamorphic anatoxites and gneisses. The proposed dam sites are located on these formations which will provide excellent construction material and sound foundations. The project area is located in one of the most densely populated departments in Cameroon[1/] and has a

1/ The department of Margui-Wandala has 69.6 inhabitants per km^2 compared to an average density in Cameroon of 16.5 inhabitants per km^2. In some parts of the department the density is much higher. For example, in Magoumaz, north of Mokolo, the density is 245 inhabitants per km^2.



MAP 2. LOCATION OF HEALTH UNITS

population of 496,000 with 98 percent of the people living in the rural areas. The region has a short rainy season of three to four months, from June to August, followed by a long dry season. Agricultural activities (millet, sorghum, and peanuts) are carried out during the rainy season. It is one of the poorest areas of Cameroon with per capita incomes of $18 annually (not including a value for subsistence agricultural production). The region is further characterized by low school attendance rates and, as a result, low literacy rates. The people of the area represent 27 ethnic groups and six languages are spoken in the region.

The Cameroonian Government has undertaken two major studies of the problem of water in the North. The first was a UNDP-sponsored study entitled Ground Water Investigations and Pilot Development in North Cameroon. Due to the geologic characteristics of the Mandara Mountains, the report recommended that small water catchment dams be constructed to provide a source of drinking water. The Government of Cameroon then commissioned the Societe Grenobloise des Etudes d'Amenagements Hydraulique (SOGREAH) to undertake a survey of possible dam sites in the Mandara region and to assess the engineering feasibility of constructing small dams. SOGREAH prepared a study entitled Inventory of Dam Sites in the Mandara Mountains. Out of 151 sites studied, 57 water catchment dams were recommended for construction. The Government requested donor assistance to finance the project.

The World Bank, through its Fonds Special d'Actions Rurales (FSAR) project, has agreed to finance 10 of the dams in the Mora-Meri area. The cost of this FSAR sub-project is $2.03 million with the World Bank financing 55 percent of the cost and the Cameroonian Government financing the remaining 45 percent. The World Bank project engineer arrived in North Cameroon in March 1978 and construction is scheduled to commence in October 1978. Two dams are expected to be completed during the 1978-1979 dry season.

USAID/Yaounde forwarded the Project Identification Document (PID) to Washington in December 1976. The PID approval cable was received in May 1977 (see Annex A, State 088518). Although the Cameroonian Government had sponsored two major engineering studies and the World Bank approved the small dam sub-project based on the engineering studies, AID/W and the Mission considered it appropriate to undertake additional studies of the sociological, environmental health, and economic aspects of the project. These studies were accomplished during the period October 1977 to July 1978 and include:

1. Sociological
   "People and Water", M. Fikry and F. Tchala-Abina.

2. Environmental Health
   "The Potential Health Impact of the Construction of Fifty-Seven Dams in the Mandara Mountains", S. Ekobo, D. Palmer and C. Ripert.
   "An Entomological Study", M. Ali, P. Enyong, S. Ekobo, D. Palmer, and C. Ripert.

3. Economic Baseline
   "Economic Survey Intended for the Small Dams Project in the Mandara Mountains Region", Bureau d'Etudes pour le Developpement Integre (BEDI).

Engineers from REDSO/WA in Abidjan have been involved in all stages of the project design process and have made four trips to the project area during the period August 1977 to July 1978.

Most importantly, of course, has been the involvement of the Cameroonians in the project design process. The project has been discussed with the people to be served by the dams, traditional leaders, and government officials at the departmental, provincial and national levels. The final project design incorporates their recommendations and has been reviewed in summary form.

C. PROJECT BENEFICIARIES

The direct project beneficiaries will be the 13,000 families, or approximately 65,000 people, living in the areas to be served by the small dams.

Most family members collect water, although the ultimate use of the water generally determines which sex obtains it. Women collect water for the family's use and to water their livestock. Men collect water for building construction (homes are made of mud), blacksmith activities and pottery making. Water is collected by women twice a day during the rainy season and at relatively close distances to their homes. During the dry season, water is collected up to four times daily and at increasing distances of up to 10 kilometers in one direction. At this time of the year, women spend four to eight hours daily walking to a water source. For the people being served by the dam, the time spent in collecting water should be halved.

The users of the dam at Djingliya were surveyed during the period January 23 - January 29, 1978. An average of 1,007 people came to the dam for water each day. Women and girls comprised 79 percent of the users and men and boys make up the remaining 21 percent. It is assumed that usage of the dam increases at the latter part of the dry season, i.e., the months of March, April and May.

D. COMPLEMENTARY ACTIVITIES

The purpose of the project is: To insure a source of year-round water supplies as a prerequisite for complementary development projects.

A number of suggestions have been made by Cameroonian officials and members of the design team for possible complementary projects in the region. As a result of his review of the project design studies, the Minister of Economic Affairs and Planning requested USAID/Yaounde assistance to prepare an integrated rural development plan for the Mandara mountains region. This request was made in his letter of 28 June 1978 and reconfirmed in his letter of 1 August 1978. A team travelled to North Cameroon to discuss the proposal with departmental and provincial representatives August 17 to 23. Team members included representatives from the Ministry of Economic Affairs and Planning, USAID/Yaounde, Peace Corps/Cameroon, and CARE/Cameroon. A number of possible activities were discussed as being appropriate for the region.

These include:

1. Wells:

This activity would include the refurbishment of existing wells and digging new wells in locations that would complement the Mandara Mountains Water Resources project. It is likely that the wells would be covered and a simple handpump would be installed. The Private Voluntary Organization, CARE, has expressed an interest in implementing this project. The Mandara Area Wells project 631-0025 is included in USAID/Yaounde's FY 1980 Annual Budget Submission.

2. Fish:

A great deal of interest has been shown in the possibility of the intensive cultivation of fish in the dams' reservoirs. A fish cultivation feasibility study will be undertaken in October 1978. Particular attention will be given to fish as a predator to the host snail for schistosomiasis and the relationship between water quality and fish production.

3. Roads:

The region's roads are often impassable during the rainy season because of the inundation of the fords that cross the rivers. As a result, during the rainy season there is very little traffic because of the uncertainty of reaching a destination. This is a problem for vehicular and pedestrian traffic. The Minister of Economic Affairs and Planning has requested the Ministry of Equipment to develop the terms of reference for an engineering study of the region's river crossings. The Minister will also identify a civil engineer to undertake the study.

4. Reforestation:

Much of the area is without any kind of tree cover. Such an activity could include the planting of fruit trees and trees that could be used for firewood. The Ministry of Agriculture has identified a forestry expert familiar with the special needs of the North to develop a plan for such a project. In addition to this the Mission would like to examine alternative energy sources that could be used by the villagers. The Center for Energy Research (CRE) in Cameroon has expressed an interest in undertaking a pilot project in the area to test alternative energy sources.

5. Training:

A new Center for Training Farm Families will be constructed in Guetele in 1979 (Project 631-0002). It could be an appropriate place to establish a series of short term training programs for the rural animateurs of the region.

Other more general suggestions were made to increase the productivity of the terraced agriculture practiced in the area and to improve animal husbandry practices.

The Minister of Economic Affairs and Planning was briefed on these possibilities after the team's return to Yaounde. Any additional planning for a Mandara Area Integrated Development plan will be done in coordination with the World Bank's integrated rural development plan that is being proposed for North Cameroon.

At the time of the PID submission for this project it was hoped that the project could act as a catalyst for other development activities. This appears already to have been the case.

II. PROJECT ANALYSES

A. ECONOMIC ANALYSIS

The project design is twofold: firstly to serve immediate basic needs rather than, from the onset, to generate income from product'on increases and, secondly, to prepare basic infrastructure--water being the most important scarce resource in the area--to enable the Mandara region to grow in a self-sustained basis. Both aspects present enormous difficulties in evaluating economic benefits with conventional analytical tools.

Two approaches have been taken: firstly, a cost-effectiveness approach to allow the reviewer to obtain an idea of the efficiency of using such dams and reservoirs as the means of carrying out the project purpose. The second approach was the more traditional listing of benefits and costs of the immediate project. As will be discussed below, neither proves totally satisfactory, since a broader view of the role of water resources utilization in the region must be taken to appreciate the value of such a project.

Table 1 is an illustrative example of the cost of water per cubic meter over a 20 year period. The total cost of the project and follow-on maintenance costs, on a cumulative basis, is divided into the total water available through the project, on a cumulative basis. As expected the first years of the project show a high cost of water per cubic meter. After thirteen years the cost of water is $1.00 per m^3 and after twenty years its cost is $.65. For the sake of comparison, the price of water in Cameroon's capital, Yaounde, is $.44 per m^3 (for the reader unfamiliar with Cameroon, Yaounde is located in the southern rain forest; there is no lack of water). As the water requirements of the Mandara region are far different from the water needs of Yaounde, no attempt is made to maintain that price in this case necessarily represents marginal utility, or relative scarcity. Table does indicate the cost efficiency of the project over a 20 year period.

A major benefit of the project will be in the time women save in the task of collecting water. A summary of the time women save on a daily basis is shown below.[1/]

Distance from Dam	0 to 2.5 km	2.6 to 5.0 km
Number of women	19,000	11,000
Hours saved daily	2.5	2.0
Total hours saved daily	47,500	22,000
Work days saved daily (8 hours per work day)	5,938	2,750

1/ The number of women involved in carrying water was calculated on the basis of 1.5 women per family involved in this task. The hours saved daily is based on a dry season average of four trips per day per family. The women living closer to the dam site will save more time each day since they live higher up into the mountains and had farther to go to lower levels for water.

TABLE 1

COST OF WATER PER CUBIC METER DURING 20 YEAR PERIOD

YEAR	Water Available (Cumulative '000 m^3)	AID Costs ($'000)	CAMEROON Costs ($'000)	WORLD BANK Costs ($'000)	TOTAL COSTS (Cumulative $'000)	Cost Per m^3 ($)
1978			62	549	611	
1979	67	941	323	210	2,085	31.12
1980	289	1,224	565	186	4,060	14.05
1981	822	1,379	672	188	6,299	7.66
1982	1,577	1,507	452		8,258	5.24
1983	2,676	1,605	525		10,388	3.88
1984	3,673		22		10,410	2.83
1985	4,670		30		10,440	2.24
1986	5,667		30		10,470	1.85
1987	6,664		30		10,500	1.58
1988	7,661		30		10,530	1.37
1989	8,658		30		10,560	1.22
1990	9,655		30		10,590	1.10
1991	10,652		30		10,620	1.00
1992	11,649		30		10,650	.91
1993	12,646		30		10,680	.84
1994	13,643		30		10,710	.79
1995	14,640		30		10,740	.73
1996	15,637		30		10,770	.69
1997	16,634		30		10,800	.65

A total of 8,688 work-days will be saved by 30,000 women drawing water from the reservoirs' water points each day. As a measure of the time women spend carrying water and the pervasiveness of this activity, after only 48 days of the full functioning of the 45 dams the women will have saved the equivalent of all of the unskilled labor[1/] that was utilized to construct the dams.

Many of the women interviewed during the course of the project's design stated that any decrease in time spent carrying water would be welcome leisure time to spend with their families. They felt that more time spent in their families' compound would decrease family tensions during the dry season.

Agricultural production may increase, to some degree, in the areas near the dams. The seepage of water from the dam, a normal situation, will result in some vegetable crops being grown during the dry season. (This activity must be controlled as much as possible, to prevent standing water which could have an adverse health effect). Women that live particularly close to a dam site will carry some water to irrigate small vegetable gardens near their homes. The projected usage of water for a family includes sufficient water for a family's livestock. The people of the region do plant a dry season crop of millet in October/November. In some areas women may devote more time to this dry season crop.

Non-agricultural activities may increase with more discretionary time available to the women. Women are involved in basket weaving and pottery making as well as blacksmithing activities--which includes the making of tools and specialty items such as tobacco holders. Many of the women felt they could increase time spent in child care activities.

There will be health benefits as a result of the project through the improvement in the quality of water. This, of course, will be closely monitored. An increase in the amount of water available will be hygienically beneficial also. During the dusty dry season with temperatures ranging above 100°F. many persons bathe or wash clothes as infrequently as once a month because of a lack of water.

As previously suggested, the dynamics of the project are not actually captured by either of the two approaches. Water resources management is viewed as the keystone upon which any future projects aimed at making the region grow in a self-sustained manner must be built. Thus, a more integrated approach is suggested, with water supply as one discrete aspect: full economic impact of the water resources project will be felt through complementary projects. Two major ones which are currently under consideration include fisheries and reforestation.

Development of a fisheries activity in conjunction with the reservoirs would increase the level of living through improved and diversified diets, thereby having an impact on nutrition and health. The potential reforestation project would have two aspects: firewood and fruit trees. The soil downstream of the dam will contain more moisture as a result of the dam and be

1/ Construction laborers porters and loaders will require approximately 416,000 work days to construct the dams. (1 work day = 8 work hours).

able to support tree growth. A firewood activity would further reduce the time spent by women in gathering firewood allowing them additional options for their time. Fruit trees would provide additional foodstuffs to the diet thereby having a nutritional and health impact. Excess fruit could also be sold providing an additional income source.

There are short-term benefits that will result from the project, i.e., the payments the people will receive for their labor at the dam sites. Some of this income will be used for prosaic expenditures such as taxes. Medicines, school fees, beer and one-way bus tickets out of the region will also claim some of the money. Although women will participate in the dam construction activities many indicated that they would set-up food stands near the work sites to sell to the construction workers.

The lack of water in the region requires that a great deal of time and effor be expended to collect it during the dry season. The time spent on this activity prohibits the ability to devote time to other activities. The project should minimize this constraint. Peak agricultural labor activities occur during the rainy season. The project will allow more free time during the dry season--a period of limited agricultural activity. The project and its potential complementary activities are primarily dry season activities which will allow for the opportunity to increase labor productivity during this period.

B. SOCIAL SOUNDNESS ANALYSIS

Technical engineering studies had been done for the project prior to AID's involvement in it. Though the construction of the small dams was technically feasible, one aspect of the project was not known: did the people of the region consider the dams important? The conclusion of the sociological study was that the impact of the dams will be of immediate significant benefit to women, the main beneficiaries, and their families.

