PN-AAT-429

WATER AND SANITATION FOR HEALTH PROJECT

Operated by
CDM and Associates

Sponsored by the U.S. Agency for International Development

1611 N. Kent Street, Room 1002
Arlington, Virginia 22209 USA

Telephone: (703) 243-8200
Telex No. WUI 64552
Cable Address WASHAID

The WASH Project is managed by Camp Dresser & McKee International Inc. Principal cooperating institutions and subcontractors are: Associates in Rural Development, Inc.; International Science and Technology Institute, Inc.; Research Triangle Institute; Training Resources Group; University of North Carolina at Chapel Hill.

OUAGADOUGOU'S WATER SUPPLY AND WATER SUPPLIES FOR DISPLACED PERSONS IN BURKINA FASO

WASH FIELD REPORT NO. 144

AUGUST 1985

Prepared for
USAID Mission in Burkina Faso
Activity No. 143

WASH FIELD REPORT NO. 144

OUAGADOUGOU'S WATER SUPPLY AND WATER SUPPLIES FOR DISPLACED PERSONS IN BURKINA FASO

Prepared for the USAID Mission in Burkina Faso
under WASH Activity No. 143

By

Ralph Preble
and
Prescott Stevens

With a supplement
by Roger Wood

August 1985

Water and Sanitation for Health Project
Contract No. 5942-C-00-4085-00, Project No. 936-5942
is sponsored by the Office of Health, Bureau for Science and Technology
U.S. Agency for International Development
Washington, DC 20523

BURKINA FASO

LA PATRIE OU LA MORT NOUS VAINCRONS

CARTE ADMINISTRATIVE

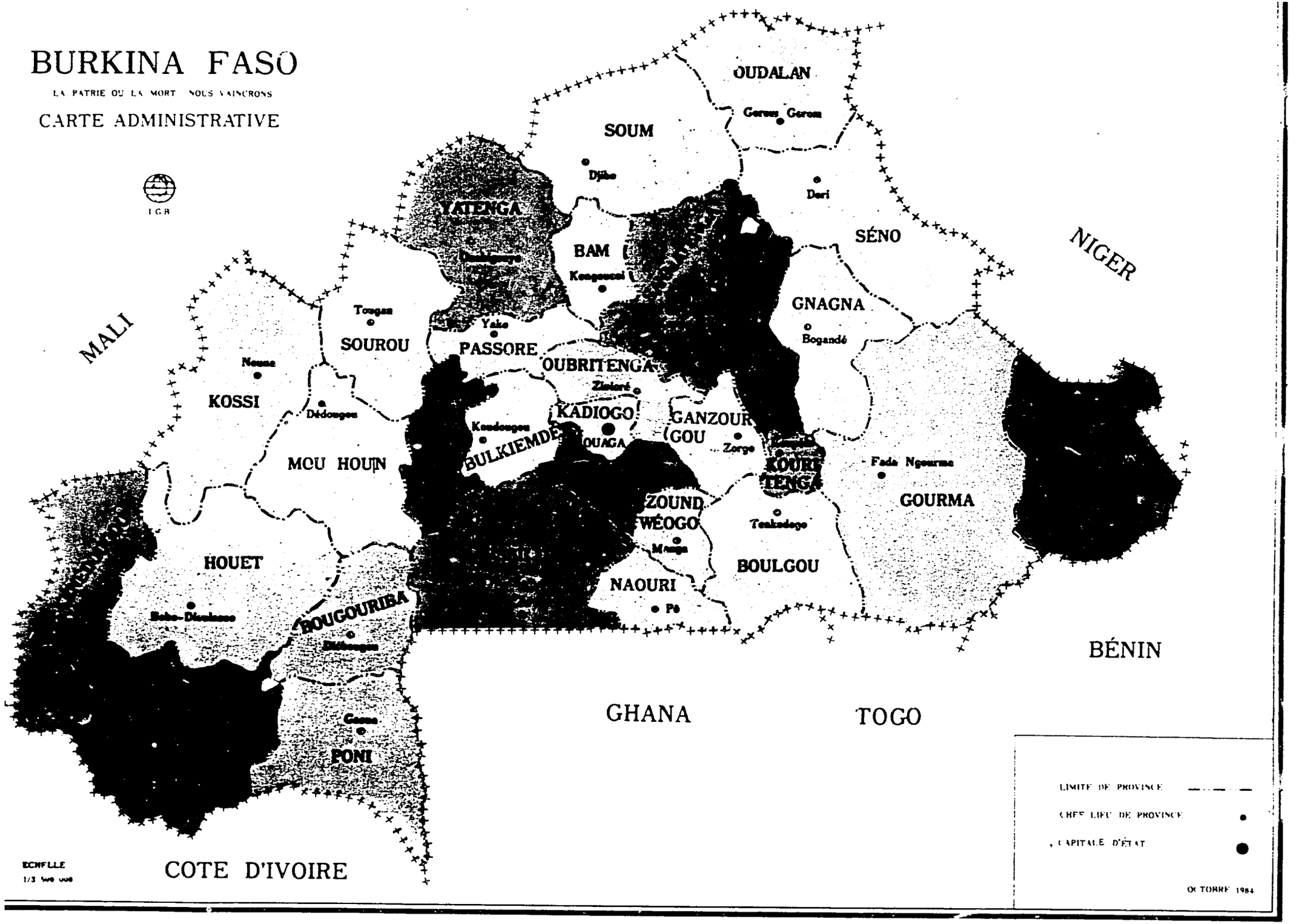


Table of Contents

APPENDICES

TABLES

FIGURES

LIST OF ACRONYMS

AID	U.S. Agency for International Development
AVFP	French Assistance of Volunteers of Progress (Assistance Française des Volontaires du Progrès)
CCCE	Caisse Centrale de Cooperation Economique
CIEH	Interafrican Committee for Hydraulics Studies
CNLES	National Commission for the Campaign Against Effects of the Drought (Commission Nationale de Lutte Contre les Effets de la Sécheresse)
DEPC	Direction of Studies, Planning and Control (Direction des Etudes, de la Planification et du Contrôle)
DPFH	Direction of Wells, Boreholes and Hydrology (Direction des Puits, des Forages et de l'Hydrologie)
FCFA	African franc (U.S. $1.00 = 490 FCFA - 3/85)
FEER	Water and Rural Equipment Fund of Water Ministry (Fonds de l'Eau et de l'Equipement Rural)
FRG (RFA)	German Federal Republic
GTZ	German Technical Cooperation Organization (Gesellschafft fur Techniche Zusamen-arbeit)
(IDWSSD) (DIEPA)	International Drinking Water Supply and Sanitation Decade (Décennie Internationale pour l'Approvisionnement en Eau Potable et l'Assainissement)
IWACO	International Water Supply Consultants
KfW	German Development Bank (Kreditanstalt fur Wiederaufbau)
lcd	Liters per capita per day
NGO	Non-governmental Organization
ONBAH	National Dams and Irrigation Office (Office National des Barrages et de l'Aménagement Hydraulique)
ONEA	National Water Supply and Sanitation Office (Office National de l'Eau et de l'Assainissement)
ORD	Regional Development Organization (Organisation Régionale de Développement)

PNUD (UNDP)	United Nations Development Program (Programme des Nations-Unies pour le Développement)
SCEE	Service of Control of Studies and of Construction (Service Contrôle des Etudes et de l'Exécution)
SPSE	Service of Planning and Follow-up of Construction (Service de Planification et du Suivi de l'Exécution)
TAMS	Tippetts Abbett McCarthy & Stratton Co., Inc.
UNICEF	United Nations International Children's Emergency Fund
(WHO) OMS	World Health Organization (Organisation Mondiale de la Santé)

ACKNOWLEDGEMENTS

Members of the WASH team wish to express their appreciation for the cooperation and assistance given by all of those who are named in the appended list of persons contacted. In addition to U.S. Ambassador Leonardo Neher, the following AID/Ouagadougou people were especially helpful in permitting the WASH team to accomplish their objectives:

- Emerson J. Melaven, Mission Director
- Lawrence C. Heilman, Deputy Mission Director
- Charles Kelly, Food for Peace Monitor
- George Thompson, Rural Water Project Officer
- Augustin Ouattara, Engineer, Office of Program
- Yeye Ousseini, Food for Peace Monitor.

Further, special note should be made of the patience and assistance provided by Genevieve Clerque, who typed the preliminary report.

EXECUTIVE SUMMARY

At the request of the U.S. Agency for International Development (USAID) Mission in Burkina Faso, a Water and Sanitation for Health Project (WASH) team visited Burkina Faso between March 2 and March 25, 1985. The team consisted of Ralph Preble, hydrologist, and Prescott Stevens, sanitary engineer. The terms of reference for their assignment were to focus on action plans needed to address short-term solutions to the current water shortage in Ouagadougou and to review a Government of Burkina Faso (GOBF) proposal to study a long-term supply solution involving a dam near the village of Ziga. After arriving in Burkina Faso, the team also was requested to evaluate the drinking water needs of displaced persons in the regions north of the capital.

The current status of the Ouagadougou water supply is precarious. Water in the reservoirs, available for use as of March 10, will be exhausted by June 10 if the average daily reduction of volume experienced in January is allowed to continue. While it is entirely possible that current supplies can sustain present withdrawal rates until refilled by the annual rains, higher evaporation rates or the later-than-normal start of the rainy season could leave the reservoirs at useless levels.

Recommendations for Short-term Emergency Actions:

GOBF emergency measures, such as control and reduction of market garden use of water, prompt repair of reported leaks, prevention of elevated storage reservoir overflows, well installations and other controls, should be continued and expanded. In addition to further restrictions on use (including limiting industrial use) and the other measures already being taken, the WASH team suggests consideration of the following additional emergency measures to the currently available water supply:

1. Transfer water from Ouagadougou Reservoir No. 2 to Reservoir No. 3 and/or from Loumbila Reservoir to Reservoir No. 3, thereby reducing the overall surface area exposed to evaporation. This transfer should be undertaken as soon as possible. (Note: In accordance with the WASH and USAID/Burkina Faso-cabled recommendations, pumps have been purchased by AID's Office of Foreign Disaster Assistance (AID/OFDA) for this purpose.)

2. Establish a means by which reservoir water remaining below levels exploitable by present facilities could be used. Adaptations and implemental plans to permit use of residual reservoir water (below normal exploitable levels) need to be developed as soon as possible.

3. Use existing and proposed wells as soon as possible. This activity should follow an analysis of the groundwater adjacent to Reservoir No. 3, in parts per billion, for possible toxic and carcinogenic pollution that could be associated with the nearby electric plant, hospital laboratory, or tannery waste discharges.

4. Inform water consumers in Ouagadougou that domestic uses of water have first priority and that further restrictions may have to be imposed on industrial and other nondomestic use of reservoir water.

5. Improve distribution of water from public standposts:

   a. Householders should be encouraged to collect their own water, when possible.
   b. Vendors should be prevented from collecting water from reservoirs or other raw water sources, except in an extreme emergency.
   c. Householders should be advised to boil water for drinking. (This practice is especially important for water supplied by vendors or in areas of the system where water is unavailable on a 24-hour basis).

Recommendations for Medium-and Long-term Actions:

During the next three to four years, the demand for water and the drain on Ouagadougou's sources of water supply will continue to increase unless a long-term solution is achieved. Various aspects of the comprehensive study now in progress by the German firm of Lahmeyer International will have a direct bearing on water conservation and use or loss reduction. Such aspects include distribution network leakage, treatment plant loss reduction, and additional wells outside of Ouagadougou.

WASH is in agreement with the GOBF view that the White Volta river (probably in the vicinity of the Village of Ziga) offers the most likely source for the city's long-term water supply needs. An analysis of the various alternatives for implementing such a project is the primary focus of the comprehensive study of overall water system improvements being conducted by Lahmeyer International. It is anticipated that these alternatives will be ready by June 1985, the recommended courses of action by September 1985, and the final tender documents by September 1986. For this undertaking, WASH recommends the full cooperation and free exchange of opinions among all concerned parties (that is, GOBF, USAID, and Lahmeyer International).

Findings:

Water Supply for Migrants and Displaced Persons

The issue of water supply for displaced persons is not, at this time, a critical problem. The dispersion of migrants and displaced persons is such that the implementation of emergency water supply measures is considered unnecessary. Concern exists, however, that conditions might change, and, therefore, that some advance planning and precautionary measures should be taken.

Although the Government of Burkina Faso is implementing water supply improvements at certain urban centers in the north, where water is in relatively short supply, no urban centers in the region at present have water systems that can support more than the basic needs of their permanent inhabitants. To date, the GOBF and cooperating organizations have taken no actions leading to the formation of large camps for displaced persons.

Sufficient water to support large concentrations of people is available only in existing impoundments. Relatively large concentrations of migrants and displaced persons have gathered at these impoundments due to the availability of water. Any new relief activities that would attract large numbers of people to locations that are not adjacent to large surface water impoundments would be potentially disastrous.

Following are recommendations addressing the issue of water supply for migrants and displaced persons:

1. Urban centers north of Ouagadougou lack adequate municipal water supplies for their own inhabitants. Consequently, actions that might lead to the concentration of any large numbers of people should be avoided.

2. Priority should be given to urban centers to the north of Burkina Faso in the action plan being developed by the National Commission for the Campaign Against Effects of the Drought.

3. Interim measures to supplement present water supplies in urban centers with additional hand-pumped wells should be initiated under an emergency program. (A tentative budget for 16 to 20 wells, exclusive of expenditures for supervision and monitoring, is estimated at $100,000.)

4. USAID/Burkina Faso should develop, in cooperation with UNICEF, a program capable of rapid response to isolated emergency water needs. A basic rapid response capability might consist of 50 water storage drums of 55-gallon capacity, along with a transfer pump held in readiness at three selected locations for filling and transport to a trouble spot. A steam cleaning unit, other preparation items, and individual water carriers also should be considered with a tentative budget of approximately $10,000, exclusive of any organizational effort.

Implementation of recommendations 3 and 4 may necessitate a short-term technical consultant. Estimated expenses and salary for such an effort would be between $16,000 and $20,000 for travel time, three weeks in country, reporting and debriefing.

Chapter 1

INTRODUCTION

1.1 Background

The City of Ouagadougou depends on the Loumbila Reservoir and three city reservoirs for its water supply. These reservoirs are filled mainly from run-off, therefore, the quantity of water available for Ouagadougou is basically a function of rainfall. During previous droughts, water shortages have affected Ouagadougou, but only recently has that concern increased because the demand for water is exceeding the capacity of the reservoirs.

In 1984, rainfall in the Ouagadougou area was less than 65 percent of the mean. As a result, a water supply crisis is expected to occur in 1985. Preliminary analysis notes the convergence of the following two trends that explain the anticipated water shortage in 1985 and beyond:

- A declining annual rainfall trend resulting in only partially filling reservoirs in recent years

- Rapid urban population growth causing an increasing demand on the city's water supply. (Such growth will increase as persons affected by the drought continue to migrate to Ouagadougou.)

Near the end of 1984 and during the first few months of 1985 increasingly frequent reports were received by USAID/Burkina Faso indicating that residents of the areas north and east of Ougadougou had begun to migrate in search of food and improved living conditions. Field travel and visits to outlying areas of Burkina Faso confirmed that an increasing number of people are moving in search of relief from the food and water shortages in the rural areas. Because this flow is expected to increase, the Government of Burkina Faso has provided tents and shelter at several locations outside Ouagadougou.

During August 1984, the Government of Burkina Faso announced that the water level in the Loumbila Dam was low and that rationing of water for Ouagadougou during 1985 would be necessary if there were no further rainfall. On October 30, 1984, the Loumbila Dam reached the peak fill level for the 1984 rainy season and was at only 60 percent of capacity. In some of the outlying areas of the city, increased use and lowered production have reduced water availability to only a few hours a day. Some partial relief has been provided through newly installed hand-pumped wells. The already scarce supplies of water for most of the permanent residents, as well as the new arrivals, will be further curtailed, and hardship and suffering will affect the drought victims as warmer weather increases the demand for water.

During the later half of 1984, there was an outbreak of cholera in Ouagadougou. It is possible that with the increased migration of drought victims and refugees from Mali to and through Ouagadougou and the reduced water supplies a renewed outbreak of cholera could take place during the next four to six months. In addition, the assessment made during the drought emergency assistance program in 1984 by USAID's Office of Health, Bureau for Science and Technology indicated that a number of endemic and infectious

diseases were being exacerbated and becoming epidemic. They concluded this was as a result of the lack of adequate water for drinking and for personal hygiene.

1.2 Request for Assistance

In response to a request from the AID Mission in Burkina Faso (USAID was responding to GOBF request, Appendix C) the Water and Sanitation for Health Project (WASH) was authorized on February 13, 1985 to send two consultants to Burkina Faso for several weeks. The terms of reference for the consultants' work specified that the team's activities be in accordance with the objectives and scope of work and are set forth in the following two paragraphs (See also Appendix A).

1.3 Team Objectives

The objective is to assist USAID/Burkina Faso and the Government of Burkina Faso in:

A. Identifying and assessing potential interventions which may relieve Ouagadougou's immediate urban water supply problem

B. Evaluating the Ziga Dam construction feasibility project and appraising its worthiness as a medium-term solution to the water supply problem in Ouagadougou and the surrounding areas.

1.4 Scope of Work

The initial scope of work required that the team assess the course of actions which may be undertaken under emergency conditions. These were to include, but not be limited to, the following:

1. Increase efficiency of actual water distribution system (for example, by reducing loss through leaking pipes).
2. Offer guidance for improved water resource management.
3. Drill wells in the city to back up the water supplies of the dams.
4. Upgrade the existing dams to increase retention capability.

The team's assessment was to focus on those action plans needed to address immediate short-term solutions to the current drought-related shortage in Ouagadougou.

The WASH team chosen to undertake this assignment was made up of Messrs. Ralph Preble, a hydrologist, and Prescott Stevens, a sanitary engineer. When the consultants arrived in Ouagadougou (Saturday, March 2, 1985), they were contacted by Messrs. Charles Kelly, Food for Peace Monitor, and George Thompson, Rural Water/Emergency Project Officer, who gave an informal briefing on conditions and problems related to the consultants' proposed activities and a somewhat more detailed scope of work than that stated above (See Appendix D). Further, almost immediately upon the consultants' arrival in the country, cable correspondence between AID/Washington and USAID/Burkina Faso resulted in

an extension of the consultants' efforts to include a brief overview of the problems of the country's population and displaced persons most affected by the continuing drought regarding drinking water and sanitation and the identification of possible mitigating actions.

1.5 Team Activities

1.5.1 Persons Contacted and References Reviewed

Following a formal briefing attended by the ambassador, deputy chief of mission, AID mission director, and other AID staff, various meetings with governmental officials were scheduled. Other meetings were held with representatives of nongovernmental organizations whose activities included the development of potable water supplies.

A complete listing of persons contacted in Burkina Faso is included as Appendix B. A list of references reviewed precedes the appendices.

1.5.2 Facilities and Sites Visited

Ouagadougou Water Supply

In addition to visiting the various offices of the Ministry of Water, the WASH team viewed the water supply reservoirs within the city referred to as Ouagadougou Reservoirs Nos. 1, 2, and 3. During these visits, the depths of water was shown by staff gages and also indicated by the presence of net fishermen in the water. Attention also was given to the condition of the separating dikes and spillways. The Ouagadougou water supply reservoir at Loumbila, approximately 20 kilometers north of the city, was visited. During this visit, the team noted the water level, observed the newly raised overflow structure, and inspected the pumping facility. An inspection of the city's water treatment plant, adjacent to the city Reservoir No. 3, also was conducted.

The GOBF arranged for a field trip to the site of the proposed Ziga Dam, some 50 kilometers northeast of Ouagadougou. Bernard Ilbouds, a DEPC Engineer, accompanied the team on this trip.

Field Trip - Assessment of the Water Needs of Displaced Persons

A brief field trip to the Provinces of Salmatenga, Namentenga, Seno, Oudalan, Soum, Yatenga, Passore, and Cubritenga was undertaken at the request of USAID/Burkina Faso with concurrence of AID/Washington. During this trip, interviews were conducted with provincial officials and other individuals at the urban centers of Pissila, Tougouri, Yalogo, Bani, Dori, Gorgadji, Arbinda, Djibo, Titao, Gourey, Yako, and Bousse.

The purpose of this field trip was to undertake a preliminary assessment of the water supply needs of migrants and displaced persons in the northern provinces of the country. The finding of the team was that public water supply facilities in those regions are generally inadequate to serve an influx of displaced persons or to even adequately serve the inhabitants of urban

centers. Notes taken during the trip are presented in Appendix E.

Before the team left Burkina Faso, a briefing was given to the various GOBF Water Ministry officials. A second meeting was held during which the team's findings, conclusions, and recommendations were explained. These conclusions and recommendations also were reviewed with the U.S. Ambassador, the AID Mission Director, and other AID staff prior to the team's departure from the country.

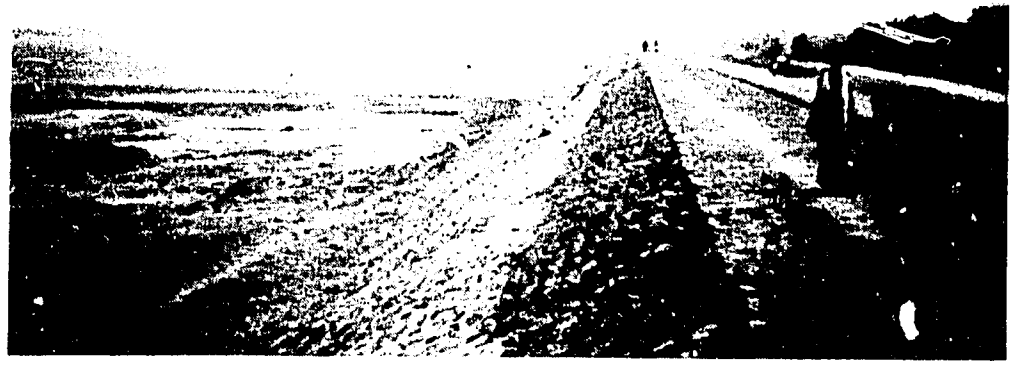


Photo 1. Loumbila Dam - 20 kilometers north of the city - is the main reservoir supply for Ouagadougou.

Photo 2. Depicted above is an abandoned village in the Soum Province.

Chapter 2

STATUS OF OUAGADOUGOU'S WATER SUPPLY PROBLEMS

2.1 General Information

The increase in Ouagadougou's population and water demands, and the reduced annual rainfall have created a serious water supply problem for the capital of Upper Volta. It now appears that this problem may be approaching crisis proportions due to the record low rainfall of 1984 in the Ouagadougou area.

In response to this situation, the National Office of Water and Sanitation-Office National de l'Eau et de l'Assainissement (ONEA) has reduced the amount of water used at the markets, undertaken the timely repair of water leaks in the distribution network, and authorized the drilling of wells to be equipped with pumps in some peri-urban zones.

The team estimated that the current situation in Ouagadougou is precarious. As of March 10, 1984 the amount of available water was scarcely sufficent for a three-month period, given the current methods of pumping out water, based on the daily outtake rate during the month of January. Although it is possible that the current water reserves will suffice until the rainy season, an exceptionally hot spring or a late arrival of rainfall could result in the water level in the reservoirs being unusable, i.e., still below the intake.

2.1.1 Geography of the Region

Ouagadougou is located in the center of the country in the hydrographic basin of the White Volta river, immediately south of one of its nonperennial tributaries, which has been dammed more than 50 years to provide a water supply for the city. Situated on a relatively flat granitic plateau about 300 meters above sea level, most of the city rests on a 20 to 30 meter layer of clayey soil usually underlain by a relatively thin layer of broken stone (alterite), which serves as a groundwater aquifer. The bedrock, which in places appears above the ground surface, contains fractures in which deeper groundwater is found.

Ouagadougou is in the savannah region 150 kilometers south of the Sahel limit. Its climate is characterized by a short rainy season from July to September, followed by nine dry months. During the past two decades, the annual rainfall has varied between 600 and 1,200 mm, but five year averages have shown a steady decrease. The 1961 to 1980 average was 833 mm, but the 1977 to 1983 average was only 702 mm. Run-off is rapid, vegetative cover is scarce, and the White Volta becomes perennial only somewhat south of Ouagadougou.

2.1.2 Demographic Information

The last census of the city, conducted in 1975, showed a population of 158,000. This is an 8 percent annual increase, thereby leading to an estimated 1985 population of 341,000 and a 1990 population projection of 501,000. The recently approved urban development plan for Ouagadougou has comparable

figures. The ONEA is, however, using higher figures: 373,000 for 1985 and 548,000 for 1990.

2.1.3 Water Supply Organizations

The Water Ministry

Created in October 1984, the Water Ministry brings together the pre-existing national services focusing on water supply and sanitation. At the operational level, there are five agencies as follows:

- Direction des Etudes, de la Planification et du Contrôle (DEPC, studies, planning and control especially in rural areas)
- Direction des Puits, des Forages et de L'Hydrologie (DPFH, surface and groundwater studies, and well installations)
- Office National des Barrages et de l'Aménagement Agricole (ONBAH, dam studies, construction and monitoring of reservoirs and irrigation schemes)
- Fond de L'Eau et de l'Equipment Rural (FEER, financing of hydraulics works).
- Office National de l'Eau et de l'Assainissement (ONEA - studies, planning, construction, operation and maintenance of urban water supplies and planning future urban sanitation schemes).

The organization chart for the Water Ministry (Figure 1) appears on the following page.

ONEA operates and maintains 18 municipal water supply systems. Progress in coverage has been regular and rapid within the framework of a master plan that has the objective of extending services to 65 urban centers. In 1977, there were 13,000 connections and 7 million m^3 of water sold. In 1983, there were 2,000 private connections and 300 public standposts and 12 million m^3 of water sold. Average revenue per m^3 sold increased from 88 to 153 FCFA (African Francs or US $0.18 to 0.31*) during the same period. ONEA enjoys a large degree of managerial and financial autonomy. It prepares its own development plans and tariff proposals and does not depend upon governmental subsidy to finance either its investment or its recurrent costs.

