WATER AND SANITATION
FOR HEALTH PROJECT

Operated by
CDM and Associates

Sponsored by the U.S. Agency
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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.

AN ASSESSMENT OF PROBLEMS AND NEEDS FOR WATER SUPPLIES AT ETHIOPIAN DROUGHT-VICTIM CAMPS

WASH FIELD REPORT NO. 138

DECEMBER 1984

Prepared for:
USAID/W/Office of Foreign Disaster Assistance
Request Memorandum No. 112

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under Request Memorandum No. 112

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December 1984

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EXECUTIVE SUMMARY

At the request of the Office of Foreign Disaster Assistance (OFDA) two WASH consultants spent approximately two weeks in Ethiopia at the end of November 1984 to assess:

- the current well-drilling equipment capability to provide drinking water to drought-stricken population areas
- well drilling equipment rehabilitation costs
- water supply needs at drought-victim camps and local capability to meet those needs.

The consultants found that both the Ethiopian government and private volunteer organizations agree that the drought-victim problem will increase. The present camps, mainly concentrated in the Wello Region, are now seeing a new influx of refugees and new camps are opening. Also, drought and lack of food reserves south of Addis Ababa indicate that present feeding centers probably will expand into relief camps with problems similar to those now in the north. Although drought-victim populations and deaths may decrease in some camps as a result of resettlement efforts, the overall trend is not favorable.

As an example of how desperate a situation exists, the consultants observed that in the Bati Camp, which has a population of about 15,000, the death rate was 30 to 80 per day the week of 21-27 November. It was 98 on 28 November, and 112 by noon of 30 November. The major causes of death were dehydration, dysentery, malaria, and pneumonia. In this camp, the water supply is barely adequate for survival, and the distribution system is so limited that obtaining water would tax even strong healthy people.

It is impossible to tell how many deaths at the camp are wholly or partly attributable to inadequate water supply facilities. However, it is obvious that the stress of competing with other camp residents for water and the inability of the supply system to provide enough water for drinking, cooking, and sanitary needs must be responsible for a large number of the deaths in this group of malnourished, sick, despondent, thirsty people. The water supply to the camp provides only about one gallon per capita per day through 24 taps operating only 12 hours per day for 15,000 persons. One well provides the sole camp supply. There will be no water if a well or pump fails.

Current efforts to relieve camp problems that are directly or indirectly associated with water supply needs and facilities are listed below.

- Government construction teams are effecting water system improvements with OXFAM assistance and supplies from the United Kingdom flown in by the Royal Air Force.

- New camps are being opened to accommodate increasing numbers of people seeking aid and to relieve the strain placed on the present unmanageably large camps (World Vision plans a new camp a month; two camps will be opened in December as the November target was not met).

- A government program, already underway, aims to resettle 1.5 million people during 1985. (This could create problems in areas to which the people are moved.)

The immediate needs which the Government Relief and Rehabilitation Commission expressed in their October 1984 report, "The Drought Situation in Ethiopia and Assistance Requirements 1984/85," were for water-tank trucks, water-storage tanks, and pumps with drivers. Additional requests from the National Water Resources Commission, which has actually been working in connection with camp water supply improvements, include well drilling equipment, pumps, construction materials and small tools. The consultants recommend that various numbers of these items plus pipes, fittings, and hand tools for water distribution; a pump-setting rig; and a drilling rig, provided on a grant or contract basis, be considered as appropriate necessary emergency aid for providing basic minimal water supply requirements for the present camps in Wello. These items would also be necessary for emergency aid in new camps which are now being formed in the Wello District.

OXFAM recognizes the same need and is providing much of this equipment and material along with expatriate and local staff to put it into service. In addition, the Japanese government is providing three water-tank trucks. Thus, the initial emergency needs are largely being met except for:

- Providing at least 12 new wells and increasing well drilling capacity by:
  - Purchasing spare parts to rehabilitate drill rigs in Ethiopia (estimated cost = $100,000).
  - Engaging the services and equipment of a well driller/company for approximately 8 months (estimated cost = 8 months x $60,000/month = $480,000).
- Increasing the capability to locate and construct water by providing:
  - Small hand tools for reconstructing and pumping systems and stations (estimated cost = $10,000).
  - Basic hydrological investigative survey equipment to site wells (estimated cost = $9,000).
  - Earth resistivity equipment to further enhance well-setting capability (estimated cost = $15,000).
  - The services of a U.S. hydrologist to use equipment and train Ethiopians (estimated cost = $25,000).
- Increasing pump rehabilitation and the setting and repair of new and existing wells (including pumps) through provision of equipment, tools, spare parts, and the services of a mechanic (6/7 weeks) (estimated cost to initiate this effort = $55,000).

- Providing containers to transport and/or store the limited amounts of drinking water being provided to camp inhabitants (estimated cost = $50,000).

- Providing short-term (60 to 90 days) oversight for water portion of the relief effort and coordination with other donors (estimated cost = $50,000).

The report presents the team's recommendations for each of the above-mentioned items and Appendices G, H, I and J present detailed lists and contact persons.

LIST OF AGENCIES AND ABBREVIATIONS

AID/W/OFDA	-	AID/Washington/Office of Foreign Disaster Assistance
ARDU	-	Agricultural Rural Development Unit
CARE	-	Cooperative for American Relief Everywhere
CEDA	-	Canadian Economic Development Assistance
CI	-	Concern Ireland
CRDC	-	Christian Relief and Development Coordination
ECA	-	UN Economic Commission for Africa
EEC	-	European Economic Community
EWWCA	-	Ethiopian Water Works Construction Authority (Division of NWRC)
IBRD	-	International Bank for Reconstruction Development
Mekane Yesus	-	Ethiopian Evangelical Church
NC	-	NORCHARCHAID/Norwegian Church AID
NWRC	-	National Water Resources Commission (formerly EWRA - Ethiopian Water Resources Authority)
OXFAM	-	Oxford Famine Relief
PVO	-	Private Voluntary Organization
RRC	-	Relief and Rehabilitation Commission
SCF	-	Save the Children Federation
SIDA	-	Swedish International Development Authority
SIM	-	Sudan Interior Mission
UNICEF	-	United Nations International Childrens Emergency Fund
WASH	-	Water and Sanitation for Health Project
WV	-	World Vision

Chapter 1

INTRODUCTION

1.1 Consultants' Objectives

Two Water and Sanitation for Health Project (WASH) Senior Consultants were dispatched to Ethiopia in November in response to a 7 November 1984 request from the AID/Washington/Office of Foreign Disaster Assistance (AID/W/OFDA).

On the day of their departure, 15 November 1984, verbal instructions were given them during an AID/W/OFDA briefing at the U.S. State Department. The instructions stipulated that their efforts should be directed towards the development of recommendations for emergency assistance that could be initiated within the next three months, not for development programs. Furthermore, the consultants' recommendations were to be based on the following assessments:

- Water supply needs at refugee camps, primarily to the north of Addis Ababa, and the deficiencies of present facilities to meet these needs.
- Local capability in the form of trained people, equipment and supplies necessary to alleviate the deficiencies of present water supplies.
- Needs for spare parts, new equipment, and supplies to construct water supply facilities where the present ones are inadequate and where local capabilities to effect improvements are deficient.

1.2 Consultants' Activities

When the consultants' arrived in Addis Ababa (Saturday, 17 November 1984) they were given a letter from Mr. Charles M. Heffernan, Assistant Program Officer AID/Ethiopia, which included notice of an appointment with Mr. K. Ray of UNICEF. Mr. Heffernan's letter also listed possible contacts with representatives of OXFAM, CARE, RRC (Relief and Rehabilitation Commission of the Ethiopian government), and Dr. Anita Mackie, USAID Representative.

Prior to the meeting with Dr. Mackie (Monday, 19 November 1984), the consultants had met with personnel at UNICEF, CARE, and RRC and had arranged for a meeting with the National Water Resources Commission (NWRC). Dr. Mackie endorsed the course that the consultants were following to meet their objectives but did suggest they contact Brother Gus at Christian Relief and Development Coordination (CRDC). Note that Dr. Mackie was ill and had to leave the country a few days later. She was replaced by Mr. F. Fischer.

A complete listing of persons whom the consultants contacted during their stay in Ethiopia is included as Appendix A and a daily log of their activities is found in Appendix B. Separate notes on the consultants' field trips are in Appendix C. A list of references reviewed precedes the appendices.

Chapter 2

OVERVIEW OF THE DROUGHT/FAMINE PROBLEM

2.1 General Information about Ethiopia

The following presentation of certain basic information about the land and people of Ethiopia has been included so that the current emergency situation can be viewed in proper perspective.

2.1.1 Population

According to a U.N. estimate, the population of Ethiopia in 1975 was just under 25 million. The United Nations also estimated that in 1970-75 the average annual birth rate was 49.4 per 1,000 and the average annual death rate 25.8 per 1,000. The 1980 population was estimated at 32.2 million (see Appendix D). The current population is 42 million, according to Voice of Revolutionary Ethiopia (VRE).

About 80 percent of the people live in the central highlands with the remainder living in the lower peripheral zones. The largest population concentration in the lower areas is in the north.

2.1.2 Subsistence Agriculture

Although only a small percentage of the land is cultivated, over 80 percent of the population is supported by agriculture. This agricultural activity is largely at a subsistence level, defined as agriculture for family use and local sale rather than for commercial production. Clark University's Country Profile of Ethiopia maps agricultural activity, showing that the subsistence agriculture is concentrated in areas of low rainfall. In other words, the farming areas with the least resources are those most affected by the drought conditions.

2.1.3 Land Area and Terrain

The area of the country is about 1.25 million sq. km. (0.5 million sq. mi.). Elevations range from far below sea level in the Danakil Depression to over 4,500 m. on Ras Dejen, the fourth highest mountain in Africa. Except for the Danakil and some other eastern areas, the country is primarily a rugged upland with extensive plateaus above 2,000 m. in elevation. The tableland in the Simien Mountain areas is above 3,000 m. Throughout the country, deep valleys divide the uplands into comparatively inaccessible areas.

2.1.4 Administrative Units

Ethiopia is divided into 14 administrative regions, 102 awrajas or subregions (shown in Figure 1), and more than 580 wordas (districts).

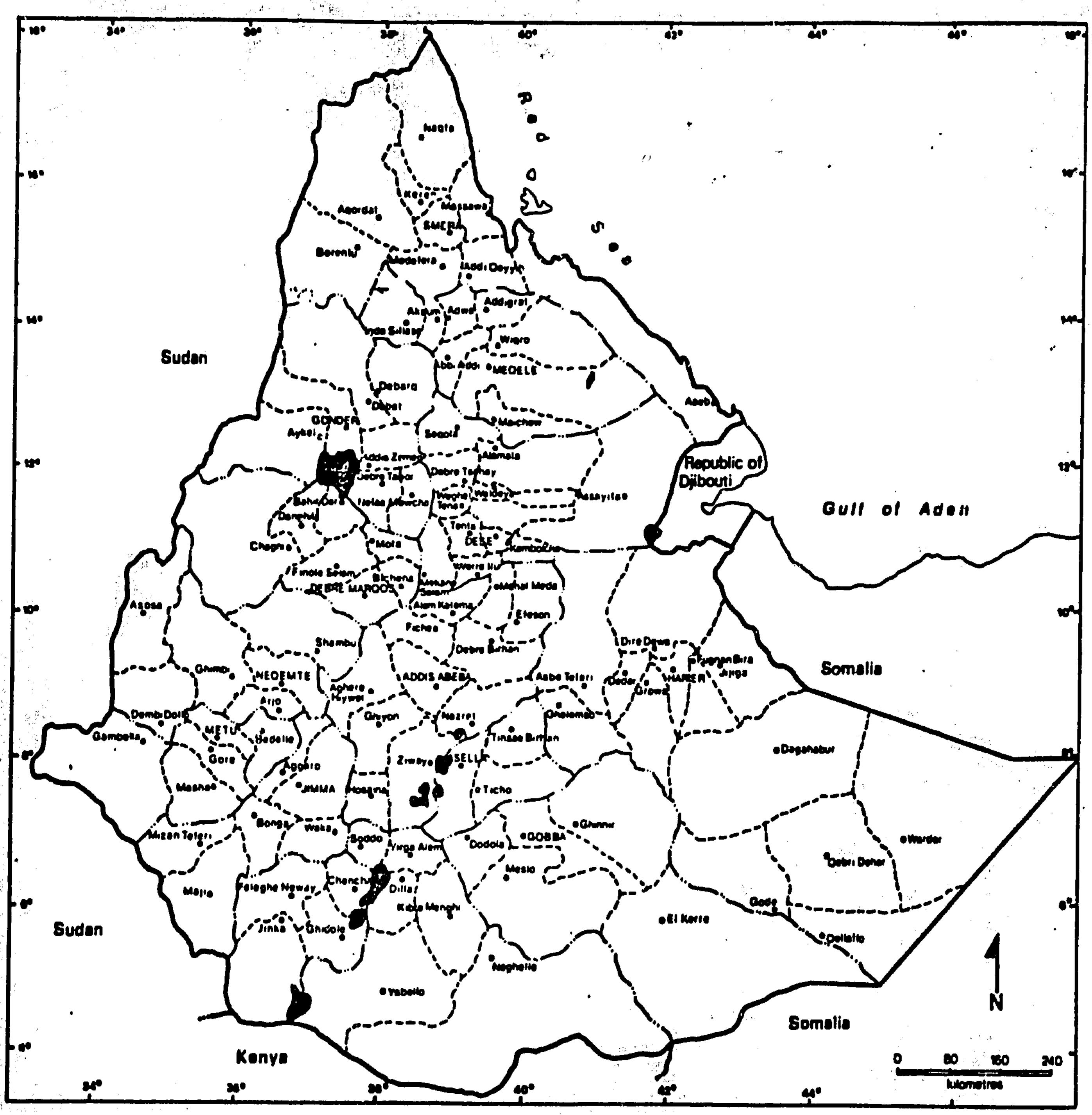


Figure 1. .Map of Ethiopia
(from Eastern Africa Country Profiles, Ethiopia, Clark University, 1980)

2.1.5 Climate

Ethiopia's rainfall is seasonal with different climatic zones related to altitude. The high central and east-central mountain and plateau areas are characterized by a generally temperate climate with a mean annual rainfall of from 800 up to more than 1,800 mm. The low-lying northern and eastern parts of Ethiopia are generally hot and dry with a mean annual rainfall of less than 400 mm. The intervening belt has an intermediate climate. Figure 2 shows the country's rainfall pattern. The region of poorest subsistence agriculture coincides with the hot, dry, low-lying zone.

Rainfall, however, varies considerably from year to year. The annual rainfall in the higher and wetter areas is relatively reliable, although in the margin of these areas low rainfall years can result in crop failures. The annual rainfall in the dry low-lying areas is quite variable with wet years providing water for good pasture and some grain crops followed by almost totally dry years. In some localities, this pattern tends to encourage expansion of farmed areas and animal herds in good years which increases the losses in dry periods.

2.2 Historic Famine Conditions

Famine conditions in Ethiopia result from drought conditions. A one-year drought can result in a serious food shortage or famine particularly in the poorest subsistence agricultural areas where reserves of food and other assets are scarce. In such cases, herds may be depleted and the viability of the area degraded for some time even if the following year's rainfall is normal. Droughts of longer periods or which are more widespread can result in local, regional or national famines.

Clark University studied data on famines occurring in Ethiopia during the 20 year period ending in the late 1970s. Table 1 summarizes the study results. During this period, even in the two best years, four or five awrajas suffered famines of local effect; and in the four worst years 52 to 60 percent of the awrajas were affected by famines of national magnitude. In the other 14 years, local or regional famines affected the country to an intermediate degree.

2.3 Current Famine Conditions

The implication of the Clark University study is that variations in rainfall patterns cause at least localized food shortages essentially every year. The current emergency situation in which large numbers of hungry or starving people are congregated in drought-victim camps and other areas to a degree never previously experienced results from three factors. One, the drought has extended over a period of several years and the drought-affected area has been increasing; two, the national population is larger than ever before and the ability of marginal farmlands to support the local population is overstressed; and, three, the provision of relief food supplies at various centralized depots has encouraged migration and concentration of the affected people. The main concentration of drought victims and relief action is north of Addis Ababa. Figure 3 shows relief areas designated by the RRC with priority status.

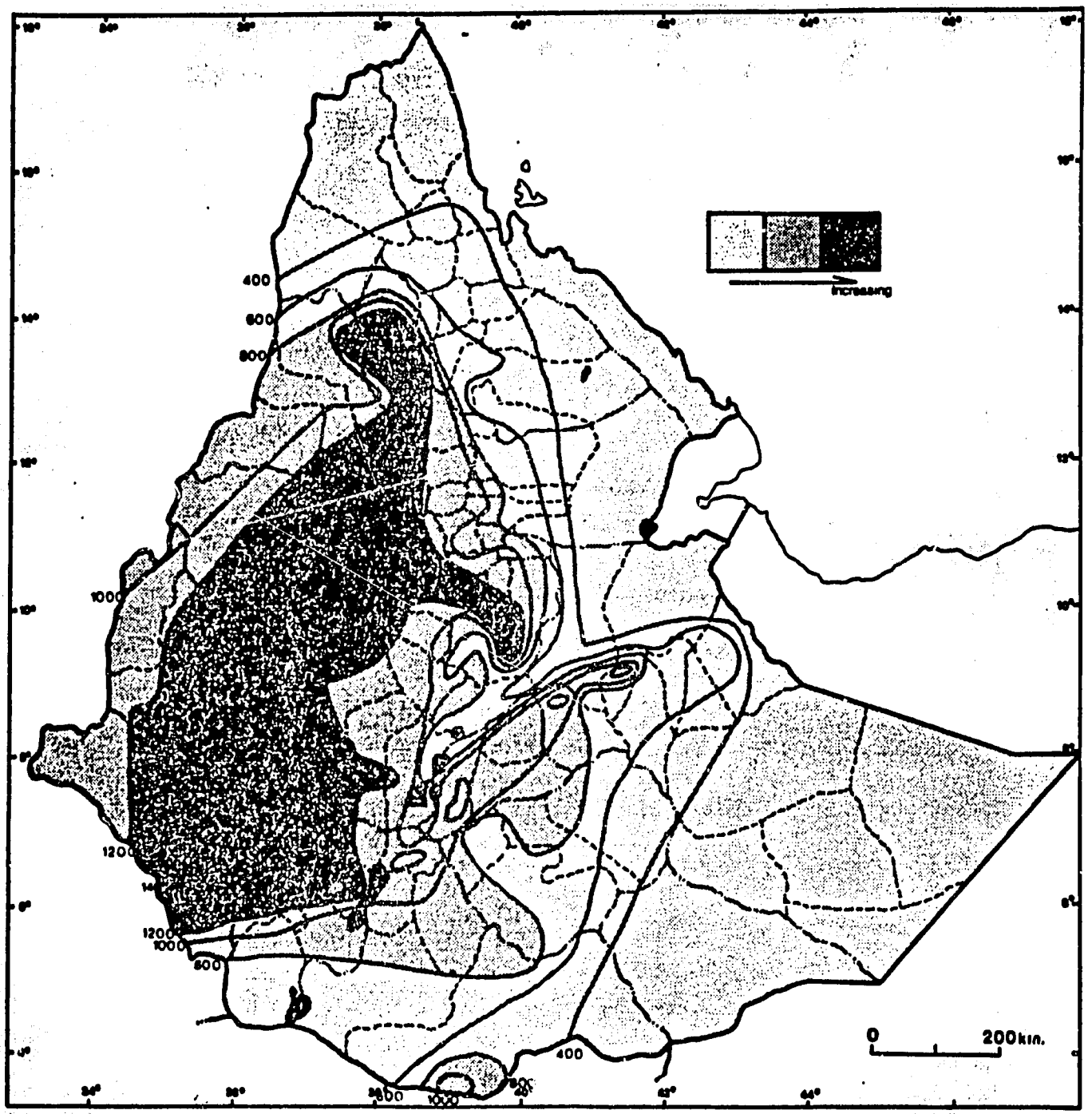


Figure 2. Mean Annual Rainfall
(from Eastern African Country Profiles, Ethiopia, Clark Universiy, 1980)

TABLE 1

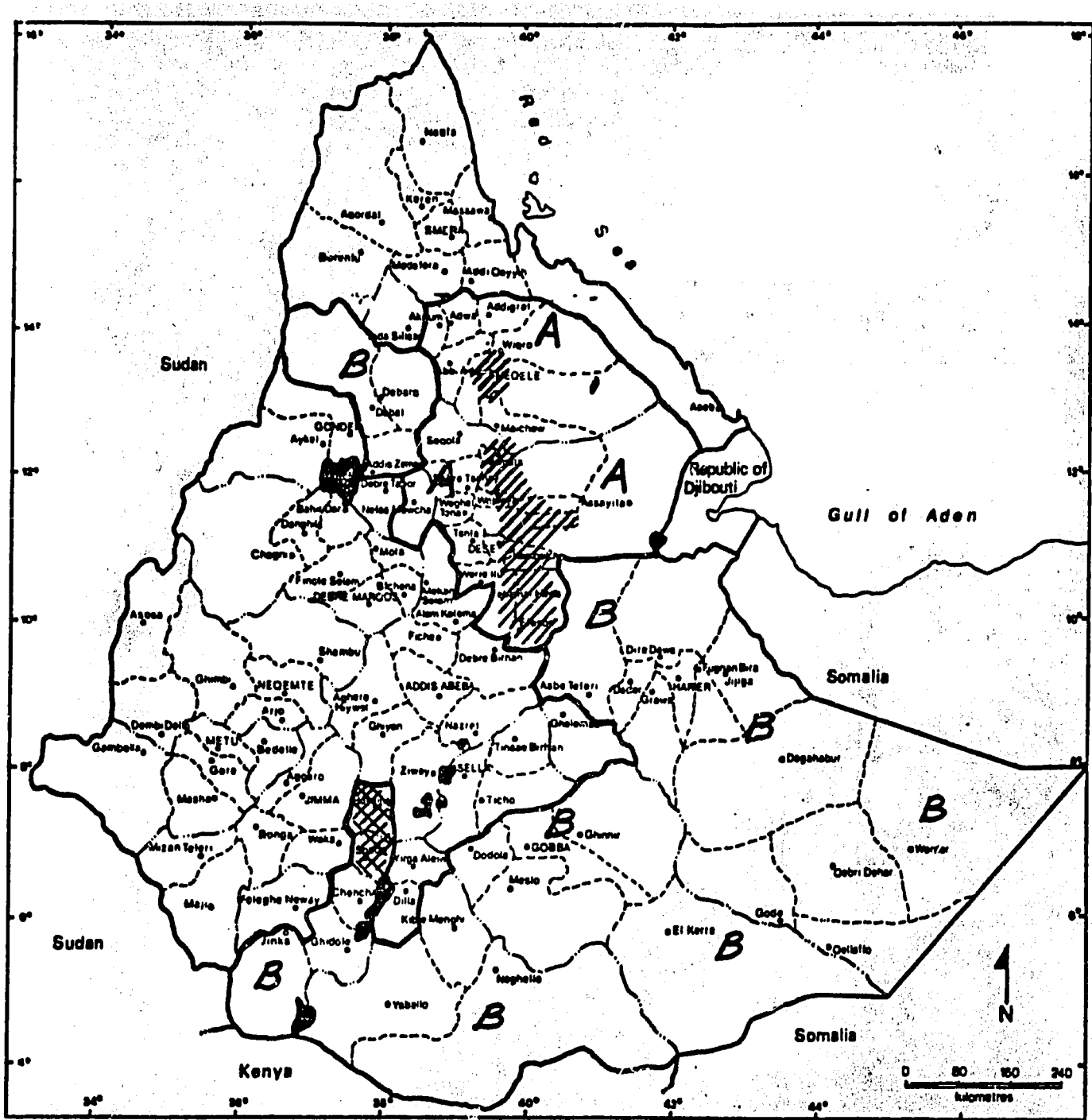
Number of Awrajas Under Famine in Each Year

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Famine Awrajas	12	21	14	11	12	10	5	25	60	10	15	4	28	12	13	56	61	53	21	26	469
% Total Awrajas	11.8	20.6	13.7	10.8	11.8	9.8	4.9	24.5	58.8	9.8	14.7	3.9	27.4	11.8	12.7	54.7	59.8	52.0	20.6	25.5	
Kind of Famine	R	R	R	R	R	R	L	R	N	R	R	L	R	L	L	N	N	N	R	R	

R = Regional L = Local tional

SOURCE: District Level (Awrajas) data.