There are 27 ethnic groups in the region. For the purposes of the analysis dam sites were studied in relation to seven of the groups as follows:

MAFA---------8 dam sites	BANA--------2 dam sites
KAPSIKI------3 dam sites	MADA--------1 dam site
MOFU---------3 dam sites	PODOKWO-----1 dam site
HIDE-NGOSSI--2 dam sites	

The sociological study was designed to determine:

-- the practices used by the people to collect water, division of labor in this collection, the users of the water, and the degree of knowledge of the relationship of water to health;

-- the need for new water sources;

-- the communal activities of the people that could be applied to the construction of the dams; and

-- the social impact of the dams, including land tenure, religious activities and relocation.

Current practices

During the rainy season water is generally available close to a family's housing compound (sare). As the dry season progresses, the village water sources begin to dry up which forces the residents to travel further from their sares to obtain water. In some areas it may be necessary to walk up to ten kilometers to obtain water. In the latter part of the dry season, in addition to long walks to a water source, it is necessary to dig deeply into a riverbed and wait, sometimes overnight, for the water to seep into the hole in sufficient quantity to fill a jug.

The collection of water for a family's use is the woman's responsibility. This practice begins early in a girl's life as three-year-olds, with small jars balanced on their heads, follow their mothers to the water source. The collection of water for livestock, construction, pottery, and blacksmith activities are shared, to some extent, by men and women. Water is generally collected twice a day during the rainy season and four times a day during the dry season. The increase of trips is due to the need to bring water to the livestock. The special needs of blacksmiths and potters for water require up to seven daily trips for water.

There appears to be little understanding of the relationship between water and health. Some groups do make a point of collecting water from a well rather than directly from a flowing river although others take whatever water is available. Health campaigns which have emphasized the utilization of a disinfectant in drinking water have not been successful. Animals use the same water holes as the people do.

Need for water

Water is of course necessary. The sociological study, and subsequent field visits, did enable the Mission to eliminate some sites from the original list of proposed sites. In some cases, people had left the area of the proposed dam (probably, in part, precisely because of lack of water). At other sites, it was learned that wells in the village did contain water throughout the year. This obviated the need for a dam but those dam sites that were eliminated will be considered for new or refurbished wells under the Mandara Area Wells project.

Communal Activities

There have been isolated examples of the people of the region constructing a well or, in one case, a small dam. Residents also assist each other at harvest time and when building a house. The departmental government sponsors projects to build or repair schools and other government buildings and to maintain roads. Voluntary unpaid labor is used.

The conclusion of the report was that local participation, on a paid basis, would not pose any problems in the construction of the dams.

Social Impact

The reservoirs created by the dams will inundate some terraced agricultural lands. The land tenure system is sufficiently flexible to allow a farmer to obtain replacement lands. Not one example was sited of any significant land shortage at the dam sites visited. Each family also has several fields in different locations so that no one family would have all their fields inundated. The people interviewed did state the individual could solve the problem and there was not a need for governmental administrative intervention.

While no major problems are foreseen in replacing lands inundated by the reservoirs, the inclusion of an additional area enclosed by the thornbush/cacti barrier could be a problem if the barrier is more than 30 meters above the reservoir's high water mark. The placement of this barrier will be done in a way that balances preventive health measures and village land requirements.

One proposed dam site happened to be at the location of a traditional altar (site No. 14). In this case, the dam can be moved a few meters upstream and has been approved by the people.

The recommendations made in this analysis are summarized below and are followed by comments on their utilization.

-- Wells could be used to complement the dams. The Mandara Area Wells project will address this need for complementarity.

-- Wells with a filtering system should be linked to the reservoir. Water will not be obtained directly from reservoir but through water points connected to the reservoir. The water will pass through a filtering system. This recommendation has been made by the Minister of Economic Affairs and Planning, the environmental health team, and the REDSO/WA engineering advisor.

-- Metal buckets should be attached to well with nylon cord for cleanliness and longevity of the well. This will not appreciably improve the cleanliness or longevity of the wells. It is, however, planned to cover the wells and install a handpump.

-- A thornbush barrier should be placed around the reservoir. This is part of the project. This recommendation was also made by the environmental health team.

-- Dam construction should start in the area between Mokolo and Meri. This is in accordance with the recommendation made by the Prefect of Margui-Wandala. The four dams planned for initial construction will also serve as training for the construction teams. The choice of location will be made by the chief engineer and will

likely be in a central, easily accessible area, such as Mokolo and Meri.

-- As some sites were recommended for elimination, all sites should be visited. All other sites were visited by USAID/Yaounde staff and a representative of the Community Development department. Additional sites were eliminated.

-- Villager participation in the construction of the dams should be paid and be done during the dry season. The villagers will be paid and the bulk of the construction will, of necessity, be done during the dry season. Community development activities and some site and material preparation can be done during the rainy season.

-- Construction laborers should come from the area being served by the dam. All of the unskilled labor will come from the area and all skilled laborers will come from Margui-Wandala.

-- A paid watchman should be hired to perform routine cleaning of the dams and wells. This will be considered during the life of the project. However, there are no guardians at the Mokolo and Djingliya dams. Since the wells will be covered there will be no cleaning required. There has been no aquatic growth in the two dams so that there may not be much of a maintenance problem. The planned community development activities will create, it is anticipated, a community sense of standards to be maintained with regard to the dam.

-- The Rural Works Department (Genie Rural) should be upgraded. Agreed. The Rural Works Department will be assisting with the World Bank funded project; however, the department does not have the engineering resources to assist with this project on a full-time basis. Rural Works engineers will assist with the periodic inspection of dams during and after construction.

-- Health campaigns should be organized. A health education and monitoring component is part of the project.

-- A fish culture activity should be considered. A feasibility study of fish culture will be done in October 1978.

-- A continuous monitoring assessment should be undertaken. It is part of the project.

Several suggestions were made regarding the elimination or relocation of dam sites. Three sites were eliminated because government resettlement efforts had taken effect and the people had left the area. A new, 5 million cubic meter capacity dam is being built north of Mokolo to serve the water needs of that town. It will inundate one site and the reservoir will border another site. Four sites were recommended for relocation: two of them will be relocated and the other two can not be relocated and will be eliminated.

Therefore, based on the sociological report seven sites were eliminated. Other field investigations resulted in the elimination of five additional sites. All of the sites that were eliminated will be considered as first priority considerations for the Mandara Area Wells project.

C. TECHNICAL FEASIBILITY

At the request of the Cameroonian Government, the UNDP funded a survey of water sources in North Cameroon. The study was undertaken by the Italian firm, Hydrogeo, and its report, Groundwater Investigations and Pilot Development in North Cameroon, was published in 1975. The purpose of the study was to identify water sources for the towns and villages and for irrigated agricultural development. The intention was to utilize wells to make water available to the residents. The study area included the Mandara mountains region.

The report concluded that, in relation to the Mandara region, "the alluvial deposits are confined to the filling of small depressions of the bedrock and are too thin to store appreciable amounts of water and to solve the problems of these areas." In the technical annexes to the report each site surveyed is described. The following are conclusions regarding water sources in the region.

Mokolo West	"Complete solution of the water problem...will be utilization of run-off water through the construction of dams."
Mandaka	"scarce possibility of discovering water"
Tsanaga	"water potential...is quite modest"
Mokolo East	"slight thickness of the altered zone leads one to conclude that its water resources are equally scarce."
Zamay	"water problem should be solved by utilization of the surface flow...through dams."
Mousgoy	"prospects of finding water resources are slight"

In order to provide water to the people of the Mandara region a massive wells digging program was not the answer. The Cameroonian Government contracted with SOGREAH to undertake a study[1/] of possible dam sites in the region. Using aerial photographs SOGREAH identified 151 potential sites. Each site was visited to determine its technical feasibility and preliminary designs for the dams were made. Based upon the following criteria, 57 sites were selected as being the most suitable for construction.

1/ The two studies cost a total of approximately $750,000.

- the number of households served by the reservoir;
- the cost per cubic meter of potable water;
- the geographic relationship of the dam sites;
- the distance that construction materials would have to be carried.

SOGREAH prepared its study entitled Inventory of Dam Sites in the Mandara Mountains detailing the 151 sites.

The SOGREAH report has been the basic document used by the design team. General engineering advisors from REDSO/WA have evaluated it. They have concluded that it contains "a very complete estimate of cost of construction," and that its "presented methodology is sound." One-third (15) of the sites were visited by a REDSO/WA engineer in December 1977, February 1978 and July 1978 and it was concluded that the report did describe the sites accurately. Foundations were checked and all sites are located on bedrock and each site has sufficient rock for construction. An engineering equipment specialist prepared the equipment list and budget (see Annex B-1).

The dams will be constructed of rubble masonry varying from 4.5m to 10m in height and from 30m to 102m in crest length.[1/] The volume of masonry used to construct the dams will range from 380 m^3 to 2390 m^3 with an average of 989 m^3. Where necessary, two meter deep cutoff wells one meter wide would be constructed in the foundation's upstream and downstream. Rather extensive dental concrete may be necessary, depending on characteristics of each location. The reservoir capacities will vary from 18,000 m^3 to 108,000 m^3. The amount of accumulated sediment in each reservoir after 30 years is projected to range from 50 m^3 to 27,300 m^3. After 30 years the accumulated sediment will represent four percent of the volume of the reservoir. (See Annex B-2, Tables 4-9 for general characteristics of each dam site.)

The climate of the area is tropical characterized by distinct wet and dry seasons. The wet season is from June to September while practically no rain falls from October to May. Annual average rainfall at Mokolo is 960 mm and at Mora it is 810 mm with little interannual variability. The annual mean temperature at Mokolo is 79°F. with a maximum of 110°F. in April. Evaporation (Colorado pan) at Mokolo is of the order of 2,750 mm representing some 2,000 mm per year from a free water surface.

The hydrology was studied by the National Office for Scientific Research (ORSTOM) between 1955 and 1971. The runoff coefficient for the catchment areas concerned by the project is 0.31 and 95 percent of the runoff occurs in July, August and September. The specific discharge estimated for the ten year flood is as follows:

1/ It will be particularly important that the proper proportions of cement, sand, gravel and water be used at all times during the construction process.

Catchment Area (km^2)	Specific Discharge ($m^3/sec/km^2$)
0.05	35
1	20
4	15
10	10
25	6

D. ADMINISTRATIVE FEASIBILITY

The line organization of the project will consist of a chief engineer who will supervise four construction teams. Each construction team will be headed by an engineer who will direct the activities of skilled and unskilled laborers. Staff positions will include community development agents and the personnel at the maintenance facility, the storage facility and the clerical office. The chief engineer will report to and be responsible to the Provincial Development Agent (PDA). The PDA is the Ministry of Economic Affairs and Planning's representative to the department of Margui-Wandala. Additional personnel will be assigned to the PDA's office to administer the project and to assist in the planning of an integrated rural development project. It is the Minister's intention that this unit evolve into a Mandara Regional Development Authority.

This organizational structure will be new and, of course, untested. This type of structure was, however, suggested by Cameroonian government officials and it has the approval of officials at the local, provincial and national level. The Mission is pleased this coordinating development authority has been proposed for the region as it is one of the most populous and poorest rural regions in Cameroon. One can not expect all things of it at once but it has the potential of evolving into a planning and implementing authority.

As previously stated, the World Bank is funding 10 of the dams. This is one of five sub-projects in the Bank's Fonds Special d'Actions Rurales project. The components to this project, in addition to the dams, are: bottomland development, market gardening, stall fattening and village wells. Project activities will be undertaken throughout the northernmost departments of North Cameroon. The FSAR project has been attached to the rural credit institution, FONADER. There is a director of the FSAR project in Yaounde and a project director in Maroua. The director of the dams sub-project, an engineer, is also located in Maroua. All aspects of the project design have been coordinated with the FSAR staff and AID and the World Bank have jointly funded the health studies. Activities will continue to be coordinated during the life of the project.

The technical assistance component of the project provides for five engineers: one chief engineer and four engineers to lead each construction team. The project budget provides for U.S.-level salaries (one FSR-3 and four FSR-5a) and related benefits. In addition there is a 100 percent overhead allowance. The Mission requests that construction firms located in Cameroon, providing they meet pre-qualification criteria, have the opportunity

to submit bids. Several of these firms do have a formal institutional relationship with U.S. engineering firms.

The Mission is concerned about AID's ability to attract engineers to the project area which is hot, dusty and isolated. A contract with a Cameroonian firm would likely be less expensive and provide engineering back-up services that would not be as readily available through a U.S. firm (see Annex G).

E. ENVIRONMENTAL CONCERNS

The major environmental concern is the health implications of water that will be impounded behind the dams.

The following diseases are endemic in North Cameroon: water-vector borne diseases such as malaria, intestinal and urinary schistosomiasis, onchocerciasis, guinea worm (dracontiasis), and fecally related diseases such as bacillary dysentary, ameobic dysentary and other diarrheal diseases.

Two visits were made to the project area: once during the dry season and once during the rainy season. In discussing the major diseases of North Cameroon the environmental health team[1/] made the following observations.

Morbidity statistics for malaria at Djingliya dispensary, located 100m from the dam, show no higher incidence of malaria than other areas without dams. Very few mosquitoes were collected near the Djingliya dam and it did not appear that either the reservoir or the water downstream of the dam provided an optimum breeding habit for mosquitoes.

Schistosomiasis is prevalent in the North. At the Mokolo and Djingliya dams no snails were found. There is no aquatic vegetation in either reservoir and the water level varies appreciably throughout the year. However, in the area downstream of each dam water had accumulated and the snail, *Biomphalaria pfeifferi*, was found. This snail is the intermediate host of *Schistosomiasis mansoni*.

The vector for onchocerciasis is the black fly of the *Simulium* genus. The only vector for human onchocerciasis is *Simulium damnosum*. It appears this vector was present and the project design has proceeded on this assumption. Final confirmation, however, is still awaited.

The following recommendations were made by the environmental health team:

-- Access to the reservoirs should be restricted. Barrier of thornbushes and/or cacti will be planted.

1/ The team included one public health specialist, two parasitologists and two medical entomologists. The entomologists participated in the rainy season study.

-- The downstream face of the dam should be a smooth curve rather than in the form of a staircase. This will be done to prevent black fly breeding places. In addition, the Djingliya dam face will be smoothed.

-- The downstream river bed should be kept free of standing water. A concrete lip will be built at the base of the downstream face of the dams. The area below the dam will be graded to avoid any depressions that could accumulate water. The Djingliya dam downstream of this dam is blocked by the road. Culverts will be placed under the road to provide for proper drainage.

