F I E L D R E P O R T

SOUTHERN AFRICA DROUGHT ASSESSMENT: IMPACT ON WATER AND SANITATION

WASH Field Report No. 375
August 1992

WATER AND SANITATION for HEALTH PROJECT

Sponsored by the U.S. Agency for International Development
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SOUTHERN AFRICA DROUGHT ASSESSMENT: IMPACT ON WATER AND SANITATION

Prepared for Office of Foreign Disaster Assistance,
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by

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and
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RELATED REPORTS

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CONTENTS

APPENDICES

TABLE

MAPS

ACRONYMS

ADB	African Development Bank
A.I.D.	U.S. Agency for International Development (Washington)
CDC	Centers for Disease Control
CIDA	Canadian International Development Agency
CRS	Catholic Relief Services
GTZ	German development organization
IBRD	International Bank for Reconstruction and Development (World Bank)
KfW	German development organization
lcd	liters per capita per day
NAC	National Action Committee
NGO	Nongovernmental organization
NORAD	Norwegian Overseas Development Agency
OFS	Orange Free State (South Africa)
OFDA	Office for Foreign Disaster Assistance (U.S. Agency for International Development)
PRONAR	National Programme for Rural Water (Mozambique)
REDSO	Regional Economic Development Support Office (USAID)
RSA	Republic of South Africa
SADCC	Southern Africa Drought Coordination Committee
SIDA	Swedish International Development Agency
UNCDF	United Nations Capital Development Fund
UNHCR	United Nations High Commission for Refugees
USAID	U.S. Agency for International Development (overseas mission)
USIT	Urban Sanitation Improvement Team (Lesotho)

VWSS	Village Water Supply Section (Lesotho)
WASH	Water and Sanitation for Health Project

Chapter 1

INTRODUCTION

1.1 Overview

This mission was organized by A.I.D.'s Office for Foreign Disaster Assistance (OFDA) in response to the ongoing drought in Southern Africa. The mission comprised two teams working in parallel, with one team visiting coastal countries (Mozambique, Swaziland, Republic of South Africa, Lesotho, Namibia, and Angola), and the other team visiting inland countries (Zimbabwe, Zambia, Botswana, and Malawi). Each team included a food specialist from OFDA; transport, logistics, and Food-For-Peace experts through USAID missions, East and West Africa regional offices; health and nutrition specialists through the Centers for Disease Control (CDC); and a water and sanitation expert through the Water and Sanitation for Health (WASH) Project.

During the initial planning session in Harare, Republic of South Africa (RSA), the two teams met with USAID/Zimbabwe staff, representatives of the World Bank, the World Food Program, the Southern Africa Drought Coordination Committee (SADCC), and other multilateral organizations to discuss regional approaches to the drought.

During this time, the two water and sanitation specialists from WASH met to develop a joint approach to follow in each country visited. They decided upon the required type of information and the methodology for gathering and assembling it into a report.

At the conclusion of the country visits, members of the two teams who were still available met to discuss the overall report. The WASH consultants met to examine results and conclusions of the trip and to establish the report format.

1.2 Purpose and Objectives

1.2.1 Overall Team Purpose

The overall team purpose was to collect and evaluate available information on food and non-food needs resulting from the drought through:

- Meetings with USAID missions, nongovernmental organizations (NGOs), host governments, and international organizations
- Field visits to affected areas
- Interviews with drought-affected people

1.2.2 Overall Team Objective

The overall team objective was to give program planners in Washington sufficient information to make informed decisions about the allocation of U.S. government resources for the Southern Africa drought.

1.2.3 Specific Team Objectives

The specific team objectives were:

- Assist USAID missions in consolidating information on the magnitude of the emergency and on the size and location of populations which may already be or may become vulnerable
- Assess countries' abilities to respond to food and non-food requirements
- Assess capacity of UN agencies, international organizations, and in-country NGOs to maximize the impact of USAID emergency drought funds

1.2.4 Water and Sanitation Objectives

The water and sanitation objectives were:

- Conduct a needs assessment of the water supply situation; conduct a survey of the following:
  - water availability
  - water requirements
  - water quality
- Recommend strategies for providing water through efficient, cost-effective methods to the affected populations
- Identify governmental and nongovernmental organizations which may have the skills and resources to implement potable water programs
- Assess the sanitation implications of the water shortages caused by the drought

1.3 Personnel

The coastal team traveled as a group between countries. The countries included Mozambique, Swaziland, Republic of South Africa, Lesotho, Namibia, and Angola. The inland team visited Zimbabwe, Malawi, Zambia, and Botswana. Team members and travel itineraries are listed in Appendix A. The principal contacts and primary references for the inland team are presented in Appendices B and C.

1.4 Follow-on Assistance

A potential opportunity for follow-on assistance by WASH was presented as a memo to the USAID/Lusaka Mission Director (see Appendix D). The inquiry regarding the availability of WASH assistance originated with the Managing Director of the Lusaka (Zambia) Water and Sewerage Company, effectively a parastatal organization. If appropriate, follow-up by WASH is herein recommended.

The WASH Project may also wish to consider bringing its expertise to bear in urban water conservation strategy and technology; training of rural technicians; and emergency preparedness and urban in-migration contingency planning for water and sanitation.

Chapter 2

REGIONAL FINDINGS: WATER AND SANITATION

2.1 General Situation

Nearly nonexistent rainfall since the beginning of January 1992 has had a major impact on water supplies throughout Southern Africa. After several years of below average rainfall in many areas, this drought dried up rivers, reservoirs and dams, reduced the flow from springs, and lowered groundwater tables. With the rainy season now over, more rain cannot reasonably be expected before October 1992 at the earliest.

In general, the most affected areas fall south of 13 degrees latitude and below 1,200 m elevation, with the most severe impact in the veld areas below 900 m elevation. During the current water year, precipitation shortfalls have been particularly acute in these zones.

Rivers in Mozambique that empty into the ocean have so little flow that sea water has moved many miles upstream. For example, river water at the intake for the Beira water system 40 miles from the ocean has become saline. Water in the Limpopo River at Xai Xai has become too saline for irrigation.

2.1.1 Decreasing Water Levels

Water levels in reservoirs that supply many municipal systems are dangerously low. Bulawayo in Zimbabwe, Maseru in Lesotho, and Chimoio and Quelimane City in Mozambique, among other cities, face the real possibility of having dry systems. Bulawayo has developed an evacuation plan in the event water runs out.

The small dams that provide water to thousands of people and millions of cattle are also drying up rapidly. As some dams dry up, grass around the remaining dams, which is used by grazing livestock, is quickly eaten down to the roots, leaving animals without food. Millions of cattle will be at risk as the drought progresses. It is expected that excess cattle will likely cause long-term damage to the land. Yet, cattle are a source of wealth and savings to traditional ranchers, who are reluctant to sell them under any circumstances.

Dry land without vegetation is, of course, extremely susceptible to erosion by wind and rain. Because eroded land holds less soil moisture and produces less vegetation, it continues to erode even more.

Whereas food and crop losses have been geographically widespread (due in large measure to the lack of precipitation throughout the region during the critical tasseling period for maize), the reach of the most severe water shortages has been less extensive. Shallow groundwater sources tapping the zone of annual fluctuation (e.g., shallow wells) and surface water sources (impoundments, springs, and even some major rivers) have been more compromised than

have deeper groundwater sources. The cumulative effect of several years of low precipitation, however, has also affected deeper borehole supplies in some areas.

Areas which derive drinking water from spring-capture systems are already experiencing reduced flows. This is especially true in Lesotho and Swaziland, but also affects the more hilly areas of other countries in the region.

Water tables are also dropping, especially where the water level is not deep. Thirty to 70 percent of dry wells are reported by UNICEF in some areas of Mozambique. There are also reports of people dying of thirst in Mozambique while leaving villages where all wells have gone dry.

Deep water tables are generally less affected by the drought. Still, in all of the countries visited, many deep boreholes have become dry. This condition causes especially severe hardship because most areas are already suffering from high pump breakdown rates.

There is almost no systematic data on the impact of the drought on water levels and flow rates. Without this information, it will be very difficult to target resources to areas with the greatest need.

2.1.2 Other Problems Affecting Water Supply and Sanitation

Throughout the region, structural and other chronic problems in water supply and sanitation are at least as great a cause of decreased levels of service as the drought. Especially in the rural areas (except, perhaps, in the special case of Botswana), a number of systems are not operating for such reasons as boreholes without casings or pumps, pumps in disrepair, a lack of money for fuel, silted-up weirs and impoundments, eroded dams, and trailer-mounted bowsers with bad wheel bearings. These conditions should be a primary concern of relief operations, i.e., rehabilitation of the existing infrastructure should be an important component of drought relief. It is most likely that as the dry season continues, there will be greater stress on currently viable water resources, exacerbating the existing threat to infrastructure.

Capital constraints (especially in foreign exchange), management inefficiencies, and a growing shortage of technicians contribute to the inability of the public sector to ensure reliable and cost-effective water supplies. Shortages of local currency for recurrent operations (e.g., salaries, fuel, transport) often limit the pace and effectiveness of front-line activities which are, in most cases, far from reaching national service-level targets. Botswana is probably an exception to these limitations.

A particular concern during the current epidemic is the high risk of HIV infection to field-level technical staff within national water supply agencies. In general, these individuals are young, (relatively) affluent, and mobile. There are already indications of a severe and growing problem in more than one country, at precisely the time when the drought response effort will place an increased burden on personnel resources.

Greater mobility of the general population may be expected in areas of food and water shortages. The associated potential for increased HIV transmission suggests that response plans for emergency water supplies should aim to minimize population movement. Such a strategy, however, would only offer potential preventative impact if a similar strategy is employed for food distribution.