(from Eastern Africa Country Profiles, Ethiopia, Clark University, 1980)



RELIEF AREAS DESIGNATED BY RRC

A - HIGHEST PRIORITY

B - OTHER PRIORITIES

/// - MAJOR REFUGEE CAMP AREAS

- AREA OF POTENTIAL EMERGENCY RELIEF

Figure 3. Relief Areas
(from Eastern Africa Country Profiles, Ethiopia, Clark University, 1980)

The RRC currently has designated 24 awrajas as high-priority famine-relief areas and 46 other awrajas as lower-priority famine-relief areas. An October 1984 "Early Warning System Report" by the RRC (Appendix E) lists 57 awrajas that are or will be affected by food shortages in the near future. The affected population is estimated to be about 7,326,370 of which close to 90 percent need immediate assistance. These figures indicate that this is probably the most serious and widespread famine in Ethiopia's history.

Some examples of death rates at drought-victim camps show how serious the situation is. In the Korem Camp, the death rate was about 100 per day in October; it decreased to about 35 per day in November as a result of the earlier deaths of the most seriously affected victims and the successes of the feeding programs. In Harbo Camp, the death rate has been increasing as the population increases. It has now reached 30 to 35 per day. In Bati Camp the death rate has been increasing. It reached 112 before noon on 28 November.

It must be emphasized that the current drought conditions show no indication of lessening, except in a few locales. While some drought-stricken areas have seen some natural relief and some victims have returned to their lands, other areas are showing the preliminary signs of shortages of food, water, and pasture. Given the fact that normal rains, if they come at all in 1985, are not expected for half a year in some depressed areas, droughts and famines are likely to spread. In the south, the impact has already been felt, and the Ethiopian government and private voluntary organizations (PVOs) are planning and implementing relief measures.

2.4 Relief and Resettlement

Obviously the first requirement for relief of the drought victims is to provide food, water, shelter, and medical care. A second requirement of equal but less urgent importance is to remove the affected people from displaced person status and return them to self-supporting status in an environment less subject to disruption by rainfall variations.

The policy of both the government of Ethiopia and some of the PVOs is to provide supplies and temporary facilities at the camps, while simultaneously conducting development and resettlement programs to return the victims to their original home areas or to new areas with facilities to minimize the impact of future droughts. Other PVOs believe the immediate relief needs are so great that they are concentrating wholly on this phase at present.

Chapter 3

WATER AVAILABILITY

3.1 Hydrology

Lakes and perennial streams are a practical source of agricultural and domestic water in much of western and southern Ethiopia. However, in the drought-stricken areas of the country, perennial surface waters are scarce or non-existent. This is generally true of the immediate vicinity of the refugee camps.

The common geologic environment at the major refugee camp sites north and south of Addis Ababa is a thick series of interbedded volcanic flows and volcanic ash beds of the Tertiary and Upper Cretaceous age. These are shown on the geologic map, Figure 4. These volcanic beds usually overlie older sandstones and limestones at considerable depth. Water is frequently found in permeable zones at the bases of the flows in fracture zones and in ancient soil horizons buried by the volcanic rocks. Recharge of groundwater is from rainfall on the highlands percolating downward through fractures in the rocks to the water tables. Successful wells range from 50 to 250 m. deep and yield 2 lps (liters per second) (30 gallons per minute--gpm) or more. Static water levels in the wells are highly variable and can be close enough to the surface for suction pumps to operate or so deep as to require deep-well pumps (more than 100 m. below ground in many areas). In this environment, medium sized air-percussion rotary (down-the-hole air hammer) drilling rigs are most suitable and will drill fastest.

Springs sometimes are an alternative water source. They tap the same volcanic and intra-volcanic aquifers. Since Ethiopia is a country with considerable topographic relief, springs occur where an aquifer crops out on a hillside. The discharge of groundwater normally concentrates in a gulley where it can be collected and piped to a point of use or storage. Springs of at least 3.5 lps (55 gpm) flow near some refugee camps and are developed or being developed for supplemental water supply purposes.

The sandstones and limestones underlying the volcanic rocks may be potentially productive aquifers, but they frequently are very deep. Although these deep beds may be valuable in the future for a water supply for agricultural and municipal development, they generally are beyond the practical depth capability of the available drilling rigs in the critical areas. As long as sufficient water is available at lesser depths, production from potentially deep groundwater does not appear to be practical.

3.2 Well Drilling

UNICEF reports completing 330 wells in eight years of operation, mostly in volcanic areas. Two Failing Model 1500 air-percussion rigs were used under the supervision of an expatriate Yugoslavian drilling superintendent, Mr. Vlado Zakula. He reported very little difficulty in drilling or with Failing machines.

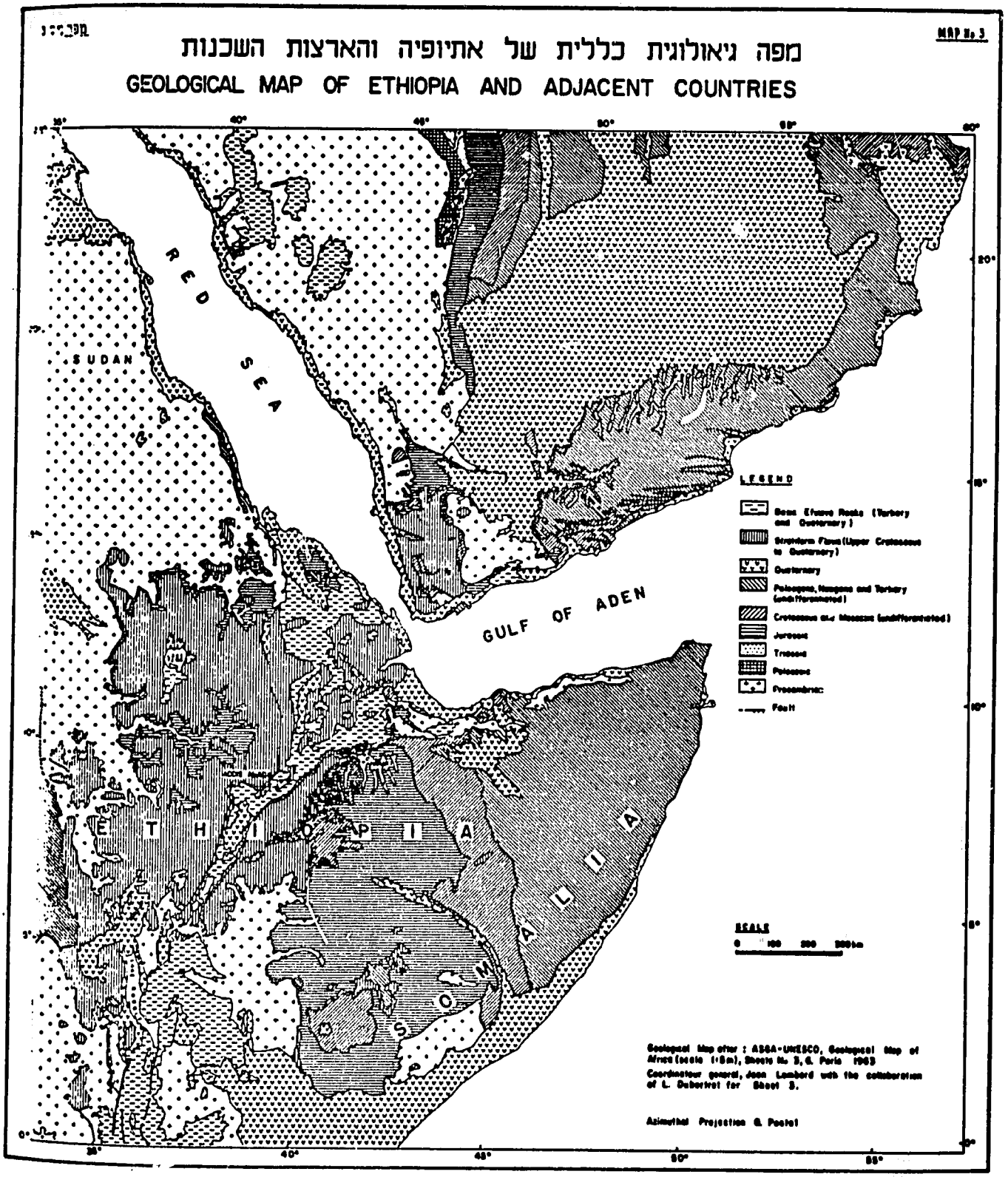


Figure 4. Geological Map of Ethiopia

Norwegian Church Aid (NC) reports drilling 50 wells in three and a half years with one drilling rig, mostly in areas of volcanic rocks between the Ungata River and Bale Mountain Park. All wells were productive, ranging from 15 lps (235 gpm) to 0.25 lps (4 gpm) capacity, but 20 have not yet been equipped with pumps.

However, not all drilling in the volcanic areas is easy or successful. Completing some wells was difficult because they were being drilled in zones where sand and other materials cave in frequently during drilling. The most serious drilling problems followed a move to the Sidamo District, some 200 km. south of Dila. This move was in response to a need for water supplies for the emergency drought relief of the local population. For the last five months, NC crews have attempted unsuccessfully to complete two wells in this water-short area on an emergency basis. They are drilling in soft sandstone and limestone beds that cave in on the borehole.

NC workers use an Ingersoll-Rand Model TH-60 air-percussion drilling rig. It is believed that their drilling problems arise from utilizing a drilling technique that is intended for the commonly encountered hard volcanic rocks. Instead they should switch to other techniques and equipment when different materials are encountered. Another problem has been the very slow delivery of spare parts from Ingersoll-Rand. For its part, the Ethiopian government has been very cooperative in arranging import permits and no delay is attributed to import formalities.

Another problem that has been encountered by the NC, the Ethiopian Water Works Construction Authority (EWWCA), and other drilling groups has been to locate specific well sites where the aquifer contains enough water bearing thickness to be productive. The NC cooperated with EWWCA in a program to introduce geophysical exploration and remote sensing to locate productive drilling sites. A training program for EWWCA personnel was carried out in late 1983 and early 1984. EWWCA finds electrical resistivity methods of exploration generally useful, but they are not always practical in the volcanic areas.

Apparently little or nothing has been done in the way of studies to identify groundwater flow and potential recharge. It is possible that large groundwater withdrawals, combined with drought, might dewater parts of the aquifers with resultant well failures and local loss of groundwater supplies. However the water withdrawals for domestic use in the camp areas, even if considerably expanded, are not great and should not exceed the capacity of the groundwater system to sustain them for at least the period of the emergency. Well production may decrease with continued pumping, and additional wells may be required to maintain necessary supply rates.

Chapter 4

EXISTING WATER SUPPLY DEVELOPMENT EQUIPMENT AND ST

4.1 General Organization

All relief activities are the responsibility of the Relief and Rehabilitation Commission (RRC). Water Supply for the RRC is administered by its Engineering and Technical Service Department to which a small Water Supply Section is attached. Some of the personnel of this section are knowledgeable well drillers with pump installation/servicing experience, but they have not been provided with equipment to work with.

To date all water supply construction at drought-victim camps has been provided, upon request from the RRC, by construction crews from the National Water Resources Commission (NWRC). The table of organization for the NWRC is presented in Figure 5. As the figure shows, the Ethiopian Water Works Construction Authority (EWWCA), which performs all well drilling and water supply construction work, operates under NWRC supervision. Not shown in the figure is the separation of activities into territorial regions. Eight NWRC regional offices (Dire Dawa, Awassa, Jimma, Bahr Bar, Asmara, McKale, Kolbolcha, and Addis Ababa) are responsible for day-to-day operations. Construction activity in all regions, except the north (Tigrai and Eritrea) and Wello, consists of development activities funded largely by outside donors. Canadian Economic Development Assistance (CEDA) and UNICEF provide major funding in the south and the European Economic Community (EEC) funds programs in the west.

4.2 Well Drilling Equipment

4.2.1 General

Almost all of the well drilling in the country is performed by the EWWCA. Rigs provided by PVOs, UNICEF, and donor countries, even when operated by an expatriate driller with outside funding, are now under the EWWRC's overall direction. Exceptions to this are the following:

- A private drilling company (Berhane-Seul) operating two or three rigs.
- A Sudan Interior Mission (SIM)-owned (U.S. made) small Deeprock rig.
- Another small rig operated by Mekane Yesus
- Two Japanese percussion rigs and two Japanese rotary rigs operated by the Well Drilling Agency, a government agency that undertakes private work.
- Three small rigs operated by ARDU (Agricultural Rural Development Unit).

ORGANIZATON CHART OF NATIONAL WATER RESOURCES COMMISSION

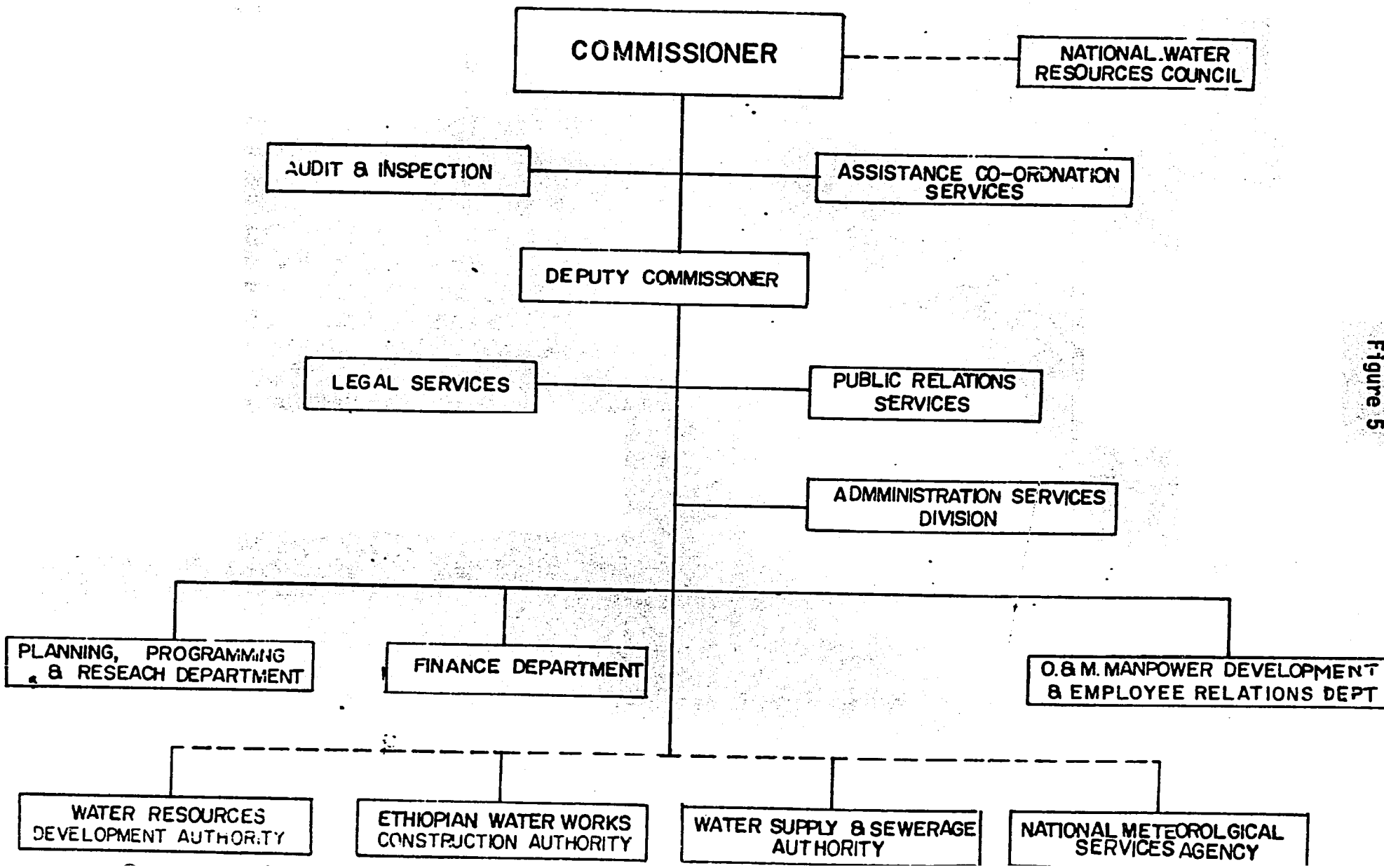


Figure 5

4.2.2 Drilling Rigs Maintained by the EWWCA

The EWWCA currently operates and maintains 38 drilling rigs of 23 different models (see Table 2). Of these, 19 are less than 10 years old, 4 are 10 to 19 years old, 4 are 19 to 30 years old, and the remainder are more than 30 years old.

Seventeen of the rigs are rotary drilling rigs, most fitted for down-the-hole hammer drilling with air. Those rigs that are operating generally are well suited to drilling in hard rock. They can drill an average of one well a month or more. Problems are encountered with these rigs when drilling in material that caves in. It is believed that most of these problems could be solved with altered drilling techniques.

The remaining 21 rigs are percussion drilling rigs, many of them very old. They can complete an average of about two to four wells per year, depending on how deep the hole is and how hard the material being drilled is. The percussion rigs are best suited to drilling relatively shallow holes in soft material; however, they are often used in hard rock because the rotary drilling rigs in the division are all in use elsewhere. Drilling in hard material with these percussion rigs is very slow. One such rig observed in the field drilling in basalt-flow rock was making only 1.5 feet per day; at this rate, it would take over a year to complete the well to the anticipated depth of 350 feet.

Of the 38 rigs, one percussion rig is suitable for well maintenance only; 7 percussion rigs are unserviceable, requiring major repairs that are unlikely to be completed in the near future; 3 rotary rigs and 1 percussion rig are in the shops in need of major repairs; and about 10 drilling rigs are in need of minor repairs. Thirteen rotary rigs and 13 percussion rigs currently* are available for field duty, although a few of these require major repairs.

4.2.3 EWWCA Staff and Administration

EWWCA drilling and well-water supply operations are organized into six major regional offices. Each region is assigned equipment which operates internally. Most drilling activity in all regions, except in the northern emergency relief areas, is largely developmental in nature. The wells are constructed where there is a definite shortage (often of emergency proportions) of good water, but they are intended mainly for the resident population and not for refugees from distant drought areas.

* Twenty-six total were reported to be operational in September, as of October-November only 24 were operational.

Table 2

SUMMARY OF WELL DRILLING RIGS

No.	Type	Description	Years of Service (less than) 10	20	30	40	Anticipated Wells/Year	Remarks and Condition	No.
1.	1	Rotamec 1300 Rotary/ DTH	x				5	Fair condition reported	1
2.	1	Rotamec 1300 Rotary/DTH	x				0	Poor - not operational	2
3.	2	Porta Drill Rotary/DTH	x				8	Gov't. reports condition good but UNICEF driller says overhaul overdue	3
4.	2	Porta Drill Rotary/DTH	x				8	Same as 3 above	4
5.	3	Failing CF 15 Rotary/DTH	x				15	Good - a 1982/83 rig	5
6.	3	Failing CF 15 Rotary/DTH	x				0	Reported Fair but is not operational	6
7.	3	Failing CF 15 Rotary/DTH	x				15?	Reported Fair - needs major overhaul	7
8.	4	Failing 1500 Rotary				x	0	Reported Fair but cannibalized for other rig - will not work again	8
9.	4	Failing 1500 Rotary				x	4	Reported Fair	9
10.	5	Gardner Denver Rotary		x			0	Reported Poor - not operational	10
11.	6	N.C.A. (Norwegian Rotary)	x				10?	Good but lacks support	11
12.	7	Halco V865 Rotary/DTH	x				12	Good - a 1982 rig	12
13.	7	Halco V865 Rotary/DTH	x				12	Good - a 1982 rig	13
14.	7	Halco V865 Rotary/DTH	x				12	Good - a 1982 rig	14
15.	7	Halco V865 Rotary/DTH	x				12	Good - a 1982 rig	15
16.	8	Halco 666 Rotary/DTH		x			12	New - arrival anticipated in January	16
17.	9	Bucyres-Erie 2400 Rotary/DTH	x				12	Good - a 1982 rig	17
18.	10	Bucyres-Erie 60L cable tool				x	3	Fair - needs minor repairs	18
19.	10	Bucyres-Erie 60L cable tool				x	3	Fair - needs minor repairs	19
20.	11	Bucyres-Erie 28L cable tool			x		3	Fair - needs minor repairs	20
21.	11	Bucyres-Erie 28L cable tool			x		3	Fair - needs minor repairs	21
22.	12	Bucyres-Erie 15L		?	?	?	0	Poor - not used for drilling	22
23.	13	Bucyres-Erie 22	x				3	Fair - needs minor repairs	23

Table 2, continued

SUMMARY OF WELL DRILLING RIGS (Cont'd.)

No.	Type	Description	Years of Service (less than) 10	20	30	40	Anticipated Wells/Year	Remarks and Condition	No.
24.	14	Bucyres-Erie 22W				x	2	Fair - needs minor repairs	24
25.	15	Hercules cable tool				x	0	Poor - not operational	25
26.	16	Speed Star 71 cable tool			x		0	Poor - not operational	26
27.	16	Speed Star 71 cable tool			x		0	Poor - not operational	27
28.	17	Speed Star 81 cable tool		?	?	?	0	Questionable - needs major repairs	28
29.	18	Ross 2000 cable tool		x			0	Questionable - needs major repairs	29
30.	19	Ross 2000S cable tool	x				0	Poor - scrap	30
31.	19	Ross 2000S cable tool	x				0	Poor - scrap	31
32.	19	Ross 2000S cable tool	x				-	Poor - operated in 1984 but not now	32
33.	19	Ross 2000S cable tool	x				2?	Poor - condition questionable	33
34.	20	Auto Mechanic Milano cable tool				x	3?	Fair - but now may not be operational	34
35.	21	Sakyo SH 28T cable tool		x			4	Fair - needs minor repairs	35
36.	22	Well master 1250 cable tool	x				5	Good	36
37.	23	Walker-Neer 32 cable tool				x	4	Fair - inspection indicates good for age	37
38.	23	Walker-Neer 32 cable tool				x	4	Fair - inspection indicates good for age	38

Summary: The WRC has 38 drill rigs. As of Oct/Nov 84 some 24 rigs were operational with approximately 3 assigned to each of the 8 regional offices. Some 7 of the "operational" rigs were over 30 years of age. Some 175 wells were scheduled for the Ethiopian year of 1984/85 (Oct-Oct). With rig No. 6 (one of 3 assigned to Wello) out of service and the new British Halco unlikely to make more than 9 the schedule is optimistically 160, if the numbers indicated by question marks are achieved. Some 3 cable tool crews have been assigned other duties along with some 3 rotary crews whose rigs were no longer capable of operation during the year. Not listed is a Ingersol-Rand rig furnished along with a Norwegian driller through Norwegian NORCHURCHAID that is drilling for southern refugee shelters.