-- Water points should be constructed which will connect to the reservoir with a pipe and a simple filtration device. This is part of the project.

-- Watchmen should be at each site to enforce health regulations. The need for this will be assessed during the life of the project. It is anticipated that the planned community development activities will create a community sense of standards to be maintained with regard to the dam. As part of the health education/monitoring component of the project, regular visits will be made to the people being served by the dams.

-- Latrines should be constructed at each site. Approximately one-half of the population in North Cameroon uses pit latrines or flush toilets and the other half of the population classified their toilet facilities as "other". Latrines will be built downstream of appropriate dam sites as part of the community development health education efforts.

-- Health education should be part of the project. This is part of the project.

The health education/monitoring component of the project will have four main elements:

-- Monitoring of statistical data from the 23 health units in the area.

-- Community development health education activities including the planting of the thornbush/cacti barriers, digging latrines and health education discussion sessions.

-- Semi-annual visits to the people being served by the dams to investigate health status and to the dams/reservoirs to inspect for water-borne disease vectors.

-- Nutrition surveillance study.

This component of the project has the full support of the Minister of Economic Affairs and Planning and the Minister of Health.1/

At the time the PID was submitted the Initial Environmental Examination was not required as part of that submission. The preparation of the IEE was delayed until the completion of the two environmental health team visits to North Cameroon. It was considered that an IEE prepared without the health assessment would be an extremely cursory product and certainly not very useful. The IEE is being submitted to AID/W as Annex H to this PP.

1/ Cameroonian officials at all levels of the Government are becoming increasingly sensitized to the relationship between water and health in development projects. The genesis of this concern was a World Bank funded irrigated rice project in North Cameroon which includes a 23 kilometer long dike to provide irrigation water to that 5,300 hectare project and the construction of the Bamindjin dam in West Cameroon which effected a watershed area of 4,000 square kilometers. Health and sociological problems have arisen in conjunction with these two water related projects. The Mandara Mountains Water Resources project was one of the first new water-related projects to be proposed after the problems of aforementioned projects became known. The Government has released its personnel to assist with the parasitological and entomological studies and has been supportive of project recommendations. NOTE: The Environmental Research Institute of Michigan has approved a grant (with AID funding) to Dr. Lucas TANDAP to undertake a year long study of the effects of the Bamindjin dam on the environment of the catchment area. Dr. Tandap is the Chairman of the Department of Geography at the University of Yaounde.

III. FINANCIAL PLAN

The total project cost is estimated to be $10,388,000. AID's portion of the project's costs will be $6.7 million (64 percent). The Cameroon Government will fund approximately $2.6 million (25 percent) of the costs and the World Bank has approved $1.1 million (11 percent) for its share of the financing. All of the project resources will be used to finance the 45 small dams (10 by the World Bank and 35 by AID) to be constructed during the life of the project. Approximately $200,000 of the project's resources will be used to finance the health monitoring portion of the project. Tables 2 and 3 show project expenditures.

The implementation of the project will require the services of representatives of the Ministry of Economic Affairs and Planning, the Ministry of Agriculture (the Rural Works and Community Development departments), and the Ministry of Health. Because of the involvement of several ministries in the project the Minister of Economic Affairs and Planning has recommended that a coordinating authority be established in Mokolo. The Ministry's representative in Mokolo, the Agent Provincial de Developpement, will direct this coordinating office. Initially, two additional Ministry of Plan representatives will staff the office. It is expected that this office will evolve into a regional development coordinating authority as planning progresses for an integrated regional development project in the Mandara area (see Section I.D.). Since this will be a newly established coordinating office, there is no past history of action with which to evaluate its effectiveness.

However, the Mission can evaluate the Cameroon Government's interest in the project. The Government has supported two major technical studies in the project area--the groundwater survey by the UNDP and the engineering study of the dams by SOGREAH. In addition, the Government and the World Bank have signed the agreement calling for the construction of the first ten dams. The Mission has every reason to believe that the Cameroon Government will continue to support the project.

The proposed project does not require assumptions about the ability of project beneficiaries to purchase agricultural inputs such as tools, fertilizers or improved seeds. There will be a need, however, of substantial participation by the project beneficiaries in the construction of the dams. There is a projected need for approximately 320,000 person days of construction/porter/loader labor during the life of the project. Incentives to participate in this labor are part of the project. Unskilled construction laborers would be hired at the rate of $1.50 per day and porters and loaders would be hired at the rate of $1.40 per day.

As has been indicated, cash incomes for the region are among Cameroon's lowest. Family field labor has been valued at $.21 per day by the World Bank. Family members travel to the plains area during the largely inactive dry season in search for a minimum income that would satisfy cash requirements beyond subsistence and provide some savings. Employment opportunities are found in (a) urban centers like Maroua and Garoua in civil construction paid at about $1.60 per day; (b) seasonal work for the Government which pays about $1.40 per day; (c) agricultural labor which pays between $.50 and $1.15 per

TABLE 2

SUMMARY COST ESTIMATE AND FINANCIAL PLAN

(U.S. $000)

SOURCE	AID		CAMEROON		WORLD BANK		TOTAL	
	FX	LC	FX	LC	FX	LC	FX	LC
PERSONNEL								
Technical Assistance	$1,800				$237		$2,037	
Local		859		818				1,677
EQUIPMENT	1,030			60	253	66	1,283	126
COMMODITIES		856		201	229		229	1,057
OPERATING COSTS		560		132	110	11	110	703
LAND AND BUILDINGS				734				734
SUB-TOTAL	$2,830	$2,275		$1,945	$829	$77	$3,659	$4,297
INFLATION	638	513		451	124	12	262	976
CONTINGENCY	222	178		203	83	8	305	389
TOTAL	$3,690	$2,966		$2,599	$1,036	$97	$4,726	$5,662

TABLE 3

PROJECTION OF EXPENDITURES BY FISCAL YEAR

(U.S. $000)

FISCAL YEAR	AID	CAMEROON	WORLD BANK	TOTAL
1978	-	62	439	501
1979	600	268	168	1,077
1980	1,022	457	149	1,623
1981	1,157	512	150	1,819
1982	1,157	313	-	1,770
1983	1,128	333	-	1,461
INFLATION	1,151	451	136	1,738
CONTINGENCY	400	203	91	69
TOTAL	$6,656	$2,599	$1,133	$10,388
PERCENT OF TOTAL	64%	25%	11%	100%

day; and (d) in a variety of casual jobs. In these circumstances, payment to the unskilled laborers is justified and the Government's minimum wage rates of $1.40 per day reflect the opportunity cost of such labor.

The project cost will be $10.4 million and includes AID, Cameroon Government, and World Bank funding. There will be 102,200 project beneficiaries who live within a 2.5 km or 5.0 km radius of the dam. The overall cost of the project is $102 per person. Based on AID-funding alone the project cost will also be $102 (the AID-funded portion of the project will benefit 65,100 persons). A disaggregation of the cost per person data indicates that the World Bank/Cameroon Government-funded portion of the project costs $55 per person. The World Bank and AID have used the same base figures to calculate the cost of the construction. There are two major reasons for the higher cost per beneficiary for the AID portion of the project. These include:

a. Technician salaries. The Bank project is utilizing one expatriate engineer and the AID project will need five engineers. The Rural Public Works department is providing two engineers to the Bank project and it is unable to release any additional engineers on a full time basis.

b. Beneficiaries. The Bank started its design process earlier than AID and was able to select sites serving the greatest population. Each Bank site will serve approximately 742 families within a radius of 5 km and each AID site will serve an average of 372 families, although 71 percent of the people served by the AID-funded dams will be within a radius of 2.5 km (compared to 47 percent at Bank-funded sites).

It is expected that recurring costs of the project for the Government will be minimal after the completion of the dams. Experience with the dams at Mokolo and Djingliya has not shown a need for any maintenance or cleaning of the dams. None of the dams have any moving parts that would need repair. There will be a need to inspect the dams on a periodic basis and change the filter materials. Health monitoring surveys will continue. These inspections of the physical and health aspects of the dams will be institutionalized into the regional development coordinating authority.

IV. IMPLEMENTATION PLAN

Project Implementation Schedule

The project implementation schedule is as follows:

1. Project Paper. The Project Paper should be approved by December 1978. This is an extremely important deadline as it will be necessary to have the engineering contract signed and the equipment in place by October 1979 in order to have full working advantage of the dry season.

2. Disbursement Plan. A Disbursement Plan should be formulated by February 1979.

3. Project Agreement. The PRO AG should be signed by February 1979.

4. Engineering Contract. The request for bids from engineering firms should be made in March 1979.

5. Peace Corps. A request for Peace Corps Volunteers should be made by the Cameroon Government by March 1979.

6. Vehicles. The project vehicles and vehicle maintenance equipment should be ordered in March 1979.

7. Coordinating authority. The Ministry of Economic Affairs and Planning, the project executing agency, should initiate the establishment of the coordinating authority in March 1979.

8. Health. The health monitoring team should visit the dams and health units in the region in April 1979 as part of the regular health program.

9. Engineering contract. The engineering contract should be signed in May 1979.

10. Equipment. The construction equipment should be ordered in May 1979.

11. Personnel. The Ministry of Plan should detail personnel to the coordinating authority by May 1979. This will be done in coordination with the Ministry of Agriculture.

12. Office. The coordinating authority should obtain office space in June 1979.

13. Site review. The chief engineer and coordinating personnel should visit dam sites during June, July and August, 1979.

14. Community development. CD agents will develop their program of labor mobilization and health education during June, July and August 1979.

15. Site design. The chief engineer will prepare final design plans for the first four dams to be constructed in August 1979.

16. Storage and maintenance areas. The coordinating authority will have these areas ready for use by August 1979.

By September 1979 all personnel and equipment should be in project area and project activities will become fairly routine. Dam construction will be undertaken according to the following schedule: FY-1980-- four dams: FY-1981--ten dams; FY-1982--ten dams; and FY-1983--eleven dams. Labor mobilization activities will be undertaken in accordance with the dam construction schedule. Health education activities will be continuous and formal Ministry of Health reviews will be undertaken twice yearly.

Project Monitoring

The USAID/Yaounde project manager will be the Mission capital development officer. The Mission engineering officer will play an important role in monitoring the technical aspects of the project. The Mission agricultural officer will be associated with the project in relation to the planning of the integrated rural development project (see Section I.D.).

Procurement

The technical assistance contract to provide five engineers will be with an engineering construction firm. Mission preference is for a Cameroonian construction firm because of the language problems and the back-stopping services a local firm could provide to the isolated project area. Annex G contains a request for a waiver. The contracting for this firm will be done through the Cameroon Government, as authorized agent.

The equipment will be obtained following normal contracting procedures. The vehicles and maintenance repair equipment will be ordered first. After the chief engineer has been selected and has reviewed the rest of the equipment needs the rest of the construction equipment will be ordered. Replacement equipment will be ordered in the second year of the project. First year equipment orders will be placed by the Mission through the Afro-American Purchasing Center but by the second year the Ministry of Plan's coordinating authority will be sufficiently well established to take over the responsibility for ordering the equipment and commodities.

The major commodity needed by the project will be cement. This will be purchased from Cameroon's cement plant at Figuil, located 150 kms southeast of the project area.

V. EVALUATION

The project calls for continuous monitoring, and by implication evaluation, of the health and engineering aspects of the dams. Morbidity data has been collected from each health unit in the project area which will provide a basis to evaluate the health effects of the dams.

Four dams will be constructed during FY 1980 and they will be filled with water during June, July and August 1980. A short evaluation survey will be made of the users of that water and its effects on family work and leisure habits in January 1981.

A mid-project evaluation will be made in FY 1982 during October or November 1981. At that time 14 dams will have been constructed under the AID-funded portion of the project and all of the World Bank-funded dams will have been completed. Cameroon Government participants on the evaluation team will include representatives of the Ministries of Economic Affairs and Planning, Health, and Agriculture (the Community Development and Rural Public Works departments). The Mission project officer and engineering officer will participate as well as a rural sociologist.

All of the dams will be completed in FY 1983 and all will be full of water by September 1983. A final project evaluation will be held during the dry season of 1983/84. The final project evaluation will be coordinated by the regional development coordinating authority. Further monitoring of the dams will continue after the termination of the project under the auspices of the regional development coordinating authority.

VI. CONDITIONS, COVENANTS AND NEGOTIATING STATUS

Conditions

There are no special Cameroon Government actions which must be taken prior to the execution of the Project Agreement.

The World Bank has already authorized its portion of the project and technical personnel are in the project area.

Covenants

The GURC will (a) review and report twice per year on the incidence, in the project area, of malaria, schistosomiasis, onchocerciasis and guinea worm, and (b) conduct yearly environmental health inspections of dams completed with AID financing.

ANNEX A. PID APPROVAL CABLE

The Mission was authorized to begin the design of the Mandara Mountains Water Resources project by STATE 088518 dated April 20, 1977. A number of suggestions were made in the PID approval cable for the guidance of the Mission and the design team. The cable is quoted in full below. Each paragraph is followed by the Mission response and is marked by an R.

1. Summary. Project review committee reviewed and approved subject PID. RDO/Y is authorized to proceed with design and documentation for project authorization target of FY 1979. Separate PRP and PP mandatory. Review focused on plethora of environmental and social issues facing designers. Technical questions were muted pending receipt/analysis SOGREAH report and Morris/Greene studies which may cover issues omitted from PID.

1R. No response required.

2. Committee considered PID well-written and innovative with appropriate and identifiable objectives and beneficiaries. Consensus was that PID comprehensive and further requests to field for information not required. Koehring's presence at meeting was extremely helpful.

2R. Thanks

3. Sense of Committee was that inherent complexity of dols 5 million 57-dam project requires that 3 or 4 pilot dams be built to test assumptions and environmental impact, facilitate on-site judgements and provide experience for any adjustments to design of social/organizational aspects of project that might be necessary. Large urban Mokolo dam for drinking water not considered comparable to proposed Mandara dams because of significantly different environments. SOGREAH study lacks social analysis. The new Africa-wide accelerated impact program (AIP) can provide the mechanism for rapid design and implementation of a pilot dam project. AIP projects require little lead time. An FY 77 AIP project offers possibility of implementing a pilot project about two years before subject project would begin. Since RDO/Y apparently prefers to proceed with project without pilot effort, committee agrees leave decision to PRP team. If RDO has reconsidered position and wishes to tap limited AIP budget for pilot project, RDO urged submit documents required reftel ASAP before AIP funds fully committed.