Where a collaborative planning effort among government, donor, and NGO parties has been mounted (e.g., Malawi), more significant initial progress has been achieved in formulating a national response to the drought within the water sector than where government entities alone have assumed the burden (e.g., Zimbabwe, Zambia). On the other hand, the Government of Botswana, which has more experience in national-level drought planning and independent action, has proceeded relatively well in its water sector response.

2.2 Expected Developments

This section outlines expected developments in human populations, soil and livestock, and sanitation.

2.2.1 Human Problems

As improved water sources such as wells, boreholes, spring captures, and piped systems dry up, several things may be expected:

- Less critical uses of water will be sacrificed first. Gardening and then bathing will be reduced.
- People will begin using less water because of the extra effort required in carrying it over greater distances.
- People will start drawing water from "fallback" water sources within walking distance.
- In the worst case scenario, people will begin migrating to areas where water supplies exist.
- Diarrheal and other waterborne diseases are expected to increase because "fallback" sources are not as well protected from pollution.
- Scabies will increase due to reduced frequency of bathing.

2.2.2 Soil and Livestock Problems

Very dry conditions and extreme heat will deplete soil moisture below normal levels. This will have an impact on next year's crop. Unless rains are heavy and sustained at the beginning of the next rainy season, poor germination and plant growth can be expected.

The drought is also having a profound impact on cattle, due to lack of water and reduced grazing. Many areas were overstocked before the drought. Experience in other droughts shows that overgrazing can become an especially severe problem near the few watering sites which remain. Many livestock deaths can be expected.

Areas which experience low soil moisture and overgrazing become especially susceptible to soil erosion by wind and rain. In turn, erosion will reduce the water-holding capacity of the soil. The impact of the drought may be felt for many years, even if good rains return the following year.

2.2.3 Sanitation Problems

The impact of the drought on sanitation will be less pronounced than on water supply. However, it still may have important implications. Those with indoor plumbing may be unable to flush toilets as frequently as usual, and may not have access to dry toilets (pit latrines). Sewer systems may have difficulty maintaining enough flow to prevent solid materials from accumulating in sewer pipes and within treatment plants. The worst eventuality would be generation of hazardous methane from material in clogged sewer pipes. Lastly, persons using pit latrines should be unaffected, except for populations like those in parts of northern Mozambique, who use water to wash after defecation.

2.3 Country-by-Country Comparisons

Reliable quantitative data have not yet been assembled, however, the relative impact of the drought on the water supply and sanitation sector can be compared among the ten countries visited, according to a qualitative scaling procedure. This procedure considers two factors:

1. Level of **preparedness** of national structures to cope with consequences of a drought

   (1 = high preparedness level; 5 = low preparedness level)

2. Perceived **risk** to populations, based on both the gross number affected and the severity of the effect

   (1 = low level of risk; 5 = high level of risk)

Based on a five-point scale, with 1 representing the optimum score and 5 representing the most unfavorable score, overall threat of these two factors can range from 2 to 10.

Table 1

OVERALL THREAT BASED ON LEVEL OF PREPAREDNESS AND RISK

COUNTRY	PREPAREDNESS	RISK	OVERALL RELATIVE THREAT
Angola	4.5	1.5	6
Botswana	2	1.5	3.5
Lesotho	3	3	6
Malawi	3	3.5	6.5
Namibia	2	3	5
Mozambique	3	4.5	7.5
RSA	1.5	3	4.5
Swaziland	2.5	3	5.5
Zambia	4.5	2	6.5
Zimbabwe	4.5	4.5	9

Chapter 3

RECOMMENDATIONS

3.1 Introduction

The impact of the drought and appropriate responses vary from country to country. There are, however, general recommendations that apply to many or all countries in the affected region.

3.2 Drinking Water Recommendations

Recommendations relating to drinking water follow.

- The least expensive "new" water supply will come from conservation. Strict rationing should be implemented for all water systems for which the source of supply is threatened by the drought. This might be implemented through a combination of pricing, greater public awareness, and reduced hours of supply.
- For reticulated water supply schemes in cities and towns, authorities should lend demand reduction as much effort as supply augmentation. There is considerable potential to expand upon existing small-scale and fragmented approaches. Additional funds should be directed toward more coordinated planning, education, information, motivation, system leak detection, water conservation technology development, and consumer dissemination. More rapid rationalization of water-pricing structures—including appropriate cross-subsidization for low-income, low-demand consumers—should be achieved so that total revenues more closely approximate delivered costs. The experience in conservation policy and strategy that the United States could apply to this problem is unique among donors.
- Another lower cost source of water is available through repair of existing water systems, i.e., replacement of pumps and pipes, and from activation of unused boreholes.
- Within rural areas, where the capacity of public organizations to provide, operate, and maintain adequate systems is limited, donor assistance should focus on sustainability. Short-term, drought-related measures should not hinder the long-term process of developing community-based infrastructures for sharing operation and maintenance responsibilities. Wide experience with failure of water supply development designs based primarily on quantitative criteria (such as the number of boreholes installed per year) suggests that community-based approaches should be enhanced, notwithstanding emergency conditions.
- A drought presents opportunities as well as problems. The best time to dig new wells is when the water table is extremely low. This is due to the difficulty of digging below the water table. Wells dug during a drought period are unlikely to ever go dry. This

also makes it an ideal time to deepen existing wells. Digging wells is labor-intensive and therefore ideal for food-for-work programs. There are never enough sources of clean, plentiful water. A time of increased public awareness of water problems is an ideal time to expand a drilling or other water supply program.

- Novel, cost-effective, and equitable approaches to greater private sector involvement in water supply development should be encouraged. These initiatives should include enhancing the capacity for private sector drilling.
- As a last resort, water may have to be transported to people. Dedicated water trucks should only be purchased for carrying water over very long distances. Use should be made first of existing trucks—government, military, or leased—fitted with water tanks or bladders (these available with necessary harnesses in South Africa). The next best option is a water trailer pulled by a truck or tractor.
- Monitoring of groundwater levels, reservoir levels, and the flow rates of spring capture systems should be started in all areas affected by the drought. This will permit timely targeting of scarce resources to the most severe areas.
- The shortage of reliable, quantitative information for evaluating the impact of the drought on water supplies in specific locations (especially for remote areas) suggests an immediate need for better drought monitoring and rapid micro-assessment techniques. Only when the most severely affected locales and populations are clearly identified, and their needs prioritized and targeted, can scarce resources be allocated effectively. In some situations (e.g., Zimbabwe), a relatively prompt, decentralized effort could be mounted, combining provincial water supply staff and appropriate NGOs that possess the infrastructure to reach remote areas. Given the shortage of public sector technicians, such an undertaking could be made part of a more comprehensive technician training program.

3.3 Nonpotable Water Recommendations

Recommendations relating to nonpotable water follow.

- Efforts to improve soil conservation measures should be encouraged throughout the region. Planting of new trees, always an important task, is even more important during drought.
- Construction of small dams for livestock should receive serious consideration.

3.4 General Recommendations

General recommendations follow.

- The individualized responses of countries to the drought so far indicate the ultimate need for a regional approach to water resource planning in Southern Africa. With several country borders formed by major river systems and downstream users dependent on the actions of upstream users, future shortages present the potential for political conflict.
- In sum, the current drought should be viewed as an opportunity to address with greater resolve and resources the neglected needs for safe and reliable water supplies in Southern Africa.

Chapter 4

COUNTRY FINDINGS AND RECOMMENDATIONS

This chapter contains findings and recommendations relating to specific countries. Sections 4.1 through 4.6 describe the coastal countries visited; sections 4.7 through 4.10 describe the four inland countries.