EWWCA equipment is committed to existing programs within each region. For this reason, and because of shortages of pumps, generators, and other equipment, it is often difficult or impossible for the EWWCA to respond to emergency needs resulting from a failure of a well or pump or from a sudden influx of drought victims to a feeding or shelter area which has an inadequate water supply. For example, the records of the Save the Children Federation (SCF)/RRC shelter and food distribution center at Eshero, Sidamo, indicated that they had been feeding more than 30,000 persons per month up through September. Much less food has been distributed in the last two months because some crops were harvested, but large scale feeding is expected to begin again since local food reserves are again nearly exhausted. There is a deep well and watering point at the site, but it has been inoperable for a long time because of failure of the generator that powers the pump. For a time after the well failure, untreated water from rain-fed ponds was used as a water source. These ponds have dried up, and now untreated water from a small stream five kilometers away is the only water source for the community.

The operating staff of the EWWCA, observed at the drilling sites in Shewa, appeared to be competent and efficient. The equipment appeared to be in good condition, the drilling sites were neat and well kept, and the drillers were knowledgeable.

4.3 EWWCA Pumps and Pump-Setting/Maintenance Equipment

Powered pumps in common use by the EWWCA are Mono pumps (helical rotor pumps), with diesel engine drive, or multi-stage electric submersible pumps powered by a diesel-driven generator. Most pumps range from 1.5 to 3 lps capacity, although a few wells are of larger productive capacity. The EWWCA does not have sufficient pumps to equip or to repair all the wells that have been drilled or that are being drilled now.

In most regions, drilling rigs are used to install and remove pumps from wells. Drilling rigs are also used to rehabilitate wells when their production has decreased to an unacceptable level. However, drilling rigs often are not available for these purposes on a timely basis because of drilling commitments.

EWWCA's Central Region does have one excellent pump-setting and work-over rig mounted on a truck. This rig is equipped with a submersible pump for testing wells, an electric generator to power pumps, and an electric welding outfit. This appears to be an ideal unit for servicing pumps and wells.

Truck-mounted cranes are also used for installing and removing pumps in some regions. Wello is reported to have one such crane.* Four regions have no cranes. Tripods are also used for pump installation and servicing, mainly for shallow-set pumps.

* This may not be correct as the Wello WWCA regional manager said he had no mechanical equipment for such purpose.

Pumps, generators, diesel engines, parts, repair equipment, and pump setting and well maintenance equipment all are in short supply. Lack of this material and equipment contributes in large part to the emergency water shortages in refugee camp areas and other drought affected areas. Adding to this problem is the difficulty of transferring material and equipment that may be available in one region to another region where an emergency need exists.

Apparently, necessary improvements to refugee camp water supplies could not be made until supplies and materials were flown in by the Royal Air Froce in November 1984.

4.4 Spare Parts and Repair Facilities

The EWWCA's Central Region repair yard in Addis Ababa was visited by the consultants on 28 November. Although several drilling rigs were in the yard for repairs, no work was being done on them, no parts were available, repair facilities were insufficient, and there was no effective staff and supervision for repair work. Lack of detailed knowledge and experience in the specialized repair of 23 models and makes of drilling equipment may also be a problem. This was in contrast to the drilling rigs observed in the field which were well maintained.

Even if needed spare parts and repair facilities were provided, it would take a long time to repair the broken down equipment, and the repaired equipment probably would not be dedicated to emergency relief activities unless there was a repair unit assigned to the Wello administrative district.

4.5 Additional Comments by Mr. Bob Lemay, Consultant

Telephone conversations were held with Mr. Bob Lemay (telephone no. 919-781-4381) on 8 and 10 December. Mr. Lemay is a retired military officer who was employed by a Washington area consulting firm (Public Administration Services) in connection with a management program for the Ethiopian Water Resources Commission during 1983/84 under Swedish government funding.

His general comments were that the NWRC's administration system had organizational problems. He had put forth a variety of recommendations for improvements. However, the managerial program he had worked on was now ended, and he was unsure how many of the needed improvements would be implemented. He pointed out that NWRC had no system of personnel control and trained people disappeared into programs other than those for which they had been trained.

His comments about the NWRC's problems at the time of his consultancy are listed below:

- The NWRC kept no records of what pump was in what well or of what materials were in different district stores.

- It was difficult or impossible to divert materials from one project to another. Donors were associated with certain geographical districts, and a donor's grant of materials and supplies for that district (or project) were considered untouchable except for the original purpose given. He cited one instance where 25 to 30 new Mono pump sets were in stores at Dire Dawa while approximately 40 percent of all wells were out of production due to lack of pumps or broken-down pumps.

- He noted that the main problem was that there was no organized system of well and well pump maintenance or for equipping new wells with pumps.

- He did confirm that there was a problem of lack of spare parts for U.S.-made drilling rigs that were assigned to the Wello District.

- He noted that the EEC provided four Halco drill rigs in 1982: two each to the Jimma and Bahr Bar regional offices. However, instead of leaving the spare parts in a central store the NWRC divided them between the two offices. Consequently it was practically impossible to get one district to release a needed part to the other.

- Drill rigs could be more productive if additional drilling crews were trained and rigs worked two shifts instead of one. Actual drilling productivity from present drilling crews amounted to only five hours a day productive work.

- UNICEF provided complete shop power tools (still crated) for a vehicle maintenance shop at the Wello regional office at Kolbacha. However, no hand tools were provided; nor was there a trained mechanic to provide any vehicle maintenance. The Wello office lacked equipment to service wells and pumps (including hand tools). This confirmed the WASH consultants' findings about what is needed to service existing and needed water supplies at the drought-victim camps located primarily in this district.

- Empty cooking oil containers are used for water storage in the camps. U.S. cooking oil is sent to Ethiopia in one-gallon sealed metal containers. European cooking oil is sent in plastic containers with screw tops. The European containers are more usable as water storage containers.

- Ethiopia needs to give more attention to spare parts supply, record keeping, and cost accounting in its supply and sanitation operations.

- The two biggest water supply donors in Ethiopia are the Canadians (in the southern region) and the Swedes (in two other regions).

Mr. Lemay also commented that an expatriate is needed for a six-month period to push the NWRC into implementing needed reforms and to ensure that needed improvements to camp water supplies are effected. The WASH consultants generally agree with the need for such assistance. It should be noted, however, that OXFAM has two men working to improve camp water supplies and will add more during December 1984. Therefore, any manpower needs should be coordinated with OXFAM. Also, contact should be made with UNICEF which is considering additional help in this connection.

Chapter 5

STATUS OF WATER SUPPLIES AT DROUGHT-VICTIM CAMPS

5.1 Number of People in the Camps

According to an RRC report released in October entitled "The Drought Situation in Ethiopia and Assistance Requirements 1984/85," some 4.3 million drought-affected people were provided with some form of emergency food aid, principally through distribution centers without major camp facilities for displaced persons. The Wello region had the greatest problems and relatively large camps were established there. Nearly 1.5 million people are reported to have received assistance in Wello in 1983/84. This was up from nearly 1.0 million the previous year, but 1984/85 is anticipated to bring an additional increase of need by some 0.3 million people (or a total of 1.8 million). At the same time that the drought situation report was prepared, an RRC Early Warning System Report included here as Appendix E, forecast that the number of persons in immediate need in Wello was over 2.5 million. This discrepancy between 1.8 and 2.5 million persons illustrates the difficulty of determining and projecting the number of people that will be staying in camps and their specific water requirements. In any case, it is obvious that a large additional population will require adequate water supplies.

A number of factors affect water supply needs at the camps. Opening an additional camp may relieve the facilities at old camps unless the influx of new refugees is too great. Also removal of persons from some camps for resettlement in the western regions of the country may relieve camp conditions in Wello and Tigrai, but new water supplies will be required in the west. A number of PVOs and the RRC have maintained feeding centers to the south of Addis Ababa since 1983. These centers have largely been for the purpose of distributing food to drought victims, most of whom have now returned to their homes. Both the government and PVOs note that the situation is now growing critical again and that more people than ever before are being affected. They expect that refugee camps, similar to those in Wello, will be seen in this area within the next few months.

A typical feeding station is in the Welayita awraja of the Sidamo Region, and will probably become a large refugee camp, such as those described in the following sections. Similar data for existing camps in Wello are also presented.

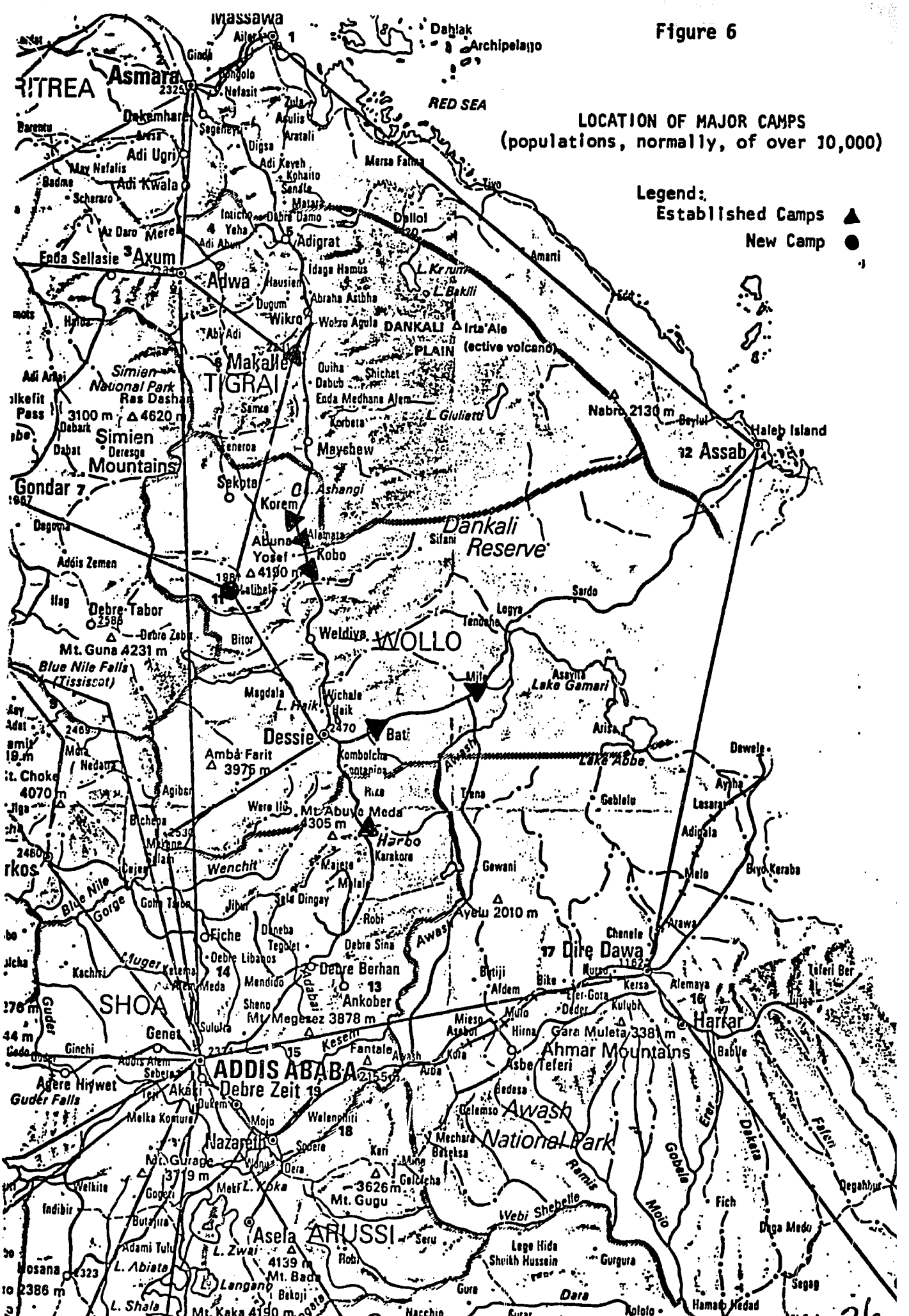
5.2 Transportation Network

The main roads in Ethiopia range from good paved highways to unsurfaced roads in poor condition. However, the roads in the main network are all serviceable for truck traffic, except in areas where insurgent groups may block them. Since the major refugee camps are on main roads, supplies of water, equipment related to water service, and other necessary supplies can normally be moved by road at least to the vicinity of the camps. Some major camps in Tigrai, where road access is blocked, and many emergency feeding stations located off the main road network are maintained by air transport.

Figure 6

LOCATION OF MAJOR CAMPS
(populations, normally, of over 10,000)

Legend:
Established Camps ▲
New Camp ●



5.3 Communications

Phone service between Addis Ababa and the United States is excellent, but local telephone communication is difficult. The telephone system appears to be overloaded and even within Addis it often take a long time to make a local call. Telephone service to the refugee camp areas is very poor, and frequently it is impossible to communicate by telephone. Staff members of several PVOs told the consultants that a radio network between Addis Ababa and the refugee camp areas would facilitate relief supplies and other measures greatly. The RRC has an existing radio network but the stations are located only in RRC offices.

5.4 Data on Individual Refugee Camps

Data sheets for individual refugee camps, including the major problem camps (those with more than 10,000 inhabitants) in the Wello Region, are presented in Appendix F. Figure 6 shows the location of the camps.

5.5 General Water Supply and Sanitation Situation in Wello

According to Mr. Tadesse Bamenew, Regional Manager, NWRC District Office for Wello, only one town or camp in Wello has an adequate water supply. This is Wogesa, where a feeding station is located. Wogesa's water comes from a large spring (20 lps) providing a gravity-flow supply. All other towns were short of adequate water supplies even before the drought-victim camps were formed. With the influx of displaced persons, the water shortages have reached desperate proportions.

At the Bati camp, water is in such short supply that people want to use river water--even though it is contaminated. Fifty-three external sanitation guards are employed to keep people away from it. Thirty-five internal sanitation guards are employed to ensure that all camp people use the latrines provided at the camp. Fortunately, sanitary latrine facilities are not a major problem. Also, 32 grave diggers are employed to bury the dead; the death rate reached 112 before noon on 29 November. A large part of the suffering and death must be attributed to inadequate water and the difficulty of obtaining even that.

Another very serious problem is the lack of redundancy in the water systems in camps and towns. Failure of a pump or a well or any other critical part of a system can drastically reduce the already inadequate supply or even completely terminate it. In such a case, the camp would have to be evacuated (partly or wholly) or water would have to be brought in from some other source by tank trucks. Additional wells and pumpsets must be provided to ensure a standby supply. Since the NWRC gives priority to sites that still need a safe basic supply, standby supplies will have to be provided by others.

5.6 On-going Efforts to Improve Camp Water Supplies

While a number of PVOs and other donors are engaged in water development projects in various regions of the country, their resources have not been diverted to improving water supplies at the larger displaced persons camps,

all of which are in the Wello District. Apparently the Ethiopian government, which supplies the labor and sets policy for those development programs, has a fear of creating a displacement of the population in the areas where these programs are now ongoing if such a diversion were to be made. For many years UNICEF has been a major supplier of equipment, advisors and funding for water supply purposes. While UNICEF has actually drilled some wells at the Wello camps, to date they have not developed any specific plans for further assistance in constructing or improving camp water supplies. UNICEF was initiating an assessment tour of the camps on the day prior to the WASH consultants' departure from Ethiopia.

Starting in November 1984, OXFAM, through an RAF airlift, began bringing in portable reservoirs, piping, spring-loaded taps (faucets) and other basic water system components. With the on-site assistance of one OXFAM engineer and NWRC labor, water system improvements were initiated at some camps in November.

Another RAF flight, to bring in the balance of the materials which OXFAM terms first phase needs, is scheduled for 6 December 1984. It is anticipated that water system improvements, not necessarily fully adequate, will have been instituted at all major camps of the Wello Region by sometime in January by NWRC workers with the assistance of the original OXFAM engineer and a second man who joined him the last week of November. While the initial assessment of need focused on the major camps in the Wello Region, supplies and assistance are being utilized to provide facilities at new Wello Region camps including a World Vision sponsored camp at Lalibela scheduled to open the first week in December and another World Vision camp to be opened later in December. Also, some supplies have been transferred to Makalle in the Tigrai Region where one of five shelter water systems is under construction and a well drilling rig has been moved in to supply a second shelter. These five shelters currently accommodate 8,000 to 10,000 people who, at present, are left to their own initiative to obtain water from a totally insufficient number of municipal public street taps.

Future OXFAM assistance is currently scheduled to provide pumps, engine pump drives and spare parts as follows:

- Pump and engine spare parts amounting to some $25,000 and ten new pump and engine sets for a 16 December shipment.

- Twenty helical rotor (Mono) handpumps.

OXFAM estimates that there are nearly 250 wells in the Wello Region, of which 50 or 60 are not equipped with pumps and of those with pumps some 40 percent are inoperative.

OXFAM is also considering the purchase of a well drilling rig and has been in contact with the George E. Failing Company. The Failing equipment is considered to be most appropriate for Ethiopian use in the current area of greatest need (major camps). A new rig is now available for purchase in Belgium but OXFAM doubts if it can go through with this purchase unless an added source of funding is found. OXFAM is supplying some four or five Land Rovers to transport its people and NWRC work crews. It is so unlikely that the drilling rig will be purchased that OXFAM has given no consideration

to the need for accompanying service equipment and to the types of drilling tools that would be necessary.

At present OXFAM is sending a mechanical engineer/mechanic to Wello the first week in December. His first activity will be to assess the tools and equipment needed for vehicle maintenance. Present plans call for him to actually set up a repair and maintenance facility (which the WASH consultants found to be essentially non-existent) and to provide training in vehicle repair and maintenance. In January, an OXFAM water supply engineer and a hydrologist are expected to join the two people engaged in improving camp water supplies.

OXFAM personnel in Ethiopia did not know exactly what assistance was planned and were reluctant to speculate. The foregoing information was obtained from discussions with Mr. Jim Howard and others, now in Oxford, after the WASH consultants had left Ethiopia. Essentially OXFAM's assessment of needs matches that of the WASH consultants. Both see first priority to be the provision of storage tanks, distribution piping and enough tap outlets to give thousands of people access to water. Also, new pumps are needed because the present pumping equipment, where available and working, is unreliable. Both OXFAM and the WASH consultants recognize that water supplies are largely dependent upon one source and that digging new wells offers the only assurance that a borderline subsistence allowance could be increased and that a mechanical failure would not return the population to a condition of desperation. New wells mean new rigs or the rebuilding of existing ones. The most desirable course of action is to obtain one new rig and to rebuild two existing rigs since diversion of equipment now in country is felt to create more problems than it would solve (see Appendix H for repair parts list). In actuality, one drilling rig was sent to the Wello Region in November to drill a well at the Harbo camp when one of the three rigs assigned to the Wello Region reached a condition where it was no longer operational. Although OXFAM recognized the need for additional well drilling capability, it did not have the resources to provide spare parts for the two Failing (8-year old) drilling rigs, or to supply a mechanic to affect the repair/overhaul and train NWRC people in this activity. OXFAM's engineer/mechanic is reported to be an expert on vehicle repair but unfamiliar with drilling rigs. As stated previously, there is only a 50-50 chance that OXFAM will be able to purchase a new rig.

OXFAM did not recognize that the equipment for pump removal and replacement in the Wello Region consisted of a tripod and an old unreliable set of chain falls that had already broken once and dropped a pump into a well, where it still remains. A specialty truck for removal and replacement of pumps is badly needed. This truck should also be fitted for well cleaning and testing so that a regular drilling rig would not need to be diverted for this purpose. (See Section 6.3 for additional equipment to be supplied by OXFAM).

5.7 Effect of Resettlement

During the month of November some 125,000 people were moved from Wello to resettlement areas in the western part of the country. The same number were moved from Tigrai for a total of 250,000. Subsequent plans are to resettle an additional 625,000 from Wello and 375,000 from Tigrai before the end of February 1985. Since problems have arisen with some of the initial resettlement, PVOs have been requested to provide tents for temporary shelter areas in

the west. In most areas temporary shelters for the resettled refugees are provided until they can move onto the land assigned to them. A standard settlement will include 500 families and 1,000 hectares. As of November, both the RRC and NWRC were still working on plans for most of these resettlement areas. Even if refugees are moved as planned, PVOs do not anticipate much relief, as the stream of refugees into the camps appears to increase daily. If resettlement is slower than present plans propose, the food and water problem in the Wello Regi will probably increase. Also, regardless of the rate of the resettlement, it cannot be achieved without creating some problems in the west. An informal discussion in the Addis airport was held with an Ethiopian hydrologist who had surveyed and made a report on several resettlement areas to the west of Gondar. His assessment was that in this area all resettlements would have water supplies from shallow hand-dug wells, springs, or river diversions. In fact, his understanding was that the selection of most resettlement areas was to locate them in areas where drilled wells were not required.

In any event, the need remains to maintain present water supplies at the Wello camps and to complete the improvements now underway.

Chapter 6

CONCLUSIONS

6.1 Introduction

The purpose of the consultancy was to make recommendations for emergency relief only. Given that limitation, the only area that can clearly qualify for assistance in the field of water supply is the group of emergency relief camps to the north of Addis Ababa in Wello and Tigrai. In the vicinity of these camps the normal resident population has been increased manyfold by a huge influx of hungry (or starving), malnourished, and ill persons fleeing from their homelands that can no longer feed them. The original water supplies of the towns, where camp areas are located, were generally inadequate even before the camps' demands were added. Supplemental water supplies have been provided by UNICEF and the Ethiopian government in a few places, and PVOs (mainly OXFAM) have assisted with distribution of pipes and faucets. However, the supply of good quality potable water is still inadequate at practically every camp. This shortage induces poor sanitary conditions, taxes the endurance of the weak and sick, and causes actual thirst and dehydration. The result is increased illness and death rates and slow recovery for the survivors.

The camp populations vary and the individual camp water demands vary correspondingly. A minimum survival water supply should be at least two gallons per day per person deliverable within a 12-hour daytime period and preferably within a 6-hour period. For each 10,000 refugees, 20,000 gallons of potable water should be delivered through 40 to 60 taps to avoid waits of many hours. A truly adequate supply to provide water for hygiene and some convenience would be several times as great. Most camps provide access to only a gallon per day per person. No standby facilities are available in case of well or pump failure. To provide a safety factor and to provide adequate water, about 12 wells should be constructed as soon as possible in Wello. One well each should be drilled in Mersa, Mile and Kobo; one or two wells in Alemata; two wells each in Bati, Harbo and Korem; and additional wells will be needed at new camps to be opened by World Vision and others.

In other parts of the country, water supply is critical. Safe potable water must be provided for resident populations who are now using unsafe, inadequate, and often distant sources and for resettlement areas intended to relieve the emergency conditions at the existing refugee camps. If future famine emergencies are to be prevented or alleviated, development projects have to be carried out. (Note: The discussion in Chapter 5 indicates that there are few or no drilled wells planned for the resettlement areas and most drill rigs are engaged in providing water for persons who might otherwise abandon their homes for food and water to be found at the camps.) Another need is to establish adequate water supplies for shelter and feeding camps in the south and elsewhere where the drought refugee population currently is low but will almost certainly become very large in the near future. Although all of these needs are related to water shortage emergencies, they are not in the same category as the current shortage of water needed for survival encountered in the camps.

The EWWCA of the NWRC is the only government agency currently drilling wells. It has 15 inoperable and about 24 operating drilling rigs in fairly good condition. All of this equipment currently is being used on resettlement and development work to provide new or improved water supplies. Even though two of the operating rigs are assigned to the Wello Region, these rigs are drilling to improve town supplies and not for relief camp supplies. Although the development work is of major long-term importance, it does nothing to relieve the desperate situation in the drought-victim camps. The promise to provide the parts and equipment to repair some of the inoperable drilling rigs would allow the Ethiopian government, if it so desired, to transfer some of the 24 operating rigs to the drought-victim camps. Work could then be started immediately to increase water supply while parts were delivered and repairs made to unserviceable equipment. If well construction assistance is to be provided to Ethiopia for emergency use, it should be provided through the RRC for direct use in the major drought-victim camps in Wello and Tigrai.