2.2 Prior Studies Regarding Ouagadougou's Water Supply

2.2.1 Introduction

To put the Ouagadougou water supply problem in proper perspective and to gain a better understanding of current and proposed activities to relieve the problem, the team undertook both direct observations of the water supply facilities and a review of prior studies addressing the problem.

* Exchange rate: U.S, $1.00 = 490 FCFA

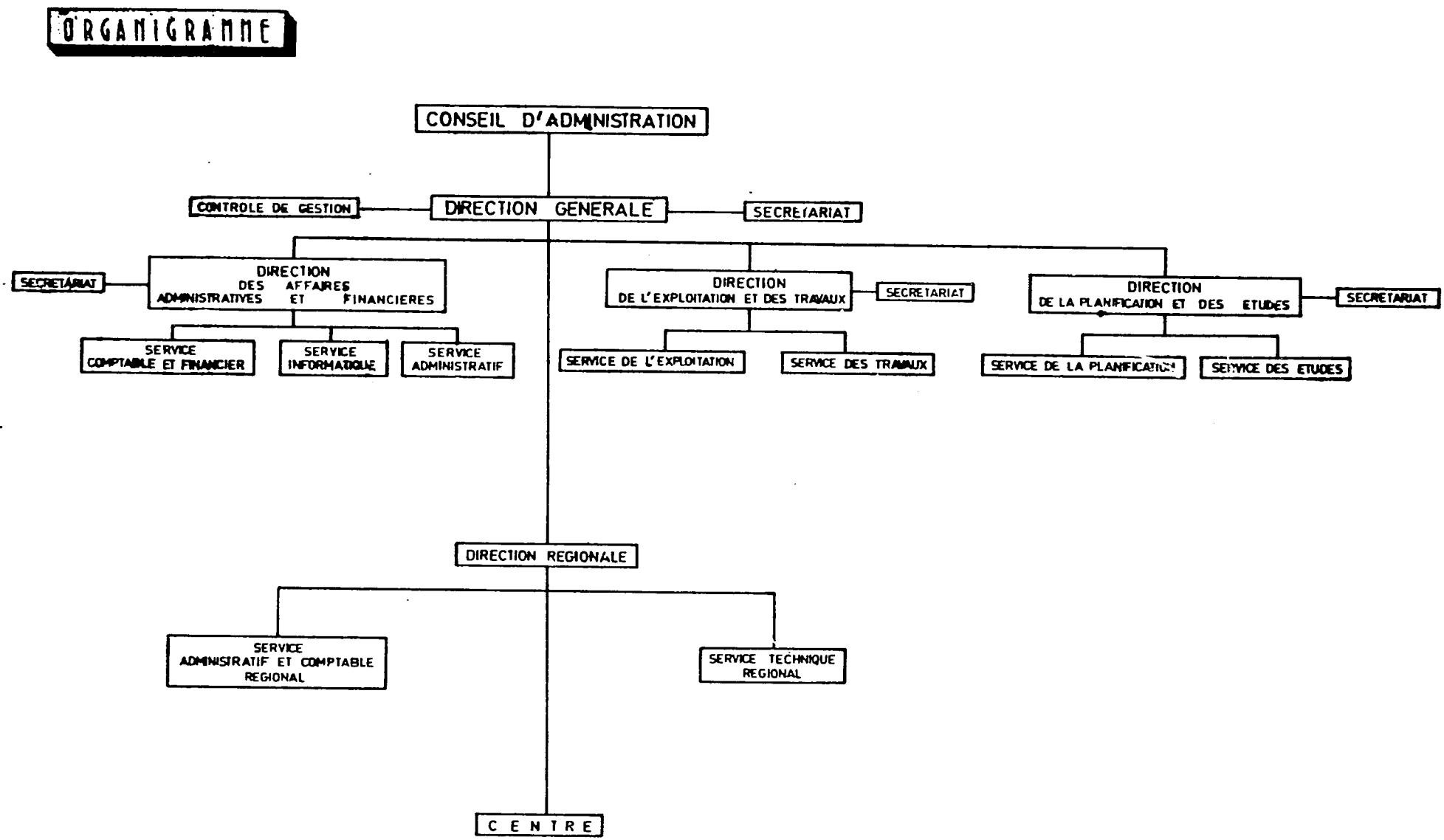


Figure 1. Organization Chart of Water Ministry

In recent years, numerous governmental bodies and external consultants have reviewed the Ouagadougou water supply problem. A master plan for 44 urban centers prepared in 1979 reviewed long-range options for Ouagadougou from the Black Volta and White Volta rivers and contained a study by a German firm (see also Appendix J) (1). A review was prepared by a German consultant in 1980 (2), and a study of interim measures was made in mid-1983 by a French consultant (3).

2.2.2 Interim Measures

The last report, (Sigismonde, 1983), assumed that the Black Volta river intake and transmission line would be constructed and operational by 1990 and examined by mathematical simulation various means of improving the use of the present water sources to reduce evaporation, the single largest factor of water loss in the system.

The report also mentioned the possibility of increasing supply to the Loumbila reservoir by an intake from the White Volta, but rejected this from further consideration as an interim solution because of its high cost. On the basis of the simulation studies, the report concluded that the best interim solution would be to reduce evaporation of water from the Loumbila reservoir by drawing it down into a large artificial reservoir. Because a large underground aquifer is apparently unavailable, a reservoir dug below the present spillway was proposed.

2.2.3 Technical Commission

The problem and some relief measures were described in a Technical Commission Report (4) which also identified the construction of a dam and reservoir on the White Volta near Ziga as a long-term solution. A summary of this report is presented below.

This report included data on water use, information concerning the capacity of pumps and treatment plant, and a discussion regarding the capacity of the Loumbila reservoir and that of Ouagadougou reservoirs 2 and 3. It also noted that some 1.5 million m^3 of untreated water from Loumbila was used each year for the market gardening done a short distance to the south of the reservoir.

(1) Plan Directeur: Alimentation en eau des 44 centres urbains de la Haute-Volta 1979-2005.

(2) Aménagement de l'alimentation en eau de Ouagadougou: analyse et évaluation, Prof. Ing. Karpe (Mars 1980).

(3) Alimentation en eau de la ville de Ouagadougou, Solutions de Soudure, J. Sigismonde (Novembre 1983).

(4) Commission Technique sur l'Approvisionnement en Eau Potable de la Ville de Ouagadougou: Rapport de la Commission, Decembre 1984).

The report expressed particular concern about the adequacy of the reservoirs to meet needs for 1984 and subsequent years should rainfall be insufficient to refill them annually. It was noted that only 11.7 million m^3 annually of the total 37.7 million m^3 capacity of the three reservoirs was available for use, after accounting for evaporation, water below the intake, and the 1.5 million m^3 reserved annually for market gardening.

Recommendations:

As immediate measures, the Commission recommended the following:

1. The improvement of the Ouagadougou dams that would include raising the overflow structure and the dikes 0.8 meters. The dike for reservoir 2 would need to be lengthened and the barrage between 2 and 3 rebuilt. The Loumbila Dam spillway should be raised 0.2 meters. The estimated cost of these modifications was 350 million FCFA (US $715,000).

2. The second recommendation was to undertake a program of cloud seeding to increase rainfall. The quotation for 100 hours of flying time from a French company was 90 million CFA (US $184,000) and from an African company 30 million CFA (US $61,000).

3. The third recommendation was to drill wells in the city's outskirts. It was noted that this recommendation had a number of constraints, such as:

   - Most wells in this area produce only a small amount of water and it is impossible to anticipate how much would be available because the aquifers are in fractured granite and are not continuous.

   - Experience indicates that it is unlikely that a well would produce more than ten m^3/per hour, and most do not yield this much.

   - The question arose regarding whether groundwater would be useable beyond a short period of time.

It was stated that people using public street standpipes would be diverted to new wells.

The project of 50 drilled wells, financed by Canada, was mentioned along with a statement that an additional 50 would be installed. Some 20 larger diameter wells with electric pumps (rather than handpumps) and 40 m^3 steel reservoirs on stands was proposed. A cost of 165 million FCFA was quoted for the 20 motorized wells.

4. The final immediate measure proposed by the Commission was to strengthen ONEA by improving the use infrastructures, by making better use of Ouagadougou's reservoirs, by correcting water losses, and by restricting water use.

For the long-term (beyond the year 2000), the Commission report stated that the construction of the Ziga Dam was the only possible solution and listed reasons why the long-planned Black Volta source was unsuitable. The Commission report listed the following actions and estimated costs related to the Ziga project:

Ziga Dam	1,500 million FCFA
High tension line	250
800 mm transmission line	2,300
1,000 mm transmission line Ziga-Loumbila	4,300
Water treatment plant	2,300
Engineering and feasibility studies	50
TOTAL	10,700 million FCFA (US$21.8 million)

The report indicated that this project would not affect the proposed downstream Bagre impoundment seriously (not more than 6 percent to 10 percent). In addition, the report noted the proposed study by Federal Republic of Germany/ German Development Bank and stated that this study could contribute mainly to the knowledge of groundwater resources near Ouagadougou. The report also concluded that the construction of the Ziga Dam should be pursued immediately with an estimated commissioning date in mid-1987. It also suggested that the enumerated urgent measures be studied and executed and an appropriate supervision and control be exercised, that the cloud seeding be repeated, that the master plans for developing the nation's rivers be developed and implemented, that all the necessary studies be executed by national services with the possibility to bring in a foreign consultant. Finally, it was recommended that studies be undertaken on reducing evaporation which represents a loss of approximately 60 percent of reservoir impoundments.

2.3 Current Water Supply Improvement Activities

2.3.1 Status of Technical Commission's Recommendations

The current status of the various Commission's recommendations is as follows:

1. The Commission's first recommendation was to raise the overflow structure and dikes of the Ouagadougou reservoirs by 0.8 meters, including a rebuilding of the barrage between reservoirs No. 2 and No. 3. A complete rebuilding of this barrage and roadway was suggested; to date, however, no agreement has been reached regarding funding.

   Another recommendation concerned the raising of the overflow structure adjacent to the spillway of the Loumbila Dam by 0.2 meters. This work was recently completed.

2. The Commission's second recommendation, to engage in cloud seeding, was attempted in September of 1984. The result of this undertaking was considered unsuccessful. The lack of success was attributed to a delay of the operation to September when the best period for such an operation is either late May or during the

month of June. The ONEA has indicated that a new attempt to induce added rainfall through cloud seeding is planned for 1985.

3. The Commission's third recommendation to complete some 20 wells with motorized pumps and 40 m^3 steel reservoirs is not yet fully implemented. Ten of the original 50 wells installed through Canadian funding were tested and identified as warranting such use; the installations are being funded by Caisse Centrale de Cooperation Economique (CCCE) and are scheduled to be installed by the end of April 1985. The Commission's recommendation to add an additional 50 wells to the initial 50 is also being funded by CCCE.

4. The Commission's final recommendation included the improved use of the water system facilities, correction of water losses, and, when necessary, restriction of water use. Measures have been taken to eliminate overflow of elevated reservoirs. The German consultant firm (Lahmeyer International) is implementing a leakage survey of the water system, and the use of water for market gardening has been restricted to one-half of what had been allowed in prior years.

2.3.2 Groundwater Utilization

Studies regarding the use of groundwater through wells in Ouagadougou are currently under way through the Groundwater Section of the Directorate of Drilled Wells, Dug Wells, and Hydrology under the Ministry of Water. Eight people work in this section, including five hydrologists and three hydrogeologists. These eight people include the Chief of the Section, Mr. Jacques Zambelongo, and a French expatriate Alain Poisson. Two geophysical teams, which are under the direction of technicians, are assigned to the Groundwater Section.

In addition to wells installed for water use, some 22 piezometers (instruments for measuring pressure) have been installed for the purpose of long-term monitoring of groundwater levels. The long-term study of water levels is being conducted by the Interafrican Committee for Hydraulics Studies (CIEH) (5). Staff within the Groundwater Section indicated that the occurrence of groundwater is similar to that described in this report. These descriptions are summarized in the paragraphs that follow.

Igneous and metamorphic rocks are impervious and have nearly no porosity except in faulted, fractured, and weathered zones. Weathering in tropical areas with humid climatic conditions starts generally at fissured parts of rocks, and results in a lateritic cover of variable thickness. In Burkina Faso, lateritic covers do exist, having been developed in past geologic times when the climate was wet. In some parts of the country, however, the lateritic cover is irregular and sometimes not well developed.

(5) CIEH/USAID, Savannah Regional Water Resources and Land use: Savanna Resources, Volume I.

In the Ouagadougou area, weathering in granite has resulted in a 0-30 meters thick weathered zone comprised, from top to bottom, of: (a) hardpan, a few meters thick, which may be missing; (b) kaolinic clay, up to some 10 meters thick, sometimes absent; (c) residual clayey sand, a few meters thick; (d) basal coarse sand, boulders and fractured bedrocks; and (e) bedrock more or less fractured generally down to 50-100 m, sometimes less or even more. This is shown in a schematic section in Figure 2.

Groundwater occurrence, although homogeneous at regional scale is much less so at local or well site scale. In fact, it is discontinuous and extremely variable, and a well may be extremely poor, if not dry, a short distance away. This situation is due to the aerial variations in weathering and fracturing. Highly weathered and fractured zones are generally coupled because weathering develops better from an already fractured zone. As a consequence, the thickest weathered zones are generally overlying fractured zones, all of which is favorable to the occurrence of groundwater. In fact, exploration regarding this type of hydrogeological environment consists in locating fractured zones by aerial photo-interpretation (for example, lines of trees) and geophysical measurements coupled with field inspection, which result in the best well yields either from the weathered horizon (residual sands and boulders) and/or better the underlying fractured zone down to, say, 80 to 100 meters. Then, as a result of geologic formations, it is generally advisable to sink the well slightly apart from the fracture (or deepest part of the weathering through), and not immediately above because clayey material generally occurs at that very point and also because of dip considerations.

Groundwater Section staff did not want to comment on the generalized figure of a 17mm per year recharge to the basement rock complex of the area that the CIEH/USAID Report had ascribed as a general figure for recharge. Conceivably, this was based on the somewhat greater than 800 mm of rainfall previously used for the average rainfall of the area. In any event, 2 percent of the annual rainfall appears to be a reasonable figure for recharge except for areas adjacent to reservoirs, impoundments and other bodies of water which would sustain recharge throughout the year in significantly higher quantities.

2.3.3 Study of Ouagadougou's Water System

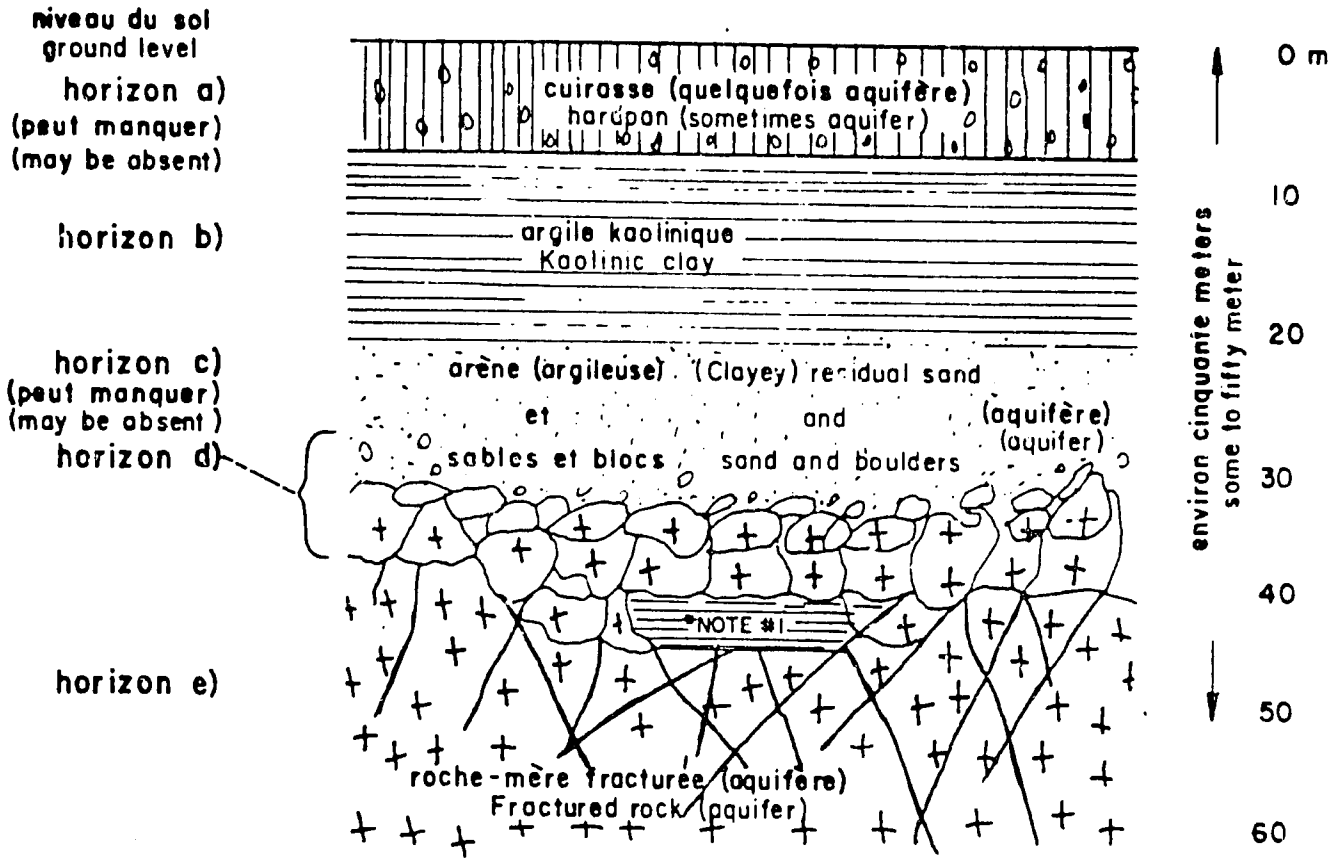
Lahmeyer International is currently engaged in a comprehensive study of the Ouagadougou water system, its operations, and necessary improvements. Funding for this study was furnished by the German banking group Kreditanstalt fur Wiederaufbau (KfW). In addition to the three areas of interest noted above, a preliminary outline of the sanitary needs of the city was to be prepared. During discussions with Lahmeyer's Chief of Project, Claus Dieter Wunderlich, and Hydrologist Edgar Firmenich, it was understood that their schedule of activities required the following:

- May 1985: A presentation of various options for medium- (1995) and long-term (2005) water system improvements

- September 1985: Completion of an analysis of the various medium and long-term improvement options with identifications of the most appropriate program of water system improvements

COUPES SCHEMATIQUES DE L'ALTERATION ET DES HORIZONS AQUIFERES DANS LE SOCLE
SCHEMATIC SECTIONS OF WEATHERING AND GROUNDWATER OCCURRENCE IN THE BASEMENT
(from CIEH/USAID, Savannah Regional Water Resources and Land Use: Savannah Resources, Volume I)

A/ Altération des Granites et Gneiss
Weathering in Granites and Gneisses



les meilleurs sites pour puits et forages sont de part et d'autre de l'argile d'altération qui occupe le centre de la zone altérée

best location for wells is apart from the residual clay (center of alteration through)

NOTE # 1
argile d'altération
Residual clay

Figure 2. Schematic Sections of Weathering and Groundwater Occurrence in the Basement

- **September 1986**: Completion of further field investigations and assemble European style tender plans and documents for a program of improvements approved by both the Burkina Faso Ministry of Water and KfW.

In addition, they had agreed to comment on the December 1983 report of the Technical Commission for Drinking Water for Ouagadougou (in which several recommendations were made for meeting the city's immediate water supply problems) by early April. Further discussions related to the city's present and possible future water supply and certain studies and activities which Lahmeyer International planned to make (or were presently engaged in) so that they could develop an appropriate plan for improving the water system. Some of the specific problems and potential remedies discussed included:

- Raising the dams and dikes of Ouagadougou reservoirs
- Undertaking cloud seeding activities
- Using wells in Ouagadougou
- Investigating the feasibility of various options in connection with the Ziga Dam proposal
- Studying the water use in the piped water system and of persons who do not have connection to the piped water system
- Reviewing the treatment plant and its operation.

Regarding the final item noted above, it was stated that Lahmeyer International had subcontracted this work to IWACO, a Dutch consulting firm. On the basis of aerial phorographic interpretation and other studies, IWACO had identified five areas within 50 kilometers of Ouagadougou that showed promise for potential groundwater development. None appeared to offer any substantial supply but might warrant installation to accommodate peak demand periods of short six-week or two-month duration. These five areas were as follows:

1) Downstream of Ouagadougou No. 3 barrage
2) Downstream Loumbila barrage
3) An area near Ziga
4) An area some 45 kilometers upstream from Ziga
5) An area southwest of Ouagadougou in the Zequedesse area.

None of the foregoing areas are anticipated to have any substantial storage capabilities, but they might be used to add supply capability for a month or two during periods of high water demand. To be practical, wells with pumping rates of 30 m^3 per hour or more would need to be found. Some 20 test wells and 40 piezometer observation wells are funded under their study, but they have not yet been installed.

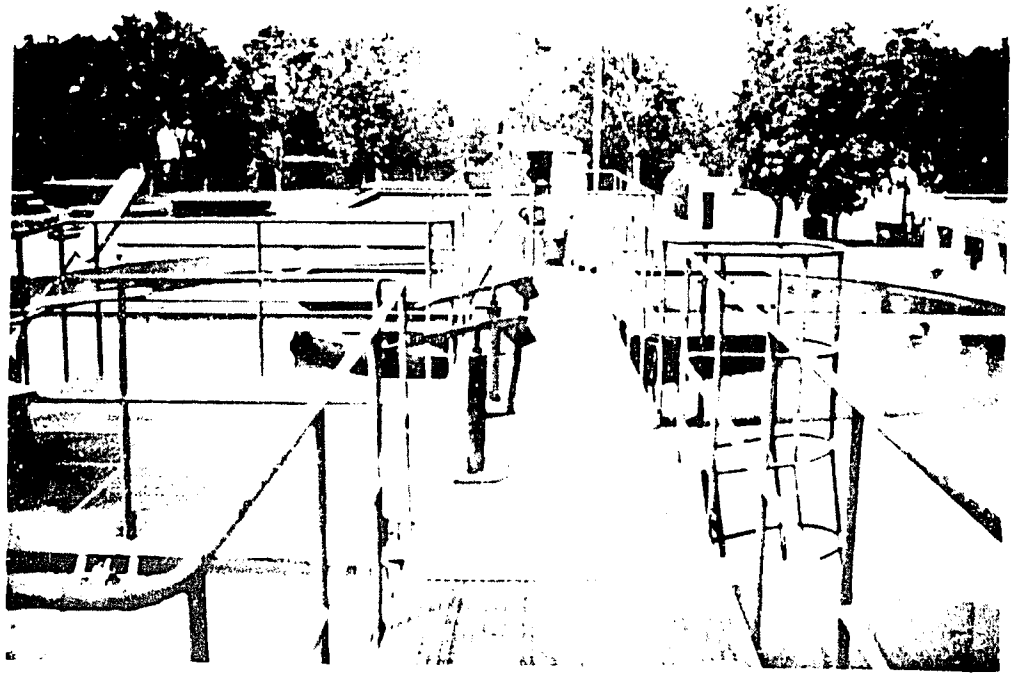


Photo 3. Records for the Ouagadougou water treatment plant show losses of water between the amounts coming in and going out of some 12 to 18 percent. The absence of formal operating procedures may in part account for such a high loss -- normally one would expect approximately 4 percent.

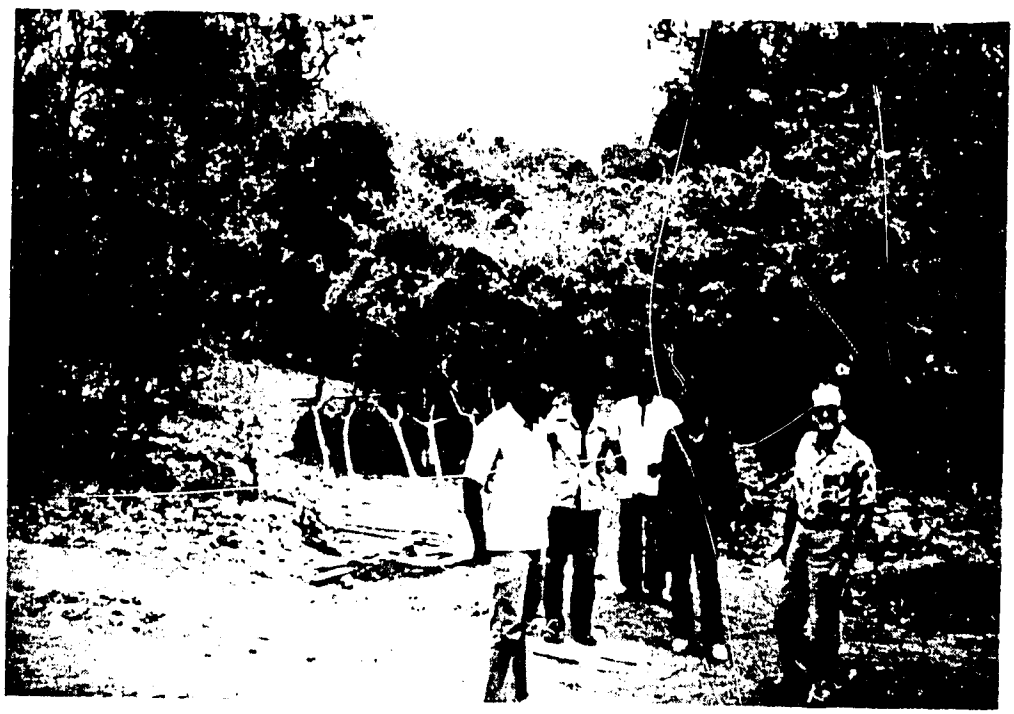


Photo 4. Depicted here is the White Volta River bed in the dry season. Ziga Dam site identified by Water Ministry -- German consultant considers it only one of possible four nearby locations with several options yet to be clarified such as stream storage, compartmental storage, and so forth.