4.1 Angola

4.1.1 Drinking Water

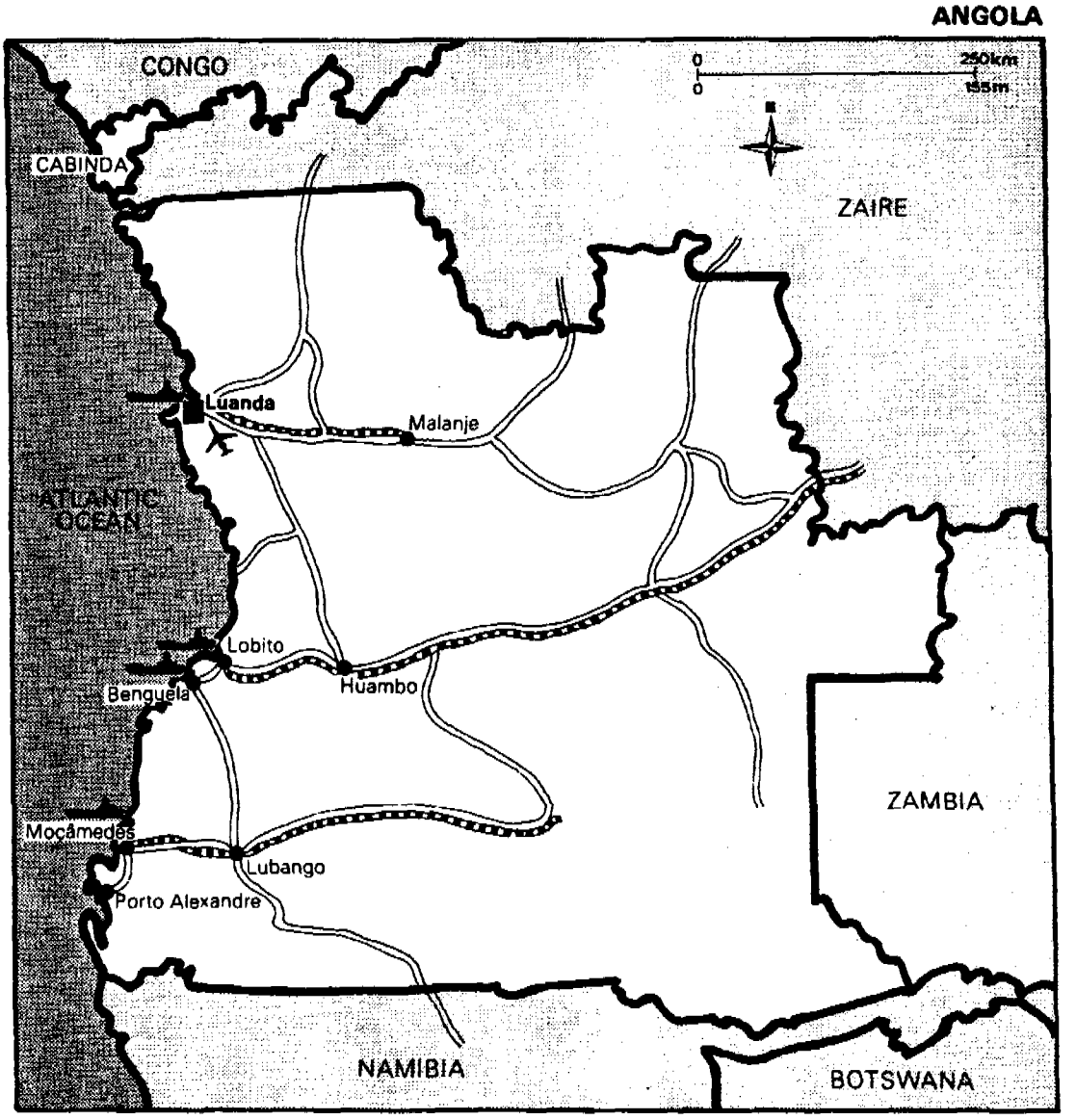
A project to drill and develop 20 wells in Jamba and two nearby villages was undertaken by the International Medical Corps (IMC) beginning in September 1991. Ten of the boreholes were to have been equipped with Lister diesel engines and Mono pumps and 10 were to have been fitted with handpumps. The project purchased a truck-mounted Atlas Copco Aquadrill 500. This rig uses an ODEX system composed of an eccentric reamer bit and pneumatic hammer which allows the overburden to be cased as drilling progresses. This technique prevents caving in of the hole walls.

Findings

The system proved incapable of drilling in the formation encountered. The casing supplied for the boreholes did not meet the specifications and was unable to withstand the force of the pneumatic hammer used to sink it. The fine sand and silt in the formation repeatedly jammed the drill bit. Under these conditions, the equipment was unable to drill the 50 to 60 meters required to meet the design yield.

In general, the gravel pack and well screen combination selected were not sufficient to keep fine sand from entering boreholes and very quickly wearing out the pump impellers. In addition, several of the wells produced to date have not been large enough in diameter to allow placement of an adequate gravel pack.

The Aquadrill 500 rig is inadequate for drilling in the Kalahari sands. Consultants have recommended that the project purchase a cable tool rig to replace the Aquadrill 500. In the past, Unita drillers have successfully used older cable tool rigs in the area.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CABINDA
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Luanda
Malanje
ATLANTIC
OCEAN
Lobito
Benguela
Huambo
ZAMBIA
Moçâmedes
Lubango
Porto Alexandre
NAMIBIA
BOTSWANA

Recommendations

- Provision should be made to provide safe, adequate drinking water in areas expecting in-migration. This is especially critical in light of the ongoing shigella epidemic. Donors should consider funding the UNICEF Emergency Water Supply Project, a program which has been developed to address this concern.
- Future well development in the Kalahari sands area should use a cable tool rig in place of the Aquadrill 500. The Aquadrill should be used elsewhere in the region where the formation permits. Wells should be large enough in diameter to allow placement of an adequate gravel pack. Extra care and expense should go into assuring that the size and uniformity of the gravel pack are adequate to prevent movement of fine sand into the well. This procedure will be cost-effective.

4.1.2 Environmental Sanitation

Visual inspection of housing near Likewa shows that the large majority of dwellings, including those of recent migrants, have a latrine. Housing and latrines are built with the assistance of area military authorities. They are built almost entirely with local materials. Pits must be reinforced with logs due to extremely sandy soil. A few structures have walls made of mud bricks, but the majority have walls constructed from grass and reed mats and lack roofs.

4.2 Lesotho

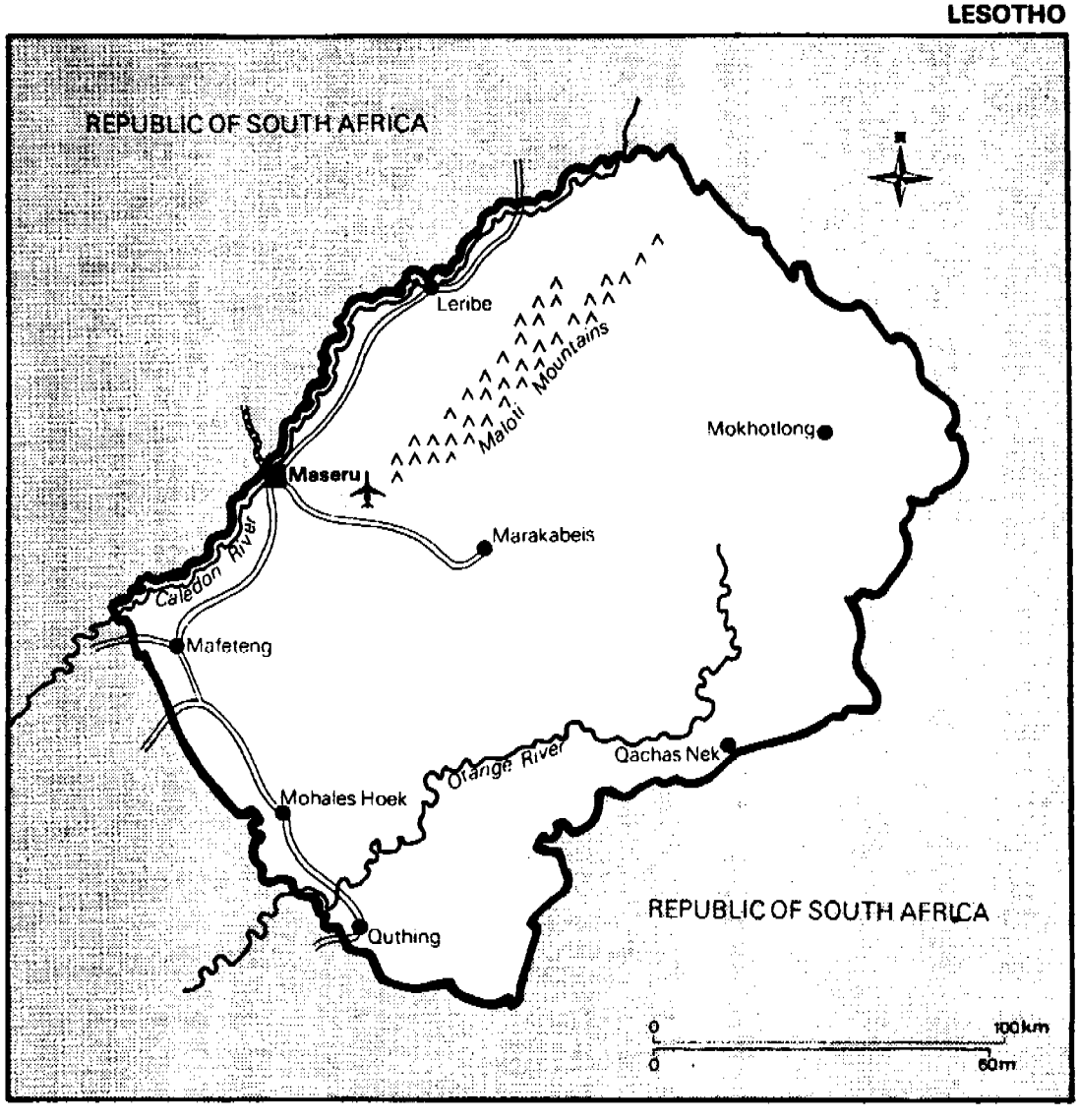
This section is based in part on meetings with Mr. Lesoeana, Chief, Village Water Supply Section (VWSS), and Mr. Pelepele, Chief, Water and Sewerage Board.

4.2.1 Urban Water Supply

Urban water supply is the responsibility of the Water and Sewerage Branch in the Ministry of Water, Energy, and Mining. The Water and Sewerage Branch has developed 13 piped drinking water supply systems, including those in Maseru and the 10 district capital cities.

Findings

The Water and Sewerage Branch indicates that they are facing critical shortages of water in 8 out of their 13 water systems and are already imposing rationing to conserve water. The situation in Maseru is especially critical. Water in the reservoir is sufficient to last only 70-80 days, and the river is almost dry. Groundwater resources in the Maseru area are very poor. The Water and Sewerage Branch intended to impose water rationing in Maseru by April 15 if significant rainfall did not occur.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Mohales Hoek
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REPUBLIC OF SOUTH AFRICA
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Recommendations

- Water rationing with strict enforcement should be introduced in all threatened areas at the earliest possible date.
- Counterpart funds from sales of donated food should be made available in case an emergency groundwater exploration and/or borehole drilling program is required in hard-hit areas.
- Potential means for bringing water from Ladybrand, RSA, for Maseru should be explored in case both surface and groundwater resources are exhausted in the near future.

4.2.2 Rural Water Supply

Rural drinking water supply is the responsibility of the Village Water Supply Section (VWSS) in the Ministry of Interior. The goal of VWSS is to provide 30 liters per capita per day (lcd). Water sources are to be less than 150 m from each household. For spring capture systems, the number of users per collection point is not to exceed 150. Boreholes are designed for a maximum of 75 to 100 users.