3R. Mission considered that existing dams in area would provide opportunity for possible environmental impacts of small dams. Mission felt that social and environmental health analyses should be accomplished prior to a pilot-project or a full scale project. Therefore, Mission proceeded with design effort for full project.

4. RDO/Y and PRP team should consider joint loan/grant project. Loan would finance equipment/commodity element for dam construction as IBRD proposes, in view fact that Cameroon exceeds dols 300 per capita GNP. Complementary technical assistance would be better funded by grant.

4R. Mission did not consider joint loan/grant funding for project was appropriate since per capita cash incomes for the region are on the order of $18 annually and the project is designed to serve social rather than economic needs, i.e., it is not an irrigated agriculture production project.

5. Design.
A. Goal. Goal needs to be stated with more precision. Project by itself will not substantially ameliorate endemic poverty of densely populated Mandaras, which will be significantly affected only by migration and family planning, education, and health programs. Given overpopulated, "harsh impoverished" mountaintop existence, PRP should explain role of reservoir development vs. out-migration as solution. If explanation convincing, project may catalyze long-range multi-donor effort. Committee strongly endorses collaboration with IBRD as suggested.

5AR. Project doesn't presume to substantially ameliorate endemic poverty of the Mandara region. This is the goal, however, of the efforts begin undertaken in the region by the Cameroon Government, the World Bank and USAID/ Yaounde.

5B. Purpose. Precise redenfinition of primary purpose is required: water for humans and animals or "complimentary development projects" or both. Linkage of purpose to outputs is crucial to project design. Will there be enough water for several purposes?

5BR. There will be sufficient water to serve the needs of 13,020 families and their livestock (an average family unit consists of 5 persons and their animals, an average of 7 sheep and goats and 1/4 cow). Water will not be available for any significant irrigated agriculture sub-projects, although the area downstream of the dam may be suitable for reforestation/firewood activities because of seepage.

5C. Beneficiaries. Area studies indicate that LDC poverty increases relative to distance from transport. By arbitrarily limiting dam sites to 3 miles from roads to minimize problems of transporting construction materials, project systematically designs out the 24 percent neediest. Can this be revised? PRP should explain how project provides "direct assistance to the poorest of the poor" in Mandara Mountains, describe precise groups to be benefitted to what degree, and their relation to other project groups in area.

5CR. The distance to a site is, of course, a consideration in a construction project. However, sites are located up to a distance of 12 km from a road. The project region is one of the poorest areas of Cameroon and fits AID criteria for assistance. The dams are located at sites which are technically and socially feasible and all serve rural populations. The proposed Mandara Area Wells project will be complementary to the project.

6. Social Issues. Committee and Koehring concurred this is social project, success or failure of which will be determined principally by social criteria, assuming dam feasibility determined, rather than engineering or economic criteria, yet location criteria to date omits social analysis. Concerns were more matter of PID emphasis than omission. Committee strongly stresses the need to reflect women in development concerns not as a separate issue but rather as part of total social picture.

6R. Social analysis was undertaken and 12 sites were eliminated. The project will be of direct benefit to women and will reduce the time required for them to carry water.

6A. Locally perceived needs. SOGREAH and PID location criteria for sites were technical, not social. PID provided no evidence that residents desire dams, how they perceive their land/water requirements, and importance of accessible small reservoirs relative to other needs. How to deal with groups, (e.g., 5C above) omitted from project, and how to gauge local opinion democratically, will challenge project designers.

6AR. Four months of field work were done at 21 sites and the residents had an opportunity to voice their interests and concerns with regard to the project. Water is perceived by the people as a necessity and the project was viewed as appropriate in those areas where the dry season forced them to walk farther and farther for water.

6B. Local Participation. PID recognizes desirability local participation. Committee offers further hypothesis: project will fail (1) if sites are based only on engineering and economics without agreement and support from beneficiaries, (2) if planned/implemented from the top rather than genuinely representative local leaders. Mechanism for local action must be found, such as fixed amount reimbursement, wherein no dam will begin until local groups decide whether, where and when they want the dams, with significant responsibility for construction and maintenance. Acknowledge difficulty this approach in face of pressures from GURC, contractors, even AID, to move ahead. How mobilize local opinion and action with minimum GURC involvement will test PRP team.

6BR. The project beneficiaries have participated in the project design process and action has been taken based on their recommendations. The Community Development agents will be instrumental in establishing levels of community development. The initial health education activities will involve the planting of the thornbush/cacti barriers around the upper perimeter of the reservoirs and the construction of pit latrines. Construction will not start at a site until these activities have been undertaken.

6C. Local Control. Analysis of how transitory groups, i.e., Fulanis, Nomads, will affect the project is needed. The equivalent of water user associations is imperative if effective control over management of and charges for resultant water resources is to be maintained by the community, after project termination, against encroachment by government, plainsmen and competing groups. No dam should begin until viable water users association mobilizes some resources to demonstrate its commitment.

6CR. Each community to be served by the dam has its local organization. This organization will be responsible for pre-construction activities.

6D. Tribalism. Factionalism is endemic to local groups who occupy massifs divided by valleys. Consequently successful water user associations will have to overcome existing competition and conflict.

6DR. There is no evidence that this will be a problem.

6E. Land Use. Analysis of groups which the project may harm will be necessary. Disruption of intensive agriculture or valley land being flooded may trigger socio-economic chain reaction. What is system of land tenure, and use by livestock? Valley groups must be given incentives to relinquish pasture or farmland.

6ER. This problem was discussed during field design work and each community considered it could take care of the problem within its existing format land tenure.

6F. Released Energies. Amount free time available due reduced woman- and child-labor remains unclear: PID states 4 km average trip to water today will become 5 km maximum after project. PP should include plans of Ministries of Economic Affairs and Planning, Community Development, Education, Health to make use of free time of 128,000 villagers. If complementary agricultural activities outside this project, e.g., irrigation, vegetable needs, livestock, fishing, are not defined and developed, project out-puts are unrealistic. Recommend early consultations with (1) IBRD re use of special fund for rural action loans for complementary projects, (2) PVO's to initiate ancillary activities.

6FR. Discussions regarding complementary activities have been initiated.

7. Environmental Issues. PID assumes increased water supply entirely beneficial. Possible negative consequences must be analyzed. Will mountain water storage impact on plains agriculture and fishing, through changes in water flow and topsoil? Will availability water attract people and livestock to area, and increase risk of pollution? Will free time release young people for outmigration? Will year-round standing water encourage malaria in mountains currently malaria-free? Committee recommends (1) health dimension be added to project, (2) women's new-found free time be utilized in nutrition, health education, vegetable gardens, etc. Initial environmental examination (see AIDTO A-493 3/8/76) should include:

7R. The amount of water to be contained in the reservoirs will have no impact upon agricultural and fishing activities in the plains because of the high amount of rainfall during the rainy season. The dams are being constructed in populated areas and no significant population migration is expected. It is not expected that increased amount of free time will result in increased out-migration. The region is not malaria free and malaria is the leading cause of reported morbidity. It is not thought that there will be a significant increase in the incidence of malaria. The morbidity statistics for malaria at the Djingliya dispensary, which serves an area where a small dam has been in existence for three years, shows no higher incidence of malaria per population than areas without dams. A health education component is part of the project. Much of a woman's free time will be utilized in rest and family care.

7A. Health. Effect of standing water as breeding places for snails, flies, mosquitoes, carriers of water-borne diseases (oncho, schisto, malaria) endemic elsewhere in region, needs research. Interrelationship with ongoing CDC project needs investigation.

7AR. The project design process included two field studies, in conjunction with the World Bank, of the environmental health implications of the project.

7B. Potable water. Keeping water pure is key. Reservoir may be swimming pool, laundry, fishing hole, cattle trough, etc., unless project measures taken to protect water by restricting access. How will reservoir water be made potable? Sanitation/hygiene education, e.g., clean containers, prevention contaminated water, is needed.

7BR. Access to reservoirs will be limited. Water drawn from water points will be filtered. There will be an on-going health education program.

7C. Livestock. PID states water needed for human and animal consumption, promises increased livestock production. How can livestock and game be prevented from contaminating lakes thereby avoiding primary pollution? Can adverse environmental effects be designed out of project?

7CR. Livestock will not have access to reservoir because of barrier. Environmental health studies have resulted in recommendations which have been incorporated into project to minimize potential adverse environmental health effects of the project.

8. Engineering Issues. Since SOGREAH was given Mandara dam sites as mandate, Committee focused on engineering policy issues which transcend technical site questions which SOGREAH and Morris/Greene studies presumed to have addressed. Obviously sites must be technically feasible, as well as socially and environmentally sound.

A. Alternatives. Committee believes alternatives and/or adjuncts to dams, including the two (wells, relocation) dismissed in PID, must be analyzed to justify investment in 57 dams, particularly if pilot is rejected. Cisterns were suggested. Water tables, terrain and rock strata dominated discussion of wells. Wells driven near reservoirs to pump water to villagers to provide potable water and decrease hauling time were suggested.

8AR. Wells may be a possibility at sites eliminated through the project design process and will be the primary consideration of the Mandara Area Wells project. In the area around the selected dam sites the water table is such that water is not available during the dry season, as established by the UNDP study.

8B. Safety. Impact on communities of dam failure, floods, and major overtopping of dams.

8BR. All dams are built in ravines/valleys where water flows during the rainy season. No dam will impound all water flow during the rainy season so that there will not be a tendency to construct housing downstream of a dam. The dams will be constructed on solid foundations. The proportion of cement used to make the concrete will be continually monitored to insure structural safety.

8C. Project Life. Number of years reservoirs usable before filling with sediment/debris is critical to cost/benefit analysis. PRP team should recommend (1) self-help method for removing material, (2) siltation studies required for PP approval.

8CR. It has been projected that after 30 years sediment will account for four percent of the dam's capacity. There has been no need to clean the existing dams of sediment deposits during the past four years.

8D. Environmental Engineering. Features designed into project to:
(1) Ameliorate prevalence/increased incidence of water-borne diseases.
(2) Reduce maintenance costs.
(3) Maintain potability, taste, etc., for human consumption.
(4) Improve sanitation.

8DR. These suggestions have been designed into the project.

8E. Technical Issues. If not covered in SOGREAH report, address following in PRP:

(1) Annual Water Budget. For each site: expected evaporation and percolation losses. Water required vs. water available after expected losses. Anticipated dry periods. (AID dam projects have seen water disappear in first month.) Additional studies needed should be described and costed.
(2) Hydrology. For each site: drainage area. rainfall rates.
(3) Geology. Are geologic structures appropriate for dams?
(4) Technical description. Type of dam. Construction methods. Alternatives analyzed. Foundation conditions of typical site (identify areas requiring further study). Spillway and flood flow protection of dam structure. Committee believes reinforced concrete is unrealistic for 57 dams with supply distance 3 miles. Request photos of dam sites in PRP for laymen who find scale of dams/reservoirs difficult to visualize.

8ER. This information is included in tabular form in Annex B-2. Photo presentation of project area and discussion of design status took place in AID/W in March 1978.

9. Economic Issues. PRP will require thoroughgoing economic analysis. Assumptions underlying income and nutrition project outputs require regional marketing analysis. If dams fail to increase agricultural productivity while occupying productive land, productivity is reduced further. Given small number Mandara livestock (one/family), PRP should analyze assumed benefits, if any, to livestock production. High dols 255 project cost/family equals annual family income.

9R. The project will not effect income levels in the region. The presence of the dams will allow for the development of other income generating activities. The economic analysis for any integrated rural development activity in the region will involve analysis of regional marketing structure (note: this analysis currently underway).

10. Financial Issues. PRP requires detailed financial planning, and justification for GURC contribution less than 25 percent. (Request RDO advise AID/W ASAP (1) breakdown LOP cost components, particularly construction; (2) major items of GURC 23 percent contribution.)

10R. AID share of project costs is 64 percent with World Bank (11 percent) and Cameroon Government (25 percent) accounting for the balance of the costs. The Cameroon share of the project costs for the AID-funded portion of the project include personnel salaries, buildings, commodities, equipment, and land.

11. AID/W checking AID experience with small dams. Assume much of SOGREAH report will be incorporated into PRP. Will relevant sections be translated? Request RDO/Y pouch copies SOGREAH report, and Morris/Greene analysis if available, to desk and SER/ENGR/WR ATTN Zobrist.

11R. SOGREAH report has been used as basis for preparing technical information in PP. It has been reviewed and approved by the REDSO/WA engineering staff.

12. Project management considerations should be major focus of PRP team. AFR/DR will field design team with mandate and capacity design detailed PRP to minimize PP work, subject to RDO/Y preparation PIO/T scope of work. Committee concluded that project feasibility and implementation must be done by interdisciplinary teams with equally significant social and technical inputs into project decisions. Committee recommends following skills be adequately represented on teams or considered in planning design work scope.

A. Design. (Since technical aspects surveyed but sociological ramifications unknown, social skills should be fielded about month earlier than technical.) Social skills suggested: Rural sociologist, development anthropologist, community development specialist, environmentalist. Technical skills suggested: epidemiologist, health educator, agricultural engineer with small dam background, environmental engineer, geologist, agricultural economist, short-term nutritionist.

12AR. Mission design team is as indicated in PP.

12B. Implementation. In addition to the three civil engineers and seven construction foremen, committee suggested: Africa development anthropologist and/or administrator (team leader), community development specialist, epidemologist/health educator. Institutions with multidisciplinary capability in African development recommended as 5-year contractor(s), such as Northwestern, Purdue, Boston U II universities considered.

12BR. Mission is considering the use of one or more rural development specialists in the implementation of the complementary integrated rural development plan for the region.

13. AFR/W prepared to program amount necessary for thoroughgoing PRP. HOBEN PPC/PDA/CP can assist in team selection, available 2-3 weeks June-July in roles of sociologist and coordinator of staggered social and technical aspects. Morris, Purdue agricultural economist, available as well.

13R. No response required.