Chapter 3

REVIEW AND RECOMMENDATIONS - OUAGADOUGOU

3.1 Reservoirs

Of immediate concern is the probability that the present surface reservoirs do not contain sufficient water to maintain a supply to the city at current withdrawal and evaporation rates. Levels of both the Loumbila and Ouagadougou reservoirs were observed by the WASH team on March 10, 1985 (see Appendix F, for a discussion of evaporation control).

The level for the largest of the reservoirs (Loumbila) translated, according to the Hydrological Service curves of volume versus level, is 6.75 million m^3. It was noted on this curve, however, that the level in Loumbila at which further extraction was impossible corresponded to a volume of 1.25 million m^3 making the useable volume on March 10, 1985 only 5.5 million m^3. A similar condition exists at the Ouagadougou reservoirs.

In January 1985 the amount of water pumped totaled approximately 25,000 m^3 per day. Comparing this figure with the total reservoir reduction volumes, and other natural losses shows that some 65 percent of the total can be attributed to evaporation. The percentage and volume of evaporation would be expected to be less as reservoir surfaces contracted. However, with a shallow depth of water, this reduction would be largely offset by anticipated higher evaporation rates in late March, April and May.

Table 1, below, is a somewhat simplified presentation of the problem. It should be noted, that pump suction intake problems might occur at reservoir levels higher than those now used by the Ministry to calculate unusable reservoir volumes.

Table 1
Summary Table of Reservoirs' Volumes (March 10, 1985)

Reservior	Theoretical Usable Volume	Reservoir Reduction Per Day*	Potential Use
Loumbila (Million m^3)	5,500,000 m^3	58,000 m^3	95 days
Ougadougou (Million m^3)	1,000,000 m^3	13,000 m^3	77 days

Should actual conditions correspond to the foregoing figures, Ouagadougou could continue to use water at its normal rate for approximately 90 days (until June 10, 1985), provided that the rainy season is not delayed and that reservoir levels did not experience further declines after June 10, 1985.

*Based on 1.8 million m^3 volume reduction during 31 days of January for Loumbila and 0.4 million m^3 volume reduction during the same period for Ouagadougou reservoir.

As serious as today's situation is, a repetition of last year's (1984) record low rainfall (584.5 mm) in 1985 would present the city with a crisis situation at the start of the dry season in September. Even with rainfall amounts equal to the average annual (approximately 700 mm) that has been recorded during the last five years (discounting the low 1984 rainfall), the reservoir at Loumbila will not fill. With the increasing population and attendant demand for water, a yearly crisis in water supply may become a reality unless steps are taken to ensure that a substantial water supply is available.

3.2 Treatment Plants

Information concerning treatment plants was furnished by the acting Director General of ONEA, Dieudonne Nikiema, and during a site visit with ONEA plant operator Mr. Koanda. The facility comprises five parallel units having a combined nominal capacity of 1,400 m^3, per hour. The plants are summarized in the following table:

Table 2
Treatment Plants

Type of Sedimentation Unit	Number of Sand Filters	Nominal Capacity m^3/h	Year of Construction
Accelator (Degremont)	3	200	1952
Pulsator (Degremont)	4	400	1962
Rectangular	2	200	1967
Circular (Danish)	4	300	1978
Circular (Danish)	4	300	1978

The plant operator indicated that the accelator unit is only moderately efficient and that he lacks an operating manual for the Danish plants. The latter are equipped with recording flow meters between units, but the meters are non-operational. Chemical dosing (aluminum sulfate and lime) is controlled by daily jar tests, and chlorination is controlled weekly by laboratory examination of treated samples at the plant and in the distribution network.

Separate raw water lines enter the plant from the Loumbila and Ouagadougou reservoirs. Three separate pumping units and mains connect the treatment facility to the city's distribution network. Total flows recorded for the last two months in m^3 are found in the following table:

Table 3
Recent Total Flows (m^3)

Month	Total Plants Inflow	Total Plants Outflow	Difference	Percent Loss in Plants
January	730,600	652,755	77,945	11
February	686,756	601,963	84,793	12

If the flow meters are correctly calibrated, the loss in the plants is excessive, because filter backwashing should not waste more than 3 to 4 percent of the water treated. The Lahmeyer team has made a detailed study of the plants, and their present operation and recommendations will soon be available to the ONEA.

3.3 Distribution System

There were 237 kilometers of mains, five elevated reservoirs with a total capacity of 6500 m^3, 12,146 private connections and 84 public standposts in the distribution network at the end of 1983. At end 1984, the number of standposts had been increased to 122.

Because the present demand equals and sometimes exceeds the capacity of the treatment plants, newly developed peripheral areas of the city are being supplied by boreholes, equipped with handpumps, and where the yield is sufficient, with motorized pumps, elevated tanks and multiple public taps. Fifty such water points have been installed since the end of 1983, 10 of which are expected soon to be equipped with motorized pumps, and 70 more are planned.

All private connections and public standposts in the regular distribution network are metered. Small consumers and users of public standposts are charged a concessionary rate and large consumers pay according to a progressive tariff. Meters are repaired when they are found to be blocked, but no routine testing of meters is carried out.

Parts of the distribution network have been controlled and repaired in recent years and the recorded unaccounted for water dropped from 10.5 percent in 1982 to 6.7 percent in 1983. No routine district-by-district search for leaks and excessive water use and wastage is conducted, however. Further, the average daily per capita consumption (62 liters per capita per day in 1983) appears high when it is considered that at least two-thirds of the city's population is supplied from public standposts. This matter is being investigated by the Lahmeyer team.

3.4 Drinking Water Quality

Current sampling and testing of water in the distribution network (three samples per week) is insufficient as a control. Under present conditions of heavy demand and frequent intermittent supply, chances for contamination of

Photo 5. This is a shoreline of Reservoir No. 2 showing a shallow configuration.

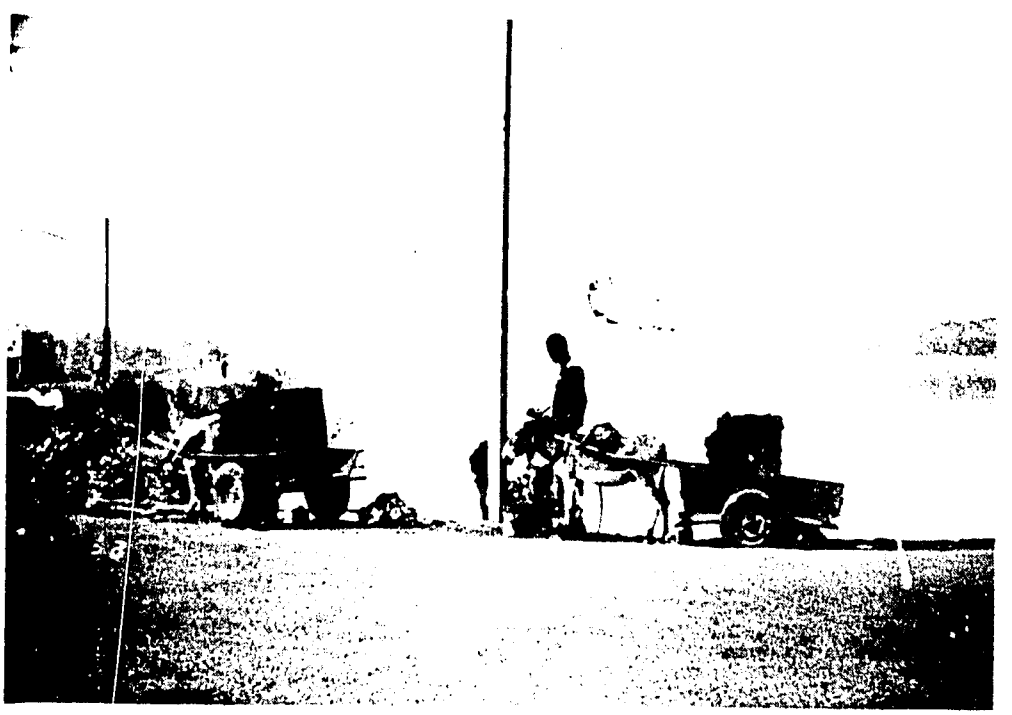


Photo 6. Ouagadougou Reservoir No. 3. Water seller receives water without either filtration or paying for it. Note: Dikes on four sides of Reservoir No. 3 restrict evaporation to approximately the same for 1 meter depth of water or 2 meters deep water or more.

water in the network are greatly increased. Sanitary precautions are not observed in filling vendor tanks at public standposts. Vendors have been observed filling their tanks directly from the reservoirs, though it was not confirmed that the water was intended for drinking.

3.5 Recommendations Regarding Ouagadougou's Water Supply

High Priority:

1. Conserve reservoir water. The city's water supply reserve is at a low level. It is possible that it will sustain current withdrawal and climatic conditions, but either higher evaporation rates or later-than-expected rains could leave the city reservoirs during June with only water below currently exploitable levels. Therefore, the WASH team recommends that ONEA continue and strengthen the measures it is already taking to conserve reservoir water for Ouagadougou by: reducing market gardening of Loumbila, controlling other large users, controlling the overflow from the reservoir, controlling leakage, and providing groundwater supplies in outlying parts of the city.

2. Reduce evaporation by transferring water from Loumbila reservoir to Ouagadougou No. 3 reservoir or from Ouagadougou reservoir No. 2 to No. 3.

Medium Priority:

3. Provide means to use residual water in Loumbila and Ouagadougou No. 3 reservoirs; and

4. Further restrict industrial and other non-domestic use of reservoir water.

Other Recommendations:

The team also recommends that five additional measures be considered to conserve water during the next few years until new supplies become available. These additional measures are to:

5. Analyze water adjacent to No. 3 prior to use. The proposed use of motorized pumps to withdraw groundwater adjacent to reservoir No.3 and in the Bois de Boulogne should be undertaken with suitable precautions. In view of the potentially dangerous industrial pollution of this water, it should be analyzed (in mg/l) and proven free of microcontaminants, or else suitably treated.

6. The water treatment plant units should be repaired and replaced as necessary and its operating procedures revised to reduce water wastage and to ensure adequate chlorination; extended assistance in plant operation should be considered.

7. The necessary equipment should be procured to recalibrate all large capacity water meters, and recalibration should be instituted on a routine basis. In a similar way, the methodology for leakage survey

now being carried out by German consultants should be taught to ONEA staff and citywide surveys should then be instituted on a regular basis. Priority attention should be given to large consumers and nondomestic users.

8. The distribution of water from public standposts should be improved in several ways: (a) householders should be encouraged to collect their own water wherever possible; (b) vendors should be prevented from collecting water from reservoirs or other raw water sources; and (c) householders should be advised to boil water for drinking.

9. The inhabitants of Ouagadougou should be reminded that domestic uses of water have first priority and encouraged to protect and conserve water in their houses and to practice personal and domestic hygiene. During the next few months nonessential private uses of water (to fill swimming pools, to water lawns, and so forth) should be prohibited.

Chapter 4

WATER AND SANITATION NEEDS CAUSED BY DROUGHT

4.1 Where Problems Exist

While facilities to provide drinking water are generally limited throughout the country, the displaced person problem exists primarily to the north of Ouagadougou.

4.1.1 Topography

The topography of the major portion of the northern part of Burkina Faso is a generally flat plain between 300 and 400 meters above sea level. This area is termed the Mossi Plateau. In some areas, exposed rock surfaces protrude above the surface of the plain and may reach elevations of 400 to 500 meters. Most of the valley of the White Volta, which cuts through the plain, is at elevations of between 260 and 300 meters, to the north of Ouagadougou. The areas between the Mossi plain and the northern border of the country in the Niger River Basin watershed are also at similar elevations.

4.1.2 Geology, Groundwater, and Surface Water

The geology of the northern part of Burkina Faso is predominantly comprised of Precambrian granitic rock, which has been intruded by numerous smaller batholiths of younger senite and alkaline and calcareous granites. In addition to the Precambrian granitic terrain, the northern part of Burkina Faso contains belts of younger metamorphosed subsea volcanic and sedimentary rock. The basic geology of the country is shown in Figure 3, which appears in the 1975 Editions of Jeune Afrique Atlas de la Haute-Volta.

These rocks have been subject to peneplanation and the development of a sometimes thick weathering sequence of rock. From the point of view of water-bearing characteristics, groundwater is to be found within the near surface weathered rock and can be obtained from this rock sequence by hand-dug wells as the soils are not particularly hard to dig. Where renewed erosion is taking place, the paleo-soil horizon is being removed to expose the crystalline Precambrian bedrock. Water is found within the crystalline Precambrian bedrock in joints and fractures which developed as a result of either tectonic activity (that is, folding and bending of the rock) or as a result of unloading as the rock is removed by erosion. Generally speaking, the fracture porosity within the crystalline rock will diminish to a negligible amount within 75 meters of the land surface.

Hand-dug wells will obtain water only from the surface-weathered soils. Drilled wells must be used to develop water supplies from the Precambrian crystalline rock in areas overlain by the weathered rocks, but where water is sought in the underlying crystalline rock.

Reported well yields are unlikely to approximate yields with any degree of accuracy because of the methods used to determine well yields. It is normal

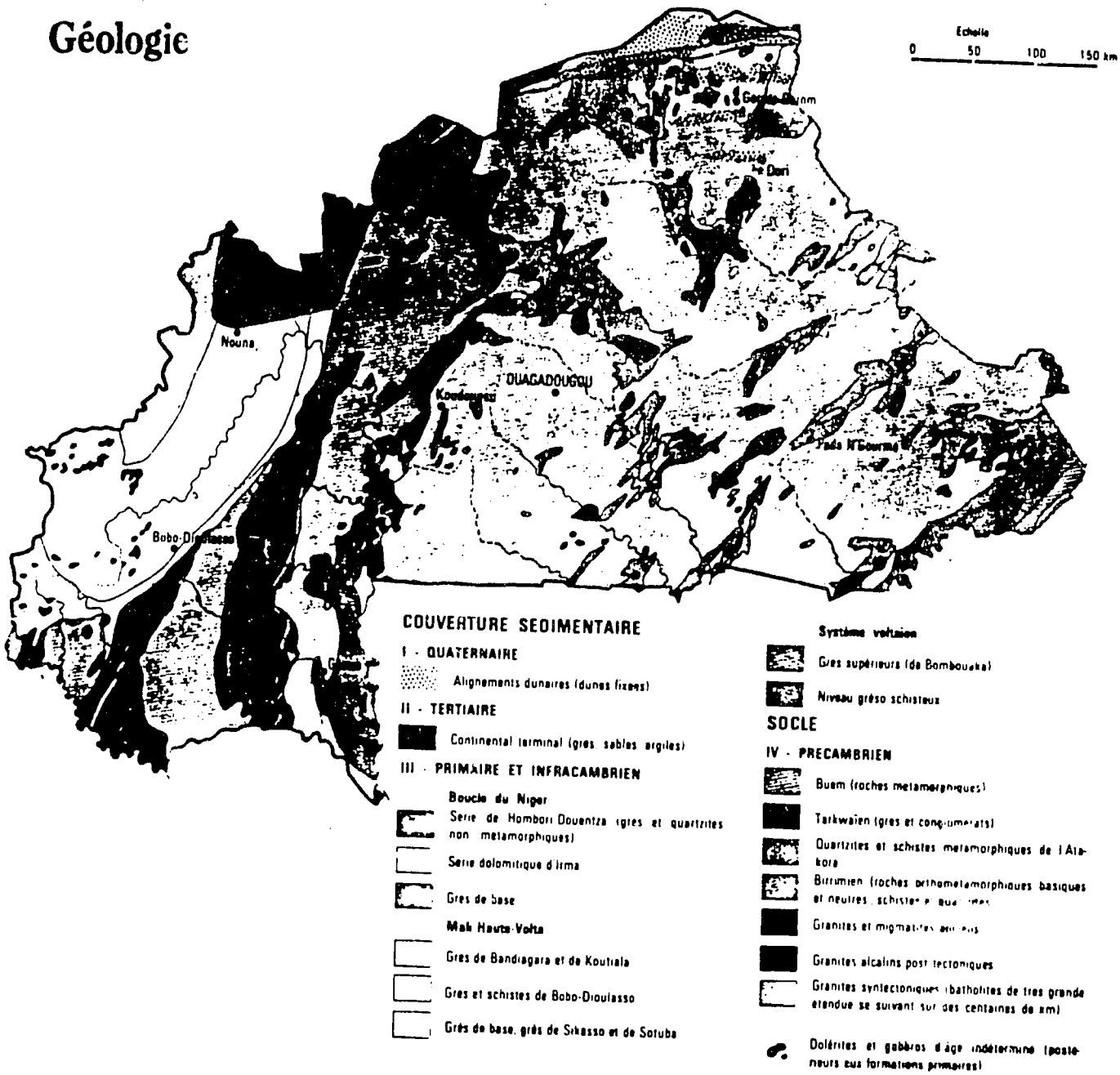


Figure 3. Geologic Map

practice to determine well yield with only air-lift pumping methods. This air-lift method is unlikely to result in adequate surging of the well, and it is doubtful if wells developed by using present air lift methods are truly well developed. Reported well yields may be lower than the actual potential of a well. Many wells that are classed as failures may actually be effective wells if air development included both surging and adequate pumping procedures.

As noted earlier, the Mossi Plain is traversed by the White Volta river. Throughout the area of interest, the river is dry during much of the year, but numerous barrages have been constructed on its main course and tributaries. To the north and east of the Mossi Plain, the drainage is through various tributaries of the Niger river. Numerous barrages have also been constructed on these tributaries with one of the largest being the impoundment on the Bouli river at Yalogo. In the northern and western portions of the plain and its fringes along the Mali border, impoundments do exist, but surface water is generally sparse and most of these impoundments are reported to have been practically dry during recent years.

4.2 Population Affected (including displaced persons)

The UNDP Country Digest of 1983 estimated that the total population of the country in December 1980 was 6.1 million and this estimate was expected to increase to 7.6 million by 1990. Figure 4, on the following page, depicts various areas of the country where food shortage has been determined to be a problem. In addition the areas north of Ouagadougou which have some of the most serious water supply shortages begin west of the main road to Kaya and Dori. The WASH team computed that the population to the north of the line shown in Figure 4 separating the area critically deficient in drinking water for migrants and displaced persons, approximated 2.9 million people. If the country population is in the order of 6.6 million people, then the population in this area would amount to approximately 44 percent of the present population of the country. The original figures depicting population, existing wells and needed wells for ten liters per day per person are also reproduced as Appendix H.

4.3 Current Water Supply Activities

4.3.1 Government of Burkina Faso

Urban Centers

ONEA is responsible for the water supply in designated urban centers. The status of these supplies throughout the country in 1982 is shown in Appendix J. Also included in this Appendix is a current update of their status.

Key urban centers to the north of Ouagadougou were visited by the WASH team in March 1985 to assess needs of displaced persons. The observations of the WASH team on the water problems of these urban centers is included in Appendix E. These observations resulted in the conclusion that no urban center to the north of Ouagadougou has an adequate water supply and distribution system for its own inhabitants and any further demands for water can only make the current water problems worse.

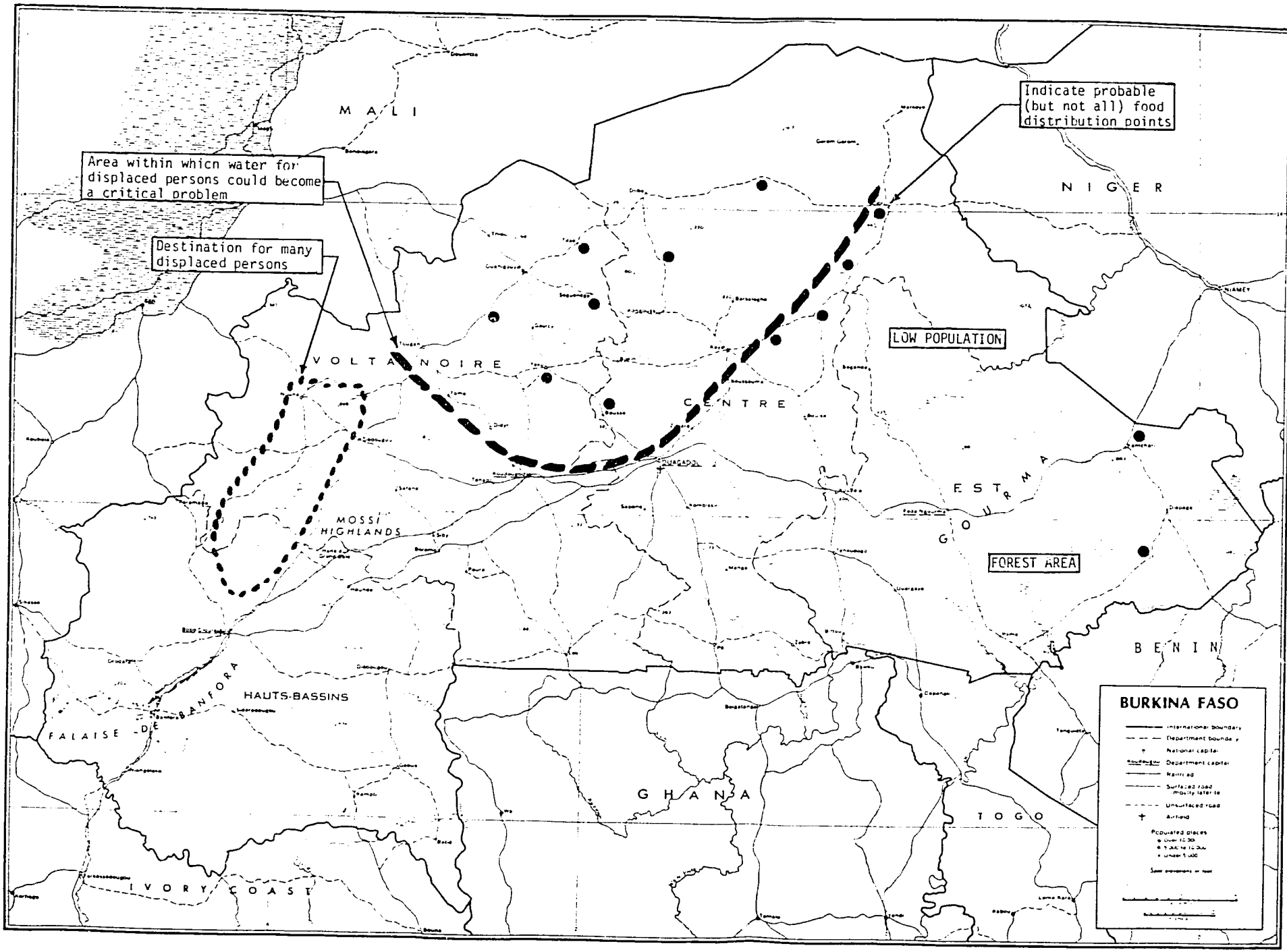


Figure 4. Food Distribution Points

Photo 7. Many families from Mali's Niger border area are normal migrants and appear to have little problem with securing either adequate water or food. They have always lived as nomads.

Photo 8. Water problems in Yako with Mono pump providing extraordinary service under constant use. Water supply for urban centers throughout the northern part of Burkina Faso is on the verge of an emergency status in almost all such communities.

In the past, most migrants and displaced persons have avoided urban centers unless adjacent barrages assured them of a source of adequate water.

Rural Areas

Appendix G contains a list of drilled and dug wells provided by the Director General of DEPC showing the status of present programs, future programs funded, and proposed programs without funding.

The Government of Burkina Faso has set rural water supply criteria of 10 lcd in 1985 and 25 lcd in 1990. It has been assumed that a typical rural water point can supply more or less 10 m^3/day, or enough for up to 1000 persons by the 1985 critera and up to 400 persons by the 1990 criteria. Appendix G shows that in 1984 there were countrywide 5,891 existing water points out of an immediate need of 9,781 and a 1990 need of 17,856. A total of 917 were under construction, and 1,068 more had funding assured. These figures do not include water points installed with the assistance of NGOs, as described in Appendix I.

In the six northern provinces there is a serious water shortage where migrants are a concern. A summary of the development of water points in these provinces is shown in the following table.

Table 4
Northern Provinces Undergoing Serious Water Shortage Problems

Province	Existing July 1984	Under Construction	Financing Assured	1985 Requirements	1990 Requirements	Financing Sought for PPD	Source of Funding
Yatenga	235	33	--	666	1217	398	FED
Soum	210	--	--	198	359	--	--
Seno	273	--	--	174	318	3	--
Bam	199	12	81	164	299	--	FENU
Sammatenga	403	95	38	318	579	--	UNI
Namentenga	278	27	--	340	626	120	AS/GTZ

4.3.2 UNICEF

UNICEF is undertaking a survey of people at risk and displaced persons. The UNICEF paper reproduced in Appendix K notes that their February 1985 information showed 20,000 migrants and displaced persons in only two northern provinces. The conditions and status of the displaced person as described in the UNICEF paper are in general agreement with the WASH team's assessment of the situation.

Chapter 5

REVIEW AND RECOMMENDATIONS - DISPLACED PERSONS

5.1 Conclusions

Drinking water for migrants and displaced persons does not seem to be a problem at this time. Those persons currently present in the regions north of Ouagadougou are fairly dispersed and look for large water sources, such as reservoirs.

The WASH team appreciates the fact that difficult conditions could occur quickly, however, and therefore, recommends that all preventive measures, such as food distribution and sufficient access to water sources, be examined. The team also recommends that USAID/Burkina Faso develop, with the cooperation of the GOBF and UNICEF, a plan of action designed to be responsive to such problems as might appear. UNICEF proposes to supply immediately 200 rubber water containers of $5m^3$ each. Because technical resources of USAID/Burkina Faso are currently limited, WASH feels that it might be necessary to send a specialist, who together with the GOBF and UNICEF, could develop a detailed plan of action.

5.2 Recommendations

5.2.1 Short-term Recommendations

1. It is the WASH team's recommendation that actions which might lead to the concentration of any large numbers of people be carefully thought out within the context of available water. In general, such actions should be avoided.

2. The WASH team also recommends that USAID/Burkina Faso develop, in cooperation with UNICEF (which is initiating a contingency plan of action) and with the GOBF, a program capable of rapid response to possible isolated emergency water needs that might materialize without warning. This program should have immediate funding for drums or locally fabricated rigid containers for the transport of water. Small engine driven transfer pumps, and other water handling equipment appears necessary on a small scale. It would appear as if the focus of UNICEF's current water supply planning has been on obtaining funding for equipment and materials which, except for 200 rubberized $5m^3$ storage tanks, may not be available for some months. Unfortunately, the absence of the principal UNICEF contact at this time coupled with a severe reduction of USAID/Burkina Faso staff would probably necessitate a short-term assignment of a consultant to work out such a contingency plan.