Approximately 70 percent of the rural water supply comes from spring capture systems and about 30 percent from boreholes. Spring capture systems have been funded by the British, Swiss, German, American, and Irish governments, and CARE, among others. Boreholes fitted with Mono or Moyno handpumps have been largely supported by the UN Capital Development Fund (UNCDF). Boreholes are drilled on a tender basis by private drilling companies. The VWSS estimates that just over 50 percent of rural households have access to improved water supply.

Operation and maintenance are largely the responsibility of district level staff. Village residents are responsible for notifying the district teams of a breakdown. The district aims to complete repairs within two weeks of notification, but response time averages three weeks. Based on notifications by village residents, it is estimated that 30 percent of the rural water systems are in need of repair at any given time. VWSS identifies lack of timely notification by rural water system users as a serious constraint on maintenance.

Findings

Seasonal reduction in the flow of springs is expected in the dry season of every year. (VWSS therefore monitors for three full years the yield from springs being considered for development of the drinking water supply.) However, Peace Corps volunteers are already reporting dry springs and boreholes during what would normally be the end of the rainy season. Reduced flow is causing problems in the district capital of Thaba Tseka. Many of the areas affected by this year's drought were also dry last year.

The Ministry of Health and rural residents are reporting a very large increase in the incidence of scabies, due to reduced quantities of water for bathing. The Ministry of Health is expecting an increase in typhoid and diarrheal diseases as people revert to traditional, unsanitary water sources. There does not appear to be increased incidence of these diseases at this time.

VWSS has not developed an emergency plan in response to water shortages caused by the drought. VWSS believes it would be possible, however, to move staff from lesser affected districts to more affected districts in response to an emergency drought.

Recommendations

- VWSS should develop a response plan emergency assistance. Monitoring of groundwater levels in boreholes and of flow from springs in reticulated systems should be started immediately to permit adequate response time in emergencies.
- Peace Corps volunteers should be requested to monitor the water situation by measuring yield and reporting dry systems.
- Counterpart funds from sale of donated food should be made available in case an emergency borehole drilling program is required in severely affected areas. Counterpart funds also should be made available, in the event of epidemics, for drugs to treat scabies, typhoid, or diarrheal diseases.

4.2.3 Urban and Rural Sanitation

Urban sewerage development is the responsibility of the Water and Sewerage Board in the Ministry of Interior. Sewerage systems exist only in the towns and cover only a small portion of the urban population. The Urban Sanitation Improvement Team (USIT), also within the Ministry of Interior, is implementing on-site sanitation in urban areas.

Rural sanitation is the responsibility of the National Rural Sanitation Program under the Ministry of Health. The program encourages construction of ventilated improved pit (VIP) latrines throughout the rural areas of the country. Coverage in 1990 ranged from 65 percent of households in the lowland areas to less than 10 percent in more remote mountain areas.

Findings

Drought may affect some of the urban sewerage systems if lower flow in sewer systems leads to deposition of material in the sewerage pipes. The drought is not expected to have a large impact on the urban latrine or rural sanitation programs unless manpower is diverted from latrine construction.

4.2.4 Soil and Water Conservation

The number of cattle and goats is thought to be as high as 40 percent above the carrying capacity of the land. Much terrain is hilly, and steep slopes are common. Violent rainstorms with heavy, highly erosive rainfall are common throughout the rainy season. Sheet and gully erosion are serious problems with deeply incised gullies dominating much of the landscape.

Findings

The extremely dry conditions, especially in the Mafateng, Mohale's Hoak, and Quthing areas, have had a severe impact on agricultural and grazing lands. Reduced soil moisture has made the land surface much more vulnerable to wind and water erosion when the next rains arrive in the spring. Overgrazing combined with this year's reduced vegetative cover will compound this effect. Land devastation by livestock is likely to be especially acute around the few surface water sources that do not dry up completely.

Recommendations

- Soil and water conservation activities are labor-intensive and therefore lend themselves to food-for-work programs as begun under Catholic Relief Services (CRS). However, food-for-work programs have been reduced to only 30 participants since CRS ceased such activities. Soil and water conservation should be greatly expanded on a food-for-work basis. These activities could include development of additional surface water supplies (check dams), prevention and repair of gullies (gully plugs), and tree planting.
- The numbers of cattle and goats should be reduced to sustainable levels.

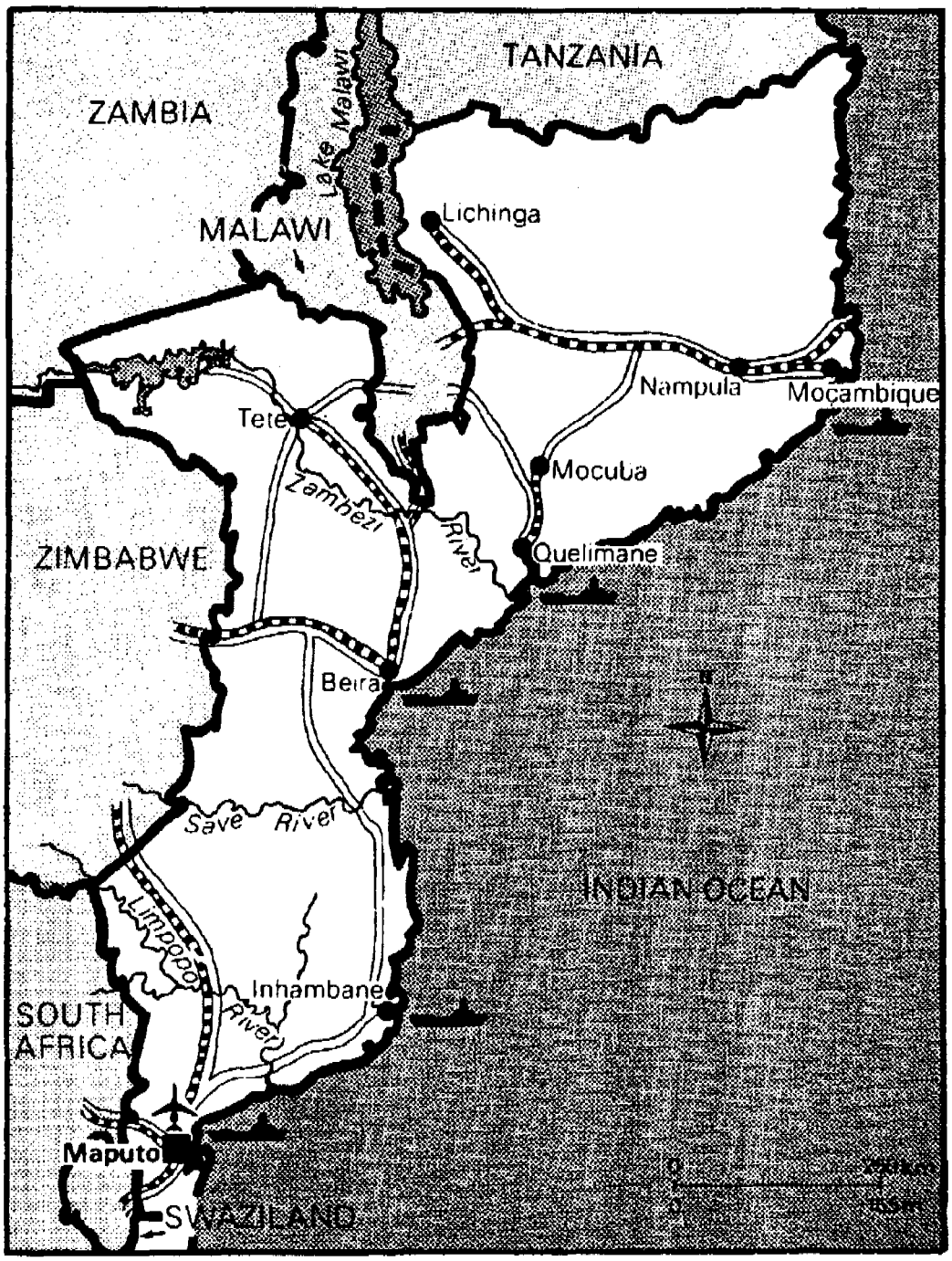
4.3 Mozambique

4.3.1 Urban Water Supply

This section is based in part on a meeting with Mr. Alvarinho, Chief, Department of Water and Sanitation, and a joint discussion with National Programme for Rural Water(PRONAR) and UNICEF.

The Department of Water Affairs under the National Directorate of Water is responsible for piped water supply systems in Moputo and 12 provincial capitals, or peri-urban areas. Moputu and eight provincial capitals are served from surface supplies (reservoirs and rivers) and the other four provincial capitals from groundwater. All systems are at least 30 years old. Water is supplied through a combination of house connections and standposts, designed to provide 20 lcd for a maximum of 500 persons per standpost. The maximum walking distance for a water bearer is 500 m.

MOZAMBIQUE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SOUTH AFRICA
Maputo
SWAZILAND

Urban growth is estimated at 4.5 percent per annum before 1985 and 8 to 13 percent since then. All water systems have been strained by age and increased population. Many standposts provide water to 1,500 or more persons; 30 standposts in Moputo provide water to 500,000 people. Water coverage in urban areas has officially dropped from 48 percent in 1980 to 25 percent in 1990. Water is now sold in the capital for 50 *meticais* per bucket. This is approximately 60 times the official rate paid by small volume users. Current revenues from the water systems pay for operational expenses but not maintenance.