ANNEX B. TECHNICAL DETAILS

B-1: EQUIPMENT LIST ESTIMATE

The following is designed to equip four construction brigades which will be capable of building 35 dams in a 5-year period:

Item	Qty	Description	Unit Cost	Total Cost
1	16 ea	Gas-driven Power Breakers with drill attachment McMaster Car Cat. 83P. 1366 No. 6079D11&12, wt. 55 pounds	2,100	
1a	1 lot	20% parts	400	
1b		Procurement cost & shipping 100%	2,500	80,000
2	4 ea	Water pump, portable, 3 H.P. gas engine, self prime, centrifugal 2"x2", 150 GPM, Poulan Mod. 3H-151 with 20' suction & discharge hose & fittings	400	
2a	1 lot	20% parts	80	
2b		Procurement cost & shipping 100%	480	3,840
3	4 ea	Water pump similar to item 2 but 5 H.P. engine, 210 GPM. Poulan Mod. 5H-212	650	
3a	1 lot	20% parts	130	
3b		Procurement cost & shipping 100%	780	6,240
4	48 ea	5-gallon cap., safety fuel cans, steel McMaster Car Cat. 83, p. 630	15	
4a		Procurement cost & shipping 100%	15	1,440
5	65 lin.ft.	Screen wire, steel, 105 diam., crimped, .25 inch space x 48 inches wide, McMaster Car Cat. No. 83, p. 1472	12	
5a		Procurement cost & shipping 100%	12	1,560
6	4 sets	Hand tools (shovels, picks, mattacks mauls, pinch bars, crowbars) (95 prs)	1,250	
6a		Procurement cost & shipping 100%	1,250	10,000

Item	Qty	Description	Unit Cost	Total Cost
7	400 ea	Head pans, steel, to carry 50 lbs. earth	3	
7a		Procurement cost and shipping 100%	3	2,400
8	24 sets	Masons Tools (trowels, chisels, hammers)	22	
8a		Procurement cost and shipping 100%	22	1,056
9	4 ea	Small, light-weight, concrete mixers, two-wheel, 2½ H.P. gas engine 3 cu.ft., McMaster p. 651	700	
9a	1 lot	Spares 20%	140	
9b		Procurement cost and shipping 100%	840	6,720
10	1 ea	Small, contractor-type, Gilson Mod. 3½ SH, with two wheels, gas engine, water meter, non-tilt., wt. 1430 No.	1,667	
10a	1 lot	Spares 20%	333	
10b		Procurement cost and shipping 100%	2,000	4,000
11	1 set	Drill Steel, bits & accessories for Item No. 1	13,250	
11a		Procurement cost and shipping 100%	13,250	26,500
12	6 ea	Pickup Truck 4x4, automatic habs, 6 cyl. gas 3 speed, Flare type 6.5 foot box, steel floor, rear step with large ball hitch; 7500 GVW; H.D. Springs & shocks; tropic cooling; steel-belted on-off hwy. tires, tube type, largest size suitable; high ration, limited slip differential short wheel base; outside mirrors both sides; no emission controls; no heater; extra fuel capacity, low maint. battery, front & rear skidplates; tire pump; fire extinguisher, tire tools, spare tire & wheel, metric speed, L.H. drive, 2 sets filters, 2 sets parts, service & oper. manuals, connections for electric trailer stakes	7,000	
12a	1 lot	20% spares	1,400	
12b		Procurement cost and shipping 60%	5,000	80,400

Item	Qty	Description	Unit Cost	Total Cost
13	3 ea	7½ T. Dump Trick 4/5 cu.yds. diesel; GVW 30,000; 150 HP; autotransmission; contractor-type body & cab protector, with P.T.O. hydraulic pump & hoist; no emission controls, no anti-skid, no shutters; tropic cooling with reservoir if avail.; front tow hooks; rear pintle hook; spare tire, wheel & bracket; tools, hyd.jack; L.H. drive; H.D. springs & front shocks, fire exting.; outside rear-view mirrors R&L, low main. high-capacity battery, R.H. sun visor, dual high-clearance fuel tanks; steel-belted radial tube-type tires, high-ratio differential air brakes and trailer connections	28,000	
13a	1 lot	20% spare parts	5,600	
13b		Procurement cost and shipping 60%	20,200	161,400
14	1 ea	Tilt-top trailer for use with Item 14, 20,000 No. cap., air brakes pintle hook connection wood deck	8,000	
14a	1 lot	20% parts	1,600	
14b		Procurement cost and shipping 60%	5,800	15,400
15	1 ea	D4D 75 H.P. Crawler Tractor with bull-dozer blade	60,000	
15a	1 lot	30% spares	18,000	
15b		Procurement cost and shipping 60%	46,800	124,800
16	8 ea	500-gallon cap. water tank trailer; 4 wheel, 10 ga. steel body, baffled tank, large ball hitch, electric brakes, top manhole screened filler, 2" gravity drain with valve, 20' of 2" dia. discharge hose, hose storage & equipment compartment at least 2'x3'x1½' with doors & hasp. fenders over rear wheels	5,000	
16a		Procurement cost and shipping 100%	5,000	80,000
17	80 ea	5-gallon water cans, steel	6.50	
17a		Procurement cost and shipping 100%	6.50	1,040

Item	Qty	Description	Unit Cost	Total Cost
18	125 pr.	Chippers Goggles	1.75	
18a		Procurement cost and shipping 100%	1.75	438
19	35 ea	Bump-resist. Hats	3.70	
19a		Procurement cost and shipping 100%	3.70	259
20	4 ea	House Trailers with air cond. generator, L.P. gas store furniture & appliances, tropic insulation	9,000	
20a		Procurement cost and shipping 200%	18,000	108,000

EQUIPMENT FOR MAINTENANCE UNIT

Item	Qty	Description	Unit Cost	Total Cost
M1.	1 set	Hand tools, shop & test equip. Lube service	3,880	
M1.a.		Procurement & shipping - 100%	3,880	7,800
M2.	1 ea	Air Compressor (Tire Service) portable 2.3 CFM McMaster Car Cat. 83p. 794	300	
M2.a.	1 lot	Parts 20%	60	
M2.b.		Procurement & shipping - 60%	220	580
M3.	1 ea	Electric Welder - Power generator Hobart 200 ADC or 5 KWAC. gas driven incl. accessories	1,667	
M3.a.	1 lot	20% parts	333	
M3.b.		Procurement & shipping - 100%	2,000	4,000
M4.	1 set	Gas welding & cutting with 3 sets oxy-acetylene bottles, hoses, regs, gloves, mask, rod, cleaner, etc.	670	
M4.a.		Procurement & shipping - 100%	670	1,340
M5.	1 ea	Pickup Truck, same as Item 12	7,000	
M5.a.	1 lot	20% spares	1,400	
M5.b.		Procurement & shipping - 60%	5,000	13,400
M6.	1 ea	Portable Generator, Poulan (Emerson Electric) 2150 watts 115 v. 60 H_2 Mod. BPA wt. 95 pounds, Bt5 5 HP engine manual start	600	
M6.a.	1 lot	20% spare parts	120	
M6.b.		Procurement & shipping - 100%	720	1,440

ANNEX B-2: DAM CHARACTERISTICS

TABLE 4. NUMBER OF FAMILIES SERVED BY EACH DAM SITE

Dam Site	FAMILIES SERVED 1/ Within radius 0 to 2.5 km	Within radius 2.51 to 5.0 km	TOTAL
10	220	480	700
14	100	-	100
19	350	-	350
22	150	650	800
28	230	-	230
36	500	-	500
47	180	-	180
48	150	-	150
50	500	-	500
51	300	-	300
55	150	-	150
56	140	160	300
59	150	110	260
64	400	-	400
83	400	-	400
86	450	-	450
95	200	-	200
99	140	60	200
103	390	-	390
104	280	620	900
107	680	-	680
112	70	30	100
117	75	75	150
119	80	120	200
125	200	100	300
127	300	-	300
130	430	-	430
131	370	-	370
132	210	180	390
134	250	220	470
135	460	390	850
141	120	80	200
145	100	100	200
153	310	290	600
154	320	-	320
TOTAL	9,355	3,665	13,020

1/ An average family unit consists of 5 persons. In addition, each family unit has an average of 7 sheep and/or goats and one-quarter head of cattle.

ANNEX B-2

TABLE 5. RAINFALL AND DRINKING WATER

Dam Site	Rainfall (mm)	Watershed Area (km^2)	Amount of Water in Watershed Area (m^3)	Total Dam Capacity (m^3)	Utilizable Water (m^3)
10	700	2.7	459,000	73,000	37,700
14	690	.8	130,000	17,600	4,900
19	710	.5	89,000	36,600	17,200
22	720	1.8	326,000	79,600	42,600
28	670	.4	62,000	20,000	11,300
36	690	.3	50,000	49,400	24,500
47	690	1.3	217,000	21,000	8,800
48	700	9.0	1,548,000	48,000	7,400
50	700	7.2	1,230,000	32,000	4,900
51	730	3.8	699,000	40,000	14,700
55	700	3.3	558,000	32,800	10,300
56	680	3.1	493,000	44,000	14,700
59	700	18.5	3,562,000	108,000	12,700
64	780	2.3	481,000	46,700	20,600
83	740	1.5	285,000	67,000	21,100
86	705	.6	112,000	44,000	22,000
95	730	.5	91,500	29,000	10,800
99	760	2.8	563,000	32,200	10,800
103	750	1.6	315,000	38,000	19,000
104	740	1.5	287,000	88,000	44,100
107	740	4.3	817,000	58,000	33,300
112	680	3.4	547,000	27,600	4,900
117	730	.6	110,000	18,000	7,400
119	730	.5	93,000	24,000	9,800
125	770	3.5	725,000	54,400	15,900
127	750	2.5	493,000	32,500	15,700
130	700	.6	102,000	42,000	21,100
131	700	.9	151,000	32,000	18,000
132	650	2.0	282,000	36,400	19,100
134	760	2.2	436,000	44,000	23,000
135	840	2.3	550,000	70,600	41,700
141	820	1.0	232,000	29,400	9,800
145	750	.3	58,000	28,000	10,800
153	810	.5	113,000	74,000	29,400
154	810	.6	134,000	28,600	15,700

ANNEX B-2

TABLE 6. DIMENSIONS AND CHARACTERISTICS OF EACH DAM SITE

Dam Site	Height (m)	Crest Length (m)	Quantity of Concrete (m^3)	Distance to Site: Access Trail (km)	Distance to Site: Foot (km)
10	7.5	38	800	11.0	1.0
14	4.5	32	400	.7	.5
19	6.0	42	680	-	2.3
22	7.0	38	830	8.2	.8
28	10.0	41	1430	1.2	.7
36	7.4	40	850	-	1.0
47	10.0	31	1040	-	1.1
48	6.7	42	650	-	2.2
50	6.8	37	630	2.3	2.6
51	5.8	56	970	8.5	-
55	6.5	31	660	-	4.0
56	5.0	39	490	-	1.8
59	7.5	38	720	.5	-
64	8.0	48	940	3.1	2.3
83	6.5	102	1600	5.4	.2
86	8.0	68	1490	.9	.5
95	5.5	30	490	-	4.5
99	5.5	32	540	-	.8
103	10.0	43	1570	-	1.5
104	8.0	34	850	1.1	.4
107	9.0	83	2390	-	.2
112	5.3	36	470	-	5.5
117	7.0	55	1180	1.0	-
119	6.0	20	380	2.2	4.2
125	4.5	65	860	-	.5
127	9.0	48	1420	-	4.8
130	9.0	42	1040	-	.6
131	10.0	42	1420	-	2.4
132	8.5	41	1090	-	4.5
134	8.0	40	950	-	2.6
135	9.0	67	1870	-	.4
141	5.5	63	1050	-	1.6
145	6.0	42	800	1.3	-
153	8.0	36	920	6.7	2.8
154	8.6	38	1160	-	1.4
TOTAL	255.6	1580	34630	54.1	59.7
AVERAGE	7.0	45	989	1.6	1.7

ANNEX B-2

TABLE 7. TOTAL DAM CAPACITY AND AMOUNT OF SEDIMENT DEPOSITED AFTER 30 YEARS.

Dam Site	Capacity (m^3)	Sediment m^3 after 30 years	Dam Site	Total Dam Capacity (m^3)	Sediment m^3 after 30 years
10	73,000	1,200	117	18,000	150
14	17,600	200	119	24,000	100
19	36,600	100	125	54,400	1,800
22	79,600	700	127	32,500	1,100
28	20,000	100	130	42,000	150
36	49,400	50	131	32,000	250
47	21,000	400	132	36,400	800
48	48,000	7,600	134	44,000	900
50	32,000	5,400	135	70,600	1,000
51	40,000	2,100	141	29,400	300
55	32,800	1,700	145	28,000	50
56	44,000	1,500	153	74,000	100
59	108,000	27,300	154	28,600	150
64	46,700	1,000			
83	67,000	500	TOTAL	1,546,400	63,600
86	44,000	150			
95	29,000	100			
99	32,200	1,300			
103	38,000	550			
104	88,000	500			
107	58,000	2,500			
112	27,600	1,800			

ANNEX B-2

TABLE 8. LABOR REQUIREMENTS FOR CONSTRUCTION OF 10 m^3 OF FINISHED RUBBLE MASONRY.

1. QUANTITY OF CONSTRUCTION MATERIAL:

10 m^3 finished rubble masonry requires:

ITEM	QUANTITY	WEIGHT
Broken stone	8 m^3	on site
Sand	4 m^3	7.2 T
Water	1 m^3	1.0 T
Cement	1.8 T	1.8 T
	Total weight transported:	10.0 T

(NOTE: average dam contains 989 m^3 of concrete)

2. LABOR REQUIREMENTS

a. Foundation Preparation
300 m^3 excavation for average 1,000 m^3 dam = .3 m^3 excavation for each m^3 dam.
One person can excavate .5 m^3 in one day.
Therefore, 10 m^3 of dam construction requires 3 m^3 of excavation or 6 person days.

b. Rockfill for Masonry
8 m^3 broken rock required for 10 m^3 dam.
At .5 m^3 per person day, labor requirement is 16 person days.

c. Mixing Mortar
10 m^3 finished masonry requires 4 m^3 mortar.
At 800 l per person day, labor requirement is 5 person days.

d. Placing rubble masonry
At .5 m^3 per person day, labor requirement is 20 person days.