3. Urban centers north of Ouagadougou do not have adequate municipal water supplies for their own inhabitants. Consequently, actions should be avoided which might lead to the concentration of any large numbers of people. Because this will be almost impossible to achieve,

an emergency program to supplement present water supplies in urban centers with added hand-pumped wells should be undertaken. A tentative budget to contract for some 16 to 20 wells, exclusive of supervision and monitoring, is estimated at $100,000.

Specific details pertaining to the implementation of recommendations 2 and 3 may necessitate a short-term assignment of a technical consultant. It is estimated that expenses and salary for such an effort would cost between $16,000 and $20,000 for travel time, three weeks in country, reporting, and debriefing.

5.2.2 Long-term Recommendations

The water supply problems for displaced persons beyond the immediate problems and potential problems is the subject of an action plan now being developed by the National Commission for the Campaign Against Effects of the Drought (CNLES). The WASH team understands that the request expressed in the UNICEF paper for one million dollars (U.S.) to accommodate water supplies for displaced persons, has been approved. This funding is for materials appropriate for medium- and long-term action. Most expatriates agree that the country would have difficulty in absorbing additional funding in water supply activities.

Moreover, for the long term, UNICEF foresees a program to increase the depth and repair of dug and drilled wells that are out of use in migration zones. Other donors and NGOs are working with the GOBF in various programs toward the goal to overcome the shortage of necessary water sources in rural zones. Along the same lines, urban water supply projects are under construction or under study for most urban centers. The WASH team recommends that efforts be put into action, particularly in areas to the north of Ouagadougou, to meet the future needs of displaced persons.

Photo 9. Tougouri -- Displaced persons build their own shelters in addition to tents furnished by GOBF water in traditional goat skins.

Photo 10. This photograph depicts one of the largest concentrations of migrants and displaced persons, but the large impoundment furnishes year-round water.

SUPPLEMENT TO
WASH FIELD REPORT NO. 144

Field Review of Existing Condition and Proposed Rehabilitation of Dam No. 2 Ouagadougou, Burkina Faso

Prepared for the USAID Mission in
Burkina Faso under Activity No. 143

by

Roger Wood

May 1985

Summary

The assessment of Dam No. 2 at Ouagadougou, Burkina Faso has been completed. The subsidence of a portion of the spillway on the dam is due to leakage through the dam of the spillway foundation level eroding the spillway foundation material. Additional subsidence of the same section and subsidence of other spillway sections are expected if the reservoir rises to normal pool level. Continued leakage exposes more of the dam's core material to erosion and results in the deterioration of the dam. Pumping into the downstream reservoir to reduce water loss by evaporation as recommended by the recent WASH team investigators will not be an immediate problem provided the downstream reservoir water level is kept below the undermined area. If the water is allowed to rise above this level, it is expected that deterioration of Dam No. 2 will accelerate.

The repairs proposed by the Government of Burkina Faso are appropriate with some modifications. The primary suggested modifications are a reduction in the amount of embankment replacement, the addition of seepage cutoff walls to the proposed spillway and the addition of filter fabric to reduce the loss of fines from the embankment.

It is expected that the proposed repairs will have a construction cost of approximately 1,000,000 dollars if weather conditions require the use of cofferdams.

1. Request for Assistance

a. The USAID Mission in Burkina Faso by 12 April 1985 cable, requested the Office of Foreign Disaster Assistance to advise it on the suitability of using disaster funding for the rehabilitation/-reconstruction of Dam No. 2, Ouagadougou, Burkina Faso. The request also included, as an immediate preliminary step, a request of an assessment of the dam road by an expert in small dam rehabilitation/construction to determine exactly what is required.

b. AID/Washington, on 18 April 1985, approved a trip to Ouagadougou and a four to five day consultancy by Mr. Roger Wood to assess needed improvements and/or to provide other appropriate advice on the dam. On completion of a prior assignment in Cairo, Egypt, the consultant arrived in Ouagadougou on 30 April 1985.

2. Purpose of Field Review

a. The east edge of a portion of the traveled way (the top of a portion of the principal spillway) experienced a subsidence of approximately 20 centimeters (8 inches) in August 1984. The dam exhibits obvious deterioration on both its upstream and downstream faces. Based on this, the Government of Burkina Faso (GOBF) banned vechicle traffic on the traveled way on the crest of the dam and proceeded to prepare plans for the repairs to the dam. The GOBF has requested assistance from the U.S. Government for the repairs.

b. A recent WASH investigative team has recommended that utilization of this dam for an emergency water conservation effort to mitigate water shortages in the city of Ougadougou. USAID/Burkina Faso is concerned on whether the dam can perform this function, whether the repairs/reconstruction proposed by the GOBF are appropriate or whether other remedial action/repairs should be employed.

c. The purpose of the field review is therefore to determine 1). the general condition of the existing dam/road, 2). the general cause of the deterioriation of the dam/road, 3). the general importance of the structure, 4). the general urgency of any necessary repairs, 5). the general appropriateness of the repairs/reconstruction proposed by the GOBF and 6). the general applicability of alternate actions with respect to the dam/road.

3. Function of Structure

a. The dam's primary function is to impound water in Reservoir No. 2 for water supply to the City of Ouagadougou. It also provides a traveled way from the villages on the north side of the reservoirs to the center of Ouagadougou. Reservoir No. 2 (to the west) and Reservoir No. 3 (to the east) are long and narrow and abut the dam. The alternate route for the large amount of pedestrian and bicycle traffic in this area is excessively long.

b. A recent WASH team investigation of the emergency water problems in Ouagadougou recommended that water be pumped from Reservoir No. 2 to Reservoir No. 3 to decrease the loss of water by evaporation. Dam No. 3 is therefore a key element in their recommendations.

4. Available Documents

a. The documents available to the consultant during the field review were as follows:

a.1. Report entitled "Refection du Barrage No. 2" (Necessary repairs to Dam No. 2) comprising a justificative report and five drawings (in French) dated February 1985. The justificative report summarizes topographic, hydrologic and geotechnical studies and includes proposed repairs to the dam with cost estimates. The contents of the five drawings are as follows:

A. Plan of the Proposed Repairs
B. Profile of the Proposed Repairs
C. Section of the Proposed Repairs
D. Masonry Outline of the Proposed Spillway
E. Steel Reinforcement for the Proposed Spillway

a.2. Report entitled "Etudes des Emprunts, Remblar du Barrage No. 2 (Study of borrow for Dam No. 2 embankment) Ouagadougou" by Laboratoire National du Batiment et des Travaux Publics du Burkina (in French) dated February 1985.

a.3. Cable from USAID/Burkina Faso to Washington dated 12 April 1985 with the subject "Funding Request for Reconstruction of Water Supply Dam in Ouagadougou."

5. Pertinent (Approximate) Data

a. Barrage No. 2 forms a barrier between downstream (to the east) and upstream (to the west) water supply reservoirs for the city of Ouagadougou. The exact age of the barrage (dam) is unknown but it is believed to be in excess of 30 years. The dam is approximately 310 meters in length and has a height of 4 meters. The dam was constructed of relatively impervious fine grain soil protected by a mortared riprap facing on both upstream and downstream slopes. The slope of these faces appears to be two horizontal to one vertical.

b. The crest has an elevation of 288.5 meters (datum unknown) and has a minimum width of 9 meters. A paved roadway is present on the crest which is depressed to elevation 287.2 meters for a length of 98 meters to effect an emergency spillway. Below the emergency spillway and extending the full length of the depressed portion of the crest, there are a series of transverse reinforced concrete box culverts which form the prinicipal spillway for the dam. This spilllway has an invert elevation of 286.7 meters. The dam has an outlet/drain near the north abutment. The reported invert elevation of the drain is 283.0 meters.

c. The adjacent terrain is relatively flat and the reservoirs are believed to be relatively shallow. Riprap paving is present along the shore of the reservoirs.

6. Field Observations

a. The consultant, accompanied by Mr. Augustin Ouattara of USAID/Burkina Faso, viewed the dam and took photographs of it during the morning of 2 May 1985. The preceding season had been very dry and the water levels of the adjacent reservoirs were near the bottom of the dam's upstream and downstream slopes. The weather was clear with little discernable wind present during the observations.

b. The upstream and downstream slopes of the dam appeared to have had a surface paving of mortared volcanic stone (approximately 20 centimeters in diameter) set in a mortar base. Most of this mortared riprap was missing from the upstream face except for near the very bottom and very top of the slope. Sloughing or raveling of the embankment appeared to have taken place in the area of missing riprap but no accumulation of the displaced embankment material was noted at the toe of the slope. Some of the riprap that remained in place appeared to have voids present beneath it. Missing riprap in the downstream face of the dam appeared to be confined to relatively large but individual areas. Core material appeared to have eroded in these areas but no deposit of the eroded material was noticed at the toe of the slope. Isolated locations were also observed in the downstream face where the riprap had moved or dropped inward with respect to the adjacent surface. Brush, with stem diameters up to 5 centimeters, was observed near the top of the upstream slope and some isolated animal burrow holes were observed in the same slope. Appreciable tresspass on both upstream and downstream slopes were observed during the visit.

c. A portion of the east half (downstream direction) of the box culvert principal spillway, approximately 28 meters in length, has rotated so that the outboard edge has subsided approximately 20 centimeters while the portion adjacent to the centerline of the dam has risen a few centimers. A large horizontal void is present beneath the subsided section. The void extends inward in excess of 2 meters and has a height of approximately 30 centimeters at its inboard end. The void exposes the underside of the concrete culverts in some areas and the underside of riprap that is present below the concrete in other areas. The observed riprap tended to be located towards the inboard end of the void. A substantial portion of the downstream edge of the spillway is undermined although the most extensive void (in the inboard direction) occurs at the subsided section. The entrance to the spillway at the upstream end is protected by concrete extending downward towards the reservoir bottom. Stepped riprap was placed in the outboard side of the concrete protection. The concrete protection is generally in good condition although one section of the concrete, approximately 3 meters in length was observed to have subsided. An open, generally horizontal crack was observed and some evidence of voids present beneath the concrete were noted. Most of the stepped riprap

protection is missing. The spillway reinforced concrete itself appears to be in good condition with little apparent evidence of deterioration or exposed reinforcing steel.

d. With the exception of the portion affected by the subsided spillway section, the crest of the dam appeared to be in good condition. There appear to be no areas of settlement or general misalignment. There are some holes and cracks in the pavement outside of the spillway area but they appear to be superficial conditions. Railing on the upstream edge of the crest is missing and railing on the downstream edge is in need of repair.

e. No detailed observations were made of the outlet drain structure near the north abutment but it was observed that there has been a loss of embankment from around the control structure.

f. No overhanging bluffs or other terrain conditions were observed around the reservoir that could, upon failure, cause a sudden rise in reservoir level. It was observed that there had been a loss of riprap along the reservoir shoreline.

g. There was no observed indication of the use of filter or filter material to control seepage in the dam. No seepage cutoff walls were observed in conjunction with the spillway structure. No instrumentation of the dam was observed during the visit.

7. Conclusions Based on Field Observations

a. The dam appears to have a relatively impermeable fine grain soil core encapsulated by a mortared riprap shell. When the shell was breeched, fine material was carried away by seepage, wave action, drainage etc. It appears that no filter material was incorporated in the design to minimize the loss of fines by seepage. It should be noted that as the fines are removed from the embankment, seepage velocities will increase, thus allowing larger size particles to be carried away.

b. The interface of different materials can form planes of weakness with respect to seepage flow. In the case of this dam, it appears that such planes were present at the interface of the bottom of the spillway concrete and the riprap below and the contact area of this riprap with the core material below it. In addition, if the joints between the individual pieces of riprap were not completely filled with mortar, the joints could serve as paths for leakage or seepage. There were no cutoff walls observed beneath the spillway concrete to minimize the passage of water or seepage along this plane.

c. Based upon the observed conditions at the dam, it is the consultant's opinion that:

c.1. The partial subsidence of the spillway was caused by water seeping through the dam at the contact area of the bottom of

the spillway and the top of the core material eroding the spillway foundation.

c.2. The loss of riprap contributed to the deterioration of the dam. It appears that major factors in the loss of riprap protection on the upstream face are displacement of riprap by wave action, loss of riprap bedding during reservoir drawdown etc., and the relatively small size of stone used being easily displaced. The major factors in loss of riprap protection on the downstream face appears to be displacement due to spillway discharges and loss of bedding by seepage/leakage through the dam.

c.3. The lack of maintenance on the dam allowed the deterioration to continue and accelerate.

c.4. The deterioration of the dam appears to be confined to the foundation of the spillway and the upstream and downstream slope surfaces. No conditions were observed which indicated difficulty with the foundation of the dam or with the core material of the dam in general.

c.5. The general dimensions of the cross-section of the embankment with respect to its height indicates that the overall stability of the dam should not be a problem.

8. Proposed Repairs

a. It is beyond the scope of this field review to perform studies, detailed analysis and detailed design for the modification/repair of the facility. The comments included in this report assume that the rehabilitated dam will be subject to loadings in the magnitude that the existing facility has experienced, spillway configuration as shown in the Government of Burkina Faso proposed repair drawings will be sufficient for future spillway discharges (it is similar to the spillway configuration of the downstream dam), structural dimensions of the spillway as shown in the Government of Burkina Faso proposed repair drawings are adequate to withstand the hydraulic pressures and vehicle loadings, and the facility may be subject to reverse loadings as would result from implementation of recommendations by the recent WASH team.

b. Review of the Government of Burkina Faso Proposed Repairs. While the drawings do show detailed information with respect to the configuration of the spillway, they do not show details of the proposed repairs to the embankment and details of the cofferdams. It is assumed by the consultant that these details would be covered by the repair work specifications or by other future detailed drawings. Comments made in this report may assume erroneously the intent of the designer of the proposed repairs.

b.1. The drawings do not indicate seepage cutoff walls beneath and at the end of the spillway structure. Cutoff walls are a major factor in preventing a recurrence of the undermining of

the spillway and should be incorporated in the design. Cutoff walls are recommended at least near each end of the spillway culverts.

b.2. It is the consultant's opinion that it is not necessary to remove the embankment in the spillway area to its foundation level. No conditions were observed during the field observations that indicated the embankment is experiencing difficulty except near its surfaces. The existing embankment should have consolidated during its life and, in general, it will be difficult to compact the new fill to the same degree. Removing and replacing the embankment fill to its foundation level will require cofferdams and dewatering to protect the excavations and the placement of fill. Replacing only the disturbed surfaces may not require an extensive cofferdam system especially if the work is performed in other than the wet season.

b.3. The drawings infer a vertical demarcation between the ends of the new fill and the existing embankments. The termination of layers of the new fill should be staggered as much as practical to prevent the formation of straight, especially vertical, planes of weakness for seepage.

b.4. The drawings indicate that the upstream and downstream faces of the new embankment be on a 1 1/2 horizontal to 1 vertical slope. The existing embankment appears to have had difficulty in maintaining steep slopes. It would be more prudent to use 2 horizontal to 1 vertical or flatter slopes.

b.5. The drawings do not indicate the details of the slope protection. The new slope protections should utilize a heavier stone than used in the original design and the stone should be bedded on filter material.

b.6. The proposed cofferdams do not show slope protection. It is assumed that such protection would be provided on the water side for the portion subject to wave action.

b.7. The proposed cofferdam system does not indicate the provisions for passing water from the upstream reservoir to the downstream one. It is therefore assumed that the flows would have to be handled by the reservoir outlet/drain or by pumping to prevent overtopping of the cofferdam. The magnitude and potential for minor floods is unknown by the consultant but it appears that additional provisions should be made to pass flows. The details of the outlet/drain are also unknown. It should be recognized that the north ends of the cofferdams are shown in this area.

b.8. The drawings indicate a wider traveled way than incorporated in the existing facility. This appears to be the result of providing sidewalks for the large amount of pedestrian traffic on the crest of the dam. It is the consultant's

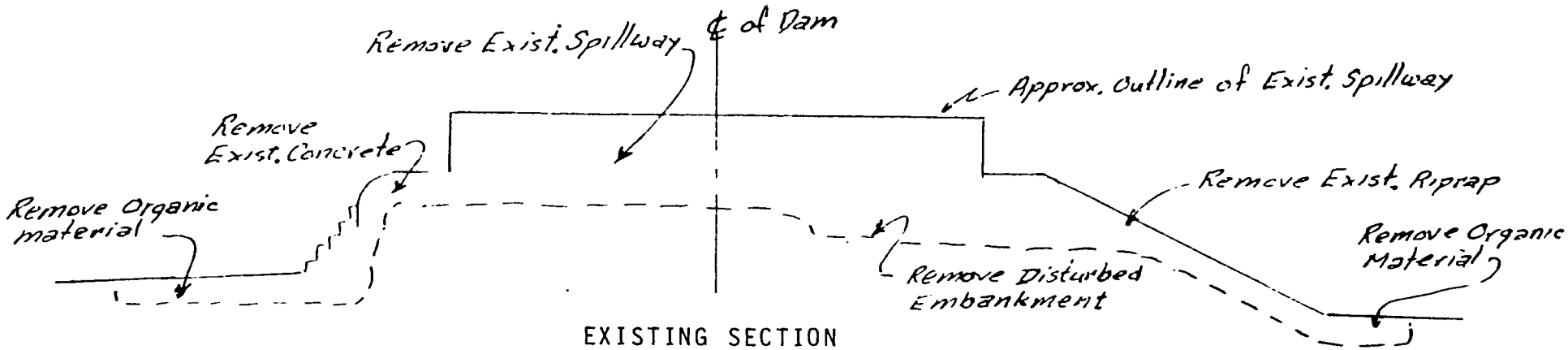
opinion that the length of the spillway and the width of the traveled way should be kept as close as possible to the dimensions on the existing facility to take advantage of the present embankment section.

c. Suggested Repairs to the Dam - There are many variations in the repair method that could be used on the dam and many spillway configurations. There would be some variation in costs but to determine the optimum system would require detailed studies of the facility which is beyond the scope of this review. The general layout of the work as proposed by the Govenment of Burkina Faso should be among the lower cost alternates. As it is of relatively simple construction the type of spillway has been constructed in the area previously and it uses materials that are generally available in the area. It is therefore suggested that the basic systems be used but modified according to comments made herein and in prior paragraphs. Sketches of the suggested repairs to the spillway embankment are shown on the following page.

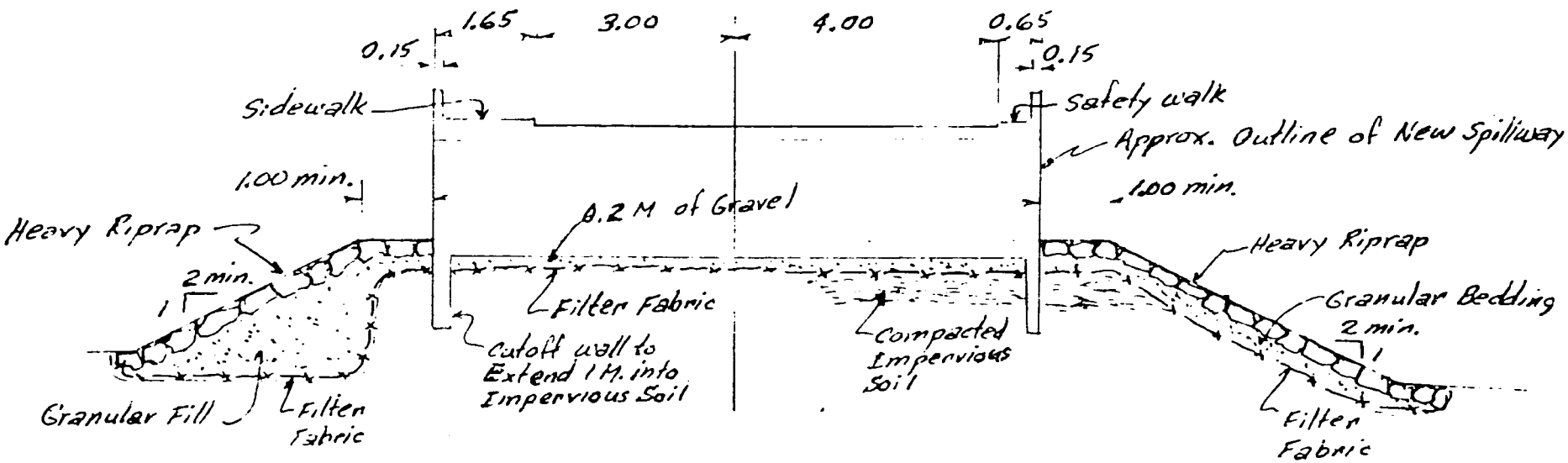
c.1. The modification of the spillway can probably be completed with only a local cofferdam at the toe of the downstream slope if the work is accomplished during the dry season. However, if attempted without the aid of a general cofferdam when there is a threat of high flows, not more than about one third of the existing culverts should be removed at one time. Sufficient sand bags should be kept on hand to divert the flow if necessary from the exposed core materials and into remaining functioning spillway culverts. If a general cofferdam is used, it should only allow for sealing approximately 50 percent of the culverts at one time. The cofferdam should be constructed to the approximate elevation of the existing roadway and the outboard side protected against wave action.

c.2. The spillway structure and adjacent riprap should be removed. The excavation should be continued until all disturbed core material of the embankment has been removed. Compacted impervious fill should be placed to bring the core material at least 20 centimeters above foundation level and then re-excavated to grade.

c.3. Cutoff walls should be placed at each end of the spillway culvert foundations and extended down into excavated trenches a minimum of one meter into the core materials. The concrete should be placed directly against the soil and formwork should not be used. The cutoff walls should be continuous and extend 2 meters beyond each end of the spillway structure. The top surface of these cutoff wall projections need not be higher than the underside of the culvert roof slab. Equalizer holes approximately 5 centimeters in diameter may be constructed in the upstream cutoff wall to minimize buoyancy on the culverts but the elevation of such holes should be above the filter fabric on top of the impervious core material. The equalizer holes should be filled with coarse gravel and covered at both ends with filter fabric.



EXISTING SECTION



Upstream Side

PROPOSED SECTION

Downstream Side

Note: All figures are expressed in meters

c.4. Filter fabric should be placed on top of the core material prior to placing granular fill or granular bedding. The fabric is used in lieu of constructing a filter of granular materials due to the ease in installation and the unknown grain size distribution of the material in the existing embankment.

c.5. The final slopes on both upstream and downstream faces should not be steeper than 2 horizontal to 1 vertical. The utilization of sloping surfaces for both upstream and downstream of the spillway is a compromise solution to the problem of the potential flow being from either direction. The slopes should be protected by heavy riprap. If larger/heavier stone is generally not available in the area, stone of the same size used on the existing slope can be used by tightly compacting them in plastic coated wire gabions. The riprap can be mortared from the edge of the culverts to a line 1.5 meters down the slope. The transition from a horizontal surface to an inclined surface should not be abrupt.

c.6 Repairs to the embankment outside of the spillway area can be accomplished by removing the loose material, covering the exposed core material with filter fabric, placing granular bedding and placing reclaimed riprap on the surface.

c.7. Bushes and brush growing in the embankment should be removed.

c.8. Large concrete pieces without projecting reinforcement salvaged from the demolition of the existing spillway may be disposed of at the toe of the downstream slope at the spillway. The pieces will provide some energy dissipation and afford some protection to the reservoir bottom.

9. Urgency of Repairs

a. The east side of the spillway for approximately one third of its length has experienced a relatively large subsidence due to undermining of the foundation by leakage through the dam. The presence of a large void under this same section indicates the section may experience an even greater subsidence under large future spillway discharges. Other areas along the east side of the spillway have also been undermined although at present no subsidence has occurred. It is expected that some if not all of these sections will also experience movement during future spillway discharges.

b. The dam currently provides a pedestrian way between villages and the city of Ouagadougou. Alternate routes would require considerable more travel time and it is doubtful that the population would resort to alternate routes unless it was impossible to use the crest of Dam No. 2. It is therefore probable that injuries will occur to pedestrians during future subsidences.

c. A recent WASH investigative team recommended, due to emergency conditions, that water be pumped into the downstream reservoir to reduce the loss of water by evaporation. The water downstream is not only impounded by Dam No. 3, but also by the questionable Dam No. 2. The conditions present at the foundation of Dam No. 2's spillway limits the degree that water can be impounded. If the reservoir surface is brought above the elevation of the spillway foundation, rapid deterioration of the dam can be expected due to the reverse leakage flow.

d. Dam No. 2 is therefore a key regardless of whether drought conditions continue in the country or if a substantial rainy period occurs. If the drought conditions continue, its competency is required to store water in the downstream reservoir. If a substantial rainy season materializes, it is needed to store water for the following dry period. In addition, the access way to the city provided by the dam to the poorer segment of the population which resides in the village is needed. If repairs to the dam are not made in the immediate future, the dam may not be available for any of the above conditions.

10. Cost Estimates

a. The cost estimate included with the proposed repairs by the Government of Bukina Faso was reviewed. The unit prices appeared to be of the right magnitude. Adjustments were made to reflect the reduction in work suggested in this report. However, one price in the government's report did appear low and that price was for the cofferdam. The net result is that if major cofferdams are required to protect work in the wet season the estimated cost of the construction is 400,000,000 CFA. If the work is accomplished during the dry season, the estimated cost of the construction is 300,000,000 CFA. These figures include a 10 percent allowance for contingencies, no allowance for inflation, and are based on the work being performed by local contractors. It must be emphasized that the estimates are based on the assumption that the government estimate reflects local pricing and that the unit prices were only reviewed for reasonableness.

11. Miscellany

a. During the course of the field review, Dam No. 3 was observed because it was reported to have a spillway similar to the one being proposed for Dam No. 2. While the basic spillway structure is similar, the spillway at this dam also has a box inlet and a Bureau of Reclamation type stilling basin at its outlet. The additional features may afford more seepage control in the region of the spillway foundation. However, there were some indications that some local/undermining may have started. It is recommended that the spillway be inspected and corrective measures instituted if necessary.