Findings

Urban migration due to drought and war are straining peri-urban water supply systems at the same time that the systems themselves are overburdened by their age, lack of maintenance, and, in some cases, impending supply shortage. Three systems are currently threatened by the drought and may be out of water within a few months. In Chimoio and Quelimane City, reservoir levels are already very low and the Beira system, which provides treated river water, is threatened by salinity from the influx of sea water to the intake 60 km upstream from the city.

Recommendations

- The Water and Sanitation Department believes groundwater resources near Quelimane City can be exploited in the short term to provide water to the city until rain refills the reservoir. Groundwater near Chimoio is more problematic and will require extensive exploration. Geophysical exploration followed by drilling (by GEOMOC, the state water well drilling company) or by digging (by the provincial EPAR, the rural water workshop) should start immediately.
- The Water and Sanitation Department is considering building a small dam across the river below the Beira water system intake to reduce the flow of salt water upstream (sand bags were mentioned as an emergency measure). A feasibility study should be undertaken immediately. Damming should begin forthwith if it is deemed feasible. External donor assistance may be required.

4.3.2 Rural Water Supply

Potable water for rural areas is the responsibility PRONAR. Approximately 75 percent of the PRONAR budget comes from external assistance; UNICEF provides the largest portion (45.4 percent). Rural coverage of potable water has grown from 6 percent in 1980 to nearly 30 percent in 1992. The wells are planned for 500 persons per well and the maximum walking distance is 500 m. Wells are expected to provide at least 20 lcd. Geophysical capacity seems adequate: the reported drilling failure rate is only 5 percent.

PRONAR has an estimated capacity of 1,250 wells per year (including hand-dug, hand-drilled and machine-drilled wells). Nearly 75 percent of all wells are dug by hand. Maximum production was 1,066 in 1989. Current funding will allow production of 850 wells this year.

The handpump program is in transition. Village teams have had difficulty maintaining locally made Mark II pumps. The program is now changing to Afridev (imported from India) and deep-well Volanta (imported from the Netherlands).

Findings

The proportion of dry wells in some areas of Gaza, Manica, Sofala and Inhambane provinces ranges from 30 percent (according to UNICEF) to 75 percent (according to GTZ). According to ICRC, people have died of thirst while fleeing war and drought. As wells dry up, less protected backup sources will be used. The potential for exposure to waterborne diseases (including cholera) and to bilharziasis will increase as people resort to poorer-quality water.

Recommendations

- PRONAR, with UNICEF assistance, has developed a project proposal for emergency drought relief in the hardest-hit areas. This proposal concentrates on drilled wells because the most severely affected areas have groundwater levels too deep for hand-dug wells. A four-year proposal has also been developed for Inhambane province. Donors should seriously consider proposals that would fund well drilling and digging up to PRONAR's annual existing capacity of 1,250 wells.

- The dropping water tables provide a rare opportunity to deepen existing wells. This improvement will not only augment existing supplies but will also make them drought-proof when the water tables drop again. Hand-dug wells lined with concrete rings can be deepened by digging out below the rings. Rings of the same diameter can be added at the top as the existing rings slide down. Wells lined with materials other than concrete rings can be deepened by inserting smaller-diameter concrete rings inside the existing lining where possible. Unlined wells should be deepened and lined with concrete rings.

- Extensive well digging should be undertaken on a food-for-work basis in areas where well water table depths permit. All wells should be lined with concrete rings made at or near the site. Ring making is an ideal food-for-work activity because it is labor-intensive, provides short-term as well as long-range benefit, and does not require expensive, difficult-to-learn equipment or skills. Hand-dug wells are also preferable because water can be withdrawn with a rope and bucket when the handpump is broken down. This is not possible with drilled wells.

- Emphasis should be on digging and lining wells rather than handpump installation. The government should install handpumps at a later date with the participation of users.

Experience shows that long-term maintenance of handpumps is extremely difficult without extensive training and participation of users at time of installation.

4.3.3 Urban and Rural Sanitation

The predominant form of improved sanitation in Mozambique is the pit latrine. Exceptions to this are the sewerage systems in Moputo and Beira. Moputo sewage is treated in a lagoon system. The bulk of Beira sewerage is discharged to the sea without treatment.

In 1990, PRONAR/UNICEF estimated that 20 percent of rural households had access to pit latrines. Figures for urban households were unavailable.

Findings

As the drought intensifies and protected water sources become dry, it is expected that the inadequate sanitation will lead to higher incidence of diarrheal diseases. Alternative water sources such as streams, ponds, and dams are easily polluted by defecation in or near the sanitation facilities.

Recommendation

Food-for-work teams should dig pit latrines for individual households when delivery of materials causes delays in well production. Designs should use locally available materials and building techniques.

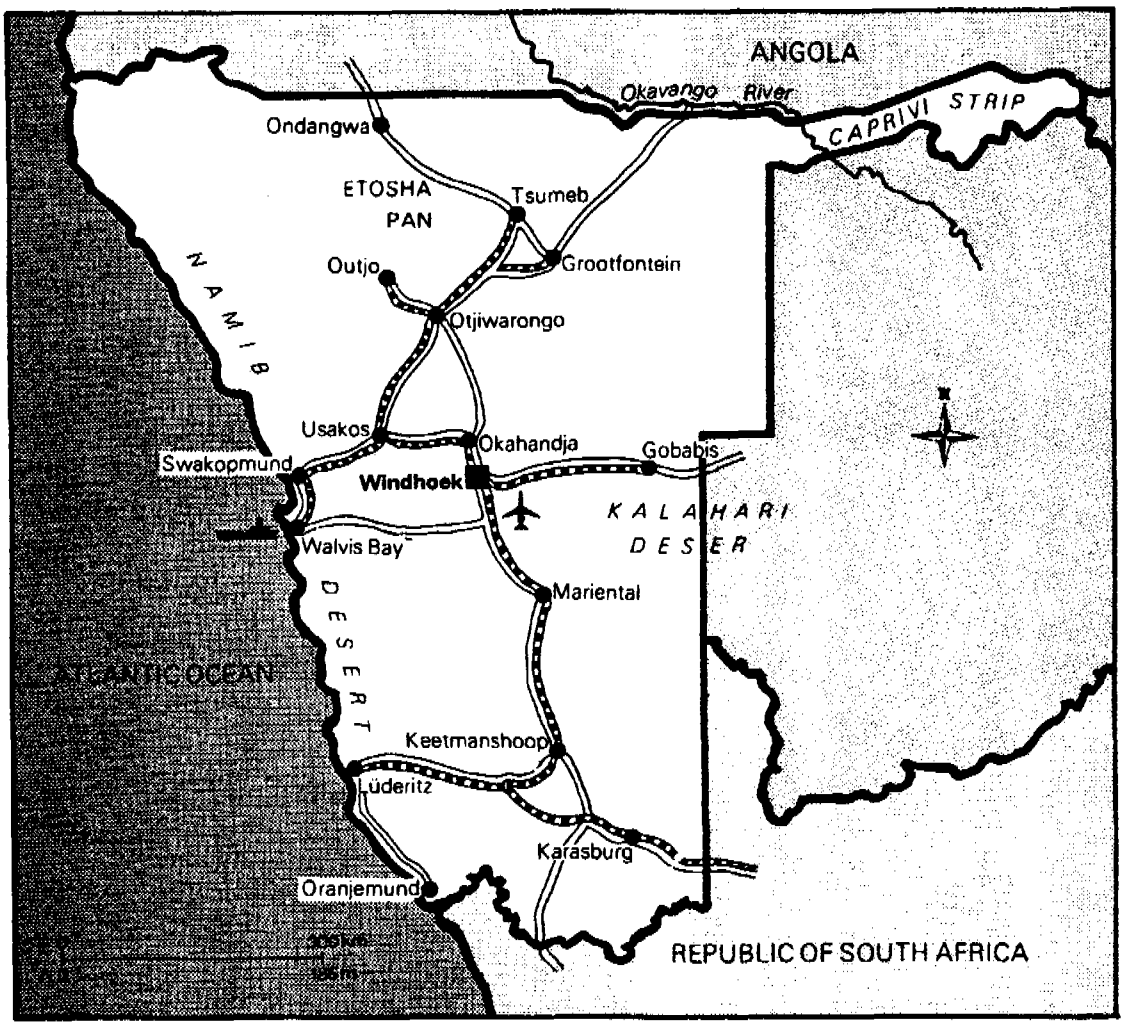
4.4 Namibia

4.4.1 Hydrology

Mean annual rainfall in the country ranges from less than 50 mm per year in the western region to more than 700 mm per year in northeastern Caprivi. A critical feature of the rainfall pattern is extreme annual variability. Deviation in rainfall may be as high as 80 percent in the southwest to 20 percent in the wetter northeast.

Most of the northern regions of the country experienced heavier-than-average rainfall during October, November, and December, 1991, encouraging many to expect a very good agricultural year. Accordingly, planting was very heavy during that period. Rainfall during January, February, and March, however, was as little as 20 percent of normal, and air temperatures were extreme in January and February. These two factors led to very heavy crop losses.

NAMIBIA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Gobabis
Swakopmund
Windhoek
KALAHARI
DESERT
Walvis Bay
Mariental
DESERT
ATLANTIC OCEAN
Keetmanshoop
Lüderitz
Karasburg
Oranjemund
REPUBLIC OF SOUTH AFRICA

4.4.2 Overall Water Development

Namibia has 126 state bulk water supply facilities throughout the country. These supply about 82 million m^3 of water per year for domestic, irrigation, and industrial purposes. Total investment in the water supply system is estimated to be R1.5 billion. Annual demand is expected to grow to 400 million m^3 by the year 2005.

4.4.3 Urban Water Supply

Urban water supply is the responsibility of the Department of Water Affairs. Coverage in urban areas is estimated at nearly 100 percent. In 1969, Windhoek became the first city in the world to circulate purified sewage water. The reclamation works can supply as much as 1.5 million cubic meters of water to the city annually.