To construct 10 m^3 of finished rubble masonry requires 47 person days.

e. Porterage of materials to site
Average spend 2 km per hour both ways and 25 kg per porter.
1 T moved 1 km in 8 hours require:

$$1/.025 \times 1/8 \times 1/2 = 2.5 \text{ porters/ton/km/day}$$

ANNEX B-2

TABLE 9. LABOR REQUIREMENTS

Dam Site	Masonry Volume (m^3)	Construction Period (days)	Construction Labor (days)	Porterage Total Ton km	Porterage Ton km Per day	Porters Required No.	Porter Labor Required Days	Loaders (days)
10	800	80	3760	800	10	25	2000	640
14	400	40	1880	200	5	13	520	320
19	680	68	3196	1564	23	58	3944	544
22	830	83	3901	644	8	20	1660	664
28	1430	143	6721	1001	7	18	2574	1144
36	850	85	3995	850	10	25	2125	680
47	1040	104	4888	1144	11	28	2912	832
48	650	65	3055	1430	22	55	3575	520
50	630	63	2961	1638	26	65	4095	504
51	970	97	4559	-	-	-	-	776
55	660	66	3102	2640	40	100	6600	528
56	490	49	2303	882	18	45	2205	392
59	720	72	3384	-	-	-	-	576
64	940	94	4418	2162	23	58	5452	752
83	1600	160	7520	320	2	5	800	1280
86	1490	149	7003	745	5	13	1937	1192
95	490	49	2303	2205	45	113	5537	392
99	540	54	2538	432	8	20	1080	432
103	1570	157	7379	2355	15	38	5966	1256
104	850	85	3995	340	4	10	850	680
107	2390	239	11233	478	2	5	1195	1912
112	470	47	2209	2585	55	138	6486	376
117	1180	118	5546	-	-	-	-	944
119	380	38	1786	1596	42	105	3990	304
125	860	86	4042	430	5	13	1118	688
127	1420	142	6674	6816	48	120	17040	1136
130	1040	104	4888	624	6	15	1560	832
131	1420	142	6674	3408	24	60	8520	1136
132	1090	109	5123	4905	45	113	12317	872
134	950	95	4465	2470	26	65	6175	760
135	1870	187	8789	748	4	10	1870	1496
141	1050	105	4935	1680	16	40	4200	840
145	800	80	3760	-	-	-	-	640
153	920	92	4324	2576	28	70	6440	736
154	1160	116	5452	1624	14	35	4060	928

ANNEX C

[illegible]

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 1979 to FY 1983
Total U. S. Funding $5.0 MILLION
Date Prepared: 20 Sept. 1978

Project Title & Number: MANDARA MOUNTAINS WATER RESOURCES PROJECT 631-0012

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: Improve the level of living of the rural poor in a self-sustaining fashion.	Measures of Goal Achievement: Increased agricultural and non-agricultural production activities in dry season: Increased prod. of dry season millet; Increased vegetable production; Increased non-agr. prod. such as baskets, pottery, agr. implements; Reduction of morbidity of endemic diseases; Improved diet through increased calories & varied diet; More time available for family activities. Multi-donor assistance effort exists in area.	Review agricultural statistical data. Review of health data. Review of donor assistance programs. Review of Cameroon's development programs.	Assumptions for achieving goal targets: Donor assistance efforts focus on rural poor. Cameroon Government continues its emphasis on growth with equity in rural areas. High correlation between availability of water, on one side, and health and economic growth on other in Mandara region.
Project Purpose: Provide a source of year-round water supplies as a prerequisite for complementary development projects.	Conditions that will indicate purpose has been achieved: End of project status. 16,634,000 m^3 of potable water will have been available to 102,000 residents by 1997. At least 1 complementary project has been initiated as a result of the dams/reservoirs. At least 1 complementary wells project made possible.	Testing of water quality. Review of health statistics. Review of other donor assistance programs and Ministry of Plan's project planning unit.	Assumptions for achieving purpose: That access to reservoirs by people and animals is limited. That filtration materials are changed annually. That there is no standing water downstream of dams.
Outputs: Dams. Health monitoring studies. Nutritional baseline data. Villagers educated in relationship between health and water. Village representatives organized and trained in maintenance of dams. Development of an organized body to pursue economic development goals of region.	Magnitude of Outputs: 5 dams providing potable water to 13,020 families by 1983. 5 Annual Health Reports by 1983. 1 Nutritional Baseline Data covering sample of 1,000-2,000 children aged 0-5 years by 1982. 1 Mandara Area Regional Development Authority est'd by 1983. 3 villagers trained in dam maintenance per site. 16,634,000 villagers trained in health protection & relationship between water & health.	Engineers' field visits. Health and nutritional reports submitted to Mission.	Assumptions for achieving outputs: GURC will establish coordinating authority. Sufficient numbers of people will be available to work at each dam site. Dispensary Health Personnel & MOH cooperate.
Inputs: Contract services Personnel Equipment Commodities Building and Land	Implementation Target (Type and Quantity) AID: 20 py engineering services 1100 py construction labor construction equipment, gas, oil 6000 tons cement WORLD BANK: 4 py engineering services 2000 tons cement, const., equip. GURC: 600 py const. labor & coordinating services, offices, storage areas, maintenance yard, land for dams/reservoirs	AID records GURC records World Bank records	Assumptions for providing inputs: -Engineering firm able to provide engineering services -PC will cooperate

50

ANNEX D

STATUTORY CRITERIA CHECKLIST

Project Checklist

A. GENERAL CRITERIA FOR PROJECT

1. App. Unnumbered: FAA Sec. 653(b)

(a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that figure plus 10%)?

FY 1979 A.I.D. Congressional Presentation describes the project.

2. FAA Sec. 611(a)(1). Prior to obligation in excess of $100,000, will there by (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?

Yes.

3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance.

Legislation not required.

4. FAA Sec. 611(b): App. Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1973?

Not applicable

5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified the country's capability effectively to maintain and utilize the project?

Yes.

6.	FAA Sec. 209, 619. Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs. If assistance is for newly independent country, is it furnished through multilateral organizations or plans to the maximum extent appropriate?	This project has been developed in conjunction with and complements World Bank.
7.	FAA Sec. 601(a): (and Sec. 201 (f) for development loans). Information and conclusions whether project will encourage efforts of the country to (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and saving and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.	This project will assist (e) "improve the technical efficiency of agriculture" by minimizing the time spent in collecting water thereby releasing time that can be spent on other activities (agricultural and non-agricultural).
8.	FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprises).	Technical assistance, supplies and equipment purchased under this project will be from the U.S.
9.	FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.	The GURC will make a substantial local currency contribution to this project to cover local personnel salaries and support; building and office space and land.
10.	FAA Sec. 612(d). Does the U.S. own excess foreign currency and, if so, what arrangements have been made for its release?	No.

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(c); Sec. 111; Sec. 281a. Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production, spreading investment out from cities to small towns and rural areas; and (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions?

This project will be of direct benefit to the rural poor and will directly involve them in its implementation. It is labor-intensive.

b. FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available:

(1) (103) for agriculture, rural development or nutrition, if so, extent to which activity is specifically designed to increase productivity and income of rural poor; 103A if for agricultural research, is full account taken of needs of small farmers.

This project is designed to increase the availability of potable water. The release time that will become available as a result of the project can be used for other economically productive activities.

c. FAA Sec. 110(a); Sec. 208(e). Is the recipient country willing to contribute funds to the project, and in what manner has or will it provide assurance that it will provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country)?

The recipient country will contribute at least 25% of the total cost of this project by funding certain local costs of salaries for Cameroonian personnel, provide building space, and land.

d. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"?

e. FAA Sec. 207; Sec. 113. Extent to which assistance reflects appropriate emphasis on; (1) encouraging development of democratic, economic, political, and social institutions; (2) self-help in meeting the country's food needs; (3) improving availability of trained worker-power in the country; (4) programs designed to meet the country's health needs; (5) other important areas of economics, political, and social development, including industry; free labor unions, cooperatives, and Voluntary Agencies, transportation and communication; planning and public administration, urban development, and modernization of existing laws; or (6) integrating women into the recipient country's national economy.

The major effect of this project will be to directly benefit women and provide them additional time that can be used for economically productive activities.

f. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civic education and training in skills required for effective participation in governmental and political processes essential to self-government.

This project is designed to provide a basic requirement--water--to the people in one of Cameroon's poorest areas.

g.	FAA Sec. 201(b)(2)-(4) and -8; Sec. 201(e); Sec. 211 (a)(1)-(3) and -(8). Does the activity give reasonable promise of contributing to the development: of economic resources, or to the increase of productive capacities and self-sustaining economic growth; or of educational or other institutions directed toward social progress? Is it related to and consistent with other development activities, and will it contribute to realizable long-range objectives? And does project paper provide information and conclusion on an activity's economic and technical soundness?	Yes. The project is specifically designed to do so.
h.	FAA Sec. 201(b)(6); Sec. 211 (a)(5), (6). Information and conclusion on possible effects of the assistance on U.S. economy, with special reference to areas of substantial labor surplus, and extent to which U.S. commodities and assistance are furnished in a manner consistent with improving or safeguarding the U.S. balance-of-payments position.	Project will utilize long and short-term U.S. technicians and U.S. equipment.

ANNEX E

611 (a) and (e) CERTIFICATION

Certification Pursuant to Section 611(a) of the Foreign Assistance Act of 1961, as Amended

I, Frederick E. GILBERT, have reviewed the following project documentation:

a) The Project Paper technical staff's oral and written comments.

b) Technical plans and cost estimates as prepared by SOGREAH and as presented in its technical study of February 1976.

c) The project description prepared by the World Bank for its portion of the project in May 1977.

As a result of this review, I believe that the $6.7 million to be contributed to the Mandara Mountains Water Resources project represents a reasonably firm estimate of cost to the United States Government. Furthermore, no additional legislative action on the part of the Government of the United Republic of Cameroon is required.

Frederick E. Gilbert
Acting Mission Director

Certification Pursuant to Section 611(e) of the Foreign Assistance Act of 1961, as Amended

I, Frederick E. GILBERT, the Principal Officer of the Agency for International Development in the United Republic of Cameroon, having taken into account the following:

A. The Minister of Economic Affairs and Planning has been charged with the responsibility to ensure necessary cooperation among the various departments and sections of the Cameroon Government to achieve effective coordination and implementation of the proposed project;

B. The emphasis the Government is placing on development projects that provide basic needs to the rural poor; and

C. The past record of the Ministry of Economic Affairs and Planning in the development and implementation of projects has shown that it has a genuine capacity to function in a coordinating role vis à vis other ministries with regard to area-specific development activities.

do hereby certify that in my judgement the Government of the United Republic of Cameroon will have the human and financial resources capability to maintain and utilize effectively the subject capital assistance project.

Frederick E. GILBERT
Acting Mission Director
USAID/Yaounde.

ANNEX F

CAMEROON REQUEST FOR ASSISTANCE

UNOFFICIAL TRANSLATION OF
LETTER RECEIVED IN FRENCH FROM:

MINISTRY OF ECONOMIC AFFAIRS & PLANNING
No. 5053/MINEP/VM/CT

DATED: September 17, 1976

ADDRESSED TO: The Director
Regional Development Office
for Central Africa

SUBJECT: Small Dams in the Mandara Mountains
"Special Fund for Rural Activities" Project

Dear Mr. Director:

I am pleased to inform you that it is the intention of my Government and the World Bank to finance a project entitled "Special Fund for Rural Activities" (SFRA), the final documentation of which is being finalized. This project will consist of the availability to the Government, through FONADER, of a credit fund aimed at financing a number of sub-projects having a direct impact on the economy of small farmers, though they are not of such consequence as to justify a separate financing.

The first phase of the project will be evaluated on and after October 25; it regards the Northern Province only and one of its key components is the construction of ten small dams in the Mandara Mountains. In view of the interest you take in the small dam project in Margui-Wandala, I would like to call your attention to the preparation of the SFRA project and I ask you to let me know if your Government is likely to be willing to finance this project, either immediately or at a later time. In any case, it would be desirable that a representative of your Agency take part in the evaluation of the project along with the World Bank representatives and, possibly those from the FAC on and after October 25. In the event of your confirming your interest, I will forward to you, as soon as possible, a copy of the feasibility study. You will find enclosed herewith, for your information, two notes written by my services on that matter.

(French closing)

/s/ Louis Claude Nyassa
Secretary General

MISSING PAGES

NO. 59 60

ANNEX H

INITIAL ENVIRONMENTAL EXAMINATION

Project Location: United Republic of Cameroon

Project Title: MANDARA MOUNTAINS WATER RESOURCES, 631-0012

Funding (FY 1979 - FY 1983): $6,656,000

Life of Project: 5 years

IEE Prepared by: Date:_____

Eric N. Witt

Agricultural Economist

USAID/Yaounde

Environmental Action Recommended: Negative Determination

Concurrence: Date: October - 1978

Frederick E. Gilbert

Acting Director

USAID/Yaounde

Assistant Administrator's Decision:

(Approval or Disapproval of Environmental Action Recommended in the IEE)

Approved:_____

Disapproved:_____

Date:_____

I. EXAMINATION OF NATURE, SCOPE AND MAGNITUDE OF ENVIRONMENTAL IMPACTS

A. DESCRIPTION OF PROJECT

The Mandara Mountains Water Resources project proposes the construction of 35 water catchment dams in the Mandara Mountains region of North Cameroon.

The water catchment dams will be built of rubble filled concrete. The height of the dams will range from 4.5 to 10 meters with an average height of 7.4 meters. The maximum volume of water retained by the dams will range from 18,000 to 108,000 m^3 with an average volume of 44,000 m^3. The dams will be built in narrow mountain valleys. The Mandara Mountains region consists of old pre-cambrian rocks of the basement complex. Geologically they are igneous granites or metamorphic anatorites and gneisses. The altitude of the region is approximately 1,700 meters. The vegetation of the region is characteristic of the Sudano-Sahelian dry savannas.

The project area is one of the most densely populated areas in Cameroon (the project area of Margui-Wandala has 69.6 inhabitants per km^2 compared to an average density in Cameroon of 16.5 inhabitants per km^2) and has a population of 496,000 with 98 percent of the people living in the rural areas. The region has a short rainy season of three to four months followed by a long dry season. Agricultural activities (millet, sorghum and peanuts) are carried out during the rainy season. It is one of the poorest areas of Cameroon with per capita incomes of $18 annually (not including a value for subsistence agricultural production). The region is further characterized by low school attendance rates and, as a result, low literacy rates. The people of the area represent 27 ethnic groups and six languages are spoken in the region.

The purpose of the project is to increase the availability of drinking water on a year-round basis. Women of the Mandara Mountains are walking up to 14 km one way to collect water for their families' use. The project is seen as a means of reducing the womens' time consuming water collection activities.