6.2 Equipment Requested by the Ethiopian Government

Through the RRC the Ethiopian government has requested emergency aid in the form of tank trucks, storage tanks, pumps and related equipment.* For Wello, where the major camps are, the following equipment has been requested specifically to meet short-term emergency needs:

- Ten tank trucks of 10,000 l. capacity
- Two storage tanks of 8,000 l. capacity
- Three water pumps

In addition, the EWWCA has requested much more equipment including drilling rigs, work-over rigs, basic hydrogeologic and surveying equipment, trucks, and various spare parts (see Appendix I). Most of the work for which this equipment is intended would be classified as development, however, not emergency relief.

In general, the consultants believe that the type of equipment (but not necessarily the quantities) requested by the EWWCA in Appendix I is suitable and necessary for emergency relief measures in the drought-victim camp areas. The consultants have added handwritten notations to Appendix I of their recommendations of quantities appropriate for the Wello Regional Office to effectively improve camp water supplies. Additional recommendations are:

- One truck-mounted pump-setting and workover rig for installing and rehabilitating wells.
- Drilling equipment or services necessary to complete 12 or more water wells in the next six months.
- Ten water storage tanks with associated water supply and distribution piping and fittings. These are needed to improve or provide reliable water supplies to a sufficient number of taps to relieve the desperate camp shortages.
- Twenty pumps and drivers. These are needed for existing wells without pumps, as replacements for camp pumpsets that fail, and for new wells for camp supply.

* Ethiopian Relief Rehabilitation Commission Document, October, 1984.

Some additional equipment, material and services are also believed to be necessary. The needs are as tabulated below:

- One truck-mounted pump setting and workover rig for installing and rehabilitating wells (see Appendix G).
- Drilling equipment or services necessary to complete 12 or more water wells in the next six months.
- Six sets of pipe fitting hand tools to maintain existing camp water distribution systems.
- Plastic 5-gallon water containers and buckets or basins for the use of camp residents. These are needed for water carrying and washing.

6.3 Equipment to be Supplied by Other Donors

On 29 November, Mr. Ephram Guade, Head of Water Supply for the RRC, reported that the government of Japan was going to provide three water-tank trucks for emergency relief.

On 30 November, Mr. Dick Copeland at OXFAM Headquarters in Oxford, U.K., outlined the OXFAM program for emergency relief in a series of telephone calls. Mr. Copeland stated that OXFAM is providing large quantities of water-supply equipment for the drought-victim camps in Ethiopia north of Addis Ababa. He read the following items from their lists:

- Fifty to 100 water storage tanks
- Pumps (Mono) and diesel drivers--L100,000 worth
- Engine spare parts--L15,000 worth
- Forty handpumps--L20,000 worth
- Three-in. PVC pipe, 10,600 m.
- Additional pipe of other sizes
- Sets of hand-boring tools--L15,000 worth
- Water survey equipment--L25,000 worth
- Survey sets--L4,000 worth
- Tripods--L4,000 worth
- Well linings--L4,000 worth
- Five Land Rovers
- Twelve water distribution frames
- Two storage packs for 5,000 persons each
- Two distribution packs with 2 km. of pipes
- Local labor, 2,700 man-days
- Water team with four expatriate staff--L63,000 worth
- One Baily Bridge

Mr. Copeland further reported that he has been talking to a group of Arabs who might provide a Failing 1500 drilling rig, but he believes that prospects are poor. Mr. Copeland said that he thought two drilling rigs would be far better.

6.4 The Need

From the foregoing it can be seen that there is a clear and desperate need to improve Ethiopia's capability to drill and equip additional wells at the existing and future relief camps as well as to repair existing wells and well

pumps in and near relief camps. In addition, it is clear that the camp residents need the ability to move water from the well head to their shelters and to store limited amounts during the day. Approximately 12 wells, well pumping units, and equipment to remove and set pumps are needed beyond the materials and assistance that OXFAM has currently provided. Coordination with OXFAM to ascertain what, if any, provision they will make in the form of providing additional piping, reservoirs and taps over and above what they have presently brought into the country is essential.

Chapter 7

RECOMMENDATIONS

7.1 Restatement of Needs

As has been stated, there is a clear and desperate need to improve Ethiopia's capability to drill and equip additional wells at the existing and future relief camps. A need also exists to repair existing wells and well pumps in and near relief camps. In addition, it is clear that the camp residents need the ability to move water from the well head to their shelters and to store limited amounts during the day. Approximately 12 wells, well pumping-units, and equipment to remove and set pumps are needed beyond the materials and assistance that OXFAM has currently provided. OXFAM recognizes the need for additional wells but has no plans to install them. Its present intent is to provide more reliable pumping units than are presently in use, connect camps to existing adjacent municipal supplies, and provide distribution taps for individuals to utilize whatever supply is available. Coordination with OXFAM to ascertain what, if any, provision they will make in the form of providing additional piping, reservoirs, and taps over and above what they have presently brought into the country is essential.

It is not the intent of the following recommendations to improve camp water supplies to normal concepts of adequacy. They are meant to supplement OXFAM's joint efforts with the NWRC, which at present provides about one or two gallons of water per person per day, to at least double that figure and to assure that the original one to two gallons are still available should mechanical or other failures occur.

7.2 Recommendations for Meeting Needs

It is recommended that an organization capable of providing well drilling, well drilling equipment, maintenance/overhaul, and pump installations be engaged either directly or through subcontract to undertake the following recommendations.

7.2.1 Provide at least 12 New Wells and Increase Well Drilling Capability

While a new U.S.-manufactured drilling rig is immediately available for purchase (with down-the-hole capability addition needed) through Failing Supply Ltd. of Surry, England (contact as noted in Appendix J, Section I), a more direct approach to providing new wells is the following:

- Purchase parts needed for a major overhaul of NWRC's non-operational Failing CF-15, now assigned to the Wello NWRC Regional office, along with the services of a Failing mechanic to supervise and conduct the work for a period of six to seven weeks. An urgent need also exists for the supply of similar parts for a second CF-15 whose condition is almost as bad but is still being operated by the Wello personnel at this time. The overall cost of this item cannot

be properly estimated until the parts list is costed but is tentatively set at $100,000. (See Appendix J, Section II for name of contact and Appendix H for details of spare parts.)

- Engage the services and equipment of an expatriate well driller/company for a contract period of up to one year for the purpose of drilling approximately 12 wells of 6 inch diameter at an estimated cost of $60,000 per month of operation with a guarantee of six months work (equipment shipment at extra cost). The company supplying services should field two drillers rather than a driller and a helper so that retraining on the rehabilitated rig could be provided following its return to service.

7.2.2 Increase the Capability to Locate and Construct Water Sources

Small tools for the construction of piping systems and pump stations are badly needed. Certain items have been identified but a more definite list needs to be prepared prior to placing an order. It is estimated that an allowance of $10,000 be provided for this purpose. Hydrologic investigative equipment amounting to $9,000 would provide much needed assistance in siting specific well locations. Earth resistivity equipment of approximately $15,000 would further enhance this activity (see Appendix I, Sections II, III, IV and V). This equipment should be used by a U.S. expatriate contractor and be employed in conjunction with NWRC personnel of the Wello office during well installation operations under 7.2.1. The following tools, equipment, and services are recommended:

- the small hand tools indicated in Appendix I, Section II*
- the hydrologic survey equipment indicated in Appendix I, Section III
- the earth resistivity equipment indicated in Appendix I, Section IV
- services of a hydrologist for 6-7 weeks

The estimated cost of this recommendation is $59,000, which includes $34,000 for tools and equipment and $25,000 for the services of a hydrologist.

7.2.3 Increase the Capability to Set and Repair Pumps.

The consultants found that there is not enough equipment in Ethiopia to adequately rehabilitate, test, and maintain either the existing or new wells (including pumps). Existing equipment is largely inoperative and nearly useless for this purpose, necessitating either inappropriate and wasteful use of drilling rigs or employment of hand methods (i.e., an unreliable chain fall used in a camp area recently broke resulting in a pump falling into a well). It is recommended that assistance for the installation of new wells incorporate the following provisions:

* This item covers small hand tools to permit additional personnel of NWRC to utilize galvanized iron pipe, now in country, for camp distribution systems in addition to limited supplies of PVC pipe furnished by OXFAM.

- supply of a welder/generator set with necessary tools and a test pump for use in the removal and resetting of well pumps and in the testing of wells;
- supply of necessary tools for pump repair with a spare parts package for rebuilding some 10 pump and diesel engine sets;
- services of a mechanic for 6-7 weeks to initiate the above work;
- flexibility for the contractor carrying out the new well installations to import, if necessary, a specialized pump setting and workover rig for effective overall production. (See Appendix G for specifications of such a well service rig.)

The estimated cost of this recommendation is $55,000, which includes $35,000 for tools and equipment and $20,000 for the services of a mechanic. If a new pump setting and workover rig is purchased, the cost would increase an additional $30,000.

7.2.4 Provide Camp Residents with Containers for Transport and/or Storage of Drinking Water

The WASH consultants found that many of the people in the relief centers do not have the necessary containers to properly transport and/or store the extremely limited amounts of drinking water that are being provided.

- It is recommended that approximately 25,000 plastic containers of 2 1/2 gallon size be provided so that people can transport water from the source and store limited amounts in their shelters. This will cost approximately $50,000. An investigation showed that the best item for this purpose was manufactured by Reliance Products Ltd. (See Appendix J, Section II for Reference Summary of proper contact.)

7.3 Oversight and Coordination

The consultants found that many of the facilities, equipment, and materials necessary for the emergency relief effort in the field of water supply are currently being provided by other donors. In some instances, technical assistance and materials have not been provided in sufficient quantities to meet basic needs. For certain problems, such as new wells, the donors have shown interest but lack the capability to effect the needed improvements.

- It is recommended that one person should be provided, on a short-term emergency basis for 60 to 90 days, to initiate close contact with OXFAM, UNICEF, Japanese, and any other donors who have exhibited an interest in drought-victim camp water supplies and with Ethiopian agencies (NWRC/RRC) that are responsible for maintaining them. There is an immediate need to effectively establish coordination and cooperation between ongoing efforts and any subsequent program of improvements.

- In addition to the initial coordination effort, noted above, there is a long term need (up to one year) for oversight and coordination of the activities described in Section 7.2.

7.4 Overall Budget Recommendations

Assuming eight months of actual operations in connection with the well-drilling phase of the recommendations, the overall estimated costs would be as follows:

Rehabilitation of 2 existing drilling rigs		$100,000
Drilling of 12 wells -- 8 months x $60,000		480,000
Hydrogeological equipment and use		59,000
Pump installation and maintenance program		55,000
Water containers		50,000
Short-term coordinator for 90 days		50,000
	Total	$794,000

The above figure does not include any cost for a long-term (up to one year) water-supply monitor to provide for the oversight and coordination noted in Section 7.3.

REPORTS AND DOCUMENTS REVIEWED

IBRD/WHO, Desk Study/Rapid Assessment Report, Sector Studies, 1977.

IBRD/WHO, Sector Digest (Water Supply), International Drinking Supply and Sanitation Decade, July 1978.

Kebede, Hanna. Improving Village Water Supplies in Ethiopia: A Case Study of Socio-Economic Implications. ECA/UNICEF, 1978.

Barry, Leonard. East Africa Country Profiles/Ethiopia. Clark University, 1980.

Government of Ethiopia Community Water Supply and Sanitation/Rapid Assessment of Current and Projected Sector Development, Ethiopian Water Resources Authority, 1979.

SIDA, Findings and Recommendations from the 1979 Review of Rural Water in the Hararghe Region, 1979.

U.N. International Drinking Water Supply and Sanitation Decade Country Report/Ethiopia, 1980.

Ethiopian Relief Rehabilitation Commission, Drought Situation in Ethiopia and Assistance Requirements 1984/1985, October, 1984.

APPENDIX A

List of Persons Contacted

LIST OF PERSONS CONTACTED

Persons contacted during the WASH consultants stay in Ethiopia are listed below in approximately the order in which contact was made. A local telephone number is included for some but not all individuals listed.

Mr. Kalida Ray - Chief, Water Section	UNICEF	153304
Mr. Vlado Zakula - Technical Advisor (well Drilling)	UNICEF	153304
Mr. Yetnayet Negussei - Hydrologist	UNICEF	153304
Mr. Stauley Dunn - CARE Representative	CARE	
Mr. Karan Kandeth - " "	CARE	
Mr. Larry Jones - Larry Jones International Ministries (Feed the Children Division)		
Major Mulugeta - Head, Engineering and Technical Service Department	RRC	160105
Mr. Demissie Alemu - Asst. to Major Mulugeta	RRC	
Mr. Ahmed Ali - Head, Aid Coordination and International Relations	RRC	
Dr. Anita Mackie - USAID Representative	USAID	110666/Ex.295
Mr. Walter North - " "	USAID	110666/Ex.295
Mr. Charles Heffernan - Asst. Program Officer	USAID	110666/Ex.295
Mr. Ephrem Guade - Head, Water Supply	RRC	158236
Mr. Kefyalew Achamyehe - Deputy Commissioner	NWRC	
Mr. Ephraim Fikremariam - General Manager (EWWCA)	NWRC	
Mr. Tadesse Bamenew - Regional Mgr. District Office for Wello	NWRC	
Mr. Eshetu Habte Mariam - Head, Foreign Assistance Service	NWRC	

Mr. Melese Endalamaw - Head, Planning and Programming Service	NWRC	
Mr. Hailu Seleman - Planning and Program Officer	NWRC	
Mr. Abera Aguma - Head, Rural Water Supply Dept.	NWRC	
Mr. Michael Miller - OXFAM representative seconded to RRC	OXFAM	
Mr. Haraldur Olafsson - Consult General, Norway/Norwegian Church AID	NORCHURCHAID	
Mr. Ian Curtis - World Vision/Australia	WORLD VISION	
Mr. Tamirat Kebede - Head, Settlement Administration	RRC	
Mr. Dagnew Eshete - Acting Head, Agri.Tech. Dept. (formerly of Central Planning Office)	RRC	
Dr. Tamirat Reta - Head, Relief Administration	RRC	
Mr. Robert Latta - World Vision/USA	WORLD VISION	447400/107
Mr. Frederick Fisher - USAID Representative (replacement for Dr. Mackie)	USAID	110666
Mr. Hugh Goyter -	OXFAM	
Mr. Clifford Benzel - V.P., World Vision/ International	WORLD VISION	
Brother Gus - Christian Relief and Development Coordination Committee	CRDC	
Mr. John A. Finucane - Field Director, Concern/Ireland	CI	122236
Mr. David Ward	WORLD VISION	

Mr. Bezabih Medhin - Well Driller assigned to RCC 1976 George Failing drilling rig at Central Workshop

Mr. James Howard - OXFAM, Oxford, England 086556777

Mr. Dick Copeland - OXFAM, Oxford, England 086556777

Mr. Robert Lemay - former employee of Public Admin Services, advisor to NWRC, financed by Sweden. 919-781-4381

APPENDIX B

Daily Log of Consultants' Activities

DAILY LOG OF CONSULTANTS

NOVEMBER

14 Thurs. Briefing meeting at State Department with personnel from OFDA, AID, WASH, State Department. Review of literature, preparations for departure. Flight from National Airport to New York, departure from New York.

16 Fri. En route; arrived Rome; hotel near airport; departure from Rome.

17 Sat. Arrived Addis at 8:00 a.m., met by AID representative at airport, AID car provided to GHION Hotel (not permitted into grounds by military guard - probably still OAS members present) and to Hilton Hotel. Checked into Hilton. Meeting in afternoon (AID car transport) with UNICEF - Mr. K. Ray, engineer; Vlado Zakula, driller; Yetnayet Negussei to discuss UNICEF drilling program, equipment in county and refugee problems in drought camps in North. Returned hotel. Talked briefly to Larry Jones (Feed the Children).

18 Sun. Consultants notified by telephone no AID cars would be available. Taxi to Ethiopia Hotel to meet Stanley Dunn, CARE, and an associate. Discussed refugee problems and camps and conditions. He said he would provide a statement of needs for emergency relief of water short camps and areas for CARE programs.

19 Mon. Taxi to RRC office at 8:30 a.m. Discussed RRC water supply programs and equipment and needs for emergency relief measures. Also PVOs providing water supplies by drilling. RRC personnel were Major Mulugeta and Demissie Alemu. They later took us to RRC AID coordinating office. Met Ahmed Ali (Head) who was emphatically helpful - said RRC could identify emergency areas and needs. Taxi to USAID at 3:00 p.m. - difficult, no taxis for some time, no telephone service, late. Met Dr. Mackie and other AID staff and outlined work to date and received suggestions as to some potentially useful contacts. She appeared satisfied or pleased.

20 Tues. Mr. Alemu brought Ephrem Guade to meet us at hotel at 9:30 a.m. We further discussed RRC programs and interrelations with Water Resources Council. Later Mr. Guade called to confirm meeting with NWRC on Wednesday. Attempted to reach CARE, OXFAM, World Vision and Sudan Interior Mission by phone but not possible. Spent remainder of day planning work, outlining and organizing report, and reviewing data already acquired. Phone call in evening from AID informing that British Embassy supplying drilling equipment to PVOs. Ephrem Guade is Head, Water Supply Relief, RRC.

21 Wed. Mr. Guade arranged a meeting at 8:30 a.m. with NWRC senior staff. We discussed drilling equipment status and needs in regard to relief areas, and made plans for a field inspection trip to emergency relief areas in the south. NWRC personnel agreed to prepare a list of equipment and support requirements necessary to

continue and increase their emergency relief measures for the refugee camps and elsewhere. Consultants accompanied Mr. Guade to the RRC compound and met Mr. Miller of OXFAM who is working with RRC. Mr. Miller could not help on water supply problems but pointed out critical relief areas and suggested other OXFAM representatives would be knowledgeable in the water supply field. Mr. Guade then took us to meet Mr. Olafsson, NC, to discuss his program and needs for emergency relief water supply. In the afternoon, E. Rumph met Mr. Curtis of WV of Aus. who could offer little information on their needs or programs for emergency relief water supply; he suggested that other WV personnel who were not available would know more. I contacted the British Embassy but could not talk to Mr. Taylor about their program of drilling equipment supply.

22 Thurs. Bob Latta called; potential for camp visits on WV plane, or on Sat. on V.S. Delegation flight.

Mr. Guade arranged a meeting at 3:00 p.m. with Head of Settlement Administration (RRC) and Acting Head of Agricultural Technology (formerly with Central Planning) - referred to Dr. Tamirat in Relief Section for Relief Camp locations and populations fed. Provided information that 1.5 million people would be moved from camps in Tigray (500,000 people), Wello (750,000 people) to temporary shelter areas adjacent to rivers in Gojan, Welega, Ilubaboe and Kefa between November 1984 and February 1985. Also that 450,000 people from Eastern Gonder would be moved to Western Gonder in the same time frame.

Visit paid to Ahmed Ali's office (RCC Aid Coordination), received promise of travel permits tomorrow, a.m.

Met Dr. Tamirat, Head of Relief Administration who had just passed list of Relief Camps and Feeding Stations to the mapping group for a map re-edit. Mapping section head was leaving for the day and promised a copy of the list would be available tomorrow a.m. Talked to Bob Latta (World Vision) on telephone regarding potential field inspection flights on World Vision aircraft, travel permits, and an offer of drilling equipment by a U.S. manufacturer.

23 Fri. Went with Mr. Guade to ADMAS AIR (charter section of Ethiopian Airlines) and paid for air charter flight to Mekale for 27th November. Returned to RRC offices to check status of travel permits and acquisition of Refugee Shelters list promised by Dr. Tamirat. Meetings with Mr. Dunn of CARE and Mr. Bob Latta of World Vision. Received agreement with World Vision for a place on flight to Alemeta for Sunday 23rd November. Flight scheduled to accommodate Congressman Gray of PA. Met with Mr. Fred Fisher of USAID at 2:00 p.m. and detailed progress consultants had made to date. Also, left draft of cable addressed to AID/W/OFDA advising of progress. Observed Japanese percussion drilling rig on grounds of U.S. compound being used for pump pulling and repair operation.

24 Sat. Discussed OXFAM's activities in connection with water supply improvements at various camps with Hugh Goyter by telephone. Apparently, OXFAM had made an assessment of immediate needs for camp water supplies (mainly Wollo Distict) in October and continuing into November and through U.K. RAF flew in needed supplies (last flight due Thurs. 29 November). OXFAM apparently the only PVO involved with camp water supply improvements.

25 Sun. E. Rumph with RCC man and 2 NWRC men on field trip to see drilling equipment and watering points. See field trip report. R. Preble scheduled for World Vision flight to Alamata Refugee camp in company with Congressman Gray of PA, his Aid and R. Latta of World Vision. Congressman Gray changed his mind and cancelled his participation in tour. Airport personnel noted plane had damaged right wing. Ethiopian plane had collided with the World Vision wing the previous night when it was left in its prescribed parking area. Upon removal of wing end covering, 3 ribs were found to be sprung so flight was cancelled. R. Preble attended reception for congressman in the evening. Entered into discussions of camp water supply problems with: Mr. Hugh Goyter, OXFAM; Brother Gus, CRDC; and John Finucane, Concern/Ireland at the reception.

26 Mon. Drafted cable to OFDA relative to status of investigation and apparently mutual desire to discuss same by telephone - quoted Washington time 9 to 11 Wed. a.m. as a suggestion. Contacted Ephram Guade about charter flight to the north on Tuesday. Found out that plane could not touch down in Kolmbolcha for desired meeting with NWRC Wollo Regional Supervisor as air strip only an emergency one for relief planes and not certified for charter or other aircraft.

27 Tues. Flight to the north could still make original destination of Makalle in the Tigrai Region. Spent balance of the day drafting report, getting first 12 pages typed by hotel secretarial service and periodically trying to telephone to the Wollo Regional NWRC office without success. E. Rumph on field visit to see potential famine areas in Sidamo and EWWCA drilling equipment in operation. See field trip report. R. Preble's charter flight to Alamata (Wollo Region) and Makalle (Tigrai Region) was aborted in the mountains west of Dessie as cloud cover so low that it was not safe to continue. Discussion with pilot of twin engine Cessna revealed that a small single engine plane without tricycle landing gear could land at Kolmbolcha. Returned to Addis Ababa at 11:30 a.m. and made arrangements with ADMUS Air for a Thursday flight to Kolmbolcha (Wollo Region). In the afternoon consultants made a visit, in company with Ephrame Guade (RRC), to NWRC offices and met with Mr. Abera Aguma (Head, Rural Water Supply Dept.). Data on drilling rigs, other assessory equipment and geology obtained. Continued draft report preparation.

28 Wed. Accompanied Mr. Guade (RRC) to meet NWRC chairman but he was not available. Met Dr. Tamirat who provided data on refugee camps and feeding centers and explained method of reporting numbers of persons aided. Visited Central Region Workshop with Mr. Guade to

observe support and repair facilities for dilling and water supply equipment. Worked on report.

29 Thurs. R. Preble on charter flight to Kolmbolcha area. See field trip report and Water Supply Data Sheets. E. Rumph completing draft of report. Delivered draft copy and briefing to F. Fisher USAID at 6:30 p.m. Mr. Guade reported Japanese to donate 3 water tanker trucks.

30 Fri. Departed Addis Ababa on morning flight to London. Made contact with Mr. Dick Copeland of OXFAM, U.K., by several telephone calls between 5:00 and 6:30 p.m. He informed us of the OXFAM plans to provide water supply equipment, materials and staff.

DECEMBER

1 Sat. In London working on report revisions and additions.

2 Sun. E. Rumph departed London to Washington. Working on report. R. Preble remained in London - will try to call Jim Howard, OXFAM, Monday morning for additional information.