4.4.4 Rural Water Supply

The provision of drinking water in rural areas of Namibia is officially the responsibility of the Department of Rural Development, although in practice many functions are still carried out by the Department of Water Affairs. It is estimated that 30 percent of the rural population has access to clean water, but it is not unusual for families to spend one to three hours per day carrying water. The department believes that access to safe water would eliminate up to 50 percent of common diseases.

The main objective of the Rural Water Supply program is "provision and maintenance of access to safe drinking water for an additional 18 percent of the rural population by 1996." Additional funding of $5,000,000 is sought to achieve this goal.

4.4.5 Rural Sanitation

The team visited the Ovambo and Kavango regions in the north and Mariental and Namaland regions in the middle south. Access to rural sanitation varies from region to region in the country. Overall access to adequate sanitation is estimated at approximately 10 percent.

4.4.6 Northern Regions

4.4.6.1 Ovambo Region

The chief source of water for both rural and urban communities is the pipeline-canal system bringing water from the Cunene River in Angola. The river water is pumped across the border and treated at Eunda prior to distribution. The treated water passes through a pipe network covering much of the northwest and central part of the region. The treated water is used for all purposes (household, livestock, gardening, construction, etc.) by persons living near the pipeline.

There is also an extensive network of boreholes equipped largely with pumps powered by Lister diesel engines in the eastern and western parts on the region. A significant percentage of these, however, is either not used or is temporarily out of service. Groundwater in the central part of the region is believed too saline at all depths for most purposes.

Those who live far from either the pipeline or a borehole dig shallow wells and draw water with a rope and bucket. As many as 10 of these wells, dug by various persons at different times, exist side by side in natural shallow depressions. Although the groundwater is generally too salty either for humans or livestock, a layer of fresh water derived from rainfall overlies the saline water. In years of high rainfall, this layer is quite deep and may last the entire season. The bottom portions of the wells are lined with logs; they take three to five weeks to dig, depending on the number of diggers. High school students living in dormitories sometimes assist in the digging. These wells are "owned" by the individual or family that initiates the digging and most are locked to restrict use to certain people or hours of the day.

Persons living near the pipeline have adequate quality water. Quantity is limited only by the distance it can be carried. A few people reportedly spend up to three hours walking to the pipeline from areas where other sources of water are unavailable. A 1990 UNICEF study estimated that the average dry season time devoted to carrying water in rural areas of Ovambo is 102 minutes per day. The same inequality of access (and thereby quantity) is likely to apply to boreholes.

People who live far from the pipeline and get water from shallow wells are experiencing great difficulty due to the shallow layer of fresh water this year. In all wells visited, only one was still yielding fresh water, and the owner placed it under severe use restrictions for conservation.

Grazing pressure is very heavy near the pipeline. Large numbers of cattle, goats, and donkeys are walked to the pipeline and watered. Unfenced areas along the pipeline are largely devoid of vegetation. Although the team did not visit boreholes, it is reasonable to assume that the veld near them is similarly in very poor condition.

4.4.6.2 Kavango Region

The main source of water in the region is the Kavango River, which forms the northern border of the region and divides Namibia from Angola. Domestic water is carried over long distances from the river. Livestock are walked to the river, thus limiting available grazing land to that within reasonable walking distance of the river.

There is also a 10-square-km^2 grid of boreholes in the northern part of the region. Each is equipped with a pump, Lister diesel engine, and storage tank with taps. The southern part of the region has very few boreholes and is therefore not used for farming or livestock production.

The river is currently higher than it has been in many years; the headlands are in a region of Angola that has received very heavy rainfall this year. This should generally improve the river

water quality, although the local hospital reports a diarrhea outbreak among those drawing drinking water from the river. No typhoid or cholera has been reported.

4.4.7 Southern Regions

The southern regions of the country are perennially dry. Government officials did not indicate that this year's drought would have a major impact on the supply of drinking water in these regions. Most drinking water is derived from deep boreholes which are not affected immediately by reduced rainfall levels. A few people living near rivers take water directly from these sources. The most severely affected condition is water for livestock.

General Findings

The Department of Water Affairs has a shortage of hydrogeological and geophysical expertise in their regional offices. This is a severe impediment to quick response to drought emergencies in the field. There is an immediate need for staff for the next year.

Several communal areas will be out of drinking water in the near future due to dry wells or increasing salinity of the groundwater (e.g., the central Ovambo region). In response, the Department of Water Affairs is planning an emergency drilling, water transport, and pipeline extension program. Water tanks, trucks, and trailers, 5,000-7,000 liter water bags and water piping are needed immediately.

Recommendations

- The U.S. Peace Corps in Namibia should consider a worldwide appeal to volunteers with appropriate qualifications who might be finishing projects in other countries in the near future and would be willing to transfer to Namibia for a period of one to two years.
- The USAID Mission in Namibia should investigate the possibility of bringing water tankers/trailers, water storage equipment such as bags and tanks, drilling rigs, geophysical equipment, and water pipes from surplus Defense Department equipment in Europe. This should be implemented in such a way that internal shipment costs are incurred by the Namibian government and not by OFDA.

4.5 Republic of South Africa

The team visited Operation Hunger feeding sites in Lebowa homeland and in squatter settlements adjacent to Hoopstad and Blomfontain Orange Free State (OFS) in South Africa.

Findings

Areas visited in Lebowa were served by boreholes fitted with handpumps and by surface water supplies. The squatter area near Hoopstad OFS was divided into plots approximately 10 by 20 m. Each plot was supplied with a water tap. At the temporary squatter area near Blomfontain, one tap was serving 250 families. Operation Hunger installs wells using a cable tool rig and equips them with handpumps. Surface water supplies throughout much of the area have dried up due to lack of rainfall. We heard anecdotal evidence of wells which had become dry due to falling water tables.

Recommendation

Operation Hunger's cable tool well drilling operation should be supported (and expanded) to increase water supplies to the most afflicted areas. This is a simple and relatively inexpensive means of increasing wells in the affected areas.

4.6 Swaziland

Mr. Mphamali, Director, Water and Sewerage Board, and Mr. Napolean Ntezinde, Rural Water Supply Board, were sources for this section.

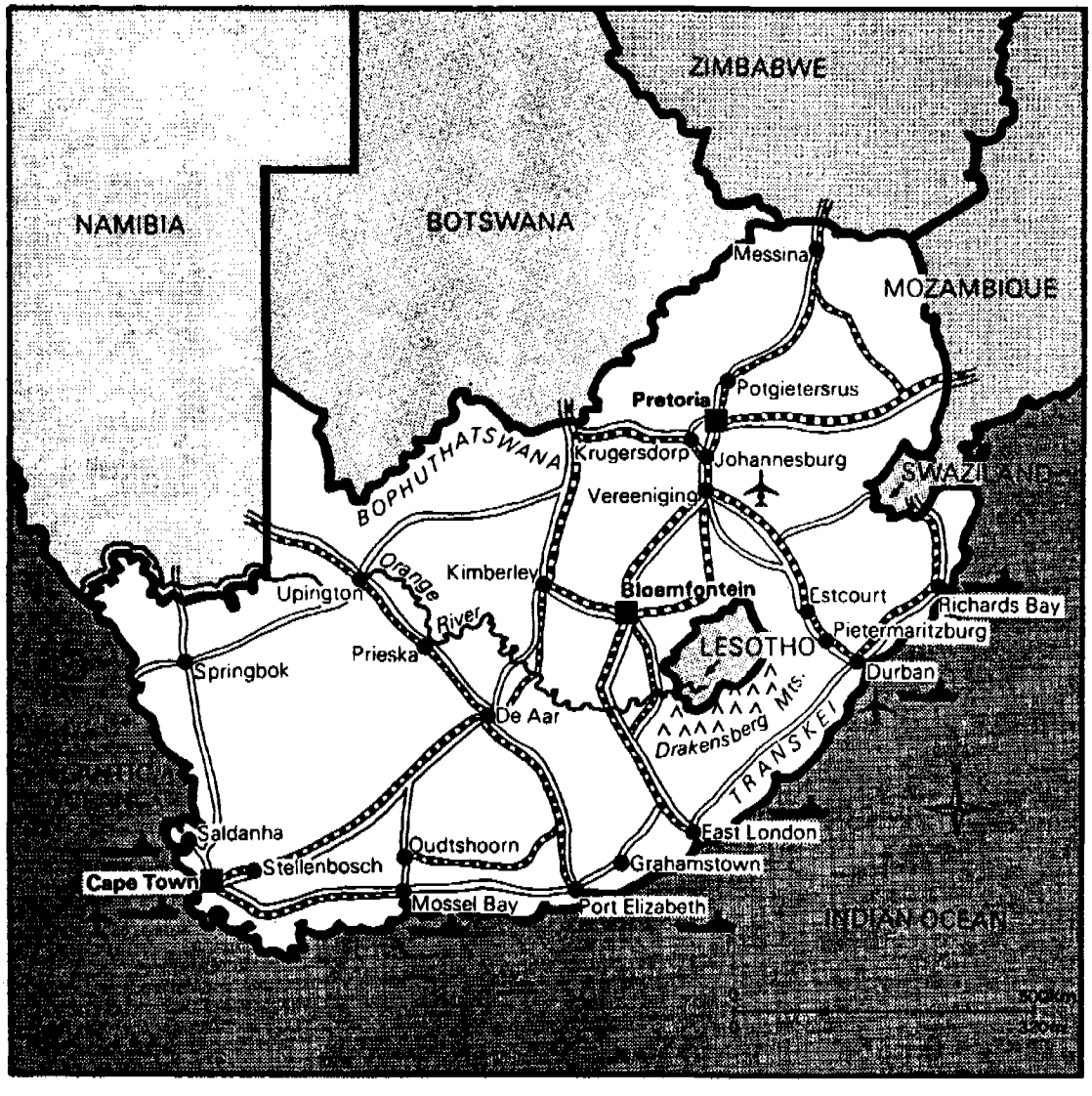
4.6.1 Drinking Water

Drinking water in Swaziland is derived from a variety of sources. All major towns have piped water supply systems, as do a number of rural areas. Many rural dwellers are also supplied by wells equipped with handpumps and some depend upon rivers, streams, ponds, and dams as sources of water for drinking, cooking, and washing.