Prior to requesting AID's assistance with the project, the Cameroonian Government had undertaken two major studies of the problem of water in the North. The first was a UNDP sponsored study entitled Ground Water Investigations and Pilot Development in North Cameroon. Due to the geologic characteristics of the Mandara Mountains, the report recommended that small water catchment dams be constructed to provide a source of drinking water. The Government of Cameroon then commissioned the Societe Grenobloise des Etudes d'Amenagements Hydraulique (SOGREAH) to undertake a survey of possible dam sites in the Mandara region and to assess the engineering feasibility of constructing small water catchment dams. SOGREAH prepared a study entitled Inventory of Dam Sites in the Mandara Mountains. Out of 151 sites studied, 57 water catchment dams were recommended for construction. At this point, the Government of Cameroon requested donor assistance to finance the construction of the water catchment dams. The World Bank has approved a project which will include the construction of ten of the dams and AID is considering the construction of 35 dams.

The PID for this project was submitted prior to the requirement for the inclusion of the Initial Environmental Examination. As the two studies undertaken by the Cameroon Government were technical, AID considered it appropriate to study the health implications of the water catchment dams and the sociological implications of the project as an integrated part of the project design process.1/

Three types of studies have been completed during the preparation of the project. They include:

1. Environmental Health.

   "The Potential Health Impact of the Construction of Fifty-Seven Dams in the Mandara Mountains", by C. Ripert, professor of parasitology at the University Center for the Health Sciences (CUSS) in Yaounde; S. Skobo, Director of Parasitology at the University Center for the Health Sciences; and D. Palmer, Public Health Specialist with USAID/Yaounde.

   "An Entomological Study", by Professor Ripert, Dr. Ekobo, Mr. Palmer, Mr. P. Enyong, a medical entomologist for ONAREST, and Mr. M. Ali, an assistant medical entomologist.

2. Sociological.

   "People and Water", by M. Fikry, anthropologist; and F. Tchala-Abina, lecturer in rural sociology at the National Advanced School of Agriculture (ENSA) in Yaounde.

3. Economic Baseline.

   "Economic Survey Intended for the Small Dams Project in the Mandara Mountains Region", by the Bureau d'Etudes pour le Developpement Integre in Yaounde.

Information contained in these studies has been used in the preparation of the IEE. In addition, the UNDP sponsored study and SOGREAH report were used.

The team evaluating the potential health impact of the project completed its first study, with AID funding, in December 1977. Dr. Ekobo, one of the team members, presented the team's findings to OCEAC's Twelfth Technical Conference in April. Health specialists from Cameroon and other Central West African nations attended the conference. Based upon discussion and recommendations of the conferences a second trip was made to the North in July during the rainy season. Because of the World Bank's interest in the health study, it funded the non-AID team members' travel costs. The two health studies have enabled the GPRC and Mission to discuss the relationship

The World Bank approved its project on the basis of the SOGREAH report alone. The IBRD funded project has participated with AID in the health studies of the area.

of this development project to and its implications for the population. Departmental officials in Margui-Wandala, provincial officials in Garoua, and national officials (including the Minister of Economic Affairs and Planning) in Yaounde have all discussed the relationship of the project to its health implications. While there is no evidence of significant adverse environmental health effects as a result of the project, they fully support the recommendations made by the design team to enhance the design of the dams and sites surrounding the dams as well as to include a project component which will continually monitor the health effects of the water catchment dams.

B. IDENTIFICATION AND EVALUATION OF ENVIRONMENTAL IMPACTS

1. Land Use

Farmers of the region have terraced many of the mountainsides for agricultural purposes. At about 20 percent of the sites the proposed reservoir will inundate two or three terrace levels. In the course of the sociological study the people of the area stated that the farmer who had land flooded would have access to other lands. The customary land tenure system is sufficiently flexible to allow for this kind of movement.

It is expected that there will be some movement of population toward the dam sites. These movements will be in terms of two to five kilometers and are not expected to be significant. The multiplicity of ethnic groups and language differences tends to keep people in one area. Differences in religion mitigate against large scale migration also. The people of the mountains are animists or Christians whereas the people of the plains outside the project area are Muslims.

As a result of the dams, there will be year-round seepage from the reservoir (a characteristic common to all dams). The Government of Cameroon is considering a reforestation project in the area below the dam. This would take advantage of the moisture in the land, be a beginning to the long-term problem of providing additional fuel sources, and be complementary to the Government's participation in the Operation Sahel Vert program.

Another alternative to the use of the seeping water is to impound it for irrigated rice or vegetable production. The Ministry of Agriculture and the health team are concerned about this use of water however. It is considered that irrigated plots would be excellent breeding sources for certain water-borne diseases.

As a result of this concern, the dams will be constructed with a concrete lip to lead water away from the dam and the land below the dam will be graded to lead water away and avoid standing puddles of water.

The farmers of the region do have a few domestic animals such as goats and chickens. The animals are kept in and around the family compound during the agriculture growing season so that the crops will not be eaten. During this period forage is brought to the animals. Water is brought to the

animals during the dry season. In order to prevent village animals from going directly to the reservoir for water, living barriers of thorn bushes or cacti will be planted to prevent access. This type of barrier is typically used by the people to prevent their animals from entering vegetable gardens or portions of the family compound.

Due to the height and ruggedness of the mountains, the region is not part of the northern transhumance zone among Nigeria, Cameroon and Chad. Therefore, herds of cattle will not be utilizing the reservoirs as water sources.

2. Water Quality and Health

These two impacts will be discussed together because of their interrelationship.

The project will create 35 bodies of standing water and the World Bank is financing 10 additional dams. The AID Mission and the World Bank project have funded an environmental health team for two visits to North Cameroon. One field trip was made in December 1977, during the dry season, and another trip was made in July 1978, during the rainy season. The environmental health team's specific tasks were to:

-- Assess the current health status of the people as it relates to the project's activities;

-- Determine the health impact of the construction of the dams; and

-- Make recommendations to eliminate or minimize possible negative health impacts of the proposed dams.

The conclusion of the environmental health impact team was that the health problems that may be caused by the construction of the dams in the Mandara Mountains region will be insignificant in comparison to the economic and social benefits gained. The conclusion, however, will be valid only if proper precautions are taken. The team made a series of suggestions that have been incorporated into the project design. One set of recommendations was concerned with the design of the dam and the area around the dam. Additional recommendations were made for health education activities.

There are a variety of water-vector borne diseases and fecally related diseases in North Cameroon. The following is a list of the diseases found in the North, and for each disease, suggestions made by the environmental health team to reduce the opportunity of negative health impacts.

(A) MALARIA

--Epidemiology

In 1959, prior to a re-organization of the anti-malaria campaign, P. Cavalie and J. Mouchet undertook a epidemiological study of malaria in the Diamare, Margui-Wandala and Mayo-Danai departments. The results of

this study show that Plasmodium falciparum is responsible for more than 95 percent of the infections whereas P. malariae, alone or associated to the previous species, can be found in less than 5 percent of cases.

Malaria, alone or associated with pulmonary or digestive infections, is responsible for more than half the cases of child mortality in North Cameroon. Fourteen species of the Anopheles type mosquito have been identified in the region, but only A. gambiae and A. funestus are vectors of malaria.

A. gambiae can be found in every village; however, in the dry season, it is absent from the places where no larval shelters are found. This fact is particularly noticeable in villages located far from temporary rivers and in the mountainous areas of the Diamare and Margui-Wandala. The typical larval shelters of the species are sunlit water bodies without vegetation. The water must be frequently changed as larva do not tolerate an excess of dissolved organic matters. The shelters during the rainy season are found in the slopes where an impermeable ground allows rain water to accumulate. Residual shelters are formed when the "mayos" dry up, leaving ponds which are very favorable to the development of A. gambiae.

A. funestus is not as frequently found in the mountainous areas as A. gambiae. The immature forms can be found mainly in clear standing water with a profuse vertical vegetation. The typical shelter is the "yaere", a vast marsh, having standing water from August to January. During the rainy season, the flooded rangeland provide good shelters both in the mountains and in the plains. After the rains, however, host shelters dry up.

--Team Recommendations

The team believes that there is likely to be some increase in incidence of malaria due to the increased number and permanence of water bodies created by the project dams. Malaria is, as previously noted, the leading cause of reported morbidity. It is not thought, however, that there will be a significant increase in the incidence of malaria. The morbidity statistics for malaria at the Djingliya dispensary, which serves an area where a small dam has been in existence for three years, shows no obvious higher incidence of malaria per population than other areas without existing dams. A very few mosquitoes were collected near the existing dam in Djingliya, and it did not seem that the reservoir or the water flowing below the dam provided an optimum breeding habitat for mosquitoes. During the July field trip few Anopheles mosquitoes were found.

There is little that can be done to insure that there will not be an increase in malaria due to the construction of the dams. It is not recommended that the Government of Cameroon be charged with application of insecticide, since this is not considered to be feasible and may be dangerous. Emphasis on health education efforts throughout the entire area should be made to encourage sanitary improvements, such as filling and draining any non-utilized small bodies of water to eliminate breeding habitats of mosquitoes.

(B) INTESTINAL and URINARY SCHISTOSOMIASIS

--Epidemiology

The geographic distribution of human schistosomiasis in Cameroon was studied by R. Deschiens, A. Delas, S. Ngalle-Edimo and A. Poirier in 1968. In the North, urinary schistosomiasis, transmitted by S. haematobium and intestinal schistosomiasis, transmitted by S. mansoni, are extremely prevalent. A few cases of schistosomiasis transmitted by S. intercalatum can be found in the Tokombere area.

In Maroua, according to A. Kegoum (1977), only 1.4 percent of the people living in the Doualare quarter emit S. mansoni eggs in their stools. In Koza, the figures are higher and have been up to 11.2 percent of the examinations performed in the Adventist Hospital (Dr. J. Steveny, 1975); 22 percent of school children emit S. haematobium eggs in their urine.

Twenty-one water points surveyed between December 14 and 21, 1977, in North Cameroon showed the presence of snails. Small "mayos", drainage canals, ponds, irrigation canals, springs and dam overfalls were visited. Bulinus globusus, intermediate host of S. Haematobium was found nine times; Bulinus forksalii, intermediate host of S. intercalatum was found ten times and Biomphalaria pfeifferi, intermediate host of S. mansoni was found seven times.

Two dams existing in the region were studied in detail. The dam providing Mokolo with water has the shape of a basin closed by a concrete wall with granite banks. There is no water vegetation in the reservoir and the water level varies noticeably around the year. No snails were found in the lake. Biomphalaria pfeifferi and Bulinus globusus, on the contrary, can be found in the overfall as well as in the river bed downstream. This area has water year-round emanating from the run-off of the dam.

The Djingliya dam is similar to the Mokolo dam in its size and capacity. The valley is closed by a wall made of granite blocks sealed with concrete. There is not vegetation in the lake and the water level varies significantly according to the season. No snails were found in the lake, but Biomphalaria pfeifferi was found in the river downstream, where rice paddies were being cultivated.

--Team Recommendations

As much as it is possible, the banks of the reservoirs created by the dams should not provide an environment for snails. This will entail constructing neat, steep slopes at least to the maximum level of reservoir during the rainy season. The banks should be free from rocks, mud and aquatic vegetation.

The team believes that in cases where significant evaporation will take place during the dry season the reservoirs will not provide a suitable environment for snails. Most snails tend to establish themselves in shallow water along the shoreline, and the water level of the reservoirs are expected to fluctuate between the wet and dry seasons to an extent that a favorable

environment for snails can not exist. Host snails, especially Biomphalaria, which make little attempt to retreat as the water level drops, will be exposed and desicated.

If it is found or suspected that there will not be significant water-level fluctuation of the reservoirs during the year because of the severe gradient of the lake shore, excessive shade in the area, etc., it will be necessary to assure that the above measures are taken.

It is recommended that there be no human and animal contact with the reservoir and the stream that enters the reservoir, which will provide a significant area of shallow water environment. To avoid contact with the reservoirs, it is recommended that a thorn fence be constructed around the reservoir. Thorn fences are common to the project area and will be of little expense.

The dam itself should be constructed so that there will be as little run-off as possible. The dams will seep water at the base of each dam and this has occurred at both the existing Djingliya and Mokolo dams. The seepage can not be avoided and it will be necessary to assure that the water issuing forth from the dams is not allowed to provide a favorable environment for aquatic plants and, consequently, for snails that may provide the intermediate host for schistosomiasis. The possibility of having a small stream and/or water bodies below the dam will be the most serious health risk from the dam sites. This area will present the most favorable environment for the transmission of schistosomiasis as well as other water borne diseases.

Depending on the individual dam site, provisions will have to be made to prevent water bodies forming below the dams, or human and animal contact with these water bodies. Team suggestions include:

(1) Constructing an open cement chute below the dam, directing the run-off to an area where it will not provide an environment for snails. A cement chute will not allow the growth of aquatic plants and water velocity will tend to sweep away any snails that attempt to establish themselves there;

(2) Fencing off any water collecting in areas below the dam;

(3) Diverting the water flow to any subterranian cavern--if such exists in the area.

There will be a tendency for local people to utilize any water bodies below the dams for irrigation. It was noted, both at Mokolo and Djingliya, that rice paddies were under cultivation below the existing dams. Both these areas harbored host snails for schistosomiasis. The cultivation of irrigated crops in this area is to be discouraged.

The wells or watering places for people and animals will likely be located below the dam area. It is important that water can not overflow out of these structures causing water bodies to form. Access to these structures must be at all times free of standing water.

(c) ONCHOCERCIASIS

--Epidemiology

The centers of onchocerciasis in North Cameroon, as described by J. Anderson, H. Fugelsang and C. Marshall (1974), are located in the valleys of the Vina and the Mbere, which are affluents to the Logone River, and are found in the valley of the Benoue and its affluents. An onchocerciasis study was undertaken by Doctor Steveny in 1977 in the Koza area in the northern portion of the project area.1/ A survey of twelve villages of the region and involving 675 people showed that 61.2 percent are infested by microfilaria of O. volvulus. These were found in skin snips taken at the iliac crest.

Onchocerciasis lesions presented by villagers are typical of the savanna region. Nodules (on the hips), skin strophy, "lizzard skin" and pre-tibial discoloration are symptoms found in the population studied by Steveny. There was also some blindness noted among the older people.

During the dry season, immature forms of the black fly are found in the permanent streams of the project area. Those found belong to the following species:

- At the Djingliya dam, downstream in the mayo, and on the dam overfall: Simulium (Eusimulium ruficorne) and, apparently, Simulium damnosum.