3 Mon. E. Rumph reported to WASH in morning. Attended debriefing session with OFDA at 1:00 p.m. Returned to Denver in evening.

APPENDIX C

Notes on Field Trips

NOTES ON FIELD TRIPS

25 Nov. 1984 - Southern Shewa Area

Party: Demissie Alemu (RRC)
Sisay Abebe (EWWCA)
Eguale Gebretsadik (EWWCA)
Eugene Rumph (WASH)

Transportation: EWWCA Toyota Land Cruiser

Notes:

1. Visited typical watering point at Tejiu (between Koka and Meki). Water supply is from a 120m. deep well with 6 inch casing and screen. A submersible pump set at 110m delivers 3 liters per second. Thirty percent of the well is screened. Power is provided by Mitsui diesel engine driving a German generator. The well was installed by EWWCA four years ago. The well serves a large population, about 2000 families and livestock, who come from 5 to 6 km distance. A storage tank and 6 taps are provided.
2. In discussion with EWWCA personnel, they noted that well production routinely decreases with time. Wells require rehabilitation to recover original production. In the area, a drilling rig is used for bailing and surging and setting pumps. The Tejiu well does not need rehabilitation yet.

3. At Baro (between Koka and Meki) we visited a large windmill pump and surface water storage tank that was installed as a joint venture with the Government of Australia. The windmill and tank have been very badly damaged by wind, and parts required for repair are not available. It has not worked for 2 years but worked for 5 years before it was damaged. The well reportedly produced 4 liters per second, and is still serviceable. The well is 125m. deep with 18m. of well screen. The casing and screen is 6 inches in diameter.

4. At Gragona (near Meki) we visited a hand-dug well with an Austrian windmill and elevated water storage tanks. The mill drives the pump with a cable; this system is troublesome. The unit produces 1.5 liters per second.

5. Just south of Meki we observed a hand dug well with a Mono pump being operated to water cattle with a portable trough made from an old tire casing.

6. A few miles south of Meki we observed a piston-type handpump (Indian Mark 2 ?) being operated for domestic water supply.

7. Between Meki and Ziway we visited an experimental site where a 10 m. diameter, 5 bladed windmill manufactured in Addis Ababa was mounted over a drilled

well. A mono pump was installed in the well with a combination straight-through/right-angle gear drive. An auxiliary diesel engine was installed. The windmill is intended to drive the pump through a rotating shaft, but it is not operational yet. A 6 tap watering point and storage tank at the site is supplied through the well and the diesel drive. The station is not open to public use yet.

8. A drilling site was visited at Awara (between Shashemene and Kulito). A Walker-Neer Spudder, 31 years old, was drilling in hard volcanic rock. Six meters of hole took 14 working days. Volcanic ash was the surface formation. The drilling rig was in good condition, the crew appeared well trained and competent, and the site was neat and orderly. A large new electric welding unit was at the site. The water supply is intended for the nearby town. The current supply is untreated water from a distant river.

9. I was informed that there are 2 wells in the vicinity of Awara producing hot water; one 140 m. deep with 70 degrees C water from a 100 m. static waterlevel, and the other 108m. deep with water hotter than 70 degrees C. Mono pumps will not operate in water of this temperature according to the manufacturer.

A submersible pump was tried in a hot water well by EWWCA but it failed after a short time of operation.

10. General observations - The farming country near Addis Ababa looks to be in good condition, but farther south the land appears drier and drier. In the Rift Valley Lakes National Park area the land is very dry (rains have been minimal for two years) and the soil is poor - sandy and derived from volcanic ash. This is cattle country with very few cultivated fields. The pasture land is all grazed to the ground; nothing seems to be left that cattle can eat and no signs of new growth can be seen. The goats are still finding a little grazing. The cattle appear thin but not starving as yet. Rains, if they come, are not expected until August according to Mr. Alemu. A famine in the making?

26 Nov. 1984 Welayita, Sidamo, and Kembata and Hadiya, Shewa, area

Party: Demissie Alemu (RRC)
Sisay Abebe (EWWCA)
Eguale Gebretsadik (WEECA)
Eugene Rumph (WASH)

Transportation: EWWCA Toyota Land Cruiser

Notes:

1. Visited drilling site at Tefo, far off the highway, north of Kulito. A Bucyrus-Erie top-drive rotary drilling rig with carousel is used. The rig is one year old. It is equipped for air-percussion or mud-circulation drilling. A nearly new Atlas - Copco, 20 bar, 350 lps air compressor is at site, as are water tanks and mud pits. The site was located with the aid of electrical resistivity surveys, but mainly because it is near the center of a water-short area. Expected total depth is 240 m; pilot hole was drilled to 150 m; drill pipe was stuck at 108m. while reaming hole; crew is attempting to free drill pipe and reaming bit by washing with mud. The crew appears to be competent; the camp and rig appear clean, well maintained and orderly. The crew drills with air-percussion in hard formations and with mud in soft formations.

2. Visited drilling site at Tikare, far off the highway south of Kulito. A 31-year old Walker-Neer Spudder (EWWCA has 4 such rigs) is drilling in soft material, mainly clay. The current depth is 30 m. after 5 working days of drilling with a 12 inch bit. The anticipated total depth is 240m. Harder rock is expected at depth. The rig appears to be in very good working condition and the crew seems competent.

3. We visited a food distribution center run by Save the Children / RRC at Esheno, north of Boditi. The center provides intensive feeding for resident children until they are healthy and no longer malnourished, and provides rations for other drought victims. Their records indicate 36,186 persons fed in July 1984, 30,064 persons fed in Sept. 1984, and only 2393 to date in November 1984. The decrease is because a harvest provided food locally. However, food reserves are again very low since the harvest was not good, and the numbers of people fed is expected to increase dramatically very soon. A EWWCA well and water tank and 6 taps are near the center, but the pump has been inoperable for a long time because of generator failure. The people used to get their water, untreated, from rain fed ponds but the ponds have dried up. The water source now is from a

5 km. distant stream. The water is not clean and is used without treatment.

4. Visited RRC Headquarters in Sodo, Welayita, Sidamo, and talked to Mr. Gashaw, District Representative of RRC. He states that there are 1,500,000 persons in the awraja of which 500,000 are starving. RRC currently is assisting 300,000 with food grains, supplementary food and medical treatment. The drought has become very serious with the last rain in August and no expectation of rain before June or July. This condition is superimposed on a pre-existing problem area with severe overpopulation. Mr. Gashaw said the local population density is 300 persons per square km, a population difficult to support on a wheat and maize agricultural base under the best of climatic conditions. Fourteen PVO's have joined RRC in providing emergency relief. They jointly are operating 25 feeding centers providing food and medical care, and 4 shelters (2 in Danot and 2 in Bolas) with 800 to 1000 residents. Water is being provided by tankers and medical supplies are insufficent.

5. General Note: The area around Sodo does not look as bad as some farther north at first glance because of the intensive cultivation. However, upon closer

inspection almost all fields have been harvested with only dry stalks remaining. The pastures are grazed to the ground and no new growth can be seen. The only green fields visible are a very few fields of maize that have not been harvested yet. An indication of the dense population is that fields have been cleared on slopes really too steep to farm high on the adjacent mountainside.

FIELD TRIP REPORT

Participants: Ralph Preble, WASH Consultant and Ephrem Guade, Head-Water Supply/RRC

Places Visited: Water Resources Commission District Headquarters at Kolmbolcha and drought refugee camp at Bati 40 km northeast of Kolmbolcha

Date and duration: Arrived Addis airport 7 am and returned to Addis airport at 4:00 p.m. the same day - 29 November 1984.

Persons contacted: Mr. Tadesse Bamenew - Regional Manager NWRC District office for Wello Region and the head doctor at the Bati drought refugee camp administered by the Ethiopian Red Cross.

Interview data: Discussion with Regional Manager NWRC first centered on his organization and how it operated in improving water supplies at camps. The organization that he is the head of comprises 6 administrative and operational branches (Hydrology, Hydrogeology, Engineering, Construction, Finance and Administration).

The workshop and maintenance crews theoretically report to administration but, at present, while he has a nice building (empty) for maintenance shop he has no tools, equipment or mechanics.

Water supply work falls under Construction. This is divided into:

Drilling Brigades: 3 rigs and 3 crews (one rig, a 1976 Failing was idle for lack of spare parts).

Hand Dug Well Brigades: 2 crews (also attend to spring supply development).

Water Supply Brigades: 3 crews which includes one for well pump removal/replacement and 2 crews for basic piping work. The number of men might be utilized as 5 crews, if he had more tools to work with, (pipe cutters, wrenches, etc.).

The balance of the interview was devoted to setting down on prepared forms details of water supplies that currently service the drought refugee camps. It became apparent that at most camps the water

supply for the adjacent town was also used as the camp's supply; or, when a separate camp supply system was operated for the camp, it was generally a well originally put in for the town but directed to camp use. In all instances supply capacity was inadequate to properly serve both the towns and the camps and the condition of pumps and power sources for pumps in every place was not good.

Removing and replacing pumps was a problem as he only had a few old hand tools to do this with a tripod and chain falls. The chain falls were old and broke about 3 months ago dropping a pump into the well. It is still there as he has no equipment to retrieve it. The chain falls are repaired but are still in bad shape.

The District Manager was asked why he did not devote his 2 remaining operative drilling rigs to adding water supply capacity for the camps. His explanation was that established villages with poor supplies, or no supply which had previously relied on a stream now dry, had priority as long as the camps had some means of getting water. Taking care of existing populations would keep them in their own villages. If this was not done these villages would also move to the camps.

The District Manager said that latrine and sanitary conditions were not good at new camps but, that work-for-food plans provided labor for digging trenches and that latrines of good design with right soil disposal in off-site trenches were practical at most established camps, with sanitary guards enforcing use of latrines.

The interview with the camp doctor was brief. His knowledge of English was limited, but understandable. Primarily it consisted of pointing out camp statistics that were kept up to date on a black board as to how many people were being taken care of and the level of fooding provided according to 4 different levels of need. Also, the number of Ethiopian Red Cross workers who were involved with the camp's operation (the Red Cross was administering and operating the camp) and the daily death rate. The death rate had

shot up in the last few days climbing from 30 to a maximum of 80 per day the previous week to 98 yesterday (28 November), 112 (29 November - at noon). All other figures, including total population, shown on the camps blackboard record were for the 27th of November.

The doctor did not seem concerned about the 300 to 400 people waiting for water. He agreed that it would be better if they had more water but thought the waiting was beneficial to the people as it gave them a goal, something to do, in the very act of waiting they thought they were working for their water. He did not take into account his assessment of a bigger camp. However, he thought the government would increase resettlement or the District Water Manager would provide and it was out of his hands. He had food shortages in the past but not critical and was building new storage building as he expected possibly demand might double in months ahead. He did not have time to get for me, and did not have readily available, figures on people removed from the camp for resettlement. Noted that sometimes 2,500 people/week were bused out (other weeks - more) but more the last couple of weeks and with 600 to 700 people entering everyday. The overall camp's size (numbers) generally averaged around 15,000.

APPENDIX D

U.N. Summary of Water and Sanitation Planning (1982)

Ethiopia

Population: 32.2 million
Currency: Birr 2 = $1.00
GNP per capita: $110
Annual ODA inflow: $241M
Infant mortality rate (0-1 year): 150
Child death rate (1-4 years): 32
Adult literacy rate (M/F): 11/5
UNDP resident representative: PO Box 5580, Addis Ababa

World Bank

DESCRIPTION REPEATED AS NO NEW REPORT RECEIVED SINCE 1981

By 1980, 82% of the estimated urban population, or just over 2.5 million was provided with adequte drinking water, compared with 80%, or just over 2 million in 1975. In rural areas in 1980 3.91%, or 11 million people had reasonable access to water compared with 2.08%, or 5.1 million in 1975.

Over the past five years rural water supply has claimed from 3.1% to 4.6% of the national development budget — increasing in cash terms from $7.1M to $11.1M. A constant sum of some $200,000 a year has been devoted to rural supply maintenance.

Sanitation

By 1979, only 1.1% of the rural population or 236,000 people had adequate excreta disposal.

National plans

A nationa plan for the period 1981/2-1990/91 is in preparation, and water supply and sanitation developments will be incorporated into this plan. A regrouping of existing agencies in the water supply and sanitation sector is under way with the objective of creating an efficient organisation. This is expected to facilitate planning and implementation of programmes for the Decade. The government is considering the establishment of an inter-ministerial national action committee. Constraints include:

- shortage of professional and skilled manpower;
- domestic financial resources;
- poor utilisation of indigenous material resources and relevant technology;
- relatively low awareness of the need for improvements in water supply and sanitation in the rural areas; and
- rough inaccessible terrain and a scattered settlement pattern.

objectives are for both safe water and sewage disposal for all urban and

Water Decade planning

The objectives for 1990 are 100% of urban populations and 50% of rural populations to receive safe water supply. No 1990 sanitation figures were available but long term social rural populations. By minimising the incidence of water-borne and related diseases the Government hopes to improve the productivity of the rural populations. These concerns will be reflected in increasing budgetary appropriations for these sectors.

Government will generally bear the construction cost of rural water supply schemes, though contributions in labour and materials will be expected from local populations. Recurrent costs in operation and maintenance are expected to be borne by the schemes' beneficiaries. In urban areas, though government will provide significant subsidies, consumers are expected to pay full economic costs.

In the sanitation sphere two million pit latrines are planned in rural areas. For urban fringe areas the introduction of water seal pit latrine pans is being considered. Refuse pits and simple type incineration systems will be built in rural and urban fringe areas.

No specific plans for a general public information programme have yet been devised, but studies in this direction are under way. For the schools, the Ministry of Education is preparing to introduce sanitation and water supply as subjects for the curricula of all primary and secondary schools. Basic hygiene education will be provided to a wider public through the mass organisations.

Project proposals are identified and prepared by the Planning and Programming Office of the Ethiopian Water Resources Authority, which then submits them to the Central Planning Supreme Council (CPSC) which appraises them to ensure consistency with the objectives of government development policy. Priority is attached to the welfare of the masses.

Statistics indicating the mobilisation of resources needed from both internal and external sources show a total investment of $1,135M to meet its Decade objectives.

A Decade sector plan is in preparation and when specific projects are prepared, it will provide a far more realistic estimate of requirements.

A training programme for engineers and technicians (professional and sub-professional) has been initiated by the Ethiopian Water Resources Authority. A technician training centre is to be established in the country shortly and engineers are already being trained in India. This course will be continued until the national university is equipped to satisfy the skilled manpower needs of the nation.

Community liaison officers will be deployed in the regional offices of the Ethiopian Water Resources Authority.

External assistance

Only a very rough idea is available of the extent of foreign financial input that will be sought for implementation of the Decade's objectives. In addition an estimated total of $21.5M is needed for management assistance, project preparation and training in the rural water supply area; $26.9M for the same reasons for urban water supply; and $6M for sanitation.

In 1979 the input for rural water supply was just $2M, while for urban water supply the figure was estimated at $400,000.

Water and sanitation agencies:

Ministry of Mines, Energy & Water Resources, Addis Ababa

Ministry of Health, Addis Ababa

Water Supply & Sewerage Authority, PO Box 5744, Addis Ababa; telex 21387.

Ministry of Agriculture: Addis Ababa

APPENDIX E

Early Warning System Report

EARLY WARNING SYSTEM REPORT
1984 MEHER (MAIN) SEASON PRODUCTION PROSPECT
SUPPLEMENT

October, 1984

EARLY WARNING AND PLANNING SERVICES
RELIEF AND REHABILITATION COMMISSION

Addis Abeba

I. BASIC FINDINGS

- This short report, which is a supplement to the September report, is intended to provide the details of the la test figure on the number of people which will be affected by food shortages due to the failure of this year's Meher crops, as well as the woredas which will be affected.

- It is estimated that about 7,326,370 people will face food shortages as a result of this year's crop failure, out of which 5,665,910 people will require immediate assistance. The rest, which total 757,460, could produce enough for a few months, and they will require assistance later, particularly during the rainy season.

-As was clearly stated in the September report Wello, Tigrai, Eritrea and Northern Shewa are the Regions hardest hit by this year's crop failure. The total number of people affected in these areas is about 5,229,686 (71% of the total).

- In the affected areas of Gonder, Bale, Hararghe, Sidamo, Gamo-Gofa, and the remaining areas of Shewa, about 2,096,690 people are expected to face food shortages.

- In the Regions where favourable crop situation was indicated in the previous report ie in Arssi, Keffa, Illubabor, Wellega, Gojam and part of Shewa, due to late planting of the crops the need for the extension of the rainy season at least until the end of September was indicated. In several of these areas, particularly in Shewa, the rain has stopped as of the middle of September. As a result, a fear of crop failure is now widespread in these areas as well.

II. The Following table summarizes the Woredas which will be facing food Shortages due to the failure of this year's Mehar Crops, and the number of people which will be affected

Region	Awraja	Number of people in each Awraja which will be affected by food shortage			Woredas Affected	Total number of cropping woredas in the Awraja
		Total	Number needing immediate assistance	Number needing Later assistance		
1. Wello	Rayana Kobo	230,370	230,370	-	Alamata Kobo	2
	Yeju	280,930	280,930		Gubalafto Habru	2
	Wag	290,780	290,780	--	Wofla, Sekota, Dehana	3
	Ambassel	363,730	363,730	-	Ambassel, Teluldere, Krebabo	3
	Dessie Zuria	239,090	239,090	--	Dessie Zuria, Kutaber	2
	Borena	47,060	47,060	--	Debresina	3
	Kalu	395,800	395,800	-	Kalu, Albuko, Eseye Gula, Artuma, Dewirahmedo, Bati	6
	Wadla Delanta	198,000	198,000	-	Wadla Dawnt, Delanta	2
	Werehemeno	170,000	170,000	-	Legambo, Tenta, Mekdela	3
	Were Ilu	113,130	113,130	-	Jama	3
	Lasta	203,530	203,530	-	Gidan, Meket, Lasta	3
Total		2,532,420	2,532,420			
2. Tigrai	Enderta	162,600	162,600	-	Enderta, Seharti, Hintalo, Selewa, Shiket, Wajrat, Gereralta Didiba Dergaajen, Wairab	9
	Kilte Awlaelo	198,450	198,450		Tsaida Emba, Atsbi, Tsera, Berahle	4
	RayanaAzebo	138,910	138,910	-	Enda Mehoni, Adea Alage, Mehoni, Chercher	4
	Agame	280,890	280,890	--	Gulo Mekeda, Genta Afeshum, Kilte Belessa, Subeha Saisi, Dalol	5
	Adwa	291,700	291,700	--	Adwa, Adi Arbaite, Ahisha, Enticho, Hahaile, Endaba Selma/Emba Seniti, Enda Selassie, Egwala Abeto, Bizet Adi	11
	Tembien	160,000	160,000		Tse Tsera, Ambera Meteka, Tankwa Millash, Abergelle	5
	Axum	205,840	205,840	-	Mai Rai, Lai Maichew, Tach Maichew, Zana Adet, Chila, Naeder	7
Total		1,429,390	1,429,390			

Region	Awraja	Number of people in each Awraja, which will be affected by food Shortage			Woredas Affected	Total number of cropping woredas in the Awraja
		Total	Number needing immediate assistance	Number needing Later assistance		
3.Shewa	Yifatna Timuga	283,800	247,000	35,800	Kewet, Mafud, Gemza, Efretana jile, Fursi	5
	Menzna Gishe	136,470	88,230	38,240	Gera Midir, Mama Midir, Ansokiya, Keya Gebriel, Mezezo	7
	Kembatana-Hadya	122,180	-	122,180	Sike	8
	Merehabete	31,600	16,000	15,600	Tachbet, Worem Wajitu	6
-74-	Haikochna - Futajira	50,000	-	50,000	Zewai Zuria	13
Total		613,050	351,230	261,820		
4.Sidamo	Wolaita	656,000	296,000	360,000	Damot Weyde, Humbo, Koisha, Sodo Zuria, Ofa Damot Gale, Boloso	7
	Arero	31,500	31,500	-	Hagere Mariam, Burji	2
	Jemjem	30,000	30,000	-	Wadera, Ado Shakiso	6
Total		717,500	357,500	360,000		
5.Gamo-Gofa	Gamo	60,000	44,000	16,000	Mirab Abaya, Boreda, Kucha, Daramalo	7
	Gardula	108,000	30,360	77,640	Konso, Kemba	5
	Gelebna Hamer-Baco	25,000	5,000	20,000	Baco Gazer	1
Total		193,000	79,360	113,640		

Region	Awraja	Number of People in each Awraja, which will be affected by food shortage			Woredas Affected	Total no. of cropping woredas in the Awraja
		Total	Number needing immediate Assistance	Number needing Later Assistance		
6. Bale	Hondiyo	50,000	48,000	2,000	Agarfa, Goro	6
	Genale	7,260	7,260	-	Adaba, Nansibo	4
	Wabe	113,170	113,170	-	Ginnir, Goloicha, Raitu, Biltu	4
Total		170,430	168,430	2,000		
7. Gonder	Gayint	255,000	255,000	-	Tach Gayint, Lay Gaint, Semada	3
	Lito	32,000	32,000	-	Ebnat, Kenkem Haroda	3
	Semien	80,000	80,000	-	Debark, Janamora, Beyeda, Dib Bahir, Telemt	5
	Wogera	6,000	6,000	-	Setit	5
Total		373,000	373,000			
8. Marerghe	Harer-Zuria	158,000	158,000	-	Fedis, Jarso, Kombolcha , Alemaya, Kersa	6
	Gursum	35,000	15,000	20,000	Gursum	4
	Jijiga	151,000	151,000		Jijiga, Kebribeyah, Teferi Ber	3
	Dire Dawa	48,060	48,060	-	Gurgura, Erer	2
	Zuria					
	Garamuleta	44,360	44,360	-	Kurfachol, Grawa, Bedeno	6
	Chercher	33,200	33,200	-	Messela, Tullo, Doba, Chiro, Meisso, Arden	6
Total		469,620	449,620	20,000		
9. Eritrea	All Awrajas	827,000	827,000		All Cropping Woredas (the detail not available)	

APPENDIX F

Data Sheets for Individual Refugee Camps

Basic Water Supply* Data - Esheno (near Bodit) Province Welayita Sidamo

* notes on sanitation included - where available

Population:- Estimated Total 36,000 fed in July 1984 (ma.

Extensive Care _____ Added Camp. Pop. _____ Aided External _____

Camp Death Rate _____ per day during _____

Water Sources:

Supply Type	Capacity	Pump Type	Remarks
1. Well at site	2.5 lps	Submersible	Not operating for a long time, generato not working
2.			
3.			

Water Transmission - Source to:-

Town-

Camp-

External-

Water Distribution at Refugee Camp:-

Reservoir Size elevated tank Number of Taps 6

Remarks (including any treatment & sanitary conditions at taps):

No treatment, good typical watering point but inoperable, no current supply

General Remarks including est. of water available/person and notes on sanitation):-

After failure of well supply, untreated water from rainfed ponds was water source; these ponds have dried up and the current supply is untreated water from a stream 5 km away, hand carried to the camp.

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4.-.- Basic Water Supply* Data - Bati Province Kalo

* notes on sanitation included - where available

Population:- Estimated Total 15,090 (29 Nov. 1984)

Extensive Care 1754 Added Camp. Pop. 7986 Aided External 53

Camp Death Rate 98 per day during 28 Nov. 1984
Camp Death Rate 112 " " before noon of 29 Nov. 1984 *
" " " 30 to 80 " " the week ending 24 Nov. (last wk

Water Sources:

Supply Type	Capacity	Pump Type	Remarks
1. Well (town)	large capacity	Submersible with UK generator *	
2. Well "	90 lpm	Mono - direct drive - 12 hrs/day	
3. Well "	abandoned		

** pumps to adjacent storage tank then 2 electric booster pumps raise water to large reservoir on hill on opposit side of town.