REFERENCES

CIEH/USAID, Savannah Regional Water Resources and Land Use: Savannah Resources, Volumes 1-3, prepared by TAMS, New York (1976).

Commission Technique sur l'Approvisionnement en Eau Potable de la Ville de Ouagadougou: rapport de la Commission (1983).

Décision No. 0003/ONEA/DG/84, establishing ONEA. (available at WASH library)

Décret No. 83-002 Z/CSP/PD/DR, Code de l'Eau (1983).

Décret No. 78-133 PRES/DR, Comité Technique de l'Eau (1978).

Décret No. 83-015 CSP/PM/DR, Comité Technique de l'Eau (1983).

Décret No. 84-394, establishing Ministry of Water. (available at WASH library)

Direction Géologie et Mines, Carte Géologique a 1:1.000.000 de la République de Haute-Volta, preparé par G. Hoffin et O.F. Ouedraogo (1975).

Editions Jeune Afrique, Atlas de la Haute-Volta (1975).

FAO, Programme des Equipements d'Hydraulique Villageoise et Pastorale: Haute-Volta (1976).

Haute-Volta/RFA/OMS, Rapport du Deuxième Atelier National DIEPA, Volumes 1 et 2 (1982), Volume 3 (1983).

Ministère de l'Equipement et des Communications, Direction Générale de l'Urbanisme et de la Topographie, Ouagadougou 2000 - Schéma Directeur d'Amenagement et d'Urbanisme, préparé par Haskoning Consulting Engineers and Architects, Nimegue, Netherlands (1984).

Ministère du Développement Rural, Plan Directeur Alimentation en Eau des 44 Centres Urbains de la Haute-Volta, 1979-2005, préparé par ONE (1978).

Ministère de l'Eau, Rapport Final Journées d'Evaluation, de Clôture et de Suivi de l'Année Nationale de l'Hydraulique Villageoise (7-9.1.85).

OMS/World Bank/GTZ: Plan de Développement Activités Préparatoires pour le DIEPA: Haute-Volta (1980).

ONE, Alimentation en Eau de Ouagadougou: Solutions de Soudure, préparé par J. Sigismond (1983).

Service de l'Hydrologie, Bulletin Hydrologique Mensuel, octobre 1983, octobre 1984, novembre-décembre 1984, janvier 1985.

USA, Office of Technical Assessment, Water Related Technologies for Sustainable Agriculture in US Arid and Semi-Arid Lands: Evaporation Control (undated).

UNDP, IDWSSD Country Digest for Upper Volta (1983).

VOLTELEC, Etude du Potentiel Hydroélectrique de la Volta Rouge et de la Volta Blanche financé par la BOAD et preparé par SNG Canada (1981).

APPENDIX A

Scope of Work

SCOPE OF WORK

Feasibility Assessment - Urban Water Supplies Projects by a WASH team.

I. Introduction

The city of Ouagadougou depends on three dams for its water supply. These dams are filled mainly from run off, thus the quantity of water available for Ouagadougou is basically a function of rainfall. In previous drought years water shortages have affected Ouagadougou but it is recently that concern has increased because the demand is exceeding the capacity of the 3 dams. In 1984 rainfall in the Ouagadougou area was less than 65% of mean and in 1985 a water supply crisis is expected. Preliminary analysis puts forward the convergence of two trends which explain the anticipated water shortage in 1985 and beyond.

1. Insufficient rainfall resulting in inadequate water supplies in the three dams to meet the demand until dam replenishment in the summer of 1985.

2. Rapid urban population growth causing the city water distribution system to be unable to deliver enough water during peak periods to meet the demand. This growth will increase as drought affected people continue to move into Ouagadougou.

II. Objective

The objective of the assistance sought from the WASH team is to assist the USAID/Burkina and the Government of Burkina (GOB)

(a) identify and assess potential projects which may relieve Ouagadougou immediate urban water supply problem.

(b) assess the Ziga dam construction feasibility project and appraise its worthiness as a medium term solution to the water supply problem in Ouagadougou and the surrounding areas.

III. Scope of assessment

1. Immediate solution: Assess following (but not limited to) course of actions which may be undertaken under emergency conditions:

1.1 Increase efficiency of actual water distribution system (e.g. by reducing loss through leaking pipes) and give guidance for a better water resources management.

1.2 Drill wells in the city to back up the water supplies of the dams (study the availability of groundwater).

1.3 Upgrade the existing dams to increase retention capability.

1.4 Cloud seeding to increase run off.

2. Medium term solutions: analyze the GOB proposal for the construction of the Ziga dam. This task will require:

2.1 Analysis of existing data on population; water distribution and consumption history and other statistics.

2.2 Based on topographic maps, aerial photographs and hydrological data of streams and rivers, determine the best site for the construction of a dam (if this is an appropriate solution).

2.3 Determine if the GOB has the capability to undertake the study for the construction of the Ziga Dam.

2.4 Determine a preliminary environmental impact if the Ziga dam has to be built.

IV. Reports

1. One week after arriving in Burkina, the team shall prepare and submit to USAID a statement outlining its understanding and course of actions it envisions to propose as solutions.

2. Prior to departure from Burkina, the team shall prepare and submit to USAID a brief report indicating its findings and final recommendations.

V. Time Schedule

It is expected that all the required work shall be performed in a period of 4 weeks.

VI. Man Power

Water Resources Engineer: Experience in Water Supply Development in semi-arid urban environments in the Third World. French S-3 R-3 (2+ 2+ min).

Engineering Hydrologist: Experience in extrapolative analysis of water resources (surface and groundwater) in semi-arid environment with limited base data.

VII. Logistic support

Vehicle, airtravel.

APPENDIX B

Persons Contacted

APPENDIX B - PERSONS CONTACTED BY WASH TEAM*

U.S. Embassy	Ambassador	Leonardo Neher
	Deputy Chief of Mission	Robert M. Pringle
USAID	Director	Emerson J. Melaven
	Deputy Director/Responsible for Emergency Operations	Lawrence C. Heilman
	Food for Peace Monitor	Charles Kelly
	Rural Water/Emergency Project Officer	George Thompson
	Engineer, Office of Program	Augustin Ouattara
	Food for Peace Assistant	Yeye Ousseini
Government of Burkina Faso	Secretary General, Water Ministry	Lamin Kou[illegible]è
	Director DEPC	Michael [illegible]da
	Chief SPSE	Kelemor[illegible]tara
	Chief SCEE (DEPC)	Mouhama[illegible] Ouedraogo
	Engineer DEPC	Ber[illegible]o
	Director DPFH	Jul[illegible]
	Chief Service Hydrologyz (DPFH)	Sie Luc[illegible]am
	Chief Service Hydrogeology (DPFH)	Jacques [illegible]ongo
	Hydrogeologist Adviser	Alain Poi[illegible]
	Chief, Service Travaux (Puits et Forages)	Celestin Batienou
	Anc. Director General ONEA	Dieudonne Nikiema
	Director ONEA Regions	Sabne Koanda
	Chief Treatment Plant	Mohamady Koanda
	Chief, Ouaga Dist. net.	Bega Ouedraogo
	Director ONBAH	Abel Tigasse
Provincial Officials	Pissila Judge	Youssouf Tamou
	Pissila Police Chief	Awecouba Yaguibou
	Tougouri Prefect	Nore Ouedraogo
	DORI ONEA Plumber	Parfait Ouedraogo
	Gorgadju Prefect	Somkeita Issaka Ouedraogo
	Djibo Provincial High Commission	Abdulaya Hama
	Titao Prefect	
	Gourcy ORD Representative	Desire Ouedraogo
	Yoko Provincial High Commissioner	Melle Aicha Traoai
	Bousse Prefect	Herve Kabore
International Organizations	UNICEF Admin. Officer	Dwight Antwine
	UNICEF Hydrogeologist	Philippe Chaperot
	UNICEF Geologist	Maurice Bro
	UN/DTCD Hydrogeologist	Jean Dubus

Non Governmental Organizations	AFVP Director BK	P. Charlier
	AFVP Deputy BK	G. Bourgeaux
	AFRICARE Director BK	Sahr Tongu
	Save the Children Director	Jerry E. Pasela
	OXFAM BK Coordinator	Yakuba Weber
	CRS Representative Dori	Emil Bougouma
Consultants and Contractors	Lahmeyer International Project Chief	Claus Dieter Wunderlich
	Lahmeyer International Hydr. Engineer	Edgar Firmenlich
	Lahmeyer Inte. Geologist	
	FOREXI Abidjan Well Driller	Claude
	FOREXI Abidjan Well Driller	Ariel

APPENDIX C

Original Request for Assistance to AID from GOBF

RESUME DU PROJET

Date : 28 / 09 / 84

N° de référence : 001 / H.U.	Désignation du projet : Etude du site du Barrage de ZIGA sur la Volta-Blanche	
Pays : BURKINA FASO	Région : Province d'Oubritenga	Secteur d'intervention : approvisionnement en eau potable

Ministère, département ou organisme responsable (adresse complète): Ministère de l'Eau, Direction des Etudes, de la Planification et du Contrôle

Objectifs du Projet: Etude d'avant projet du site de ZIGA, en vue de la construction d'un barrage devant permettre l'approvisionnement en eau potable de la ville de OUAGADOUGOU et la mise en valeur de terres à voccation Hydro-Agricole

Coût total approximatif : 70 000 000 F CFA	Financement extérieur demandé: néant Financement intérieur: Fonds de contre-partie à l'Aide Alimentaire

Description sommaire du Projet: Le Projet consiste en l'Etude technique des différents ouvrages à mettre en place :

* Barrage avec prises d'eau diverses
* adduction d'eau
* mini-centrale Hydro-électrique pour permettre les différents pompages locales
* aménagements Hydro-agricoles

Etudes à réaliser par les cadres nationaux.

Durée anticipée : 6 (six) mois	Date souhaitée de démarrage : 15 Octobre 1984

Projet nouveau (cocher la case correspondante) [X]

Suite à une opération déjà amorcée [ ] , et Montants déjà engagés:n

Sources de financement :

contactées: Budget National

déjà impliquées: néant

Documentation disponible:

Oui [X] Non [ ]

Dossier établi par (nom, titre, ou qualité) :
SAVADOGO Kandaogo

Signature : Dteur des Etudes, Planification et Contrôle

MINISTERE DE L'EAU

SECRETARIAT GENERAL

DIRECTION DES ETUDES, DE LA PLANIFICATION ET DU CONTROLE
(DEPC)

BURKINA FASO

LA PATRIE OU LA MORT, NOUS VAINCRONS

TERMES DE REFERENCE

APPROVISIONNEMENT EN EAU POTABLE DE LA VILLE DE OUAGADOUGOU

ETUDE DE SITE DE BARRAGE A ZIGA

OCTOBRE 1984

1°/ OBJECTIF

L'Etude du site du barrage de Ziga a pour objectif principal, la recherche de solution au crucial problème de l'Alimentation en Eau Potable de la ville de Ouagadougou.

Cette étude portera sur l'examen des possibilités d'aménagement à des fins alimentaires et agricoles d'une part et d'autre part à des fins énergénitiques placées au second plan.

Elle consistera en l'établissement d'un dossier d'exécution d'ouvrage principal (un barrage) et d'ouvrages annexes divers devant permettre le transport d'eau brute jusqu'à Loumbila pour assurer des apports plus substentiels à ladite retenue, et jusqu'aux éventuelles plaines aménagées à vocation agricole qui pourraient être identifiées dans la zone du projet étant entendu que la priorité est réservée à l'alimentation en Eau Potable.

Elle devrait déboucher sur le choix d'une variante à exécuter, établie sur les critères de fonctionnement et d'économie notamment.

2°/ PROGRAMME D'ACTION

L'Etude sera effectuée par les services compétents nationaux du Burkina Faso dans les domaines suivants :

- topographie et cartographie
- hydrologie
- barrage
- géotechnique
- pédologie
- irrigation
- adduction d'eau
- énergie

Les activités principales envisagées sont un assemblage et une analyse des documents existants, une reconnaissance sur le terrain des zones intéressées enfin des Etudes sur terrain et au bureau.

La durée de l'Etude est estimée à 6 mois.

3°/ METHODOLOGIE

Elle est similaire à celle couramment utilisée par les services nationaux Burkinabè pour chaque spécialité lors des études de routines.

La production et la répartition actuelles de l'eau potable à Ouagadougou seront comparées à celles après réalisation de ce projet de même qu'il sera fait le point sur la production agricole de la sous région concernée, la situation énergénitique dans ce cas précis trouvera une solution même circonstentielle et locale.

La méthodologie choisie est axée sur les possibilités de trouver une solution aussi rapide que possible dans le domaine de l'AEP de Ouagadougou.

4°/ LES TACHES

Les principales tâches à effectuer sont exposées ci après :

- Etude des rapports et documents existants
- Sélection des critères et classification des domaines de l'étude
- Analyse de données existantes (population, distribution eau, statistiques diverses .....).

- sur la base des cartes topographiques, des photographies aériennes et autres documents existants, définition des zones d'intervention et des ressources en eau, choix définitif du site du barrage, évaluation de la surface du bassin versant, examen des possibilités d'installation de micro-centrale hydro-électrique

- après la collecte des données de base l'Etude consistera :

4-1 GENERALITES

Introduction du projet dans ces grandes lignes ou généralités (localisation, accès au site et buts de l'aménagement).

4-2 ETUDES TOPOGRAPHIQUES

Ces études déboucheront sur :

- un levé de la cuvette et de la plaine à aménager, (Etablissement des courbes de niveaux), un établissement de profils en long des axes de digue, de chenal ou tout autre ouvrage composant du projet.

a) levé de la cuvette à l'échelle de 1/5000 avec des courbes de niveau d'équidistance 0,5 m

b) plan de masse sur une largeur de 200 m autour de l'axe du barrage à l'échelle de 1/500

c) profils en long des axes de digue choisis, échelles 1/1000, 1/100

d) levé de l'aval aménageable à l'échelle 1/2000 avec des courbes de niveau d'équidistance 0,5 m

e) plan d'ensemble de l'aval et de l'amont à l'échelle de 1/10 000.

4-3 ETUDES HYDROLOGIQUES

Il s'agit de dégager les caractéristiques du bassin versant, d'estimer les apports au site et la crue, d'établir les différents hydrogrammes de crue et faire ressortir les contraintes hydrologiques de la région.

4-4 ETUDES GEOTECHNIQUES

Ces études feront ressortir les contraintes liées à la nature de l'assise des ouvrages, des emprunts et de la cuvette. Elles indiqueront la disponibilité des matériaux locaux et décriront leur qualité.

4-5 ETUDES HYDRAULIQUES

Les études hydrauliques ont pour finalité le dimensionnement hydraulique des différents ouvrages composants le projet. Il s'agit notamment de :

- calage du plan d'eau en tenant compte des caractéristiques de la retenue et de l'estimation des besoins en eau

- choix de type et dimensionnement du déversoir

- définition des caractéristiques de la digue

- dimensionnement et calage des ouvrages de prise et des installations de refoulement

- schéma d'implantation des ouvrages (digue, évacuateur de crue .....)

- centrale hydro-électrique

4-6 PEDOLOGIE

Cette étude permettra l'identification, la caractérisation des terres à aménager et le choix des cultures à pratiquer.

Une carte sommaire pourrait être établie à l'échelle de 1/20 000.

4-7 IRRIGATION

- L'Etude portera sur les possibilités d'équipements de plaines aménagées.

- le Réseau d'irrigation et dimensionnement des ouvrages
- les besoins en eau pour l'irrigation

4-8 ADDUCTION D'EAU

L'Etude devra déboucher sur des solutions :

- au prélèvement d'eau du barrage de Ziga, et son transport jusqu'à Loumbila
- tracé de la conduite de refoulement et/au dimensionnement des conduites
- aux aspects des questions liées au traitement de l'eau brute et la distribution de l'eau potable.

4-9 ENERGIE

L'Etude des aspects énergitiques devra permettre de déterminer la puissance installée de l'Usine Hydro-Electrique et les conditions de la mise en oeuvre et de fonctionnement d'une telle infrastructure.

- Centrale

4-10 INFLUENCE DE CE PROJET SUR D'AUTRES SITUES SUR LE MEME COURS D'EAU ET VICE-VERSA

On dégagera dans la vision d'un schéma directeur, l'influence de ce projet sur les autres et vice-versa et on montera des senarios prévisionnels fonctionnels.

4-11 VERIFICATION DE LA STABILITE DES OUVRAGES

Il faudra calculer dans les conditions du projet, la stabilité de tous les ouvrages d'art mis en place.

4-12 DEVIS ESTIMATIF (Coûts des ouvrages)

Il s'agit d'estimer sur la base d'un mètré le coût de l'exécution du projet. Ce devis devra être aussi exhaustif que possible.

OBSERVATION

Il sera souhaitable d'envisager le refoulement de l'eau brute jusqu'à Ouagadougou.

APPENDIX D

Enlarged Scope of Work

Scope of Work for GOBF Study of Ziga Dam

A detailed Scope of Work was requested by AID/BF for response to the requested GOBF Ziga Dam Study. While AID/BF and the team's final recommendation was to delay any consideration of a GOBF study prior to receipt of the German consultant's recommendations for a long-term water supply source for Ouagadougou, the team's SOW is presented on the following pages for ease of possible future reference.

SCOPE OF WORK OUTLINE
DAM AND RESERVOIR EVALUATION AND FEASIBILITY STUDY

(The term Engineer may be interpreted as the Agency Private Firm responsible for the conduct of the study)

Task 1.1 - Data Collection and Review

Engineer will obtain and review available data pertaining to hydrologic, hydraulic, geologic and environmental characteristics of the study area, including but no limited to:

- precipitation data,
- streamflow data,
- reservoir water surface data for existing reservoirs,
- reservoirs withdrawal data for existing reservoirs,
- soils/geology data for proposed reservoir sites,
- land use data,
- baseline environmental data,
- well field withdrawal and drawdown histories at water supply well locations in the study area,
- studies by governmental agencies pertaining to the study area.

It is anticipated that the ONEA will provide assistance in obtaining data collected by departments or agencies of the Ministry of Water.

Task 1.2 - Assess Watershed Hydrology/Hydraulics

Precipitation, streamflow and reservoir storage characteristics will be evaluated using the data collected in Task 1.1. This evaluation will determine:

- statistics defining precipitation and/or streamflow characteristics in the study area,
- correlation between observed precipitation and/or streamflow at local guages and inflow to existing reservoir(s).

Task 1.3 - Assess Site Area Geology

Geologic/soils data collected in Task 1.1 will be reviewed to:

- assess general suitability of proposed reservoir sites whith respect to soil and foundation conditions,
- identify potential project constraints,
- assist in definition of detailed field investigations to follow in Task 2.3.

Task 1.4 - Assess Site Area Environmental and Land-use Factors

Appropriate data collected in Task 1.1 will be reviewed to:

- identify potential project constraints,
- assist in definition of detailed field investigations to follow in Task 2.3,
- establish specific programs for aerial photogrammetry and field surveys to provide mapping of sufficient detail in study area.

Task 1.5 - Model Formulation

Engineer will:

- prepare input data to the Storage-Yield model* to represent the hydrologic, hydraulic, reservoir storage and spillway characteristics and operating policies of the existing water supply system,
- compare simulated results of system behavior for a historic period to observed performance to verify the accuracy of the model.

Task 2.1 - Identify Alternate Projects

Engineer will:

- formulate alternative reservoir development plans at one or more sites,
- formulate alternative operating policies and management rules for the integration of new supplies into the existing system,
- meet with all appropriate government officials to review potential solution schemes,
- prepare input data to Storage-Yield model to represent alternative projects,

Task 2.2 - Preliminary Estimates of Safe Yield

A Storage-Yield model is to be developed and used to:

- estimate the safe yield for each alternative project developed in Task 2.1,
- assist in the definition of detailed field investigations to be carried out in Tasks 2.3 and 2.4.

---

* The term Storage-Yield model refers to a mathematical model which would simulate actual physical conditions and permit the evaluation of alternatives by "modeling" different parameters.

Task 2.3 - Soils/Geologic Field Investigations

The results of Task 1.3 and 2.2 will be used to define and carry out detailed field exploration program to include:

- ground reconnaissance of the entire reservoir area: test pits, boring and seismic exploration, as needed.
- typical cross-sections for the dams, based on the availability of native soils in sufficient quantity to enable construction at reasonal costs, will be developed from the information collected in this task.
- determine subsurface soil and rock conditions as well as ground water levels through soils investigation programs.
- recommendations will be made concerning foundations for dams and other structures.

Task 2.4 - Environmental and Land-use Investigations

The results of Tasks 1.3 and 2.2 will also be used to define and carry out field surveys to:

- provide detailed mapping of the proposed reservoir areas
- estimate potential damages due to construction of the proposed facilities, including impact on the resident population, wildlife and vegetation,
- determine present ownership and estimate current market value of all land which would be affected by the proposed facilities,
- estimate project impacts on nearby municipal ground water supplies,
- identify existing roads, bridges, utility lines and villages or other structures that would need to be relocated or reconstructed,
- in consultation with all appropriate government officials, identify positive impacts such as possible limited hydroelectric use, and possible water supply for agriculture,
- address other environmental issues as appropriate.

Task 2.5 - Assess Hydraulics of Connections to Existing System

In this task, Engineer will:

- investigate system hydraulics and operation for connections between the proposed reservoirs and the existing transmission system,
- develop and evaluate alternative means of integrating the proposed new reservoirs into the water supply network or constructing as a separate supply.
- recommend the best alternatives for linking the proposed reservoir sites to Ouagadougou's water supply and identify any necessary renovation or reconstruction of existing facilities.

Task 2.6 - Define Spillway Characteristics

Proper design of reservoir and dam facilities requires consideration of flooding hazards; specific tasks include:

- determination of reservoir inflow in response to Probable Maximum Precipitation,
- determination of reservoir inflow hydrograph for spillway design,
- development of spillway type that will safely convey expected flood flows without endangering any part of the dam of area immediately downstream,
- preliminary design of outlet works to enable sizing and cost estimates to be prepared for inclusion in overall construction cost.

Task 2.7 - Refine Project Configurations and Safe Yield Estimates

Project characteristics and impacts on safe yield will be re-evaluated for each alternative, as necessary, based upon the results of Tasks 2.3 - 2.6. In this task, the Engineer will:

- revise model input data, as needed, to reflect changes in project configuration,- use the Storage-Yield model to estimate the system safe yield for each project.

Task 3.1 - Project Evaluation

A complete evaluation of selected alternative projects will be carried out to identify the "best" overall solution; major sub-tasks include:

- impact of proposed project on ground water supply wells in the vicinity of the project area,
- impact of proposed project on environmental factors identified in Tasks 1.4 and 2.4,
- preparation of total project cost estimate, including construction costs, land-taking costs and operation and maintenance expenses,
- assessment of hydropower generation feasibility to offset costs,
- discussions with all appropriate government officials to assess relative advantages/disadvantages of propose projects.

Task 3.2 - Recommendations and Report

Based on the results of all tasks, Engineer will:

- recommend the most cost-effective project to maximize the safe yield of the system with minimal environmental impact,
- summarize all findings in a report complete with necessary figures and tables, including preliminary costs estimates for construction and operation of the recommended alternative.

Task 3.3 - Final Report

After submission of the draft report and review of same by all appropriate government officials, a meeting will be held to discuss comments by the all appropriate government officials, after which the final report will be modified to reflect comments and then be submitted.

APPENDIX E

Assessment of the Water Needs of Displaced Persons

APPENDIX E

Assessment of the Water Needs of Displaced Persons

The WASH Team left Ouagadougou on 17 March 1985 and returned 19 March 1985 with overnight stops at Gorom-Gorom and Ouahigouya. The itinerary of stops included: Pissila, Tougouri, Yalago, Bani, Dori, Gorgadgi, Arbinda, Djibo, Titao, Ouahigouhya, Goursi, Yako and Bousse. Interviews were held with various individuals at the places noted above. The substance of these interviews is as presented below.

PISSILA (District Center -- Sanmatenga Province)

Information was provided by Youssouf Tamou, Judge, and by Awecouba Yaguibou, police chief. The fixed population is 9,000 and there are no displaced persons (DPs) in the town. However, 20 km north at Dibilou, DPs have been arriving since 2 weeks and now number 1.600; also at Kaemna where there is a nearly dry barrage 18 km north DPs have been arriving since 1 month and now number 1.000; Kaemna has also a borehole. The town has 6 60 m deep boreholes and a dugwell, but some of them become dry in April. The Water Ministry indicated that a study is underway for improving the town supply, funded by the Danish Government. Construction is tentatively scheduled for 1987.

A Water Ministry survey in 1984 showed that the geographic quadrangle 15' latitude by 15' longitude (about 500 km2), which includes Pissila has a rural fixed population of 43,000 which has a basic requirement of 43 water points. In the same area, there were 30 modern boreholes or wells and 83 traditional wells, 13 of which could be improved to satisfy the basic requirement. It would appear, therefore, that the water supply needs of DPs could be met.

TOUGOURI (District Center, Namentenga Province)

Information was provided by Nore Ouedraogo, Prefect. The town population is 2,600, and there are 1,400 DPs camped in the vicinity, some housed in tents provided by USSR aid. The number of DPs is increasing throughout the district and exceeds the number last year. They are arriving from Dori and from Mali. Pneumonia is prevalent. Fixed population takes water from one borehole equipped with handpump; a second is out of service. There is sizable reservoir beside the town from which most DPs take their water. The Catholic Mission takes water by windmill from a shallow well adjacent to the reservoir which it uses for gardening and drinking water. The reservoir supply is considered sufficient, but the DP's animals are consuming a large amount. A study is to be undertaken for an improved supply, funded by the Dutch Government and construction is tentatively scheduled in 1988. The Water Ministry's 1984 survey shows that within the Tougouri quadrangle (see explanation under Pissila) there are 22,000 rural inhabitants and only 7 modern water points. Fifteen water points are therefore needed, and the urgency is increased by the DPs.