- At the mayo near Gousda, having a rouch granite sand bed, on plants: S. (Metomphalus) medusaeforme hargreaveni.

- At the mayo near Kilda, granite flags, waterfalls and sand bed, on immerged plants: S. (Eusimulium) ruficorne, S. (Meilloniellum) adersi, S. (Metomphalus) medusaeforme hargreaveni.

- At the Mayo Taanaga, under the bridge on Mokolo-Goza road, granite and sand: S. (E.) ruficorne, S. (Met.) medusaeforme hargreaveni, and S. (Meil.) adersi.

Simulium damnosum, the only vector of human onchocerconia known in North Cameroon, was apparently found at the Djingliya dam during the survey. In the dry season, the hydrographic network of the region, tributaries of the Logone River, is almost completely dry. During the rainy season, it appears that the vector black flies are carried upstream from tributaries of the Vina River, such as the Touboro in Cameroon and Baibokoum River in Chad.

1/ The prevalence rates observed in the Koza study are as follows: Nguetchwewe (45, 69%), Gokoro (132, 79%), Mozogo (50, 22%), Gabanae (50, 86%), Nararawa (50, 74%), Monkota (62, 48%), Mawa (50, 68%), Gabona (84, 73%), Koofta (22, 90%), Koza (50, 44%), Djingliya (50, 36%), Gousda (30, 7%).

During the rainy season black flies were found at the Djingliya dam. Adult flies were captured around the dam and eggs and larvae were found on the steps of the dam. The structure of the dam provides an ideal breeding site for this insect during the rainy season. The flies collected are of the genus Simulium, and some of them were preliminarily identified as Simulium damnosum. While this has not been finally confirmed, it is necessary to proceed on the assumption that onchocerciasis is a danger that must be minimized in planning the design of the dams and the run-off areas below the dams.

--Team Recommendations

Onchocerciasis is, as stated, a serious problem in the area of Koza and Tokonbere. There will be three dams (two by the World Bank and one by AID) constructed in the most seriously affected area. However, because of the long flight range of the black fly, it is important to assure that the dams in the project area do not create any rapidly running streams, which will create the breeding environment for the female black fly (genus Simulium).

As in the recommendations for schistosomiasis, measures will have to be taken to control water flowing from the base of the dams. The use of insecticides to control vector larvae, as for the control of other disease agents of concern in this project, is not recommended. The team believes that the use of insecticide will not be feasible because of cost, administrative constraints and isolation of the area.

The physical structure of the dams should not be designed in the form of a staircase as is the case of the Djingliya dam. The recommended shape should be in the form of an "S", as the present small dam at Mokolo. The run-off over the dam should be concentrated to one side of the structure. This will provide an adverse environment for black fly breeding.

(D) GUINEA WORM DISEASE (DRACONTIASIS)

--Epidemiology

The epidemiological study of Dracontiasis among the Podokwo population of the Mandara Mountains was made by H. Issonfa (1976). The most important center of Guinea worm disease in the project area is located in Oudjilla and the adjacent area. The disease, however, can also be found in other villages such as Doukoula and Gavara near Koza, and Gokoro.

In Oudjilla, 26.6 percent of the 944 patients examined were carrying Guinea worms and 75.7 percent had been infested at least once in their life. Both male and female were infested, especially between 6 and 33 years of age.

The number of worms varies from 1 to 5 per carrier. In 93 percent of cases the legs are infested, in 47 percent of cases the feet are attacked. Less frequently infested are the head (0.3 percent), the breasts (0.3 percent), the external genitals (0.8 percent). Definitive anchylosis of the ankle is frequent and the knees are often attacked.

The prevalence of the disease varies according to whether water is hauled from a modern well with lips or from an unprotected traditional well. To collect water, the people must enter the traditional wells up past their ankles (where the nematode infection usually occurs) and, thus, they contaminate the well with nematode larvae. The larvae will infect humans when the contaminated water is drunk.

--Team Recommendations

Guinea Worm Disease is a serious health problem in the Oudjilla village area. It is also found in the villages of Doukoula, Gokoro and Gabora near Koza. For the construction of the dams in the project, it is recommended that a special effort be made to prevent humans entering the water. It is also recommended that emphasis be put on health education efforts in the infected areas. Any health education efforts should include the presentation of the mode of Guinea worm infection and stress why it is wise to boil water. It is to be understood, however, that the team believes that environmental change, i.e. barring entrance to water, is the more important and feasible method than an attempt to change the practices of the people in the project area.

(E) CATTLE LIVER FLUKE-WORM (FASCIOLA GIGANTA)

--Epidemiology

Lymnaea nacalensis, intermediate host of the cattle liver fluke-worm, Fasciola giganta, is very frequent in the North. This snail was found in 3 out of the 21 stations surveyed. Human fasciolisis caused by this parasite is scarce, but it does cause important losses among livestock according to the annual reports of the Maroua Veterinary Sub-Sector. The statistics of the slaughterhouse in Maroua verify this.

Team Recommendations

It is important to prevent cattle from coming into contact with the reservoir or any water bodies below the dam that may harbor the vector snail.

(F) FECALLY RELATED DISEASES

--Epidemiology

Bacillary dysentary, amebic dysentary and other diarrheal diseases are very prevalent and the second leading cause of morbidity in the project area. Intestinal nematode worm infections (ascariasis, etc.) exist in the project area but are not serious. Other parasitic diseases exist in the project area, but are not considered to be of serious consequences to the project.

A study made by E. Kegoum (1977) of a population sample of the Doualare area showed the following results:

> Trichomonas intestinalis (11.9 percent), Taenia saginata (9.3 percent), Necator americanus (2.5 percent), Ascaris lumbricoides (1.4 percent), Strongyloides stercoralis (0.1 percent).

The presence of skin Leishmaniosis in North Cameroon has been detected for 40 years, but the center near Mokolo was described in 1976 by K. B. Duibrilla. The disease appears during the rainy season with the multiplication of the vector phlebotomi. Fifty-eight patients were identified in 1976 and nineteen among them were native of Mandaka. The uncovered parts of the body, face and members are particularly attacked. Leishmaniosis will not affect the project.

--Team Recommendations

Fecally related diseases are prevalent in the project area. This problem requires that all water bodies created by the dams be protected from fecal contamination by the population using the water source.

It did not appear to the team members that the local population used latrines to any extent. It will, therefore, be important to assure that all bodies of water (the reservoir, the area above and the banks of the reservoir, and the water bodies below the dam) are not contaminated with human or animal feces. Needless to say, contamination can take place not only by direct contact but indirectly, especially during the rainy season when fecal material may be washed into the reservoir.

It is recommended that:

-- Access to all reservoirs be restricted. A thorn fence, mentioned previously, appears to be the most reasonable means to do this;

-- Pit latrines be constructed on the path leading to the water source--close enough and convenient to be used by those coming for water but far enough away so as to prevent any contamination; and

-- Health education efforts be directed towards fecally related diseases.

SUMMARY

Overall morbidity for the project area is sketchy and somewhat outdated. What follows are figures obtained at the Ministry of Health, Bureau of Statistics in Yaounde, for the Department of Margui-Wandala which encompasses most of the project area, excepting the region around Meri. The latest statistics available are for 1974.

Selected Morbidity Statistics for the
Department of Marqui-Wandala, 1974

Disease	Males	Females	Total
Malaria	22,505	21,248	43,753
Dysenteries	9,919	9,145	19,064
Intestinal worms	5,154	4,704	9,858
Schistosomiasis (Intestinal)	1,172	1,032	2,204
Schistosomiasis (Urinary)	1,238	800	2,038

NOTE: According to the 1976 Census, the population of Margui-Wandala was 496,000.

In summary, malaria, bacillary and amebic dysentaries, diarrheal diseases, intestinal and urinary schistosomiasis, and onchocerciasis draconcosis, are the major human diseases found in the region where the project will take place. These diseases are water borne, transmitted by an organism developing on a vector living in water all or part of its life, or a disease whose transmission is greatly affected by water.

The prevalence of these diseases, and liver-fluke worm disease in cattle, is likely to be most influenced by modifications occuring in the hydrographic network through the dam construction. Diseases such as amoebiasis and intestinal worms (ascaridiosis, nectorosis) though transmitted by water wet ground, will probably be less influenced by the project. The prevalence of skin leishmaniosis and taeniasis will not be affected by the project.

3. Atmospheric

The project is not expected to have any effect upon the atmosphere. During the construction of each dam there will be some noise and dust but since the average length of time to construct a dam will be 2 1/2 months it is not expected to cause any problems.

4. Natural Resources

The project will create a year-round source of water where none had existed during the dry season.

Water-vector borne diseases were discussed in Section 2. The project area is in the semi-arid north and one of the activities that may be undertaken as a result of the project is a reforestation activity. This would include species of trees suitable for firewood and fruit trees. This activity, though still in a planning stage, could have a positive effect on the region's natural resources.

5. Cultural

During the course of the field work that had been done for the project design, one proposed dam site was identified as a traditional alter place. The site will be moved a few yards upstream from the original site. The people of the area are in accordance with the shift.

The project region has one of the highest population densities in Cameroon. The people of these mountains are Christians or animists whereas the people of the lower plains are generally Muslims. There has been pressure on the varied ethnic groups of the region to move to the plains. This pressure has been the result of a lack of resources in the mountains, such as sufficient water; a sense of isolation brought on by poor roads and lack of opportunities for employment, both on and off the farm; and occasional attempts at planned resettlement projects by the government. The provision of more readily available water through the project will make the option of staying in the mountains more feasible and attractive for those who so wish.

In addition, the provision of water will have a significant impact upon the family, particularly women. A major portion of a woman's time is spent in carrying water for her family's use. For the families that will be served by the small dams there will be increased time available for other activities such as child and home care, agricultural and artisanal activities as well as leisure time.

6. Socioeconomic

The project has been developed in response to the needs of the people for drinking water. The rationale for the project, therefore, is on a social rather than an economic basis. There will be short term economic--or monetary--gains to the people in the area being served by the dam. During the construction of each dam, people in the area will have short term employment opportunities. Since this area has an average per capita income of $18 annually, even these short term employment opportunities will have a significant impact. It is not planned that the reservoirs will be used for irrigated agriculture activities and therefore there will be no direct economic benefit.

The proposed project is of great interest to Cameroonian officials at the departmental, provincial and national levels. The Mission has received a request from the government to assist in developing a series of follow-on activities or an integrated rural development project. Therefore, secondary or complementary effects of the project will likely have a greater economic effect, e.g., fish culture.

7. Health

The health implications of the project have been discussed in Section 2 in connection with water quality.

IMPACT IDENTIFICATION AND EVALUATION FORM

Impact Areas and Sub-areas	Impact Evaluation
1. LAND USE	
A. Changing the character of the land through:	
Increasing the population	L
Extracting natural resources	N
Land clearing	N
Changing soil character	N
B. Altering natural defenses	N
C. Foreclosing important uses	N
D. Jeopardizing man or his works	N
2. WATER QUALITY AND HEALTH	
A. Physical state of water	L
B. Chemical and biological states	L
C. Ecological balance	L
D. Changing a natural environment	L
3. ATMOSPHERIC	
A. Air additives	N
B. Air pollution	N
C. Noise pollution	N
4. NATURAL RESOURCES	
A. Diversion, altered use of water	L
B. Irreversible, inefficient commitments	L
5. CULTURAL	
A. Altering physical symbols	L
B. Dilution of cultural traditions	L
6. SOCIOECONOMIC	
A. Changes in economic/employment patterns	L
B. Changes in population	L
C. Changes in cultural patterns	L

N - No environmental impact
L - Little environmental impact
M - Moderate environmental impact
H - High environmental impact
U - Unknown environmental impact

II. RECOMMENDATION FOR ENVIRONMENTAL ACTION

The project will have no significant adverse effect on the environment and therefore a negative determination is recommended.

The project design process has resulted in a series of recommendations by the environmental health specialists, the sociologists, the REDSO/WA engineer, and GURC officials. Based on the recommendations of the various experts involved in the project design process and with the support of GURC officials at each level of the Government it is expected that the project will have a positive impact upon the rural people in the densely populated and very poor Margui-Wandala department.

ANNEX I

DRAFT GRANT AUTHORIZATION

AID Loan No.:
Provided Under: FAA Sec. 103
For Mandara Mountains Water Resources

Pursuant to the authority vested in the Administrator of the Agency for International Development (A.I.D.) by the Foreign Assistance Act as amended, and the delegations of authority issued thereunder, I hereby authorize the establishment of a grant pursuant to Section 103 FN of said Act to the Government of the United Republic of Cameroon (Borrower) of not to exceed six million, six hundred fifty-six thousand U.S. dollars ($6,656,000) to assist in financing United States dollar and local currency costs (such local currency not to exceed the equivalent of two million, nine hundred sixty-six thousand U.S. dollars ($2,966,000) of the general construction and engineering contract for the Mandara Mountains Water Resources project.

This project consists of providing technical assistance, equipment and services for the construction of approximately 45 gravity over-spill dams of rubble filled concrete. Their height will range from 4.5m to 10m and they will have a storage capacity ranging from 18,000m^3 to 108,000m^3. An additional concrete lip will be constructed on the downstream slope of the dam to lead over-flowing water or seepage away from the dam. One or two water distribution points (which will look like wells) will be built downstream of each dam, and will be connected to the reservoir by pipes. Water will be filtered between the reservoir and the water point. Essential to this project is the health survey and health education component.

The creation of these dams will assure year round water supply for approximately 13,020 families, thereby freeing time for agricultural and non-agricultural production, and leisure. This project is considered the prerequisite for any further development projects in the region.

Conditions Precedent

Other than standard legal and budget conditions, there are no particular conditions precedent in this project.

Covenants

The GURC will covenant to (a) review and report twice per year on the incidence in the project area of malaria, schistosomiasis, onchocerciasis and guinea worm (dracunculiasis) and (b) conduct yearly environmental health in the project area, inspections of dams completed with A.I.D. financing.

Waivers

Based on the justification set forth in Annex G of the project paper, I hereby waive AID's nationality requirements to authorize the inclusion of

cooperating country Cameroon to be included in Geographic Code 941 for the procurement of up to but not to exceed $1,700,000 for engineering and related services, provided that the contractor meet AID's approval and be required to meet standard AID procurement procedures.