Water Transmission - Source to:-

Town-

Camp-

External-

Water Distribution at Refugee Camp:-

Reservoir Size 15000 l Number of Taps 24 (4 points with 6 taps each)

Remarks (including any treatment & sanitary conditions at taps)

General Remarks including est. of water available/person and notes on sanitation):-

The #2 well is diverted to the shelter but shelter residents complain supply is inadequate.

The abandoned well is 15± ft. from the well used for the ca but debris has been dumped into it because it is not capp

* dehydration, malaria, disentary and pneumonia stated as many causes of death.

4.-.- Basic Water Supply* Data - Harbo Province Mersa

* notes on sanitation included - where available

Population:- Estimated Total 10,000 +

Extensive Care _____ Added Camp. Pop._____Aided External___

Camp Death Rate_____ per day during_____

Water Sources:

Supply Type	Capacity	Pump Type	Remarks
1. Well (Town)	2-2.5 lps	Mono - direct drive	See general remarks
2.-			
3.			

Water Transmission - Source to:-

Town-

Camp-

External-

Water Distribution at Refugee Camp:-

Reservoir Size_____Number of Taps_____

Remarks (including any treatment & sanitary conditions at taps):
4 Water points each with 4 taps in Town only - each person from camp collects water at Town Taps.

General Remarks including est. of water available/person and notes on sanitation):-

Expect borrowed drill rig to put in well in next 2-3 wks.
Existing well is in unconsolidated material and well design or construction (gravel pack) is poor - well constantly produces sand - they are afraid pump will jam at any time.
No agreement with OXFAM for supplies but OXFAM may have ordered pipes and pumps on their own - if not, another old pump and generator that is available may have to be installed in the new well when it is finished to avoid interrupting water service to the Town.
There are no plans for an additional camp supply.

4.-.- Basic Water Supply* Data - Mile Province Ambasel

* notes on sanitation included - where available

Population:- Estimated Total 7000

Extensive Care _____ Added Camp. Pop._____ Aided External___

Camp Death Rate_____ per day during_____

Water Sources:

Supply Type	Capacity	Pump Type	Remarks
1. Well at Camp	90 lpm	Mono-direct drive	
2. Upper Town Well	2-2½ lps	"	" "

3. Lower Town has water supply under construction but pump supplied does not work- use water from river

Water Transmission - Source to:-

Town-

Camp-

External-

Water Distribution at Refugee Camp:-

Reservoir Size_____ Number of Taps 6 only at camp

Remarks (including any treatment & sanitary conditions at taps

No reservoir for camp

General Remarks including est. of water available/person and notes on sanitation):-

Two towns about 2km apart with shelter between but shelter some 5km from main road (river by side of camp)

Problem is not enough management to prevent people using polluted river water.

Need additional well and supply as present inadequate according to Regional WRC Manager- without a reservoir added capacity and/or well might not help- added taps a must.

4.-.- Basic Water Supply* Data - Korem Province Wag

* notes on sanitation included - where available

Population:- Estimated Total approx. 55,000

Extensive Care _____ Added Camp. Pop. _____ Aided External _____

Camp Death Rate _____ per day during _____

Water Sources:

Supply Type	Capacity	Pump Type	Remarks
1. Well	2-2.5 lps	Mono - direct drive	
2. Well (Town)	"	Submersible	Town has 16 hr supply - operates 2 generators 8 hrs each per day. Town pu
3. Well (near school)	"	Submersible w/ one generator	

4. Spring will be to Town supply in about 1 month - no pump yet, pump required.

Water Transmission - Source to:-

Town-

Camp-

External-

Water Distribution at Refugee Camp:- at main camp

Reservoir Size 5000 l Number of Taps _____

2 x 1500 l each UK reservoirs at school to service children feeding station

Remarks (including any treatment & sanitary conditions at taps):

3 water points (2 w/ 8 taps each, 1 w/ 4 taps) at main shelter.
8 taps at one water point also provided outside childrens camp, and 2 points inside of 6 taps each plus kitchen tap at main shelter on opposite side of the main road.

General Remarks including est. of water available/person and notes on sanitation):-

Main shelter NW of town has Well #1 - children feeding station across street.
Town Well (#2) just supplies town with 12,000 l reservoir.
2,000 population grown to 18-20,000 - plans to supplement town supply from 3.5 lps spring.

Children feeding center has separate well supply from main camp opened about 4 or 5 months ago when capped well was equipped with pump and UK reservoirs added.

Main problem is no standby for main camp - Town could have problem if present supply fails before spring supply is connected.

4.-.- Basic Water Supply* Data - Kolo Province Rayon Kolo

* notes on sanitation included - where available

Population:- Estimated Total 5000 to 6000

Extensive Care _____ Added Camp. Pop. _____ Aided External ___

Camp Death Rate _____ per day during _____

Water Sources:

Supply Type	Capacity	Pump Type	Remarks
1. Well (in town)	Original Supply - not used		Pump fallen in well
2. Well (near river)	9.75 lps	Submersible with Generator	Put in by Germans
3. Well (near river)	9.75 lps	"	"

Water Transmission - Source to:-

Town- pipe line from river wells to town system

Camp- pipeline from town system to camp

External- No supply other than 8 taps in center of town for 3,500 - 4,000 people considered camp outside people

Water Distribution at Refugee Camp:-

Reservoir Size 0 Number of Taps 4 for 1000-2000 camp people

Remarks (including any treatment & sanitary conditions at taps): Town has big reservoir (size unknown) and camp connection takes off town supply so camp essentially uses town reservoir.

General Remarks including est. of water available/person and notes on sanitation):-

SCF have children feeding station - have made an agreement with town to connect to the town supply - they have 4 taps outside of kitchen supply. There is a problem with payment to town for supply and town is threatening to cut off supply.

Transit people served by 8 taps in center of town

There are no plans to provide additional/improvements

4.-.- Basic Water Supply* Data - Mersa Province Mersa

* notes on sanitation included - where available

Population:- Estimated Total variable 2-3,000 /day

Extensive Care _____ Added Camp. Pop._____Aided External___

Camp Death Rate_____ per day during_____

Water Sources:

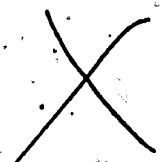
Supply Type	Capacity	Pump Type	Remarks
1. well	2.5 lps	submersible	generator
2.			
3.			

Water Transmission - Source to:-

Town-

Camp-

External-



Water Distribution at Refugee Camp:-

Reservoir Size 15,000 l Number of Taps 6

Remarks (including any treatment & sanitary conditions at taps):

_____

_____

General Remarks including est. of water available/person and notes on sanitation):- _____

Not a true camp - food distribution point only. People come for only 1 or 2 days for food and then return home.

4.-.- Basic Water Supply* Data - Wogesa Province _____

* notes on sanitation included - where available

Population:- Estimated Total See general note

Extensive Care _____ Added Camp. Pop. _____ Aided External ___

Camp Death Rate _____ per day during _____

Water Sources:

Supply Type	Capacity	Pump Type	Remarks
1. Well			not used, USA drilled
2. Well			not used " "
3. Big Spring	20 lps	gravity supply	

Water Transmission - Source to:-

Town-

Camp-

External-

Water Distribution at Refugee Camp:-

Reservoir Size _____ Number of Taps _____

Remarks (including any treatment & sanitary conditions at taps):

_____

_____

General Remarks including est. of water available/person and notes on sanitation):- _____

Grain distribution only at this time.
No water problem — only camp or Town that does not have water problem according to WRC Regional Mgr.

Basic Water Supply* Data - Alamata Province Rayanakoba

* notes on sanitation included - where available

Population:- Estimated Total 24-26,000

Extensive Care _____ Added Camp. Pop._____ Aided External ___

Camp Death Rate_____ per day during_____

Water Sources:

Supply Type	Capacity	Pump Type	Remarks
1. Capped borehole to be used for shelter - no pump or generator			
2. Well	2.5 lps	Submersible w/ generator	previously not operating, this month in use
3. Well for town	2-2.5 lps	Mono-direct drive	at edge of town
4. Well for town	2-2.5 lps	Mono	Mechanical problems -
5. Pumped from river for town	Used to some extent until last month		serves part of town, water treatment no longer in use - facility gone

Water Transmission - Source to:-

Town-

Camp-

External-

Water Distribution at Refugee Camp:-

Reservoir Size 100,000 l Number of Taps ?

Remarks (including any treatment & sanitary conditions at taps):

Reservoir for town only, none for camp

General Remarks including est. of water available/person and notes on sanitation):-

Two shelters - one RRC, other World Vision; both are without water supplies - population fetch their own water from the Town supply taps. OXFAM promised pipe and taps for supply and distribution system for one camp - other needs the capped borehole checked and pump installed and delivery system with taps. Present plan to service the camp is to lay a 3½-in. transmission line ½ to 1 km (may be ¾ km) To 5th well at military camp outside of Town. This well has good submersible pump and generator. Size of reservoir uncertain.

APPENDIX G

Specifications for Well Service Equipment

THE BIG THREE

3T

6000 lbs. capacity
32 ft. mast

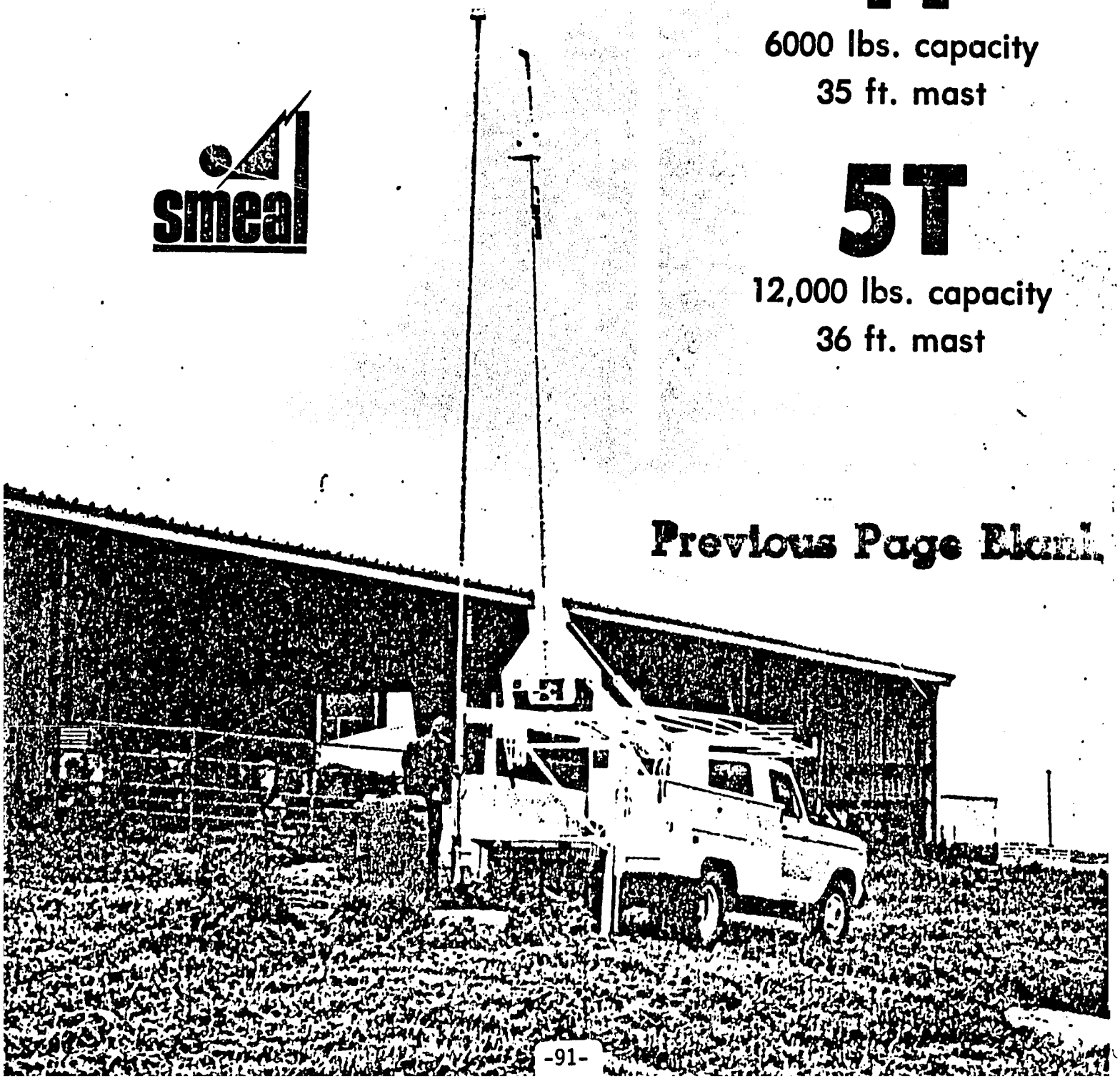
4T

6000 lbs. capacity
35 ft. mast

5T

12,000 lbs. capacity
36 ft. mast

smeal



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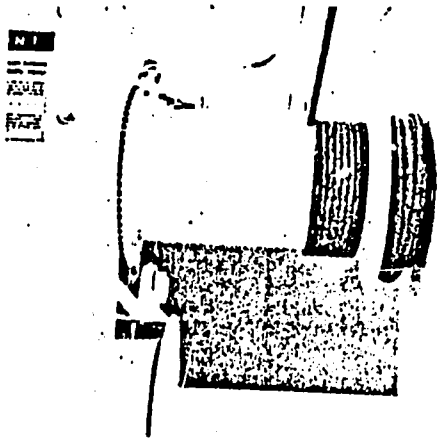
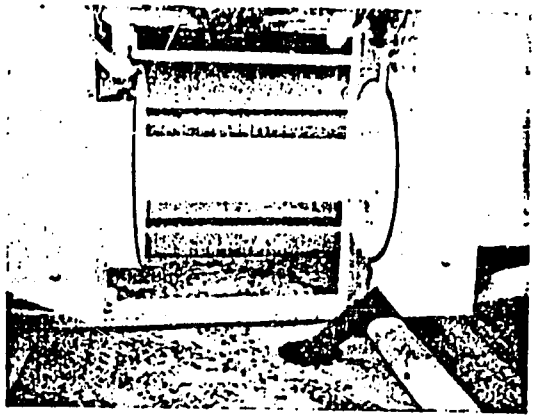
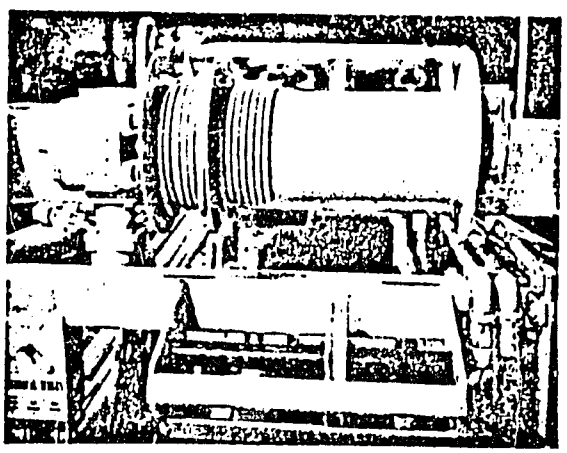
Optional Equipment a



The 5T and 4T all hydraulic winch with the original engineered Smeal automatic fail safe brake has a 120 feet per minute line speed with a 3000 lb. single line lifting capacity on the 5T, and a 150 ft. per minute line speed with a 2000 lb. single line lifting capacity on the 4T. The hydraulic motor is direct coupled to the heavy duty pinion gear.

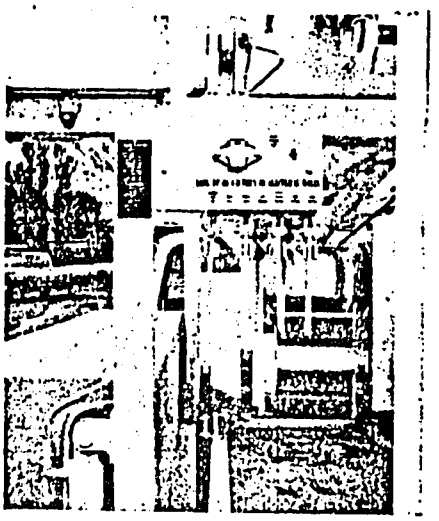


The sandreel attachment has a 1000 lb. bare spool lifting capacity with a 350 ft. per minute line speed. Power up-power down plus a 100% freefall for deep well work. Another feature of the sand-reel is a level wind mounted on the back frame to allow equal distribution of the cable to the drum. 350 ft. per minute line speed with a spool capacity of 1650 ft. of ¼" cable, 1050 ft. of 5/16 cable, and 740 ft. of 3/8 cable.

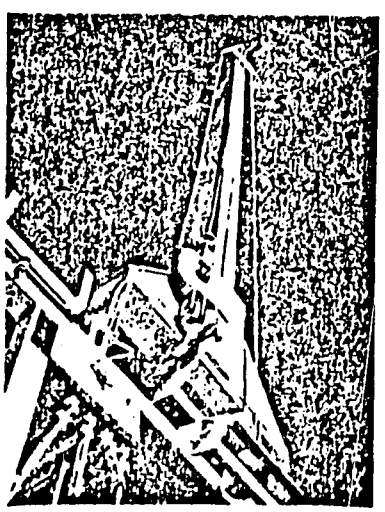


The 3T main winch assembly is a hydraulic worm driven gear box to drum assembly. The worm driven drum requires no brake because the winch cannot be raised or lowered unless the input shaft is rotated by the hydraulic motor.

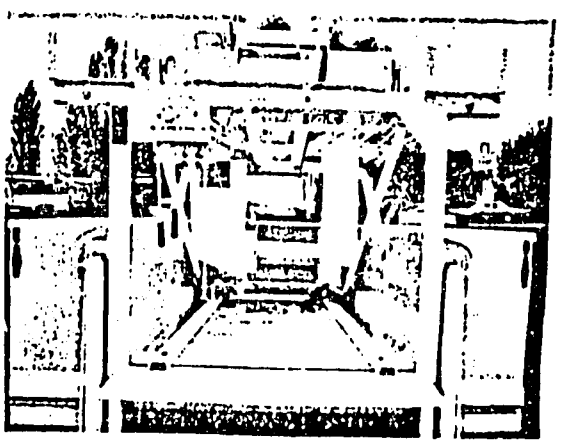
The 3T has a single line pull of 2000 lbs. at 45 ft. per minute. Any overload or misuse is prevented by the by-pass or relief valve incorporated in the hydraulic system. The 3T winch is totally a fail safe winch.



The operating controls on 3T-4T-5T derricks are conveniently positioned at the left rear corner of the rig and easy accessible from ground level. The machine is protected from any type of overloading or misuse by a special hydraulic by-pass valve incorporated into the hydraulic system.



All Smeal Derricks are equipped as standard equipment with the unique method of reeving a one-two or three part line without the problem or time consuming delay of lowering the tower to reeve



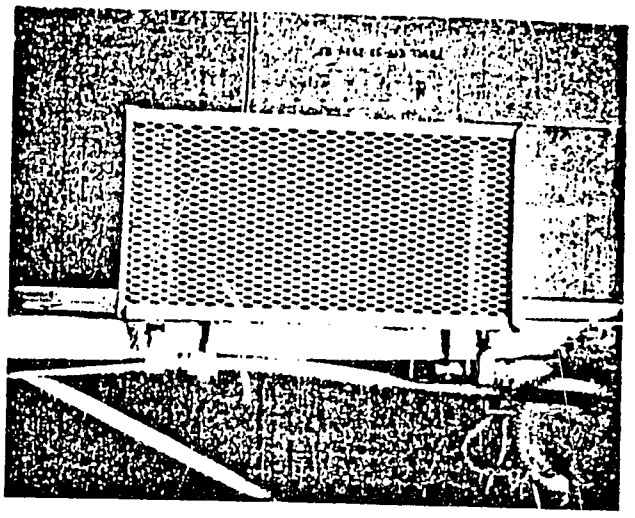
The main frame assembly on the 3T-4T-5T allows full use of the interframe for material hauling or any other use the customer may require.

The 3T-4T-5T will mount inside a utility type body with a minimum 48" width and 100" length. The lower frame assembly is modified to accommodate the wheel wells on dual wheel type

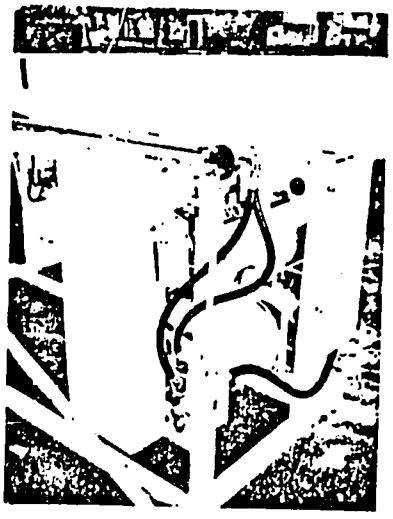
nd Features on the 3T

Dual rear hydraulic outriggers are standard equipment and are independently controlled to afford easy leveling on uneven terrain.

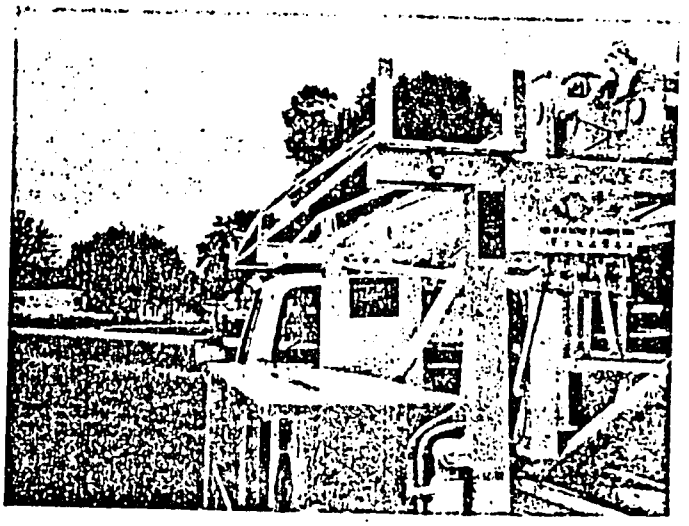
The heavy duty tailgate is designed for extreme strength and long life.



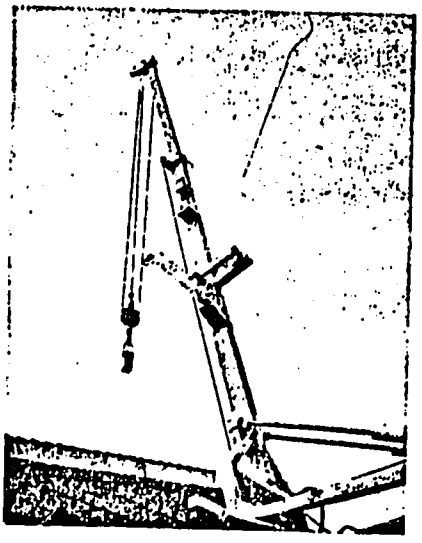
The oil cooler is a Hayden heavy duty hydraulic cooling coil with a 12 volt D.C. fan which in most operating conditions allows for continuous operation normally curtailed by overheated hydraulic oil.