YAGOLO (District Center in Namentenga Province)

No official could be contacted and there is no current government plan for developing a community water supply. Town population appears to be several thousand. There is an encampment of DPs outside the town who appear to be attracted by its large reservoir and by the possibility of finding goldbearing rocks in nearby hills. The rocks are washed in the reservoir. Water Ministry statistics show that the Yalogo quadrangle (see Pissila) has 8,000 rural inhabitants, served by 9 modern and 1 traditional water points. Water supply does not appear to be an urgent problem in the vicinity of Yalogo.

BANI (District Center in Sahel Province)

No official was contacted. The town is dominated by a new mosque. A solar pumping unit provides a regular water supply. Water Ministry statistics show that the Bani quadrangle (see Pissila) has 11,000 rural inhabitants supplied by 8 modern and 11 traditional water points and that 3 of the latter can be improved to meet the basic need.

DORI (Provincial Capital of Sahel Province)

Information was obtained from Parfait Ouedraogo, ONEA plumber, and from Emil Bougouma, CRS official. Fixed population is about 8,000; about 1,000 migrants are camped nearby. The town is supplied from three 14-16 m dugwells and two 45 and 62 m boreholes by electric pumps. The most productive dugwell supplies 12 m3/h and one borehole supplies five m3/h, the other being under repair. The dugwell is pumped dry in 2 h, and needs 2,5 h to refill. Water elvel decreases 0,2 m/week but there is 10 meters left. The town has 175 private connections and 8 standposts. The 100 m3 elevated reservoir is seldom filled. A complete revision of the system is planned by ONEA in 1987. The wells are located NW of the town near a natural lake, at present nearly dry. DPs take water from the lake. They come from Mali and Niger. CRS has installed 275 dugwells in the region since 1973. Its current program in 23 villages includes vegetable gardening and reforestation. CRS helped distribute 175 tons of food in 1984. Water Ministry statistics show that the 20,000 rural population in the Dori quadrangle (see Pissila) are supplied by 19 modern water points and 3 traditional wells, one of which can be improved to satisfy the basic need. The needs of the city of Dori itself may be more urgent from those of the surrounding villages.

GORGADJI (District Center in Sahel Province)

Information was provided by Somkeita Issaka Ouedraogo, Prefect. The fixed population of the town is 12,000 but 4,000 have departed for other regions. DPs only stop briefly near the town. Water is supplied by two 70 m boreholes delivering 15-20 l/min each and by 2 dugwells with low output. A well equipped with a solar pump is out of commission since 1980. Gorgadji being a rural centre, the government has no immediate plan for developing a community water supply. The majority of surrounding villages have water supplies; the Water Ministry's survey showed that the 12,000 rural dwellers in the Gorgadji quadrangle have 12 modern water points and five traditional wells.

ARBINDA (District Center of Soum Province)

No official was available to provide information. The town is supplied by several dugwells, which appeared to be operating satisfactorily. Construction of a water supply system was originally projected for 1988, but has now been funded (by MAC) and is expected to begin in the near future.

DJIBO (Provincial Capital of Soum)

Information was provided by the High Commissioner Abdulaya Hama. The town's fixed population is 10,000, and there are 2,000 DPs mostly from Mali who are encamped near the reservoir east of the town. A small water distribution system (borehole pump elevated tank, a few connections) is out of commission; water is drawn from two dugwells and from the reservoir. Construction of a water supply system is scheduled for 1985 with funding by BOAD and the Dutch Government. The Water Ministry survey showed that there are only 18 modern water points and 8 traditional wells to supply the 42,000 rural dwellers in the Djibo quadrangle (see Pissila).

TITAO (District Center in Yatenga Province)

Information was provided by the Prefect. The town's fixed population is 3,500 and there are about 300 DPs near the town. Two 30-40 m dugwells supply the town with water, but they are rapidly pumped dry. Vendors sell water for 125 FCFA per 200 l drum. A Danish-supported study is underway and construction of a water supply system is tentatively scheduled for 1987.

GOURCY (District Center of Yatenga Province)

Information was provided by Madame Basono, wife of the Prefect, by the Regional Development Organization ORD representative Desire Ouedraogo, and by Gerard Bourgeaux, a volunteer working for AFVP (see Annex). The town's fixed population is 17,000; few DPs stop because there is a shortage of water. Only two boreholes with handpumps supply water to the town's people. One was observed to continually run dry so that only 180 l could be pumped per minute. A project financed by BOAD and the Dutch Government has begun; two boreholes have been drilled and capped one month ago. Despite the serious shortage, residents pay as much as 200-285 FCFA/200 l to vendors, and it was remarked that neither ORD nor AFVP has received requests for water supply assistance from town dwellers. The Gourcy quadrangle is heavily populated but water supply provision is apparently less critical in rural areas. Water Ministry statistics show that the 72,000 people have 33 modern water points and 49 traditional wells. Of the latter 39 can be improved to meet the basic need (see Pissila).

YAKO (Provincial Capital of Passore)

Information was provided by Melle Aicha Traoai, Haut Commissaire. There are no DPs in the town. The town's 18,000 residents used to have a small water distribution system, broken since three years ago. They draw water from two

operating boreholes equipped with handpumps; four other pumps are broken. A study has been made and construction is expected to begin shortly, supported by BOAD and Dutch Government. it is hoped that a wealthy resident who has built his own water system will also contribute it to the town supply. In rural areas the picture is better. The 61,000 rural dwellers in the Yako quadrangle (see Pissila) have 54 modern water points and 45 traditional wells.

BOUSSE (District Center in Oubritenga Province)

Information was provided by Herve Kabore, Prefect. Four hundred of the town's 6,000 residents have left permanently to seek homes in the West. The residents buy water from vendors (for 125 FCFA per 200 l) who draw it from a few traditional wells. Food is in short supply. A town water supply study has been prepared with Dutch assistance (IWACO) and is awaiting funding. The surrounding rural areas appear better supplied: there are 60 modern water points and 24 traditional wells for the 79,000 residents of the Bousse quadrangle (see Pissila).

APPENDIX F

Evaporation Control Through Reservoir Water Transfer

OUAGADOUGOU WATER SUPPLY
ACTIONS TO TRANSFER RESERVOIR WATER

1. SUMMARY

Evaporation of reservoir water should be rapidly minimized by keeping Reservoir No. 3 full and drawing down Loumbila, Ouagadougou Reservoir No. 2, and possibly Ouagadougou Reservoir No. 1. Provision should be made to withdraw Loumbila and Reservoir No. 3 "residuals" so that the city could be supplied under such an extreme condition. Estimated foreign cost for these actions are as follows:

Drawing down Loumbila	(No cost)
Drawing down No. 2 reservoir	$60,000*
Drawing down No. 1 reservoir (probably inappropriate -- no cost estimate)	(No cost)
Provision to withdraw reservoir residuals	$10,000

2. DRAWING DOWN LOUMBILA

The four pumps at Loumbila should be run simultaneously, giving an estimated increase in flow from 900 to 1,400 m3/h. This will draw down Loumbila to the residual level sooner than otherwise but two-thirds of the extra water pumped into reservoir No. 3 (2/3 x 540,000 = 360,000 m3) will represent a net saving, which would ultimately extend the city water supply 360,000/24,000 = 15 days. The 540,000 m3 pumped into Reservoir No. 3 will raise its water level about 0.72 m (540,000 m3/750,000 m2 surface). The only cost entailed will be for operating 2 additional pumps at Loumbila and sandbagging the easterly side of the barrage No. 2 to prevent further erosion.

3. DRAWING DOWN NO. 2 RESERVOIR

To move the 500,000 m3 from reservoir No. 2 to No. 3 in a short time (14 days), needs the 500 m3/h pumps or equivalent. The first option is to use idle pumps and motors in Ouagadougou (2 x 250 m3/h removed recently from Loumbila, 1 x 500 m3/h and 1 x 200 m3/h idle at the treatment plant, and 1 x 250 m3/h idle at the barrage No. 3). These five pumps should be moved to barrage No. 2. A power line should be run from the nearby power plant. Flexible intake piping should be connected to floats at a suitable distance upstream from barrage No. 2 to permit optimum withdrawal. Outlet pipes should be run over the spillway. The gate valve should be securely closed. Two thirds of the water transferred from No. 2 to No. 3 will represent a net saving. If the amount transferred is 500,000 m3, the saving will be 330,000 m3 which will extend the city water supply an additional 330,000/24,000 = 14 days. The transferred water will raise the water level in Reservoir No. 3 500,000 m3/750,000 m2 = 0.67 m. Together with the transfer from Loumbila this will raise the level of No. 3 by 1.4 m. The only cost would be for moving, installing, and running the pumps.

* Exclusive of pump transport costs.

If local pumps cannot be used, 3 pumps x 500 m3/h (2200 gpm) might be obtained from the USA, estimated cost excluding shipment $50,000 for diesel-powered pumps.*

Reinforced suction hose might need to be imported for which an allowance of $10,000 should be made.

4. DRAWING DOWN RESERVOIR NO. 1

The old outlet from Reservoir No. 1 to No. 2, which is visible on the upstream side, has been buried on the downstream side. The outlet should be located by digging. If the pipe is still usable, Reservoir No. 1 can be partly emptied by gravity into No. 2. The only preparation necessary is to dig a V-shaped channel by bulldozer from the outlet to the present water edge in Reservoir No. 2. A 50 cm deep channel is adequate. The amount of water which could be transferred fom No. 1 via No. 2 to No. 3 is estimated to be 200,000 or 300,000 m3 all of which is at present unusable; this would extend the city supply by 8-12 days. The cost would be only for exploration and bulldozer operation for 2 or 3 days.

5. PROVISION TO WITHDRAW RESERVOIR RESIDUALS

Transfers to Reservoir No. 3 described above will extend the city water supply 30 to 40 days, in other words until mid-June or end June. In case a further extension is required this year or in succeeding years, provisions should be made to withdraw part or all of the reservoir residuals. This will entail modifications to the intake structures and possibly installing flexible intakes on floats, for which an allowance of $10,000 should be made. Also, see note in paragraph (3) concerning the use of diesel pumps.

6. RATIONALE FOR TRANSFER OF RESERVOIR WATER

The basic rationale for proposing the transfer of reservoir water from multiple reservoirs to one reservoir (especially one with relatively steep diked sides) is as discussed in the excerpt presented on the following two pages.

*Diesel pumps would accommodate the potential added need of using residual water (below installed pump suction levels) in an extreme emergency.

Extract from Water-Related Technologies for Sustainable Agriculture in U.S. Arid/Semiarid Lands - published by the Congress of the United States Office of Technology Assessment

Evaporation Control

INTRODUCTION

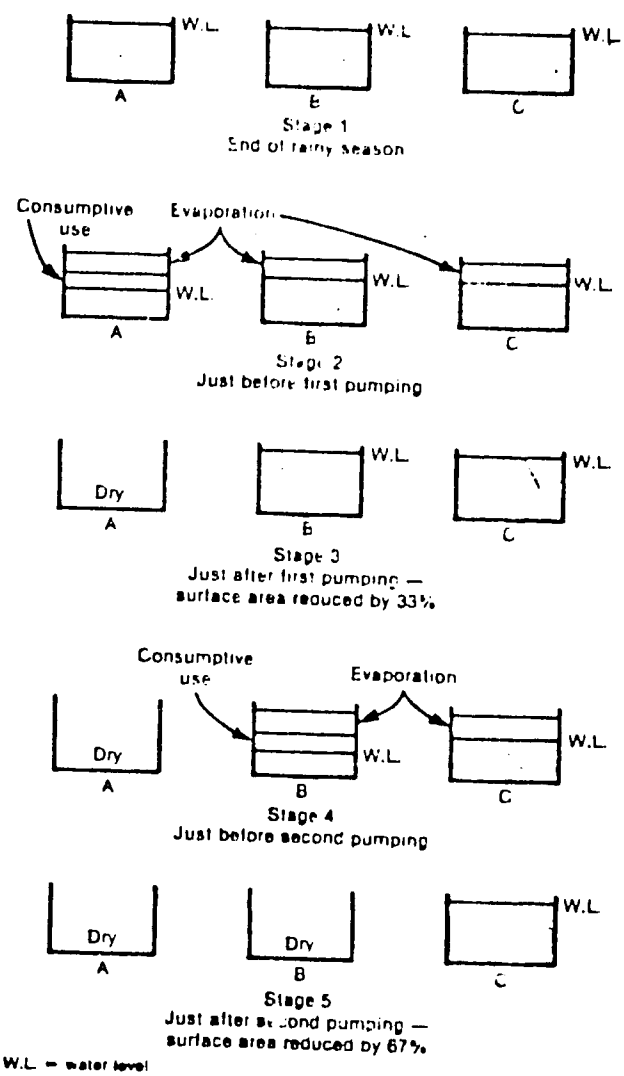
The process of evaporation requires a source of energy to vaporize water and a mechanism to transfer water vapor from the liquid's surface to the air. The climate in arid and semiarid lands provides both factors in abundance, and evaporation is high. Solar energy drives evaporation while low atmospheric humidity and frequent high winds accelerate the transfer of water vapor into the air.

Since conserving collected water is one of the most economical methods of maintaining an adequate water supply, a great deal of research has sought effective evaporation control technologies. These technologies increase water supplies, in effect, by increasing reservoir capacity without new construction. They alter the processes that contribute to evaporation by: 1) lessening the amount of energy that reaches the water surface to drive evaporation, and 2) altering the ease with which vaporized water moves into the air.

Four methods of controlling evaporation have received attention: 1) surface-area reduction, 2) reflective coatings, 3) surface films, and 4) mechanical covers. Surface-area reduction can be achieved by selecting proper sites, by diking to eliminate shallow areas of each reservoir, by deepening existing reservoirs, or by compartmentalizing them. Deepening reservoirs reduces evaporation both by exposing less water surface to warm, dry air and by lowering the temperature of the deeper water (and thus increasing the amount of energy needed to evaporate that water). "Compartmented" reservoirs actually consist of several separate reservoirs of varying depths (fig. 42). Water is used from the shallower reservoir until the remaining water equals the storage capacity of the other compartments. Water from the first container is pumped to fill the others at that time. This process is repeated as other reservoirs are drawn down. It ensures that most reservoirs will have the lowest possible ratio of surface to volume water and thus the lowest evaporation.

Figure 42.—A Compartmented Reservoir in Operation

Water is used from and pumped between separate reservoirs so that the evaporative surface is as small as possible



W.L = water level

SOURCE: C. Brent Cluff, "Surface Storage for Water-Harvesting Agrisystems," *Rainfall Collection for Agriculture in Arid and Semi-Arid Regions*, G. R. Dutt, C. F. Hutchinson, and M. Anaya Garduno (eds.) (Slough, U.K.: Commonwealth Agricultural Bureaux, 1981), p. 27, fig. 1

Reflective coatings are designed to reduce the amount of incident solar radiation reaching the water. They also may provide a barrier to vapor. Surface films, which do act as barriers,

received considerable attention during the 1950's and 1960's. Single-molecule films of long-chain alcohols were applied, sometimes by airplane. More substantial floating covers also have been developed. These mechanical covers include polystyrene sheets, lightweight concrete slabs, wax blocks, and rubber sheets.

Assessment

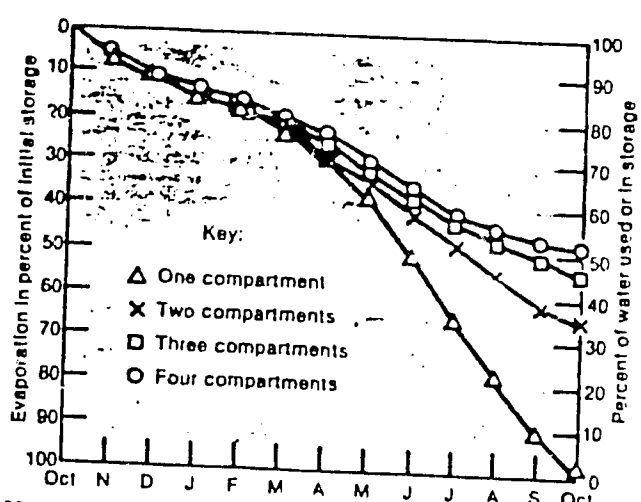
Average evaporation from reservoirs throughout the West is approximately 6 percent. In some regions, though, reservoir evaporation may reach about 40 percent of usable storage (4). Small reservoirs, stock tanks, and farm ponds with large surface areas exposed to arid conditions may lose more water to evaporation than is used productively (26). Compartmented reservoirs can reduce evaporation substantially (fig. 43). Measurements made under idealized conditions in Arizona suggest that savings of 35 to 50 percent are possible, but these amounts vary in different climates (6).

Evaporation reductions achieved using different methods have been variable and often disappointing. For example, reflective coatings have reduced evaporation by about 50 percent for 1 month, but the materials used, such as perlite, eventually become waterlogged. Once coatings are wetted, evaporation savings drop to about 10 percent, making such technology impractical. Reflective coatings and surface films are unstable if the water surface is not still. Long-term field studies show that monomolecular layers of alcohols reduce evaporation only about 10 to 20 percent (4,14). These controls are most economical for large reservoirs or in highly regulated river systems where evaporation losses are large and increasing salinity levels must be controlled.

Mechanical covers are often simple and cost-effective and have the highest potential for use on small reservoirs, stock tanks, and ponds. Materials of various kinds have achieved reductions in evaporation of 80 to 90 percent. Only minor problems have been reported, such as damage by birds and weathering (14). Some elaborate types of covers are specially treated to retard weathering, but this makes them too expensive to use for conventional agriculture. They may be cost-effective when used in conjunction with water-harvesting methods, compartmented reservoirs, or less-than-full irrigation.

Figure 43.—Evaporation From Compartmented Reservoirs

Reservoirs with several compartments have the potential for reducing evaporation. The amount of water "saved" can be substantial, as illustrated in this idealized graph for Tucson, Ariz.



SOURCE: C. Brent Clull, "Surface Water Storage for Water Harvesting Agri systems," *Rainfall Collection for Agriculture in Arid and Semiarid Regions*, G. R. Dutt, C. F. Hutchinson, and M. Anaya Garduno (eds.) (Slough, U.K.: Commonwealth Agricultural Bureaux, 1981), p. 28, fig. 2

APPENDIX G

Listing of Dug and Drilled Wells

PROGRAMME POPULAIRE DE DEVELOPPEMENT

Provinces	Chef-lieux	Population estimée 1985	Population estimée 1990	Points d'eau existants Juillet 1984	Projets en cours: Source	Projets en cours: Nbre de points d'eau	Financement Acquis: Source	Financement Acquis: Nbre de points d'eau	Besoins horizon 1985	Besoins horizon 1990	Financement à rechercher pour P.P.D. en nbre de pts d'eau
1- Bam	Longoussi	170.482	184.689	199	FENU-UNI.	12	AS/GTZ	81	164	299	0
2- Bazèga	Kombissiri	197.166	212.939	cf 11	FENU+BID	78	AS/GTZ	44	315	580	17
3- Bougouriba	Diebougou	207.174	224.439	157	US-AID				396	723	239
4- Boulgou	Tenkodogo	336.320	364.347	227					414	754	187
5- Boulkiemdé	Koudougou	537.112	581.871	474	FDR 3		AS/GTZ	148	568	1.048	158
6- Comoé	Banfora	135.847	147.167	279	FED	30			352	640	43
7- Ganzourgou	Zorgho	146.544	158.756	74	FENU+BID	98	AS/GTZ	51	239	434	16
8- Gnagna	Bogandé	167.582	181.548	104			KFW	150	353	642	99
9- Gourma	FadaN'Gourma	188.507	204.216	141			KFW	150	405	740	114
10- Houet	Bobo-Dioul.	232.330	251.690	214	US-AID	88			463	844	161
11- Kadiogo	Ouagadougou	276.262	298.362	800	FENU.UNI.	24	AS/GTZ	55	440	811	24
12- Kénédougou	Orodara	107.551	116.514	175	US-AID	30			150	271	0
13- Kossi	Nouna	228.641	247.694	189	Pays-Bas	30			370	674	151
14- Kouritenga	Koupéla	88.425	95.499	cf 17	FAO	30			150	261	35
15- Moun-Hou	Dédougou	230.524	249.734	254					357	650	103
16- Nahouri	Po	77.450	83.905	104	BID	71	AS/GTZ	26	141	256	0
17- Namentenga	Boulsa	322.069	348.908	278	FENU.UNI.	27	AS/GTZ		340	626	120
18- Oubritenga	Ziniaré	312.642	337.653	cf 11	FENU.UNI.	85	AS/GTZ	99	498	918	27
19- Oudalan	Gorom-Gorom	95.823	103.488	cf 24			CCCE	50	155	283	3
20- Passoré	Yako	285.120	308.888	281	FENU+FDR	40	AS/GTZ	23	392	714	48
21- Poni	Gaoua	216.346	244.374	243	US-AID	20			404	736	141
22- Sanguié	Réo	208.118	224.767	cf 5	FDR 3		AS/GTZ	29	336	618	95
23- Sanmatenga	Kaya	317.382	343.831	403	FENU.UNI.	95	AS/GTZ	38	318	579	0
24- Séno	Dori	175.287	189.309	273					1.4	318	3
25- Sissili	Léo	137.662	149.133	210	FDR 3				202	366	0
26- Soum	Djibo	153.371	166.152	210					198	359	0
27- Sourou	Tougan	219.703	238.012	213	Pays-Bas	39			422	769	170
28- Tapoa	Diapaga	103.724	112.368	59			KFW	100	222	405	63
29- Yatenga	Ouahigouya	605.402	655.853	235	FED	33			666	1.217	398
30- Zoundwéogo	Manga	109.829	118.981	95	FENU+BID	87	AS/GTZ	24	177	321	0
T O T A U X				5.891		917		1.068	9.781	17.856	2.415

Avertissement: ces données sont approximatives compte-tenu de l'imprécision des informations et des limites administratives.