Findings

The government is expecting shortages of drinking water throughout the country, with the low veld areas the most severely affected. Although groundwater levels are dropping, it is expected that those who depend on surface water supplies will also be seriously affected. Many springs along the Lobomba escarpment have dried up entirely or are experiencing greatly reduced flow. Urban areas which are expected to be the most affected include Siteki, Lomahasha, Lubuli, Lavumisa, Piggs Peak, and Hliti. Rural areas with water shortages include Maphumangwane, Mambane, Siphofaneni, Groorydon, and all border posts.

SOUTH AFRICA



A part of the team visited the Lomahasha area and found the borehole almost dry. All town residents, school children, the health clinic, the agricultural post, and large numbers of cattle depend on one nearby dam for all water needs. Total rainfall in the area since October 1, 1991, has been 40 percent of the comparable period in the 1990-1991 rainfall season. Rainfall in the January-March period has been only 20 percent of the 1991 level. Unless there are unseasonal rains, it is unlikely the water in this dam will last through the entire dry season.

The Water and Sewerage Board and Rural Water Supply Board are both preparing emergency drought response plans for the government. For rural areas the plan includes augmenting the existing drilling plan in areas of food shortage. In urban areas there are several interventions planned. A request will be made to revive old, inactive wells which are under the control of the Department of Geology and Mines. Where possible, these will be equipped with new electric pumps. There also will be a request to the government for purchase of 20 water trucks. These will be used to fill existing concrete reservoirs to maintain urban supplies.

Recommendations

- The government response of increased drilling and reactivation of existing wells is an adequate intervention to the extent that the additional supplies make up the actual shortfall in drinking water. It should be supported.
- Water transport by trucks will almost certainly be required not only for urban areas but for rural regions, too. Purchase of new water trucks should be evaluated in terms of long-term government needs. If truck transport is required only for the duration of this drought, the option of leasing trucks or equipping existing government or military trucks with water tanks on an emergency basis should be evaluated.

4.6.2 Irrigation Water

The chief water users in low veld areas are the large sugar cane producers. These estates irrigate extensively using predominantly spray techniques.

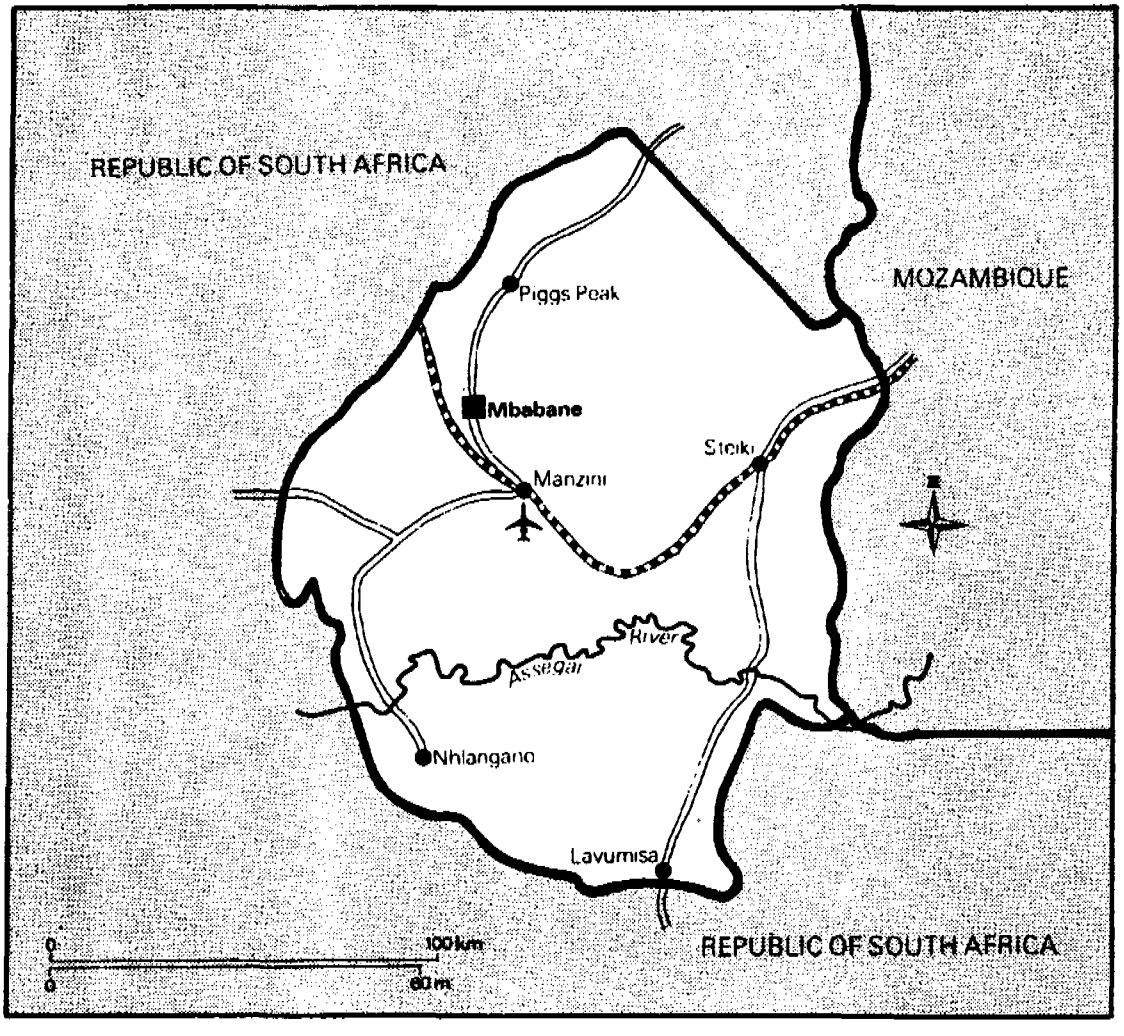
Findings

Due to supply shortages, the government has reduced quantities of irrigation water available for sugar cane irrigation by 50 percent. During field trips to the low veld areas, it was noted that most sugar cane was being irrigated during the height of the afternoon heat.

Recommendation

To the extent possible, sugar cane should be irrigated at night and during times of lower potential evapotranspiration.

SWAZILAND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REPUBLIC OF SOUTH AFRICA

4.6.3 Sanitation

Findings

The Water Supply and Sewerage Board is responsible for the five large urban sewerage facilities that serve 30 percent of the urban population of the country. Figures for pit latrines were not available for urban or rural areas, but visual inspection showed that latrines are used in all areas of the country.

As the drought intensifies and protected water sources become dry, it can be expected that existing sanitation facilities will reduce the incidence of diarrheal diseases. Disease transmission may continue in areas where alternative water sources (streams, ponds, dams, etc.) become contaminated.

Recommendation

The diarrheal disease situation should be closely monitored so that adequate supplies of oral rehydration salts and medicines are available and consultation is provided to mothers of children with diarrhea.