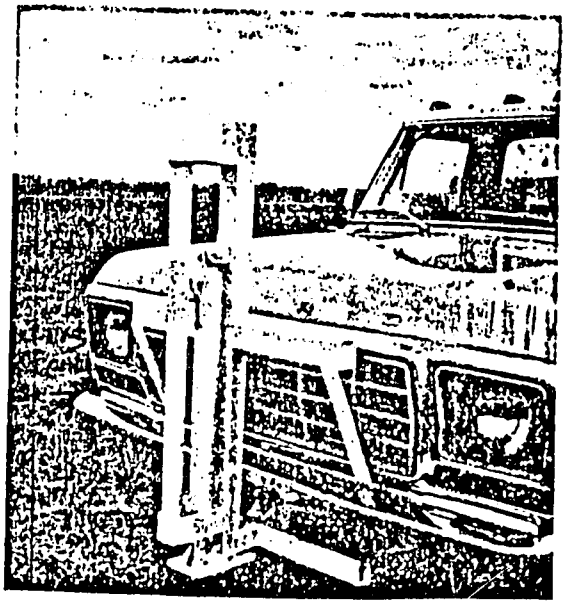
The Power To Rear attachments operates the Cathead, Plastic Pipe Reel, Walking Beam, or other hydraulic equipment.



The Pipe Racks mount independently on right or left side of the derrick and will carry approximately 700 ft. of 1" pipe on each side.

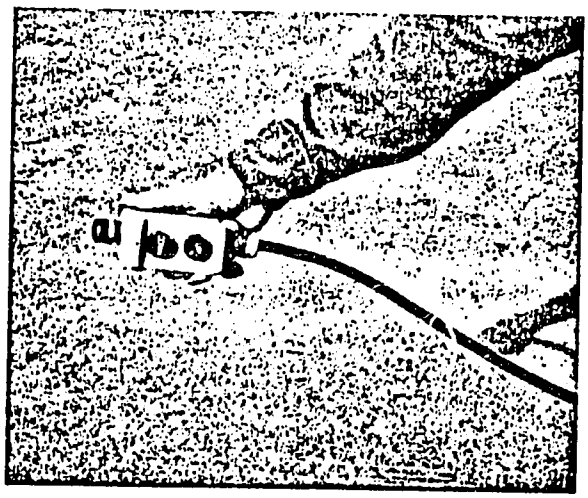


The Walking Beam is a new concept in the line of jarring or cleaning and pumping wells. The unit consists of a mast mounted beom powered by a 2½" D.A. Cylinder with capacity in excess of 1000 lbs., maximum 18" stroke, and up to 60 cycles per minute. An electric valve automatically changes cycles with micro switches that

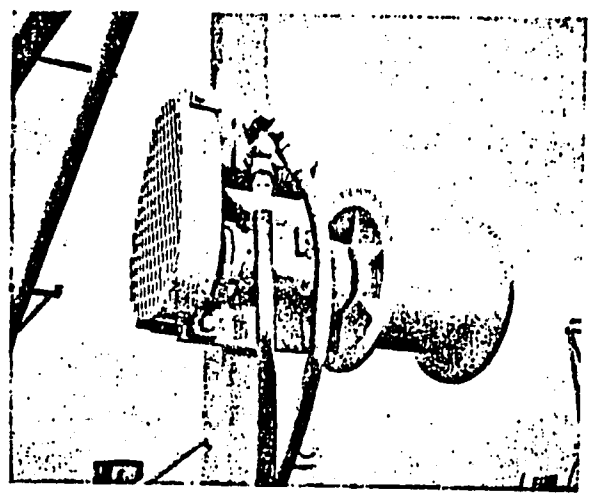


The front hydraulic outrigger is designed to eliminate the truck spring reaction when the load

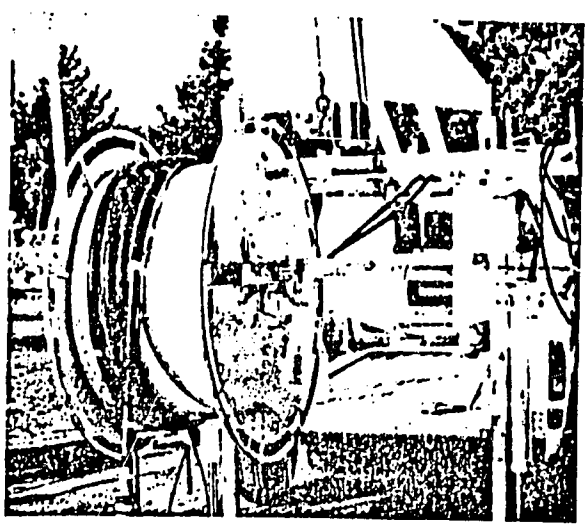
4T and 5T Derricks



The Remote Control attachment controls the main winch or sandreel plus the engine speed and can be used to the rig's maximum winch capacity within a 30 ft. range of the machine. Eliminates the need for two men on most jobs.

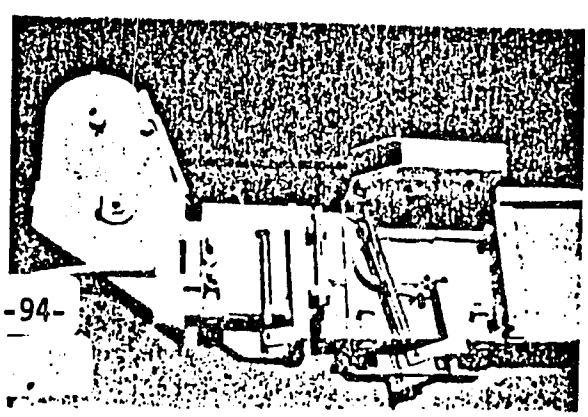


The cathead attachment is a hydraulic driven 7" capstan; right rear mounted which develops approximately 1000 lbs. pull.



The Plastic Pipe Reel solves at long last the problem of pulling and servicing submersible pumps hung on plastic pipe. The Plastic Pipe Reel has a 700 lb. working load with a 100 ft. per minute line speed and a spool capacity of 300 ft. of 1¼" pipe.

The E3 attachment which adapts to all Smeal Rigs is designed for light work in hard to get places or windmill work. It allows 10 ft. additional mast height and 4½ ft. additional lay back. Capacities on the different models are 1500 lbs. on 5T and 800 lbs. on 4T and 3T.



3T Hydraulic Derrick

The 3T is the most economical all around rig on the market today. Low in cost and simplicity in construction makes it one of the best small machines available. The 3T has 6000 lb. capacity. The 3T is designed to fit on a ¾" ton truck or larger. The 3T has a self supporting most which eliminates need for a guy cable affording fast and easy setup. The 3T Basic Rig consists of a 32 ft. telescoping mast, 125 ft. of 3/8 NSNR cable, 2 and 3 part line blocks, open spelter socket with a 3 ton safety hook, hydraulic outriggers, automatic engine speed control and power-take-off for a 4 speed transmission. Shipping weight is approximately 1760 lbs.

NOTE: 5 speed transmissions may require a special double gear P.T.O.

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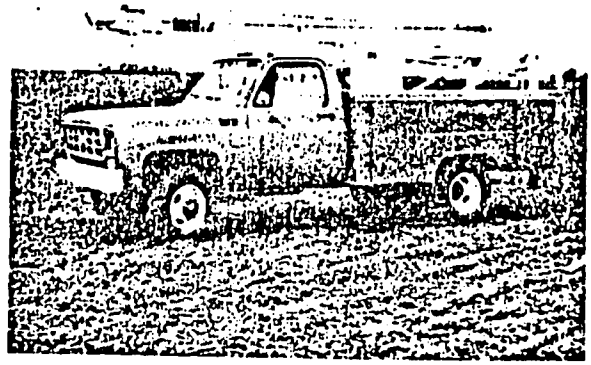
4T Hydraulic Derrick

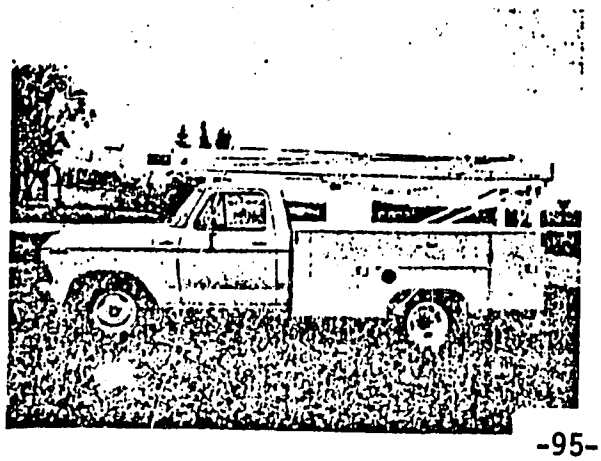


The Smeal 4T is the newest addition to the complete line Smeal pump hoists. The 4T is designed for the pump man who requires speed in his operation. The 4T is designed with a self-supporting mast which eliminates the need for guy cables. The load is supported by two 3½" x 48" double acting cylinders. Maximum layback on the 4T is 10 ft. back of the truck to allow easy access to hard to get pumps or pump houses. The 4T Basic Rig consists of a 35 ft. telescoping mast, 6000 lb. capacity, 150' of 3/8" NSNR cable with a swaged socket, 3 ton swivel safety hook, blocks for a 2 or 3 part line reeving, hydraulic outriggers, automatic engine speed control, and a single gear P.T.O. for 4 speed transmission. The 4T will adapt to ¾" ton truck or larger. Shipping weight is approximately 2300 lbs.

NOTE: 5 speed transmissions may require a special double gear P.T.O.

The P
Pipe Reel,

5T Hydraulic Derrick



The 5T is the most popular all around pump hoist on the market today. Its extreme versatility ranges from small submersible pumps all the way to line shaft turbines. The 5T is designed with a self-supporting mast which eliminates the need for guy cables. The load is supported by two 3½" x 48" double acting cylinders. Maximum layback on the 5T is 11 ft. back of the truck to allow easy access to hard to get pumps or pump houses. The 5T Basic Rig consists of a 36 ft. telescoping mast, 12,000 lb. capacity, 220 ft. of 7/16" NSNS cable with an open spelter socket, 4½ ton swivel safety hook, blocks for 2-3 or 4 part line reeving, hydraulic outriggers, automatic engine speed control, and a single gear P.T.O. for 4 speed tronsmission. The 5T will adapt to a 1 ton truck or larger. Approximate shipping weight is 2600 lbs.

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Note: The addition of a test pump, welder/generator and necessary tools for well cleaning, testing, pump removal and pump replacement is estimated to add approx. $20,000 to the quotation made below.

MANUFACTURING COMPANY—SNYDER, NEBRASKA 68664—PHONE 402-568-2221

NOTE: As of 7 DEC 1984 Mr. Kassmier confirmed that the quotation on this page was still appropriate for this equipment. However truck delivery is 120 days. A truck is available 600 miles from Snyder but is more expense than one quoted in January — See next page.

January 25, 1984

American Ground Water Consultants
2300 Candelairia Road NE
Albuquerque, N.M. 87107

ATTN.: Mr. Bill Turner

Dear Sir:

Thank you for your inquiry regarding two Smeal units for export to Bolivia. Also enclosed please find a 5T brochure.

Some of the features of the 5T are:

- 36' telescopic mast
- Free standing mast no guy cables required
- 11' layback
- 4 part mainline reeving
- 12000# maximum mainwinch capacity
- Independently controlled rear outriggers
- Automatic engine speed
- Automatic failsafe brake on winch
- Main winch has ring gear attached to one side and is driven by a pinion gear
- 120 FPM mainline single line speed

All of the above is standard equipment on a 5T basic unit. Please see the brochure for specifications on the optional equipment.

5T hydraulic derrick	$7490.00	
Sandreel less cable	1500.00	
Remote control	655.00	
2--Pipe racks	220.00	
Tailgate	90.00	
Oil cooler	750.00	
Mounting	600.00	
TOTAL		$11,305.00
Standard utility body	$2200.00	
Aux. tank modification	150.00	
TOTAL		$ 2,350.00

1 ton Chevrolet 4x4 chassis 60" cab to axle
H.D. rear springs 5000# H.D. Stabilizers front and rear
750x16 8 ply rear dual all mud and snow tires
Spare tire and wheel
350 V-8 engine
4 speed
4:10 ~~4:56~~ rear axle ratio
West coast mirrors

air conditioned
H.D. Battery
H.D. Cooling
Gauges
H.D. stabilizer
Power steering
Power brakes
Auxilliary gas
Hydraulic jack
TOTAL OF TRUCK.....~~$11,915.00~~ $14,400

Ramsey 200 front winch with 150' 5/16 cable
6000# pull installed with bumper kit..... ~~1,171.00~~

Delivery to port at Houston, Texas (per unit)... 1,000.00

Price per unit F.O.B. Houston, Texas.....~~$27,741.00~~
Price per 2 units F.O.B. Houston, Texas.....~~$55,482.00~~

The dimensions and weight of the unit are:
Approximately 8' wide
10½' high
20' long
9200 lbs.

67¢ The length could possibly be under 20' depending on the front winch dimensions.

If the cable is desired for the sandreel you need 5/16 6x19 which is ~~58¢~~ per foot. If you need the cable please state the length up to 1200' and add the amount to the quoted price.

Below is listed the suggested spare parts list for the 5T unit.

TC pump seal kit.....		$ 44.22
2--F410 mast cylinder seal kits	~~29.70~~	~~59.40~~ 3.50 ea.
2--F406 out. cylinder seal kits	21.80	43.60
2--R1440 brake cyl. seal kits	~~11.50~~	~~23.00~~ 14.25 ea
1--brake cylinder.....		70.80
1--7/16x220' mainline cable.....		259.80
1--cooler fan motor.....		~~18.90~~ 21.50
2--filter elements.....	6.75..	13.50
1--AM mainwinch or sandline hyd.motor		227.00
4--safety latches for mainline hook		
3.65 ~~3.50~~.....		~~14.00~~
1--12 volt solenoid.....		55.50
1--4x203 switch.....		5.00
1--2x464 switch.....		4.00
TOTAL OF SPARE PARTS.....		~~$838.72~~

Hoping the enclosed is sufficient and please contact me for any further information.

SNEAL MANUFACTURING COMPANY

Gerald Kassmeier

Gerald Kassmeier
Sales Representative

GK/mh

APPENDIX H

Government Request
Repair Parts for George E. Failing Drill Rigs

(Covers two of three rigs currently assigned to the Wello Region)

(Provided to OFDA to illustrate condition of existing rigs)

SPARE PARTS DRILLING ACCESSORIES FOR FAILLING

CF-15 WOLLO ADMINISTRATIVE REGION

No	Description	Unit	Quantity
1	Flush joint drill pipes 4½" x 20ft. long; with 3½". API F.H. welded tool joints and break out flats; thread protectors fitted.	pse.	60
2	Flush joint drill pipes 3½" O.D.x20ft.long with 2⅞".API 1.P.tool joint thread and break-out flats, .300 wall thickness.	"	30
3	Slips for 4½" O.D. Flush joint drill pipe to fitted taper in rotary table 7½" on Failing CF-15 drilling rig.	"	10
4	Slips for 3½" O.D. Flush joint drill pipe with breakout flats(100 F 815)	"	4
5	Drill collars 5¼" O.D. x 20ft. long with upper tool joint 3½" API F.H. box and lower tool joint 3½" API PIN with milled flats for table slip (drill pipe will connect directly together also these 5¼" drill collars will connect directly to the 7¼" drill collar)	"	2
6	Drill collars 4½" x 20ft. with 2⅞" API 1.F box to pin and flats for 100 F 266 breakout fork.	"	2
7	Hoisting plug with 2⅞" I.F pin for 3½" Flush joint drill pipe (H-175)	"	2
8	Sub for Kelly to 3½" flush joint drill pipe S-626-C	"	2
9	Sub 2⅞" API IF box to 4½" API regular box	"	2

No	Description	Unit	Quantity
10	Sub 2 7/8" API IF box to 3 1/2" API regular box	pse	2
11	Breakout fork for 4 1/2" drill collar with breakout flats	"	"
12	Mission series B-53-15 Mega drill 5 7/8" with 3 1/2" API F.H. box connection	"	3
13	Mission button bit 6" for B-53-15 Mission Megadrill	"	10
14	Mission Button Bit 8" for B-53-15 Mission Megadrill	"	5
15	Special wrenches and tools for dismantling mission Megadrill B-53-15-5 7/8"	Set	3
16	Megadrill mission series 150 4 7/8" with check valve and top by-pass sub with 2 7/8" API regular box connection	Pse	1
17	Mission button bit 5" for semal 150 megadrill	"	6
18	Breakout tong georonch friction grip size two reguired (for 4 7/8" Megadrill)	Set	1
19	Breakout plate for mission button bit 5"	Pse	1
20	Breakout plate for mission button bit 6"	"	3
21	Breakout plate for mission button bit 8"	"	2
22	9 7/8" 3-cone roller bit with 4 1/2" API regular PIN type W7R or similor	"	12
23	Sub with breakout flats and check valve 3 1/2" API F.H. box to 4 1/2" API regular box(to connect 8 1/2" diam. bits to 5 1/4"drill collars, also to connect to some diam.bits to 4 1/2"O.D. flush joint drill pipe	"	2

No	Description	Unit	Quantity
24	Sub with breakout flats and check valve. 3½" API F.H. box to 6⅝" API reg box (to connect large size bits to 5¼" drill collars, also to connect the same diam. bits to 4½" O.D flush joint drill pipe.	Pse	2
25	Table slip to 5¼" drill collars	"	2
26	Sub to connect Kelly to 4½" flush joint drill pipe (lower end 3½" API F.H.PIN	"	2
27	7½" Rotary Table Assemoly on drilling Rig Failing CF-15 Shop No.906146/47	"	1
28	<u>Spare Parts for Rotary table 7½</u>		
	PINJON No. 10010	"	3
	Gear Ring No. 10009	"	3
	Seal Grase x GP 53FI-3606	"	4
	Cone Bearing x TI-544091	"	3
	" " x TI-4559	"	3
	" " x TI-458-5	"	3
	Cup bearing x TI-544118	"	3
	" " x TI-LM-742710	"	3
	" " x TI-4536	"	3
	" " x TI-453-A	"	3
	Cone bearing x TI-L/9 742745	"	3
29	Heavy duty water swivel zixm 2" water course with pulldown trunions with sub to kelly type 15-XV swivel	"	1
30	High Pressure 2½" two wire braid swivel nose complete with 2" boss male fittings H12-K17-A	"	3

No	Description	Unit	Quanti
31	Spare parts for Rotary table 8" on drilling rig Failling CF-15; shop No.906785		
	Two set ring gear and pinion 14 F771		
	Seal XCR-28700	Pse	10
	Seal XCR-88710	"	4
	Seal 154 F 491	"	4
	Seal 154 F 492	"	4
	Cup XTI-72487	"	4
	Cone XTI-72187	"	4
	Cone XTI-65200	"	4
	Cup XTI-65500	"	4
	Cup XTI-8520	"	4
	Cone XTI-8578	"	2
	Cone XTI-8573	"	2
32	Rotary table transfer cylinder assy. part No.155F 458	"	2
33	7½" table drive U-Joint assembly No.102F666	"	2
34	Mechanical clutch assembly No.160F469	"	2
35	U-Joint Repair kits		
	Repair kit XSM 5-178-X	"	3
	" " XSM-5-115-X	"	3
	" " XSM-5-116-X	"	3
	" " XSM-CF-45M	"	8
36	Block pillow XFB-LAM-2	"	4
37	Bearing Seal XSK-6214	"	3
38	Bearing, ball XSK-6214-Z	"	2
39	Main drill head clutch(BORG & BECK 12E)	"	2
40	Water injection pump assembly No.X2MY-A08-4	"	2

No	Description	Unit	Quantity
41	Spare parts for water injection pump No.X2MY-A08-4 on drilling rig failling CF-15 Shop No.906785		
	O-Ring X2MY-5876-A-53	Pse	6
	O-Ring X2MY-5876-A-52	"	6
	O-Ring X2MY-5876-A-68	"	6
	Plunger assy. X2MY-15422-B-2	"	10
	Nut,Hex X2MY-19109-A-48	"	10
	Liners,Upper Cyl.X2MY-15427-C-2A	"	4
	Liners,lower cyl.X2MY-15427-C-3A	"	4
	Retainer,Suction valve X2MY-15429-A	"	4
	Spring,Cuction valve X2MY-11432-A	"	4
	Cap lower X2MY-M-2168-A-2	"	4
	Valve suction X2MY-17714-A-1	"	4
	Plug,Pipe X2MY-5022-A-15	"	4
	Ring,Retainer X2MY-10848-A-8	"	2
42	Pressure regulating relief valve assembly No. X2MY-11550-8	"	4
43	Orbit motor models C5A.8.C5B	"	2
44	Air line conditioner unit assy.No.154F185	"	4
45	Pressure regulator model XWB-P55135-1	"	3
46	8" mast raising cylinder assembly No.10700-D	"	2
47	Breakout tong assembly No.156F288 type LF tong,for 4½" flush joint drill pipe	"	2
48	Breakout tong assembly No.156 F-288 type LF"tong(for 3½"flush joint drill pipe)	"	1
49	Spare parts for 6½" front hydroulic jack assembly No.106F726		
	O - Ring XNC NS-437	"	4
	Plate,Piston 102F-660	"	2
	Set packing 140 F 917	Set	4
	O - Ring XNC-NS-223	Pse	4
	Nut,Top Plate.BC-N	"	16

No	Description	Unit	Quantit
	Bolt top plate BC18-B	Pse	16
	Washer,Lock B-LW	"	16
	Nur,Lock XSK-N-12	"	4
	Washer, Lock XSK-W-12	"	4
	SCR EW,Clanp cap 6C12-C	"	4
	Set packing 142F375	"	4
	Ring packing 100F537	"	4
50	Spare parts for water swivel type 15-PXV		
	Packing 15xV-5	"	10
	Wear bushing 15XV-6	"	4
	Housing seal 15XV-7	"	4
	Shield seal 15XV-9	"	4
	Bearing shield 15XV-10	"	2
	" retainer wire 15XV-11	"	2
	" XSK-7214-BYG	"	6
51	Spare parts for air compressor Leroi Model 100S2(part No.425x408)		
	Suction valve Assy.	"	12
	Discharge valves assy.	"	12
	Repair kit	"	10
52	12¾" 3-Lone rotary rock birs for soft and medium formation	"	10
53	Tool Joint dope brush D-1933-DB	"	12
54	Pipe wrench ridgid 18"	"	6
55	" " " 24"	"	6
56	" " " 36"	"	6
57	" " " 48"	"	6
58	Spare parts for air compressor 100SDS		
	Oil filter element XLR-43-381	"	10
	" " " XLR-43-397	"	10

No	Description	Unit	Quanti
59	Spare parts for 7¼" X8" FY-FXX Gardner-Pump		
	BAFFLE,Piston Rod 250-1-FXX-840	Pse	4
	Oil Stop Head 250-FXX-495	"	2
	Gasket,Discharge Flange 250-25-C-603		4
	Gasket,cylinder head	"	8
	Packing,stuffing box 250-60-BG-13	"	24
	Junk Ring,Stuffing box 250-BC-317	"	4
	Bushing Gland 250-1-FD-152	"	4
	Rod Piston with nuts 250-FXX-183-X	"	4
	Nut,Crosshead 250-50-T-137	"	4
	Liner,Cylinder 7½" 250-FY-456-75	"	4
	Packing,liner set screws 250-60-C-5	each	48
	Liner sleeve 250-3-BN-519	"	8
	Piston 7½" API-3-250-45-D-262	"	4
	Rubber,piston R7-½" B	"	8
	Valve assy.250-4-FO-482-B	"	8
	Sear,valve 250-FO-451	"	16
	Spring valve 250-76-A-139	"	16
	Gasket,valve cover 250-25-G.32	"	16
60	Filters for truck engine		
	Fuel filter primary XGM	"	10
	" " secondary XGM-TP916	"	10
	Oil filter XGM-PF-911	"	10

DRILLING MATERIALS

No	Description	Unit	Quantit
1	EZ - Mud packed in 5 gallons plastic pails	Pails	100
2	Baroid quick Foam in 55 gallons drums	Drums	25
3	Revert/Mud in 25 lb bags	Bags	50
4	Tool joint compound in 5 gall.	Pails	20
***	Supporting Vehicles		
1	4 x 4 pick-up 1 ton	No	3
2	4 x 4 Cargo Truck 10 tons	No	2

*** - not included in recommended budget

APPENDIX I

Request of Equipment & Construction Materials to the Government of the United States of America for Drought Affected Areas of Ethiopia

(Includes pencil notations on recommendations for small tools, etc., by WASH consultants)

Section I: Drilling Rigs Being Requested by Ethiopia

Section II: Tools and Equipment Requested by Ethiopia

Section III: Hydrologic Survey and Investigation Equipment Requested by Ethiopia

Section IV: Earth Resistivity Unit Requested by Ethiopia

Section V: Miscellaneous Items

Section VI: Construction Material Estimates

SECTION I

Drilling Rigs Being Requested by Ethiopia

Item	Description	Unit	Qty.	Remark
	I. Drilling Activities Drilling Rigs			
1	Truck Mounted DTH/Rotary Rigs capable to drill to 499 mts.	each	2	For Southern, Shoa & Hararghe.
2	Truck Mounted DTH/Rotary Rig capable to drill upto 250 mts.	"	1	Southern Region, Sidamo
3	Truck Mounted DTH/Rotary of Medium size capable to drill to 150 mts.	"	2	Wollo & Tigrai
4	Auger Rigs with accessories /Attachments/ to drill large diameter wells capable to drill upto 60 mts.	"	5	For the above drought affected areas.
	II. Drilling Accessories			
	A - DTH/Rotary Rig capable to drill 400 mts.			
1	Drill collar	"	3	
2	" pipes	"	140	6 mts. length
3	" Bits, Rock Roller bit 15"	"	6	
4	" " " " " 12"	"	8	
5	" " " " " 10"	"	8	
6	" " " " " 9 7/8"	"	10	
7	" " " " " 8 7/8"	"	10	
8	" " " " " 7 7/8"	"	8	
9	Reamer bits " " 12"	"	6	
10	" " 10"	"	6	
11	" " 9 7/8"	"	8	

SEE APPENDIX J —

NOTE:
If a new rig was to be furnished and or rigs rebuilt assessories would need to be reviewed.