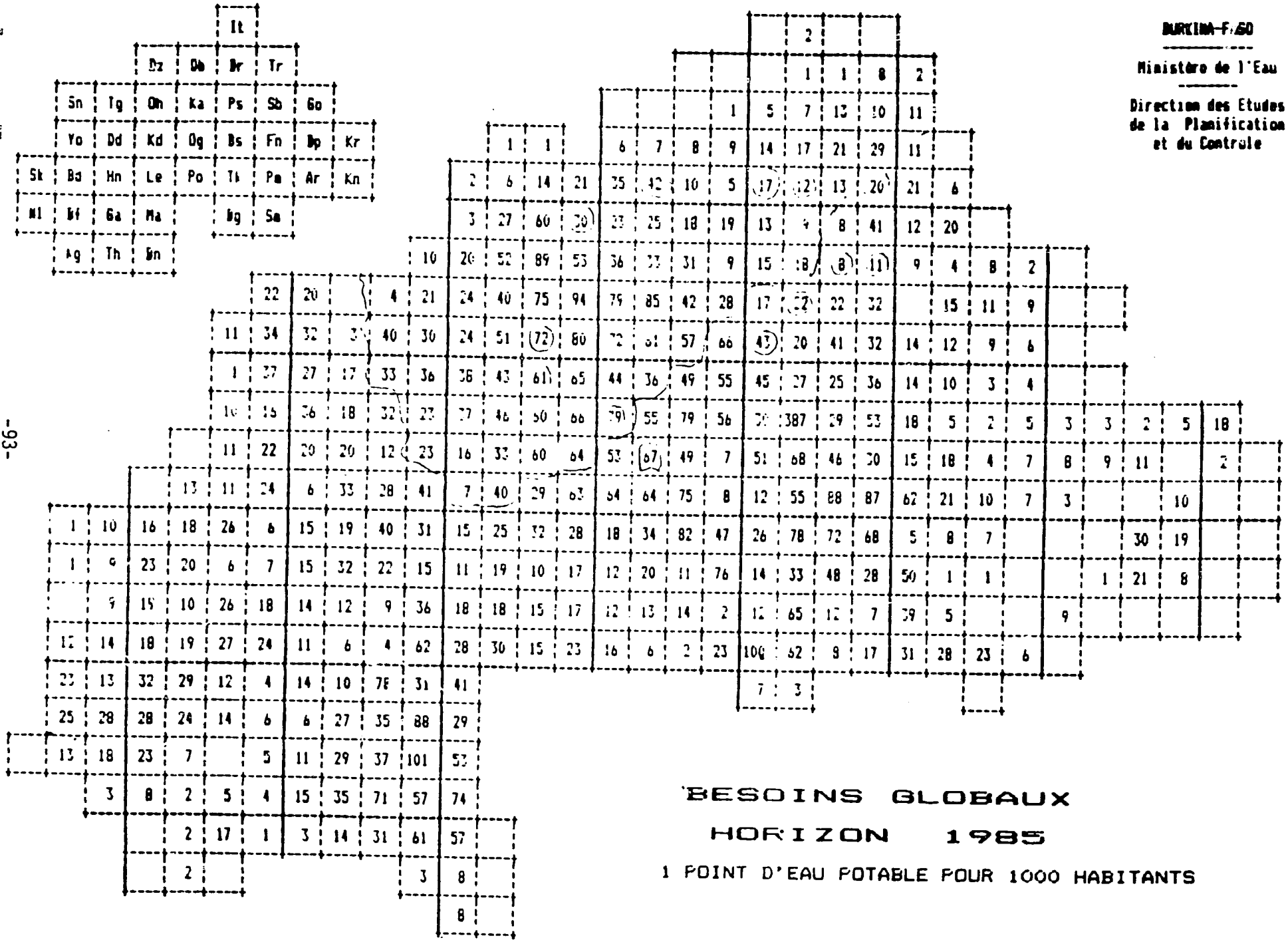
APPENDIX H

Status of Rural Water Points

BURKINA-FASO

Ministère de l'Eau

Direction des Etudes de la Planification et du Contrôle



BESOINS GLOBAUX

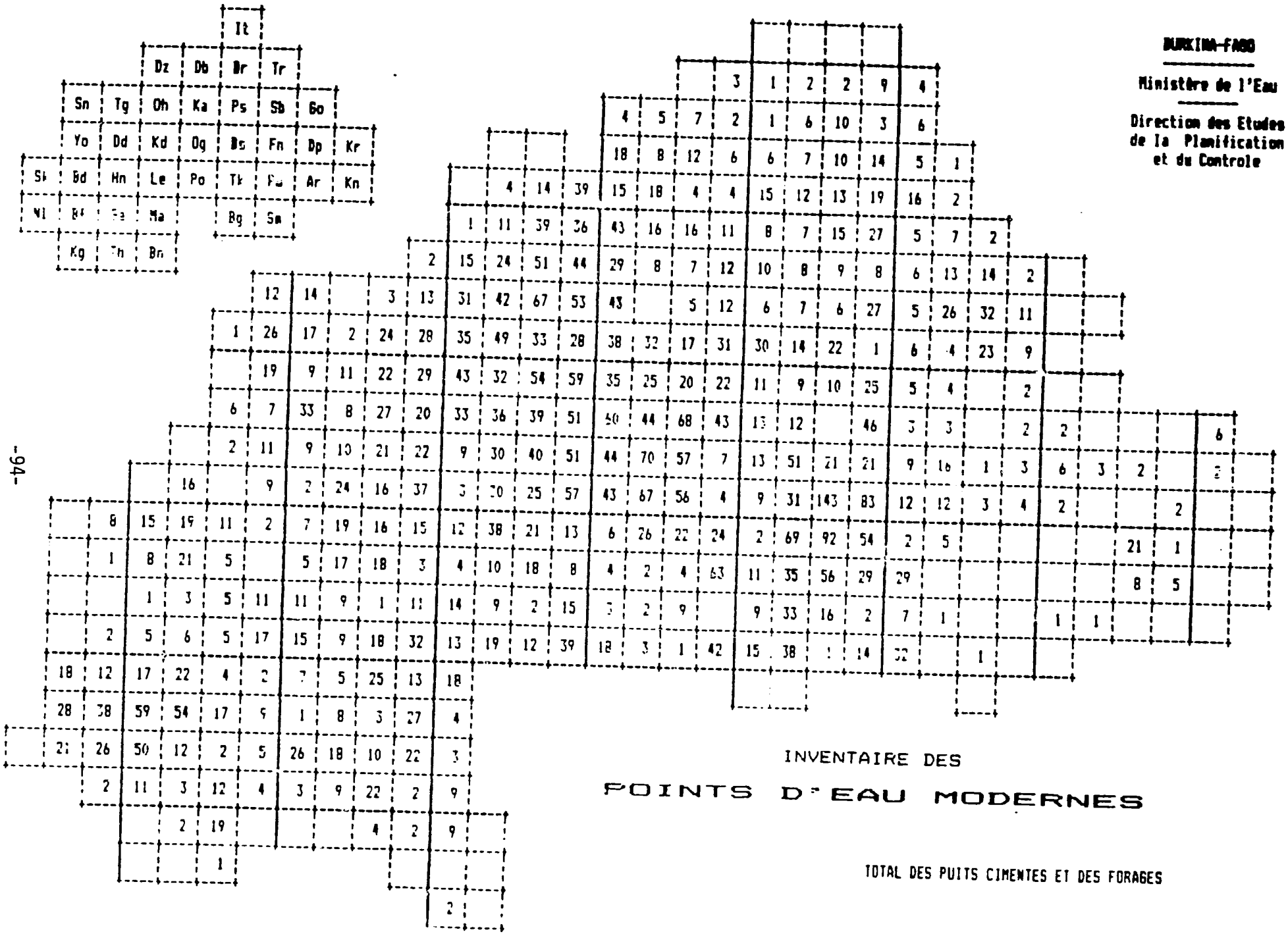
HORIZON 1985

1 POINT D'EAU POTABLE POUR 1000 HABITANTS

BURKINA-FASO

Ministère de l'Eau

Direction des Etudes de la Planification et du Controle



INVENTAIRE DES

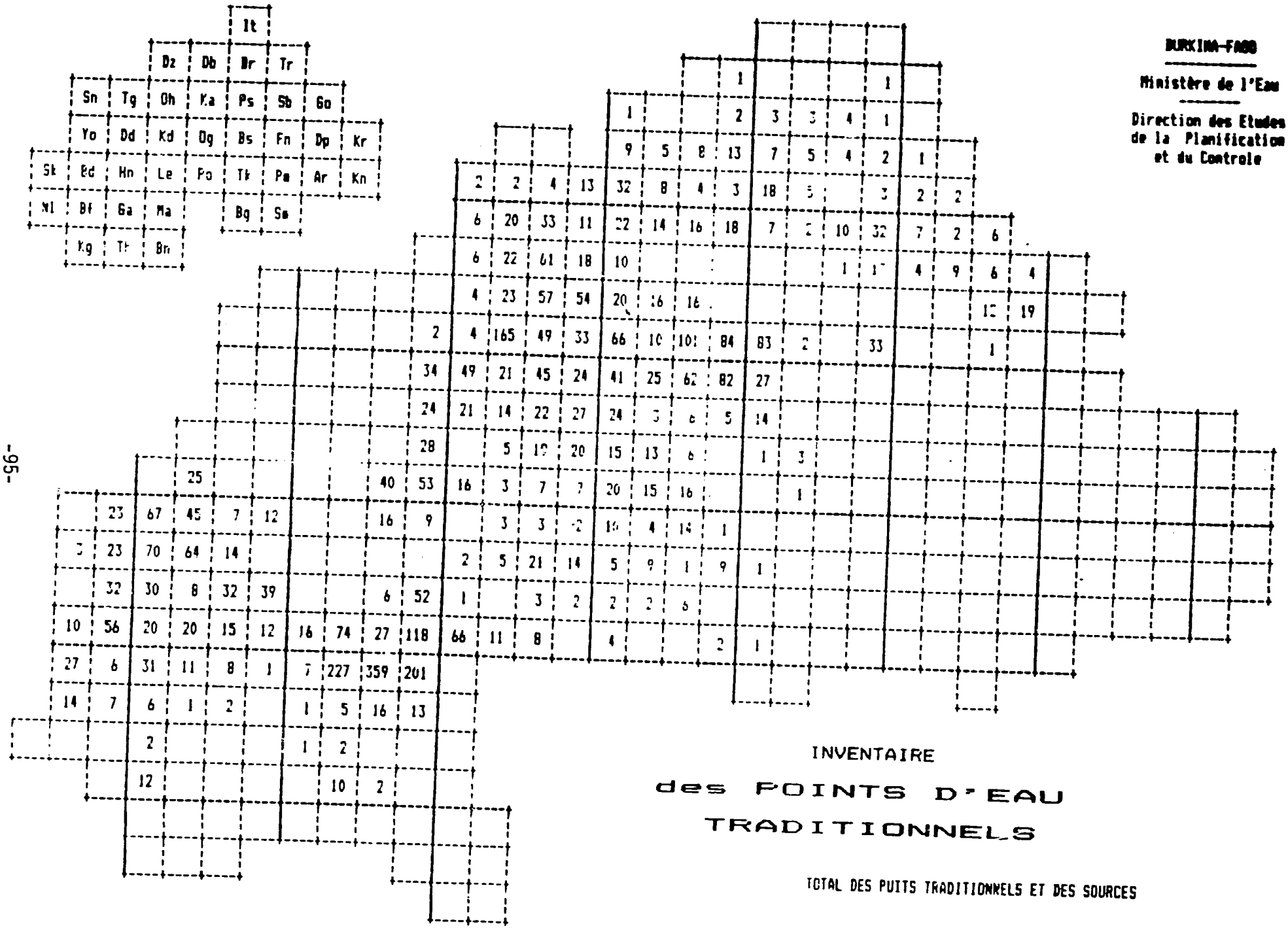
POINTS D'EAU MODERNES

TOTAL DES PUITS CIMENTES ET DES FORAGES

BURKINA-FASO

Ministère de l'Eau

Direction des Etudes de la Planification et du Controle



INVENTAIRE

des POINTS D'EAU

TRADITIONNELS

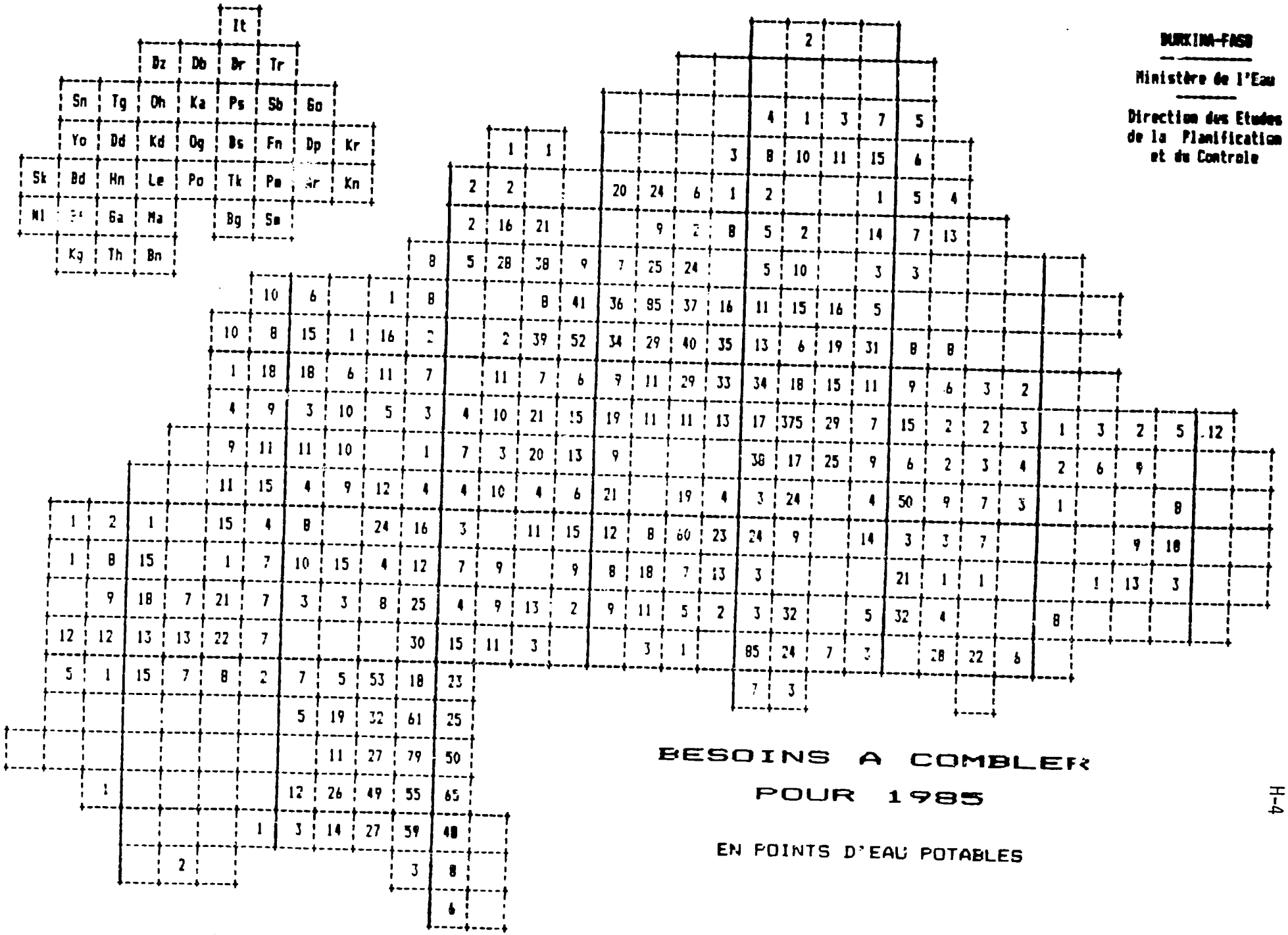
TOTAL DES PUITS TRADITIONNELS ET DES SOURCES

H-3

BURKINA-FASO

Ministère de l'Eau

Direction des Etudes de la Planification et du Contrôle



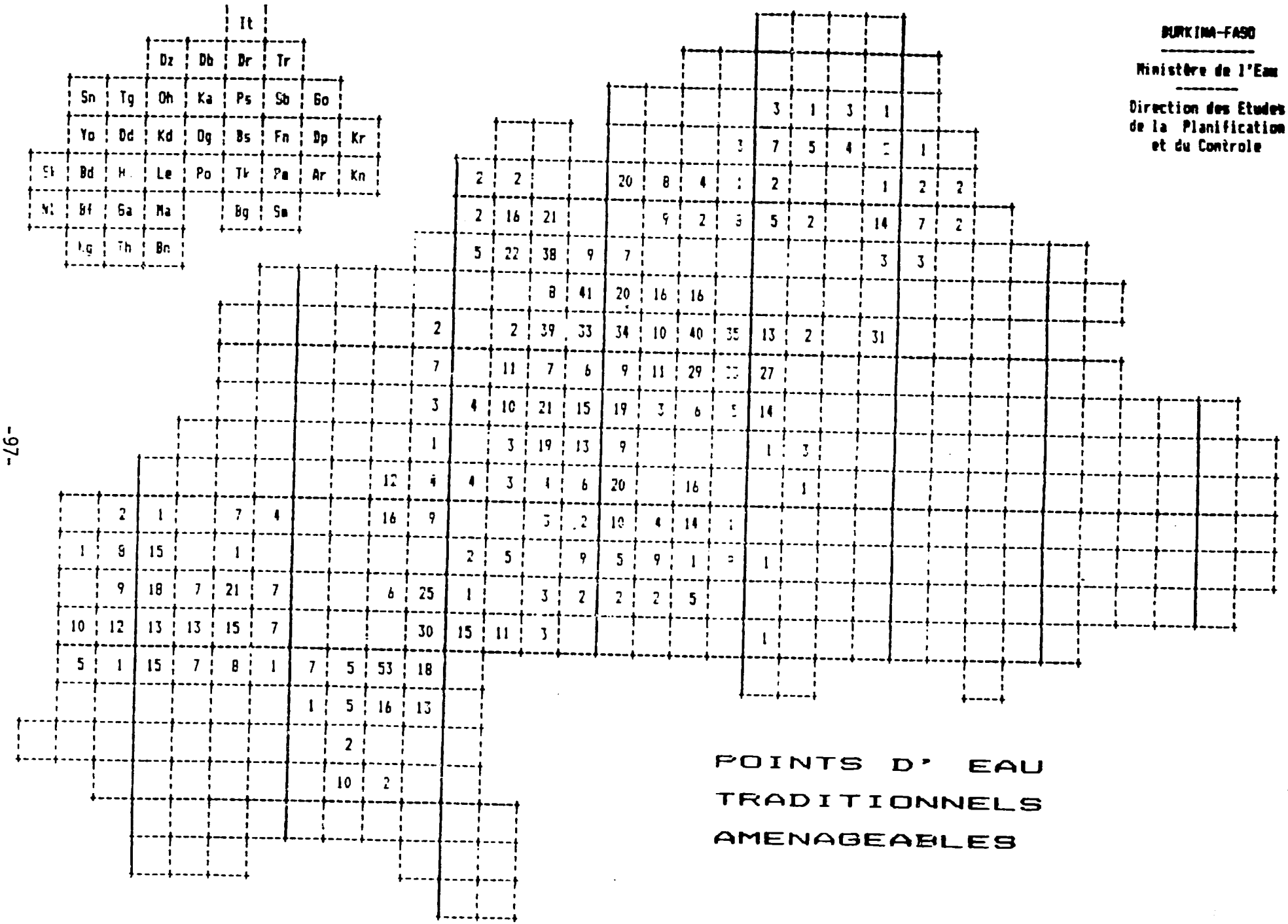
BESOINS A COMBLER POUR 1985

EN POINTS D'EAU POTABLES

BURKINA-FASO

Ministère de l'Eau

Direction des Etudes de la Planification et du Contrôle



POINTS D' EAU TRADITIONNELS AMENAGEABLES

APPENDIX I

PVO Activities in Rural Water Supply

Previous Page Blank

1. AFVP

Information on the work of this NGO in Burkina Faso was provided by its local director, Mr. P. Charlier and deputy, Mr. Tardy.

AFVP's objective is to promote "human investment" in rural hydraulic works, by developing simple inexpensive structures which can be erected mainly with locally available materials and without mechanized equipment and by instructing and guiding would be users of them in the construction technique. Works in the AFVP program include small-scale community water supplies, irrigation, animal watering, erosion control, and soil replacement. AFVP cooperates with ORD, Prefects, ONBAH, and DPFH. Forty technicians and five animators are working in a number of places in central and southern Burkina Faso.

Traditional dugwells are constructed or deepened 120, 140, or 180 cm diameter using curved brick elements to form casings. The only equipment is a series of curved molds. (See Mennonite Central Committee, 21 South 12th Street, Akron Pennsylvania 17501 U.S.A., publication "La Construction de Puits en Maconnerie", 1981). For digging below the water table, a R.C. sharp outer edge ring is sometimes used below the casing. The construction costs about FCFA 12000 per meter of depth (cf method proposed by Monsieur Dubus which AFVP estimates costs at least seven times as much per meter.)

Small dams (at least 3m deep, at most six to seven meters deep) are built using rock-filled "gabions" on the downstream side and packed earth on the upstream side. Each gabion consists of wire netting in the shape of a box 2 m long, 1 m wide and 0.5 m high. The netting is locally hand-fabricated from heavy metal wire. The uncapped dam top serves as spillway. The use of a truck is required to haul stones to fill the gabions. Such dams can be built in one or two dry seasons. Sometimes a wet season is necessary to help compact the earth fill. They cost 2-7 million FCFA.

A third type of work promoted by AFVP is valley development, based on a series of rock barriers which temporarily impound rainwater resulting in erosion control, soil renewal, and groundwater recharge.

AFVP Paris address is Boite Postale 2, 91310, MONTLHERY, Telephone (6) 901-10-95.

2. AFRICARE

Information was provided by M. Jonathan Evans, administrative assistant. Director of AFRICARE/BF is Mr. Sahr Tongu. AFRICARE is involved in rural water supply installations of all kinds, for people and domestic animals, in villages, schools, and dispensaries. Their work is particularly concentrated in the north in the vicinity of Seguenega (Yatenga Province) and in the southwestern part of Burkina Faso. AFRICARE cooperates with the Organisation Regional de developpement, ORD, and their approach in terms of community cooperation resembles that of AFVP. AFRICARE has worked since 1978 in 140 villages. They construct mainly open, cement-lined wells, with or without handpumps. they also develop small ponds into reservoirs by digging them out. They are not starting a program of small dams to create reservoirs. AFRICARE receives support from USAID.

3. Save the Children

Information was provided by Mr. Jerry E. Pafela, Director for Burkina Faso. Save the Children's main effort in rural water supplies is in the vicinity of Dori (Sahel Province) where they are working in a total of 30 villages. Until now they have installed only large-diameter dug wells for human and animal use, but they expect to go into boreholes and small dam construction, the latter in particular having been requested by the government. Their water supply work is done under subcontract by the Union Fraternal des Croyants (which also has drilling rigs). In mid-1985, Save the Children plans to set up its own construction team.

Save the Children's method of work resembles that of the other cited NGOs. It promotes integrated projects to provide water for human and animal use and vegetable gardening, and it depends upon community cooperation and initiative. At present the demand in Dori area is for small water supplies; they have a two-year waiting list. Water supply work has been funded by USAID. A new project is now being negotiated with GOB and AID, Project Conjoint de Developpement de Feseno.

4. OXFAM

Information was provided by Mr. Michel Butcher. OXFAM funds the purchase of materials for village water supplies, such as cement and reinforcing rods. They cooperate with village organizations such as the Association des Macons Puisadiers de Yako. They build open wells and small dams for water supply and irrigation, the latter in technical cooperation with ONBAH. Their work is centered around Ouahigouga, Gourey, and Yako.

APPENDIX J

1982 Status of Urban Center Water Supplies

1982 STATUS OF URBAN CENTER WATER SUPPLIES

(Extract from Volume II of Report of Second National Water Decade Conference-1982/WHO)

Investissements nécessaires en AEP Urbain

A - Centres pourvus de réseaux

Numéro	Centres Urbains	Nature des Opérations	Coûts des Projets x 1.000 Frs CFA
1	OUAGADOUGOU	-Adduction de la Volta-Noire -Extension des réseaux de distribution -Centre de formation professionnelle	19 250 000
2	BOBO-DIOULASSO	-Extension de la station de pompage et de traitement -Extension des réseaux	2 535 000
3	KOUDOUGOU	-Extension de la station de traitement et des réseaux	950 000
4	BANFORA	-Renforcement canalisation d'adduction -Extension station de traitement et des réseaux	1 375 000
5	OUAHIGOUYA	-Extension des réseaux	500 000
6	KAYA	-Amélioration captages et conduites d'adduction -Extension des réseaux	450 000
7	DORI	-Amélioration captage, adduction et réseaux (système pratiquement à refaire)	200 000
8	GAOUA	-Fourniture du matériel divers et extension des installations	56 000

Previous Page Blank

A - Centres pourvus de réseaux (Suite)

Numéro	Centres Urbains	Nature des Opérations	Coûts des Projets x 1.000 C.F.A.
9	DEDOUGOU	-Fourniture du matériel divers et extension des installations	56 000
10	BOROMO	"	56 000
11	PO	"	56 000
12	KOUPELA	"	56 000
13	TENADO	"	56 000
14	TENKODOGO	"	56 000
15	NOUNA	"	56 000
16	FADA N'GOURMA	"	56 000
17	SABOU	"	56 000
18	TOUGAN	"	56 000

B - Centres en cours d'études

N°	Centres Urbains	Etudes	Sources de Financements	Coût Etudes x 1.000 CFA	Coût global du Projet x 1.000CFA	Coûts des Projets x 1.000 Frs CFA
19	BOGANDE	Etudes	KFW		107 000	Financement des travaux d'exécution à rechercher - Approches en cours auprès de la KFW
20	DIAPAGA	"	KFW		112 000	
21	BOULSA	"	KFW		141 000	
22	ZORGHO	"	KFW		58 000	"
23	ZINIARE	"	KFW		44 000	"
24	GARANGO	"	KFW		74 000	"
25	KOMBISSIRI	"	KFW		106 000	"
26	BOUSSE	"	Pays-Bas		108 000	Négociations prévues avec Pays-Bas
27	KONGOUSSI	"	Pays-Bas		88 000	
28	MANGA	"	Pays-Bas		60 000	"
29	ORODARA	"	Pays-Bas		208 000	"
30	REO	"	Pays-Bas		338 000	Négociations prévues avec la KFW
31	TOMA	"	Pays-Bas		128 000	
32	ZABRE	"	Pays-Bas		153 000	"
33	DJIBO	"	Pays-Bas		124 000	Promesse BOAD
34	GOURCY	"	Pays-Bas		240 000	"
35	YAKO	"	Pays-Bas		256 000	
				350 000		

... / ...

C - Etudes à entreprendre, financements des études acquis

N°	Centres Urbains	Etudes	Sources de Financements	Coûts des Etudes x1.000 CFA	Coût global du Projet x 1.000CFA	
36	BARSALOGHO	Etudes à faire	DANIDA		97 000	Financement des Etudes acquis autres de DANIDA
37	PISSILA		"		101 000	
38	TITAO	"	"		63 000	"
39	GOROM-GOROM	"			79 000	"
40	SEGUENEGA	"			99 000	"
41	TIEBELE	"			51 000	"
42	SAPONE	"			56 000	"
43	LEO	"	FAC		132 000	Financement Etudes et travaux promis par FAC

D - Centres identifiés, financements des études recherchés

44	HOUNDE	Etudes à faire			72 000	Négociation avec le JAPON
45	DIEBOUGOU				108 000	"
46	TANGHIN-DASSOURI	"			59 000	Financement Etudes et travaux à trouver
47	POUYTENGA				151 000	
48	TOUGOURI				109 000	"
49	BOUSSOUMA				64 000	"
50	KOKOLOGHO				128 000	"
51	FARA				47 000	"
52	KINDI				167 000	"
53	PAMA				53 000	"
54	KOALLA				203 000	"
55	NIANGOLOKO				130 000	"
56	SIDERADOUGOU				50 000	"
57	TOUSSIANA				144 000	"
58	THIOU				78 000	"
59	SEBBA				34 000	"
60	ARBINDA				65 000	"
61	DISSIN				101 000	"
62	DANO				116 000	"
63	SAFANE				118 000	"
64	BONDOKUY				147 000	"
65	TIKARE				68 000	"
					31 115 000	

.../...

Tableau N° 12

VII) — Programme des investissements en AEP Urbain (en millions de Frs CFA)

Numéro	Centres Urbains	1982	1983	1984	1985	1986	1987	1988	1989	1990	TOTAUX
1	OUAGADOUGOU	150	1100	16000	925	350	-	375	-	350	19 250
2	BOBO-DIOULASSO	-	100	1000	550	475	-	-	-	410	2 535
3	KOUDOUGOU	-	-	500	-	-	-	-	-	450	950
4	BANFORA	-	-	1175	-	-	-	-	-	200	1 375
5	OUAHIGOUYA	-	-	-	500	-	-	-	-	-	500
6	KAYA	-	-	-	450	-	-	-	-	-	450
7	DORI	-	-	-	-	-	200	-	-	-	200
8	GAOUA	6				50					56
9	DEDOUGOU	6				50					56
10	BOROMO	6				50					56
11	PO	6					50				56
12	KOUPELA	6					50				56
13	TENADO	6					50				56
14	TENKODOGO	6						50			56
[illegible]	NOUNA	6						50			56
[illegible]	FADA N'GOURMA	6						50			56
17	SABOU	6							50		56
18	TOUGAN	6							50		56
19	BOGANDE			54	53						107
20	DIAPAGA			56	56						112
21	BOULSA			70	71						141
22	ZORGHO				29	29					58
23	ZINIARE				22	22					44
24	GARANGO				37	37					74
25	KOMBISSIRI				53	53					106
26	BOUSSE				54	54					108
27	KONGOUSSI				44	44					88
28	MANGA				30	30					60
29	ORODARA				104	104					208
30	REO						338				338
31	TOMA						128				128
32	ZABRE						153				153
33	DJIBO				124						124
[illegible]	GOURCY				240						240
[illegible]	YAKO				256						256
36	BARSALOGHO						97				97
37	PISSILA						101				101
38	TITAO						68				68
39	GOROM-GOROM							79			79
40	SEGUENEGA							98			98
41	TIEBELE							51			51
42	SAPONE							56			56
43	LEO				132						132
44	HOUNDE						72				72
45	DIEBOUGOU						108				108
46	TANGHIN-DASSOURI						59				59
47	POUYTENGA						151				151
48	TOUGOURI							109			109
49	BOUSSOUMA							64			64
50	KOKOLOGHO							128			128
51	FARA							47			47
52	KINDI							167			167
53	PAMA							53			53
54	KOALLA							203			203
55	NIANGOLOGHO								130		

APPENDIX K

UNICEF-Burkina Faso

UNICEF BURKINA FASO

paper prepared for the

SECRETARY-GENERAL'S CONFERENCE ON THE EMERGENCY SITUATION IN AFRICA

Geneva, 11-12 March, 1985

This paper presents fuller, updated details of the emergency needs assessment for Burkina Faso, to be presented by the Secretary General at the Geneva Conference. It concentrates on those areas of special interest to UNICEF within the context of the overall needs as determined jointly by the Government, the locally-constituted WFP/ UNDP/ UNICEF joint committee, and virtually all other agencies playing an active role in emergency operations.