.../2

Item	Description	Unit	Qty.	Remark
12	Rock Roller bit, Tungestion carbide tips 12"	each	4	
13	" " " " 10"	"	4	
14	" " " " 9 7/8"	"	4	
15	" " " " 8 7/8"	"	4	
16	Hammer Button bits 10"	"	4	
17	Rock Roller bit, Tungestion carbide tips 7 7/8"	"	4	
18	Hammer Button bits 9 7/8"	"	6	
19	" " " 8"	"	6	
20	" " " 7 7/8"	"	6	
21	" " " 6"	"	4	
22	Chain Tongs	"	10	
23	Pipe Wrenches 48"	"	10	
	B - DTH/Rotary Rig capable to drill 50 mts.			
1	Drill Collar	"	3	
2	Drill Pipe	"	70	6 mts. length each
	C - DTH/Rotary Rig capable to drill 250 mts.			
1	Drill Collar	"	2	
2	Drill Pipe	"	50	6 mts. length each
3	(½ of 3-24 aobe)			
	III. Construction /Drilling/ Materials			
1	Casings, Mild Steel API Standard			
	- 6 5/8"	psc	3000	
	- 8 5/8"	"	200	
	- 10 5/8"	"	50	
	- 12 5/8"	"	20	
2	Casings; PVC riged & double coated 6 5/8" blind	"	1000	

Item	Description	Unit	Qty.	Remark
3	Casings, PVC riged & double coated 6 5/8" screen	pcs	375	
4	Drilling Foam	Drums 200 l.	25	
5	Aqua Jell	sacs	2000	
6	Dop /Petrolium Product/	Drums	12	

SECTION II

Tools and Equipment Requested by Ethiopia

CONSTRUCTION ACTIVITIES /PIPE LAYING/

I. Tools & Equipment

Recid be furnished to Wello District (WRC)

Item	Description	Unit	Qty.	Remark
1	Pipe Threader 1-2"	each	20	2
2	" " 2" - 4"	"	10	2
3	Pipe cutter 1"-4"	"	25	2
4	Vice	"	30	2
5	Reinforcement bar cutter upto 20mm.	"	5	—
6	Pipe Wrench			
	- 14"	"	40	4
	- 18"	"	40	4
	- 24"	"	40	4
	- 36"	"	40	4
	- 48"	"	20	2
7	Chain Tongs	pcs	20	4
8	Hack saw	"	40	4
9	" " blades	"	200	48
10	Plumb bob	"	40	—
11	Steel meter tapes			
	- 50 mts.	"	10	2
	- 30 mts.	"	10	—
	- 20 mts.	"	15	—
	- 3 mts.	"	20	4
	- 2 mts.	"	30	—

.../4

Item	Description	Unit	Qty.	Remark
12	Vibrators	pcs	25	—
13	Compactors	"	25	—
14	Mixers			
	- ½M³ capacity	"	15	—
	- 1M³ "	"	10	—
15	Hammer Jack with drilling accessories & compressors	"	6	—
16	Wheel barrow	"	200	20
17	Welding machines	"	15	—
	II. Pipes & Fittings			
1	Galvanized steel pipe			Need to coordinate with Oxfam who have furnished PVC piping
	4"	"	1000	
	3"	"	2000	
	2½"	"	3500	
	2"	"	4000	
	1½"	"	1500	
	1"	"	1000	
	3/4"	"	1000	
	III. Pumps & Generators			
1	Submersible pumps			
2	Q = 3l/sec H= 75 mts.	"	20	
3	Q = 3 l/sec H = 150 mts.	"	20	
4	Q = 2.5 l/sec H = 200 mts.	"	10	
5	Q = 2.5 l/sec H = 250 mts.	"	15	
6	Q = 2 l/sec H = 300 mts.	"	10	
7	Q = 2.5 l/sec H = 200 mts.			
	hot water pump able to work at 70°c	"	5	
8	Generating set H.P 9	Nos	20	
9	" " " 18	"	20	
10	" " " 19	"	10	
11	" " " 20	"	15	
12	" " " 18	"	10	

Item	Description	Unit	Qty.	Remark
13	Mono Vertical Shaft Pump single cylinder	pcs	10	Oxfam has 10 Monos for December delivery and 20 Mono hand pumps
14	" " " " double cylinder	"	20	
15	" " " " 3 cylinder	"	35	
16	Centrifugal Pumps	"	15	
17	Hand Pumps	"	500	
18	De-watering Sledge Pumps	"	20	possibly 20 additional well pump units but would need to coordinate with Oxfam

SECTION III

Hydrologic Survey and Investigation Equipment Requested by Ethiopia

	SURVEY & INVESTIGATION EQUIPMENT			
	I. Surveying Equipment			
1	Theodalite with tripods	"	5	
2	Leveling Dust. with tripod (Automatic)	"	5	
3	Range Pole	"	50	
4	Leveling Staff (stadier) Sectional	"	10	
5	Setimeter	"	10	
6	Pocket scientific calculator	"	5	
7	Direction compass	"	5	
	II. Geological & Hydrogeological Investigation Equipment			* one approx. $8,000 package
1	Pocket lens x 20	"	10	*
2	Branton Geological Compass	"	15	*
3	Altimeter	"	10	*
4	Water level Ladicator	"		
	a) 100 mts. length	"	15	3 not incl in package
	b) 150 mts. "	"	10	
	c) 200 " "	"	10	
	d) 300 " "	"	5	
7	Side bags	"	15	*
8	Stop Watch (pumping test)	"	15	*
9	Earth Resistor	set	5	
10	Photo Sounder with enough films	"	5	
11	Chemical Analysis kit with enough chemicals (Hatch kit)	"	5	*

.../6 * and other equipment list to be developed

SECTION IV

Earth Resistivity Unit Requested by Ethiopia

Item	Description	Unit	Qty.	Rate In Birr	Amount
1	Earth Resistivity Unit:-				
	- Digital read out				
	- A low frequency AC Resistivity system operating frequency $5H_z$; range 100 UR set		3	25,000	75,000
	- 10 KR (e. 10 - V/1)				
	- Receiver: range 100 UV-1V				
	- Transmitter: output voltage 500V (1000V peat - 10 peak)				
	- output power max. 80W				
	- operating: $5H_z$ square wave				
	- Power supply: independent chargeable battery sets				
	- Charger: charging time about ten hours for fully discharged batteries				
	- Accessories: set of two reels with 1.5 km. (5000 ft.) wire each four stainless steel electrodes; detachable battery power supply for the transmitter				
2	Water Conductivity Meter:-				
	- Digital read out				
	- Automatic temperature compensation (from 0-100°c)				
	- Battery operated				
	- Probe: no field effects				
	- Differentrange selections: 0-2, 0-20, 0-200, 0-2000, 0-20,000 (micromechs/cm.	set	4	3,000	12,000
3	Wall-logger:-				
	- Electrical logger				
	- For measuring sub-surface resistance in water wells to be drilled, in all geological formations, upto the depth of 300 mts.				
	- Complete with all necessary part and accessories.	set	3	18,000	54,000

Suggest one unit possibly Bison Model #2 390 with offset sounding system ±$15,000

Not for emergency camp supplies

Not for emergency camp supplies

Item	Description	Unit	Qty.	Rate In Birr	Amount
4	PH Meter - Preferably digital read out - Range 0-14 PH - Accuracy ± 0.28 PH -Smallest scale division 0.2 PH - Repeatability ± 0.14 pH - Temperature compensation (0°-100°c)	set	6	800	4,800
5	Tele - meter or range finder(FOR measuring horizontal distance upto 500 m.)	pcs	6	300	1,800
6	Voltimeters for checking the direct flow of current in electrical wire	"	6	350	2,100
7	Plastic measuring tape graduated in meters 100 m. long	"	12	300	3,600
8	Sounding Cable Set Wound on two separate plastic reels, each containing 500 m. of .75 mm² wire	set	10	500	5,000
9	Portable fluoride meter	"	6	800	4,800
10	Walkie - Talkie with range of 3 - 5 km.	"	15	150	2,250

Not for emergency camp supplies — one is available in recommended HACH TEST KIT (page 6)

No

No

2 Recommended

2 recommended

No

No

SECTION V

Miscellaneous Items

	III. Drafting Instruments				
1	Laroy Guide Amharic	set	16		
2	Rapidographs	"	10		
3	Drafting Drawing table	pcs	5		
	OTHERS (MISCELLANEOUS)				
	I. Electrician Tools & Inst.				
1	Ammeter	pcs	5		1 rec'd
2	Voltmeter	"	5		1 rec'd
3	Multitester	pcs	5	1 rec'd	
4	Screw Drivers, Insulated handle	set	5	1 rec'd	
5	Special Insulating Taper	pcs	200	10	
6	Pliers	"	10	2	
7	Tools Kit (Electrician)	kit	5	1	
	II. Camping Equipments			NONE	
1	1 man tent	pcs	15		
2	2 man tent	"	45		
3	4 man tent	"	30		
4	10 man tent	"	5		
5	Cooking set	set	25		
6	Eating set	"	50		
7	Field bed	Nos	150		
8	Air mattres	"	150		
9	Sleeping bags±	"	150		
10	Camping table (folded)	"	50		
11	" chair	"	150		
12	Tea cups (set)	"	150		

SECTION VI

Construction Material Estimates

Construction Material Estimates

Item No	Description	Unit	Quantity
1	4" Union	No	12
2	3" ø "	"	24
3	2½" "	"	36
4	2" "	"	40
5	1½"	"	16
6	1"	"	12
7	4" Nipples	"	24
8	3" "	"	48
9	2½" "	"	60
10	2" "	"	80
11	1½" "	"	30
12	4" Elbow 90°	"	16
13	ø 3" Elbow 90"	"	32
14	1" Nipples	"	24
15	2½" Elbow	"	24
16	2" Elbow	"	36
17	1½" "	"	20
18	1" "	"	16
19	4" Elbow 45°	"	8
20	3" " 45°	"	16
21	2½" "	"	24
22	2" "	"	70
23	1" "	"	8
24	4" 78° Bends	"	16
25	3" 90" "	"	32

Item No	Description	Unit	Quantity
26	2½" 90° Bends	No	24
27	2" " "	"	60
28	1½" " "	"	16
29	4" 45° Bends	"	16
30	3" 45° "	"	32
31	2½" "	"	24
32	2" "	"	60
33	1½" "	"	32
34	4" Sockets	"	250
35	3" "	"	500
36	2½" "	"	650
37	2" "	"	800
38	1" "	"	250
39	4" Crosses	"	8
40	3" "	"	15
41	2½" "	"	12
42	2" "	"	70
43	1½" "	"	36
44	4" Tees	"	12
45	3" "	"	24
46	2½" "	"	36
47	2" "	"	48
48	1½" "	"	18
49	1" "	"	12
50	4"	"	8
51	3" Pluga	"	16
52	2½" "	"	24
53	2" "	"	32
54	1½" "	"	12
55	1" "	"	8
56	4" "	"	8

Item No	Description	Unit	Quantity
57	4" Redueers	No	32
58	3" X2½" reducers	"	60
59	3"X2" "	"	45
60	3"X1½" "	"	30
61	2½"X2 "	"	40
62	2"X1½" "	"	50
63	1½"X1" "	"	20
64	1"X ¾" "	"	20
65	1" faucets	"	80
66	¾" "	"	80
67	3" Check valve	"	10
68	2½" " "	"	10
69	2" " "	"	10
70	3" Gate valve	"	20
71	2½" " "	"	20
72	2" " "	"	20
73	1½" " "	"	20
74	1½" Water meter	"	10
75	3" Air release valve	Pcs	5
76	2½" " " "	"	5
77	2" " " "	"	5

APPENDIX J

Contacts for New Drilling Equipment and/or Equipment Rebuilding

Section I: Contacts for New Drilling Rig for Quick Delivery

Section II: Principal Contact List

SECTION 1

Contacts for New Drilling Rig for Quick Delivery

CONTACTS FOR NEW DRILLING EQUIPMENT OR EQUIPMENT REBUILDING (information was obtained)

As a result of a Phone call 7 Dec 1984 to Dale Melott at Failing, Enid, Okl. Tel. 405/234-4141 the following:

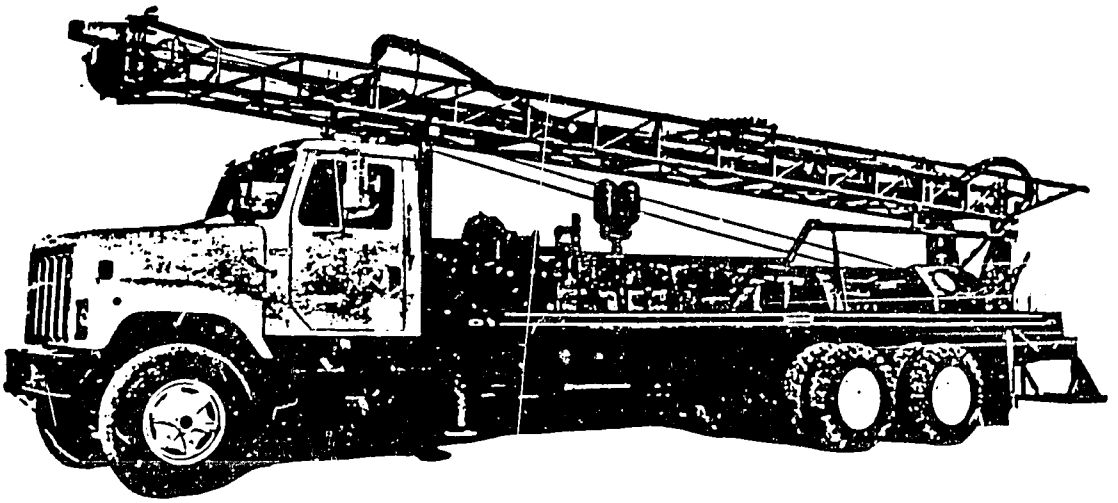
1.) New Drilling Rig for Quick Delivery

Failing Supply Ltd.
2nd Floor, Bank House
1-7 Sutton Court Road
Sutton, Surrey SM1-4SP, England
phone 01-642-9090
Cable FAILINGRIG, Sutton
Telex 21260 Ans. back: DRILLS G

— at the above address a Mr. James Michael has price and details on CF-15 Rig now available in Belgium

The rig in Belgium is mounted on a Belgian made HFT 266 truck — has large 7½ x 5 mud pump, 3 drum drawworks, 38 ft mast, rotary table (and 8 inch) — for down the hole hammer work would need an auxiliary compressor.

The basic specifications (general) are as listed on the following page.



Specs/CF-15

RATED CAPACITY	1500 ft. (457.2 m) holes with 2-7/8" (73.025 mm) drill pipe	Designed to handle casing loads up to 25,000 lbs. with single sheave block.
MAST Choice of two lengths	Electrically welded from cold drawn steel tubing. Rigid structural sections. Raised and lowered by one large double-acting hydraulic cylinder. (Masts with expanded working areas are available.)	Height.....31'6" (9.61 m) or 35 ft. (10.7 m), or 38 ft. (11.51 m) clearance above table for using 20 ft. (6.1 m) drill pipe. Total gross capacity.....40,000 lbs. (18,144 kg) Max. hook load capacity ...25,000 lbs. (10,340 kg) with single sheave block Crown.....2 sheaves for wire line, angled over hole and drums, roller bearing (3-sheave crown available when drill is equipped with optional third drum. Spring tension provided in crown for each pulldown chain.
DRAWWORKS	Two identical drums. Spiral bevel gear drive. Oil bath lubrication. Friction clutch on each drum. Air clutches optional. Third drum or sand reel for bailing. (Optional) Friction clutch standard. Air clutch optional.	Spool diameter .....7" .....(17.78 cm) Spool length .....8-3/4" .....(22.22 cm) Max. single line pull .....15,000 lbs. .....(6,804 kg) Brakes .....16" x 6" single .....(40.64 cm x 15.24 cm) Line capacity .....1/2" x 500 ft. .....(12.7 mm x 152.4 m) Clutches .....14" 3-plate .....(35.56 cm) Spool diameter .....7" .....(17.78 cm) Spool length .....24" .....(60.96 cm) Max. single line pull .....4,000 lbs .....(1,814 kg) Brake .....16" x 4-1/2" single.....(40.64 cm x 11.43 cm) Clutch .....11" 3-plate .....(27.94 cm)
ROTARY TABLE	Retractable hydraulically 14". Spiral bevel gears. Oil bath lubrication. Tapered roller bearings throughout.	Opening .....7-1/2" .....(19.05 cm) or .....5-1/4" .....(13.34 cm) or ..... 8" .....(20.32 cm)
PULLDOWN	Hydraulic motor drive. Two 1-1/2" pitch chains. Two-speed transmission. Hold-back feature optional.	Pulldown in low gear ..... 4,680 lbs. per 100 psi hydraulic pressure. Pulldown in high gear ..... 2,900 lbs. per 100 psi hydraulic pressure. (Actual stall or 80% theoretical.)
MUD PUMP (Optional)	V-belt drive. Choice of models. Friction clutch allows belts to remain idle when pump is not running.	FAILING Model FM-45, 5" x 6-1/4" (12.7 cm x 15.88 cm) duplex reciprocating type power pump. Optional mud pumps include the 5" x 6", 5" x 6" and 5-1/2" x 8" (12.7 x 15.24 cm, 12.7 x 20.32 cm and 13.97 x 20.32 cm)
CENTRIFUGAL PUMP (Optional)	V-belt drive.	Size .....3" x 4" .....(76.2 mm x 10.16 mm) Available only on certain units.
AIR COMPRESSOR (Optional)	V-belt drive. Choice of models. Equipped with safety valve, air cleaners, unloading mechanism and surge tank.	Model 50-S1 provides operating pressures up to 45 psi. Model 50-SDS or 100-SDS provides operating pressures up to 125 psi. Model 256-S2 provides operating pressures up to 250 psi.
MECHANICAL ROTARY DRIVE	All helical gears. Single plate 12" (305 mm) rotary clutch ahead of transmission.	Four speeds forward, one speed reverse. Rotary speeds from 35 to 220 rpm with engine at 1800 rpm. Remote controlled from driller's station. An optional 3-speed auxiliary transmission is available, in addition to the 4-speed, when slower rpm, desirable when using down-the-hole tools, is required.
HYDROSTATIC ROTARY DRIVE (Optional)	Fluid motor flange-mounted to a 4-speed transmission.	Rotary speeds .....0 to 115 rpm Rotary torque .....12,000 lb. ft. at stall
SUB DRIVE	Three-shaft, chain drive. Ball bearing. Oil bath.	Quadruple roller chain, 3/4" (19.0 mm) pitch. Unitized assembly with friction clutches for reciprocating pump, centrifugal pump, or small air compressor, if the drill is equipped with one or more of these options.
OIL PUMP	V-belt drive.	40-gal. (150 liters) per min. at 1000 psi (70.4 kg per sq cm) max.
CONTROLS	Engineered design.	Conveniently grouped at driller's station, including safety switch and engine starter button.
MOUNTING	Truck of suitable capacity. Specifications depend on drill components selected. Weight varies with truck and optional equipment.	Truck engine powers rig through power take-off and sub drive arrangement. Truck axles, springs and tires must meet federal regulations pertaining to total vehicle weights.

FAILING®

GENUINE PARTS FOR ALL FAILING AND/OR WABCO DRILLS ARE AVAILABLE FROM

LARGO, FLORIDA	PLAINFIELD, INDIANA	HOUSTON, TEXAS	GRAND JUNCTION, COLORADO	IN CANADA
FOREST PARK, GEORGIA	CASPER, WYOMING	ODESSA, TEXAS	FRESNO, CALIFORNIA	EDMONTON, ALBERTA
NEW ORLEANS, LOUISIANA	GRANTS, NEW MEXICO	ST. MICHAELS, MD	BURNSVILLE, MINNESOTA	CALGARY, ALBERTA

SECTION II

Principal Contact List

II. Principal Contact List

WATER SUPPLY NEEDS
ETHIOPIAN DROUGHT-VICTIM CAMPS

(WASH would be pleased to assist with any or all contacts)

Status of Improvement efforts by OXFAM
James Howard - OXFAM/Oxford, England 08-655-6777
or: Dick Copeland

UNICEF - Future Plans
Martin Beyer - UNICEF, Chief Advisor/Water (212) 754-1234
or: Jacques Beaumont - Coordinator/Emergency Unit (212) 415-8370

Drilling Rig - New for immediate delivery - need to add air hammer capability.
(See Appendix J - Section I for contact)

Drilling Rig - Rebuilding and Overhaul
Galen Braithwaite - George E. Failing Co.,
Enid, Oklahoma (405) 234-4141

Contact for parts and service personnel

Drilling Contract with US Drilling Firms - to include pump repair and hydrogeologist services.

William Turner - American Groundwater Consultants
Albuquerque, New Mexico (505) 884-2768

Robert Vanvaler - Roscoe Moss Co.
Los Angeles, CA (213) 263-4111

Paul Sutton - HYDRO-GROUP
Boston, MA office (617) 648-3200

or: Hawkins Oil and Gas
Tulsa, OK (918) 585-3121

via non-profit offer from Charles Bartlet (703) 628-4136

Containers for individual transport of water
Tony Russel - Reliance Products Ltd.,
Winnipeg, Canada (207) 921-2980

Quote: 50,000 "Fold-a-carriers" in stock at $1.85 U.S. ea.
special run - without advertising
packaging at $1.70 U.S. ea.

(prices FOB Winnipeg with special run of 2 1/2 gallon size not available until 16 January 1985 due to Christmas week shut-down of plant).