SITUATION OVERVIEW

The current situation was reviewed in a telex sent 16 January to the Office for Emergency Operations for Africa (OEOA) (see Annex 1). That assessment remains valid on the whole, with some modifications.

A survey of migrant populations (funded by UNICEF) is now nearly completed and indicates that approximately 20,000 displaced persons are located in a wide band from Soum Province in the east to Yatenga Province towards the west. Roughly half are refugees from Mali or Niger. Many are accustomed to a nomadic life and are travelling as family units. Their penetration towards the south is much greater than in past years, and many have no intention of returning to their traditional areas once the rains begin in May. Analysis of the survey results will permit more effective planning over the next few weeks to assist these scattered, very at-risk populations.

An updated compilation of all known cereal food aid committments

was telexed to WFP and OEOA on 14 February (see Annex 2). The total food aid import requirement has been estimated officially, and accepted as realistic by the international agencies, at 70,000 metric tonnes, of which 59,017 is known to be in the pipeline or firmly pledged. The Government successfully executed "Operation Express Sahel" , distributing over 2,500 tonnes of cereals in two weeks to the four hardest-hit northern provinces. A serious problem is forseen during April and May, when the ports of Abidjan and Lome will be overwhelmed with very large cereal imports for Niger, Burkina Faso and Mali. WFP and USAID are working to relieve this bottleneck.

An assessment of the short-term (6 months) needs for essential medicines and related medical supplies has been completed and orders have been placed by UNICEF.

The funding proposal produced by UNICEF in July 1984 for emergency relief and rehabilitation (E/ICEF/624) provides a great deal of useful background information (see Annex 3).

ADMINISTRATIVE STRUCTURE

The Commission Nationale de Lutte Contre les Effets de la Sécheresse (CNLES) was established in December, 1983. It is an interministerial consultative and action-oriented organization, presided by the Ministère de l'Essor Familiale et de la Solidarité Nationale, which analyzes the various aspects of the drought's effects, proposes appropriate actions to the Conseil National de la Révolution and the President, and subsequently coordinates and evaluates the approved actions which are carried out by one or more Government agency.

In December 1984 a Permanent Secretariat for the CNLES was established to help cope with the increasing workload. UNICEF and USAID

have assisted with the physical establishment of the office, and UNICEF will provide funds for its operating expenses during 1985. The Permanent Secretariat has been very effective in coordinating Government emergency actions and in providing a constant link between the Government and those external agencies providing emergency assistance. Regular meetings are held involving the Permanent Secretariat and all interested donors and agencies. This process has helped immensely to ensure that all parties are aware of Government policies and approaches, to exchange information, and to coordinate actions.

Each of the most-affected provinces has established coordinating commissions; the most populous of these provinces (Yatenga) has also established a Permanent Secretariat. This key unit is also recieving support from UNICEF.

ASSESSMENT OF EMERGENCY NEEDS FOR 1985

1.FOOD

The assessment of cereal import requirements and related commitments is provided in Annex 2. The WFP (Rome) will provide the Conference with a complete assessment of (i) the targets and costs for basic rations and supplementary food for vulnerable groups, (ii) the amounts committed, (iii) the amounts in stock and being distributed, and (iv) the remaining unfilled requirements.

2.BASIC AGRICULTURAL AND PASTORAL INPUTS

This assessment will be provided by the FAO, using the report of the FAO/WFP Multidonor Mission of December 1984.

3.ESSENTIAL HEALTH ACTIONS

These actions are of principal interest to UNICEF, with advisory

service from WHO. Substantive actions have already been taken to prevent epidemics of measles, yellow fever and cerebro-spinal meningitis. The Government successfully executed a national mass immunisation campaign ("Vaccination Commando") during less than three weeks last December. The results:

VACCINE	DOSES CONSUMED	TARGET POPN.	NUMBER VACCINATED	AGES	% ACHIEVED
MEASLES	1 456 000	1 260 000	1 184 412	9 MO.- 6 YRS.	94
YELLOW FEVER	2 198 750	2 326 793	2 110 230	9 MO.- 14 YRS.	91
MENINGITIS A + C	2 857 870	2 426 000	2 517 834	9 MO.- 14 YRS.	106

Target populations were estimated on the basis of a total population of about 700,000; although the percentage figures are only indicative, the vast number of children vaccinated provides assurance that the objectives of Vaccination Command were met. Rapid progress is now underway towards the establishment of a national Expanded Programme of Immunization.

Early in February the Provincial Directors of Public Health for the most-affected provinces gave their estimates of requirements for drugs and medical supplies. These estimates have been considered carefully by the Ministère de la Santé Publique in consultation with WHO and UNICEF. Limited quantities of essential medicines have been procured locally by UNICEF ; along with the Ministy's current stocks and other donor's contributions (particularly those from the the French "Operation Sahel '84") the current situation appears to be satisfactory. Large orders, however, have now been placed by UNICEF for both essential medicines and medical supplies which should cover the critical needs for the six

months following their expected delivery in April or May.

Concurrently an Essential Drugs Programme is being developed with WHO, World Bank and UNICEF, which has received funding from the Government of Italy (approximately $1.8 million for 1985/1986). Orders for drugs under this programme are not expected to be placed for several months, during which time the Government is expected to complete the planning of the necessarily complex organizational arrangements.

With the immediate short-term requirements having been met or concretely planned, and with the process of planning the long-term Essential Drugs Programme underway, the Ministry, WHO and UNICEF are currently focussing on the medium-term (6 to 12+ months) requirements which will be imposed by the emergency situation. The table below indicates the amounts of additional external assistance felt to be required for emergency-related health actions during 1985/86:

	(U.S. Dollars)
Medical equipment and supplies	140 000
Drugs, vaccines	350 000
Construction of health posts	300 000
Training of health workers (including PHC village health workers)	140 000
Logistical support (trucks, fuel, maintenance)	400 000
TOTAL	1,330 000

It is very important to note that all of these emergency actions are viewed by the Government (as well as by UNICEF and WHO) as excellent opportunities to strengthen and to expand Primary Health Care. Within this context, the practice of oral rehydration therapy and of course the expansion of immunization services are being very strongly promoted. Wherever possible, the other elements of the GOBI-FFF strategy are also

being encouraged.

EMERGENCY NUTRITION ACTIONS

A rapid nutrition assessment survey for the most-affected provinces, to be executed by the Ministère de la Santé Publique with support from USAID and UNICEF, is under preparation to occur during March and April. The results will help to identify the nature of the problem as well as the geographic areas most severly affected. Concurrently an improved sentinel system is expected to be developed.

The Government places a very high priority on the reinforcement of at least 15 existing- but marginally operating- nutrition rehabilitation centres located in the four northernmost provinces. Through these centres two major activities could be rapidly expanded: (i) the distribution of food to malnourished groups (children 0-5 yrs, pregnant and breast-feeding mothers); and (ii) the encouragement of local food production (gardening, poultry) through women's groups.

There are approximately 75 Maternal and Child Health Centres in the most-affected areas. The Government proposes to improve the performance of the existing staff by conducting a series of intensive, essentially on-site training sessions at each of these centres. This would require the establishment of a full-time mobile health training team, as well as the supply of training materials and equipment for each of the centres. Where possible the number of women working as regional or local educators would be increased by short-term contracts with the Government. These centres, while not equipped to engage in nutrition rehabilitation of severely malnourished children, could nevertheless expand their actvities in emergency feeding programmes and in improved agricultural production and storage, given additional resources.

With the rapid nutritional survey completed, it will then be

necessary to strengthen and expand the sentinel system for nutrition surveillance. Associated with this it is hoped to rapidly expand the use of growth charts. These actions are proposed to complement the National Nutrition Survey which is also being charted. It will involve the Ministries of Health and of Agriculture, with support from WHO, FAO, and UNICEF (as part of its regular programme).

All of the above emergency-related nutrition activities will require substantial transport and travel costs. The breakdown of the proposed activities is as follows for 1985/86:

	(U.S. Dollars)
Food for nutrition rehabilitation	300 000
Improving local food production	300 000
Nutrition education activities	250 000
Transport: food and materials	150 000
Training and assistance to health workers	150 000
Nutrition surveillance system	20 000
TOTAL	1 170 000

4. RELIEF SURVIVAL ITEMS INCLUDING SHELTER, CLOTHING AND OTHER REQUIREMENTS

The February 1985 survey of displaced persons indicated a total migrant population (displaced persons or refugees) of approximately 20,000. These people are not settled into organized camps but rather form spontaneous settlements around water sources (usually small, shallow dams). Few of these settlements contain more than 1000 persons. Typically their shelter consists of straw mats arranged to form a protective hut; these will afford little protection when the rains begin

in May or June. Clothing, especially for children, is wholly insufficient.

The bulk of the diet consist of tubers and leaves which are by no means part of the normal diet, and which require an enormous effort to attain. Many of these families still have some cattle, sheep or goats but their value in the market has plummetted due to excess supply; yet these animals are regarded as the last real resource and so will not be eaten unless starvation threatens. Government and NGO's have distributed limited food supplies to the larger "camps", but there are extraordinary logistical difficulties in reaching a significant proportion of these highly at-risk families, especially given the limited financial resources at he Government's disposal.

Potable water supplies are generally unavailable; there have already been conflicts reported between these new-comers and the resident populations. Health services are virtually non-existent since local health authorities seldom have the vehicles necessary to operate mobile curative units.

Within the next two months the local governments will have to act to prevent serious conflicts over farmland allocations between the displaced and the resident populations. Although some of these migrants intend to retun to their traditional areas to the north, a large proportion intends to remain where they can be assured of farmland, pasturage, or both. Those who intend to settle will need some assistance, particularly if their traditional ways were nomadic.

Immediate assistance is desired by the Government. The following table provides an indication of the most urgent needs.

1500 tonnes food, purchased in W. Africa	300 000
2,000 six-person tents	400 000
10,000 blankets	40 000
200 5000-litre rubber-reinforced portable water reservoirs	180 000
10 15-tonne 4-wheel drive tipper trucks	500 000
Fuel, maintenance for 10 trucks	50 000
Farming tools, seeds	330 000
construction materials for new villages	200 000
TOTAL	2 000 000

5. ESSENTIAL WATER PROJECTS

In considering proposals for rapid, emergency water projects a number of key factors were taken into consideration: the available technical and human capacities as well as the logistical and technical constraints related to the procurement of equipment and to the execution of the work.

The geographic areas selected for concentration are the four northernmost provinces (Yatenga, Soum, Oudalan, Sêno) and the northern sectors of Sanmatenga, Namentenga and Passoré.

The effectiveness of the actions will be primarily determined by the care taken for their programming, coordination and supervision. The Ministère de l'Eau will assume overall responsibility for project execution. Within that Ministry, the Direction DPFH (Puits, Forages, et Hydrologie) would be the most directly involved, though some actions would be managed by the ONBAH (Office Nationale des Barrages et Amenage-

ments Hydrauliques).

The management approach would be based on the principles of teams working independently and flexibly with competent support from the central level. These actions should contribute to an acceleration of the decentralized approach already started by the Direction DPFH. The advantages include an improved appreciation of the problems encountered, as well as their appropriate solutions, and quicker, less costly response.

The Government therefore forsees first of all a reinforcement of their existing structures in the regions concerned; if necessary and feasible, given the resources available, additional temporary teams would be constituted. The emergency water supply operations would be based on these structures. It is certain that the feasiblity of these operations will be much improved with the installation of permanent communications systems and a structure able to provide mobile technical services. The Government has thus proposed the following elements as feasible, taking into consideration the constaints of time and availability of technical resources and trained personnel:

	(U.S. Dollars)
Reinforcement of regional infrastructure (equipment and personnel)	100 000
Establishment of mobile mechanical workshop in Sahel.	100 000
Rehabilitation, replacement and maintenance of Handpumps	300 000
3 water-tank trucks	150 000
2 borehole repair teams	200 000
1 team to deepen existing wide-diameter wells	150 000
TOTAL	1 000 000

It should be noted that the construction of new wells is an ongoing programme and must of course continue unabated. To the extent possible

construction of additional new wells and small dams is being avidly pursued within the Government's National Development Plan.

UNDP OUAGADOUGOU 18/01 09277

WORLD FOOD
ROME (ITALIE)

OZO FOR EXEC DIRECTOR JAMES INGRAM FROM RIBO-DIEGUEZ EMERGENCY IN AFRICA. FOLLOWING MESSAGE SENT 16/1/85 TO BRADFORD MORSE. OEOA UNDEVPRO NEWYORK QUOTE :
019 BRADFORD MORSE, OEOA, FROM RIBO-DIEGUEZ
REF YOURTEL 4599 OF 29/12/84 FOOD EMERGENCY IN AFRICA.
SITUATION CREATED BY DROUGHT IN BURKINA FASO NOT ONLY TO BE VIEWED AS EMERGENCY BUT CONTINUING FOOD SHORTAGE CALLING FOR LONG-TERM STRUCTURAL MEASURES. INFORMATION BELOW COLLATED IN CLOSE COLLABORATION WITH MULTILATERAL, BILATERAL, NGO AND UN AGENCIES.
REPLY QUESTIONS IN PART SECUNDO YOURTEL
SECTION ONE AAA
EIGHT PROVINCES AFFECTED IN BURKINA : YATENGA, SOUM, OUDALAN, BAM, SANMATENGA (NORTHERN HALF), NAMETENGA, SENG, GNAGNA AND TAPOA (NORTH ONLY). **BBB** 500,000 PEOPLE MOST SEVERELY AFFECTED, APPROX 25 PCT POPULATION OF AREA. **CCC** 1984/85 HARVEST (METONS) SORGHUM 616,000 , MILLET 397,1000 , MAIZE 80,500 , RICE (PADDY) 43,000 , FONIO 5,000 , OTHER 1,500 TOTAL 1,143,100.
SECTION TWO AAA AFTER ASSESSMENT TOTAL RESOURCES AND NEEDS GOVT ANNOUCED LATE 1984 NET GLOBAL DEFICIT 163,000 METONS FIGURE CONFIRMED BY MULTIDONOR FAO/WFP MISSION DECEMBER. MEETING GOVT/DONORS 4/5 JANUARY ARRIVED AT FOLLOWING : GOVT TO PROCURE 63,000 METONS OF GLOBAL DEFICIT INDEPENDENTLY, 30,000 METONS FROM BILATERAL COUNTERPART FUNDS, LEAVING GOVT REQUEST TO DONORS FOR FOOD AID AT 70,000 METONS. PLEDGES OF FURTHER 60,000 METONS ANNOUNCED AT MEETING (SEE BELOW) LEFT NET SHORTFALL OF 10,000 YET TO BE PROVIDED. ADDITIONAL PLEDGES (TOTAL 60,000 METONS) : USAID 26,000 , CEE 11,000 , FRANCE 5,000 , CANADA, ITALY EACH 3,000 , F.R.G. GERMANY (FR), GHANA EACH 2,000 , CARITAS 1,000 , TOGO 435, AND WFP 2,500 (UNDISTRIBUTED RESIDUE OF 1984 EMOP).
BBB SUPPLEMENTARY FOOD AID FOR VULNERABLE GROUPS UNDER REGULAR CATHWELL PROGRAMME COVERING MOSTLY STRICKEN AREAS. GOVT INTENDS GIVE MORE EMPHASIS TO VULNERABLE GROUPES AND FFW RATHER THAN TO FREE FOOD DISTRIBUTION. WFP STUDYING WITH GOVT SCOPE FOR FUTURE PROJECTS OF THIS KIND. **CCC** HEALTH ACTIONS. **1/-** UNICEF/WHO ASSESSING WITH GOVT NEEDS FOR BASIC MEDICINES FOR PRIMARY HEALTH CARE IN AFFECTED ZONES AND WILL AIM TO MEET NEEDS. **2/-** FOR LONGER TERM, WORLD BANK IS UNDERTAKING STUDY PROJECT ON REINFORCEMENT OF HEALTH SERVICES STRUCTURES. **3/-** UNICEF/WHO AND LOCAL AUTHORITIES JUST COMPLETED MASSIVE VACCINATION CAMPAIGN WITH FOLLOWING RESULTS (PCT OF POPULATION IN TARGET AGE-GROUPS IMMUNISED) : MEASLES 81 PCT, YELLOW FEVER 61 MENINGITIS 91
DDD SHELTER ETC. 1/- STUDY IN PROGRESS UNDER UNICEF SPONSORSHIP TO ASSESS NEEDS OF APPROX 20,000 DISPLACED PERSONS EX MOST AFFECTED AREAS - WITH VIEW ESTABLISH PROVISIONAL CAMPS. 2/. FOOD NEEDS FOR THESE CAMPS TO BE MET BY CATHWELL UNDER SPECIAL PROGRAMME.
EEE AGRI INPUTS FOR 1985 HARVEST. **1/-** FAO CONDUCTING OPERATION TO ENSURE 3,600 TON SEED STOCK SUITED TO REGION THROUGH EXCHANGE PROGRAMME USING 10,000 TONS FOOD GRAIN AS INCENTIVE AMONG FARMERS. **2/-** NEED FOR VACCINATION PROGRAMME FOR 210,000 HEAD OF CATTLE TO COVER 80 PCT OF STOCK REMAINING IN REGION. **3/-** URGENTLY NEEDED FUNDS TO PURCHASE LOCALLY AND TRANSPORT 4,000 T COTTON CAKES FOR ANIMAL FODDER (LOCAL PRODUCTION 10,000 T P A).

4/- AGRI IMPLEMENTS - ESTIMATED MINIMUM NEED : FOR FLOOD AFFECTED FAMILIES IN GOROMGOROM
(A) TOOLS FOR 450 FAMILIES WORKING 6 HA EACH
(B) 450 PAIRS OF BULLOCKS/OXEN
(C) 450 PLOUGH HARNESSES (COMPLETE) FOR SAME
(D) 150 KG FERTILISER PER FAMILY.
FFF WATER SUPPLY PROBLEM ALREADY COVERED BY NATIONAL DEVELOPMENT PLAN (PPD) PARALLEL TO EMOP. CONSTRUCTION ALREADY BEGUN OF 250 DAMS, 1,415 WELLS, 1,000 BORES, ASSISTED FAO/UNDP/USAID/NGO/WFP (REGULAR PROGRAMME).
GGG FOLLOWING UNDP PROJECTS UNDER WAY
(A) BKF/84/004 RESCUE OF CATTLE SLRS 210,000
(B) BKF/84/005 FOOD PRODUCTION USD 180,000
(C) BKF/84/006 ESTABLISHMENT OF TEAM FOR DEEPENING WELLS
(D) RECONSTRUCTION OF GOROM-GOROM UNDP/UNDRO TOTAL USD 50,000
SECTION THREE LOGISTICS
PORT CAPACITIES.
1/- LOME PORT. UNLOADING CAPACITY (6PIERS) 150-200 METONS/DAY/TEAM STORAGE CAPACITY FOR BURKINA FASO 15,000 METONS. INLAND TRANSPORTATION SPECIAL AGREEMENT WITH TOGO SHARING TRANSPORT COSTS 2/3 BURKINA FASO, 1/3 TOGO. STRICTLY CONTROLLED BY FREIGHT UNION. CLEARANCE FROM PORT : 300 TO 500 METONS/DAY FROM WAREHOUSES PLUS DIRECTLY UNDER SHIPS TACKLE IF TRUCKS AVAILABLE. ABIDJAN PORT. UNLOADING CAPACITY (35 PIERS) 200 TO 300 METONS /DAY/TEAM. STORAGE CAPACITY 50,000 METONS REDUCED TO 30,000 METONS FROM NOVEMBER TO MARCH (COFFEE AND COCOA SEASON).
PORT CLEARANCE : (RAIL) 6,000 METONS/MONTHS (ROAD) 8,000 METONS/MONTH TAKING INTO CONSIDERATION THAT PART OF FLEET (TRUCKS) USED FOR COFFEE AND COCOA MOVEMENTS DURING SEASON.
AAA TRANSPORT COSTS (PER METON)
1/- FOOD ITEMS : LOME-OUAGADOUGOU 28,000 FCFA , ABIDJAN-OUAGADOUGOU (RAIL) 22,700 FCFA (ROAD) 25,000 FCFA. NON-FOOD ITEMS : LOME-OUAGADOUGOU 26,000 FCFA, ABIDJAN-OUAGADOUGOU (RAIL) 30,700 FCFA (ROAD) 30,000 FCFA.
BBB CAPACITY OF GOVT TO CONTRIBUTE TO TRANSPORT COSTS IS MINIMAL.
CCC STORAGE. CURRENT TOTAL CAPACITY 83,150 TONS OF WHICH : (1) STABILISATION 26,500, (2) SECURITY 30,000 TONS (3) MOVABLE SILOS 26,650 TONS. GOVT CURRENTLY UNDERTAKING CAMPAIGN TO RELOCATE STORAGE FACILITIES TO TAKE BETTER ACCOUNT OF DISTRIBUTION OF STOCKS THROUGHOUT COUNTRY. PART OF THIS EXERCISE INCLUDES CONSTRUCTION 440 SMALL RURAL CEREAL BANKS (PARTICIPATION BY NGO, USAID/FAO AND ILO/WFP/UNDP THROUGH REGULAR PROGRAMMES.
SECTION FOUR. SAFETY FACTORS AFFECTING DISTRIBUTION. NONE IN BURKINA. UNQUOTE
REGARD. (UNDEVPRO OUAGADOUGOU)
NNNN

612030 WFP I
P N U D 52516FMMMMM
TRAN 02034 DUREE 017.6MN

PROGRAMME ALIMENTAIRE MONDIAL

WORLD FOOD PROGRAMME

Adr. Télégr. UNDEVPRO-OUAGADOUGOU
TELEX No 5251
TELEGRAMME-TELEX

Date : 14 February 1985

Rédigé et Visé par : CON/RD

Compte : WFP

Classement : PRO 20/OEUA

ADRESSE WORLDFOOD - RUME

TEXTE

AAA 072 MOLLER FROM RIGO-DIEGUEZ. REYOURTEL 479 OF 12/02/85 FOOD EMERGENCY IN AFRI AFTER ASSESSMENT TOTAL RESOURCES AND NEEDS GVT ANNOUNCED LATE 1984 NET GLOBAL DEFICIT 163000 MTN FIGURE CONFIRMED BY MULTIDONOR FAO/WFP MISSION DECEMBER. MEETING GVT/DONORS 4/5 JANUARY ARRIVED AT FOLLOWING / TOTAL CEREAL IMPORT REQUIREMENT = 163000 MTN TOTAL CEREAL FOODAID REQUIREMENT = 70000 MTN TOTAL KNOWN PLEDGES = 59017 MTN.

BBB AFTER MEETING WITH GVT, MULTILATERAL, BILATERAL, NGO AND UN AGENCIES HELD ON 11/2 FOLLOWING DATA ARE CONFIRMED

FIRM PLEDGES

NO	DONOR	YEAR	CHANNEL	TYPE	COMMODITY	QUANTIT
100	USA II	84/85	USAID	S	SORGHUM	15000
	USA II	"	"	E	"	4000
	USA II	"	CRS	E	CORN MEAL	8792
200	FED	"		E	CORN	11000
300	FRANCE	"	OFNACER	S	CORN	3000
	FRANCE	"	"	S	WHEAT	1000
400	GHANA	"	"	S	CORN	2000
500	TOGO	"	"	S	CORN	465
600	JAPAN	"	"	S	RICE	8235
700	CANADA	"		S	CORN	3000
800	GERMANY	"		S	CORN	2000
COMMERCIAL IMPORTS						
100	CAISSE PEREQUATION	"	"	S	CORN	15000
200	OFNACER	"		S	CORN/MILLET	12000

E.NEEKIO, UNDP Res. Rep. a.i.

Autorisé par :

nombre de mots 168

PROGRAMME ALIMENTAIRE MONDIAL

WORLD FOOD PROGRAMME

Adr. Télégr. UNDEVPRO-OUAGADOUGOU
TELEX No 5251
TELEGRAMME-TELEX

Date :

Rédigé et Visé par :

Compte :

Classement :

ADRESSE

suite telex 072

TEXTE

NON CONFIRMED PLEDGES

NO	DONOR	YEAR	CHANNEL	TYPE	COMMODITY	QUANTITY
100	USA	84/85	CRS	E	CORN	10250
200	USA	84/85	BAPTIST MISSION	E	SORGHUM/CORN	4000
300	RED CROSS	84/85		E	CORN MEAL	2600
400	ITALY	84/85		E	?	3000
500	CHINA	84/85		S	CORN	2000
600	WFP	84/85		E	SORGHUM	18000
700	RED CROSS	84/85		E	WHEAT	4000

NON CONFIRMED COMMERCIAL IMPORTS

100	CAISSE PEREQUATION	"	USA	S	RICE	47000

CCC IN VIEW SUCCESSFULL OPERATION "EXPRESS SAHEL" GVT REQUESTED WFP TO PROVIDE 18000 T CEREALS AND 216 MILLIONS FRS CFA FOR INTERNAL TRANSPORTATION COST TO CONTINUE DISTRIBUTION FOR 90 DAYS.

DDD REYR 387 PT6. FOR YR INFORMATION REGULAR MEETINGS WITH GVT, BILATERAL, MULTILATERAL, NGO, UN AGENCIES ARE BEING HELD REGULARLY TWICE A MONTH SINCE SEPTEMBER.

Autorisé par : B. NZEKIO, UNDP Res. Rep. a.i.

nombre de mots 110