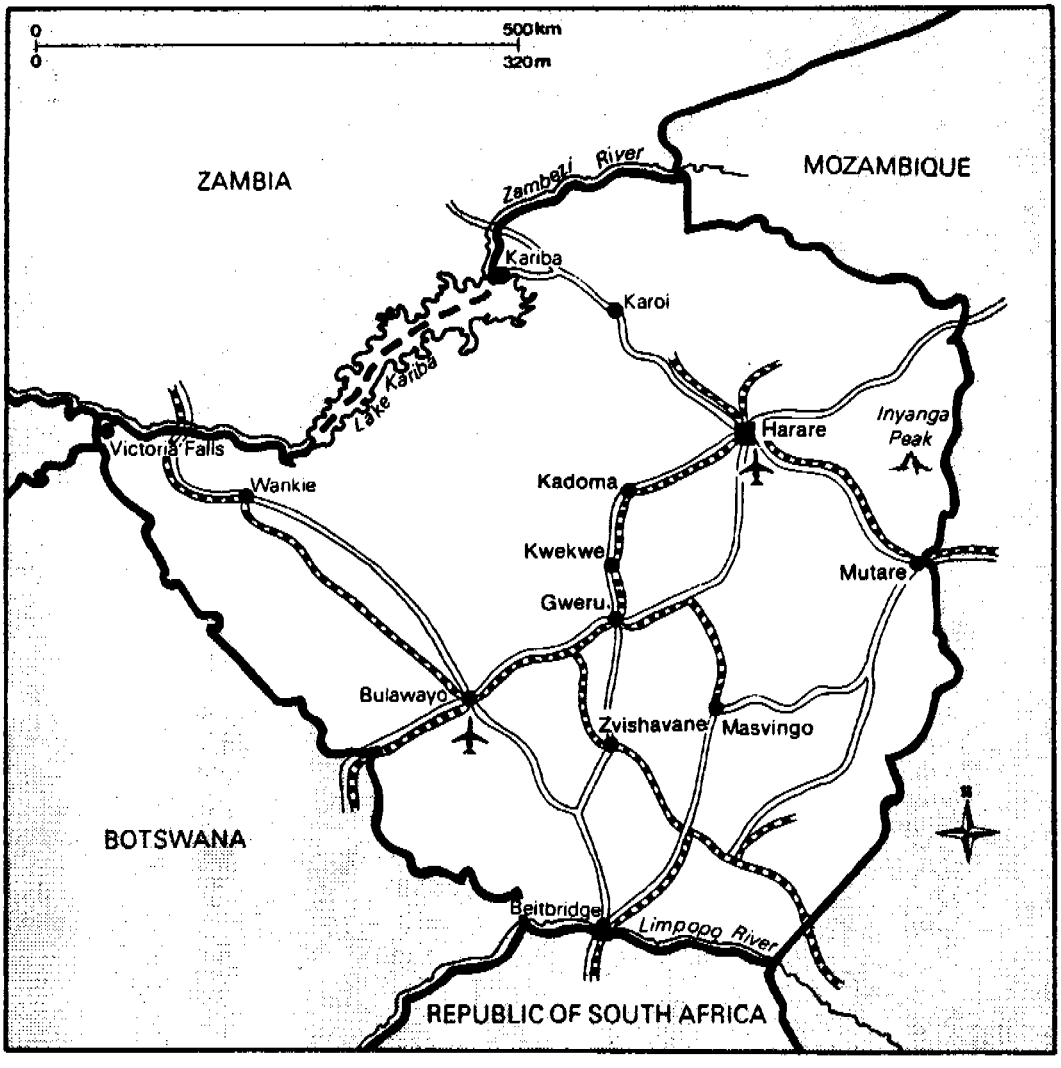
4.7 Zimbabwe

The absence of reliable information at the central government level has precluded a detailed quantitative assessment of the problem. Facts must be separated from hearsay. Reliance on informal techniques has been necessary. The drought has caused widespread crop failure, low water levels in numerous surface impoundments, and downward pressure on livestock prices. Still, considerable variation even in the availability of surface water resources is evident. Within the regions, there have been significant microclimatic effects from patchy rainfall distribution.

Government estimates are that two major towns (total population 100,000) and 20 smaller urban centers (population unavailable) are in immediate danger. The most adversely and widely affected zones are the communal areas of Matabeleland South and Masvingo Provinces (mostly less than 1,200 meters elevation). There is a minimum population of 100,000—and potentially many more—at immediate risk. In addition, the low veld areas of the northeast in parts of Mashonaland are significantly affected. In these lower regions, shortages result primarily from the cumulative effect of poor levels of precipitation over several years, exacerbated this year. In Manicaland, where there is a higher average rainfall, supply interruptions are more to blame for this year's especially dry conditions.

Since Zimbabwe relies heavily on surface water, its groundwater has not been well studied or documented. This is particularly true in the outlying communal areas of Matabeleland and Masvingo. Anecdotal evidence indicates, however, that water levels in boreholes and dug wells east of the Kalahari sands have experienced a continual decline in recent years. This year's poor rainfall most likely has not yet affected these sources. The government reports that 25

ZIMBABWE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Mutare
Gweru
Bulawayo
Zvishavane
Masvingo
BOTSWANA
Beitbridge
Limpopo River
REPUBLIC OF SOUTH AFRICA

percent of the 23,000 boreholes and deepwells supplying the communal lands and resettlement areas are dry. Perhaps half of these dry sites have resulted from the past two years of drought.

Findings

In comparison with the three other inland countries visited during this mission—Malawi, Zambia, Botswana—the impact on water supplies in Zimbabwe has been more severe, in terms of both the level of preparedness and the risk to the population.

Effects have varied in town and urban water supplies. A review of two dozen reticulated systems in Matabeleland North and South indicates shortages in about half. (See Appendix E.) Of this amount, at least 15 percent result from deferred maintenance and are unrelated to the drought. Perhaps half are the result of the cumulative effects of previous low rainfalls. Rationing and conservation programs are in effect in the most seriously affected centers, with price-induced limits of 12 m^3/month per household, regardless of size. In Bulawayo, the lack of control over institutions, the widespread distribution of private boreholes, and uncontrolled abstractions for agricultural use have limited the impact of conservation to date. Therefore there is opportunity in some reticulated systems for further demand-side intervention.

In Masvingo Province, the most serious, concentrated impacts may result from water cutbacks on irrigated land, where mass layoffs were expected by May 1. The anticipated furlough of 6,500 workers would deprive a population of more than 50,000 of its main source of income in an area with few other economic opportunities.

It is evident that deteriorating service levels—especially in the rural areas—frequently result from chronic, structural problems related to the sustainability of otherwise viable sources (e.g., pumps in disrepair, boreholes not fitted with pumps, shortages of casing and rising main). Local experts estimate that hundreds of boreholes are not equipped with pumps. At least 100 are fitted with unserviceable pumps. Three hundred trailer/bowsers are out of service due to bad wheel bearings. Major donors are concerned lest an infusion of emergency relief for capital procurement—items such as drilling rigs—and an overemphasis on quantitative targets (e.g., number of new boreholes drilled) overwhelm slow but steady progress in developing community-based strategies. Such strategies clearly address the relative responsibilities for operation and maintenance between the government's executing agencies and the communities.

The National Action Committee (NAC), an interministerial body set up in 1985 to coordinate Water Decade activities, has been designated the point agency in developing and implementing the government's policy on the drought and for management of water resources. On the one hand, this policy could strengthen the NAC in the long term. On the other hand, the absence of donors and front-line NGOs from the core planning effort inhibits the government in formulating a rapid, focused, and coordinated response to the deteriorating situation. To date, the NAC has been ineffective in establishing priorities and setting realistic targets for the most severely affected populations and areas. Furthermore, the performance

of the government during a drought emergency response effort assisted by NORAD in 1985 showed significant weaknesses both in planning and implementation. There is no evidence that the structural causes of these problems have been addressed and remedied.

IDA will initially fund a $10 million Rural Water Rehabilitation Component of IBRD's Emergency Drought Recovery Project. The component, it is estimated, could reach a population of 1.5 million. It includes a potential $3 million buy-in by SIDA and CIDA.

A critical need the IBRD proposal does not address is improved assessment and monitoring of the actual impact of the drought on water supplies in the field. The lack of a systematic and reliable system that includes direct inspection by technically trained staff hinders detailed drought response planning for the cost-effective allocation of scarce resources.

Drought recovery can be expected to last several years, as long as there are emergency needs. The IBRD project envisions a centrally-executed response in the water sector to ensure rapid implementation. Currently, the water sector suffers from too much central planning and implementation.

Recommendations

- The most effective drought response in Zimbabwe may be viewing the current crisis as an opportunity to invest more resources in a sector that remains chronically underfunded and poorly managed. In the long term, this means building up the implementation capacity of the private sector and the supervisory, monitoring, and community mobilization skills of the public sector, assisted by NGOs where appropriate.

- The immediate response should restore service to the already existing water supply infrastructure and install new boreholes in critical, targeted areas. New installations should emphasize, for the sake of rapid mobilization, government-supervised private sector contracting. The thrust of the Rural Water Rehabilitation Component is in line with the other recommendations of this mission. It is believed, however, that additional financing will be required to reach the number of people desired.

- Given the deficiencies in the IBRD plan, donors and the government should consider a rapid, yet detailed *field-based* assessment of the most affected regions. Further assessment should be made in other regions, in descending order of critical impact, and include a geographically extensive sample of water supply points. Implementation could be by joint teams of the government and NGOs working in the water sector. It is believed that a country-wide assessment could be completed within two months.

- Given the overemphasis on central planning, mechanisms should be put in place over the medium term to enable the government's decentralization policy. The development of technicians and managers at the district level needs to be encouraged as a component of any recovery project that looks beyond the immediate season. Involvement by NGOs in addressing local training needs should be considered.

- A comprehensive urban water conservation strategy should be formulated and implemented on a national scale. The small effort in Bulawayo is an encouraging start. What is lacking is a national commitment to urban demand reduction at least as great as supply augmentation. Such a commitment requires financial resources and better organization. The U.S. experience has shown that significant benefits can result from a conservation policy. The IBRD project has proposed an urban conservation component. A donor should be identified.

- The Disaster Mitigation component of the IBRD Drought Recovery Project should be supported. Two elements of that component have important links to the water supply and sanitation sector: Emergency Preparedness and Accelerated Urban In-Migration Contingency Planning. Donors should consider technical assistance in both areas (e.g., an emergency preparedness plan should contain an evaluation and identification of underutilized water supply points in district centers). This exercise must be combined with an analysis of logistical requirements, resources, and constraints for the bowsering of water to isolated areas if and when necessary. Such a plan should seek maximum use of private sector capacity. Also, appropriate water supply and sanitation options, together with implementation mechanisms, need to be identified for fast-growing peri-urban areas. Potential donors should be able to obtain the requisite expertise for planning and training on short notice.

- The capability of NGOs and international agencies to assist with field-level implementation of new and rehabilitated water supplies should be assessed. In cases where the local desire to proceed with projects is hampered by lack of experience, low-risk pilot projects administered by one entity should be used to test local capabilities. The most appropriate project types for NGO involvement would include community-based, small-to-medium-sized earth dams and shallow wells. Africare and UNICEF are among the organizations in Zimbabwe that have expressed interest in greater involvement in water and sanitation sector activities. The procurement capabilities of UNICEF should also be considered.

4.8 Malawi

Findings

The joint government-donor-NGO Water Task Force estimates that approximately two million Malawians will be severely affected by lack of water during the current drought. The most severe impact has been on rural groundwater supplies. Although statistically reliable data are not available, a recent survey in one refugee camp (Mwanza District) indicated average daily per capita consumption rates of 5-8 liters, down from a wet season norm of 25 liters and a dry season norm of 10-15 liters.

In general, the nonrefugee population does not enjoy better water supply conditions than the population of this camp. Based on field observations, it is estimated that 50 percent of the

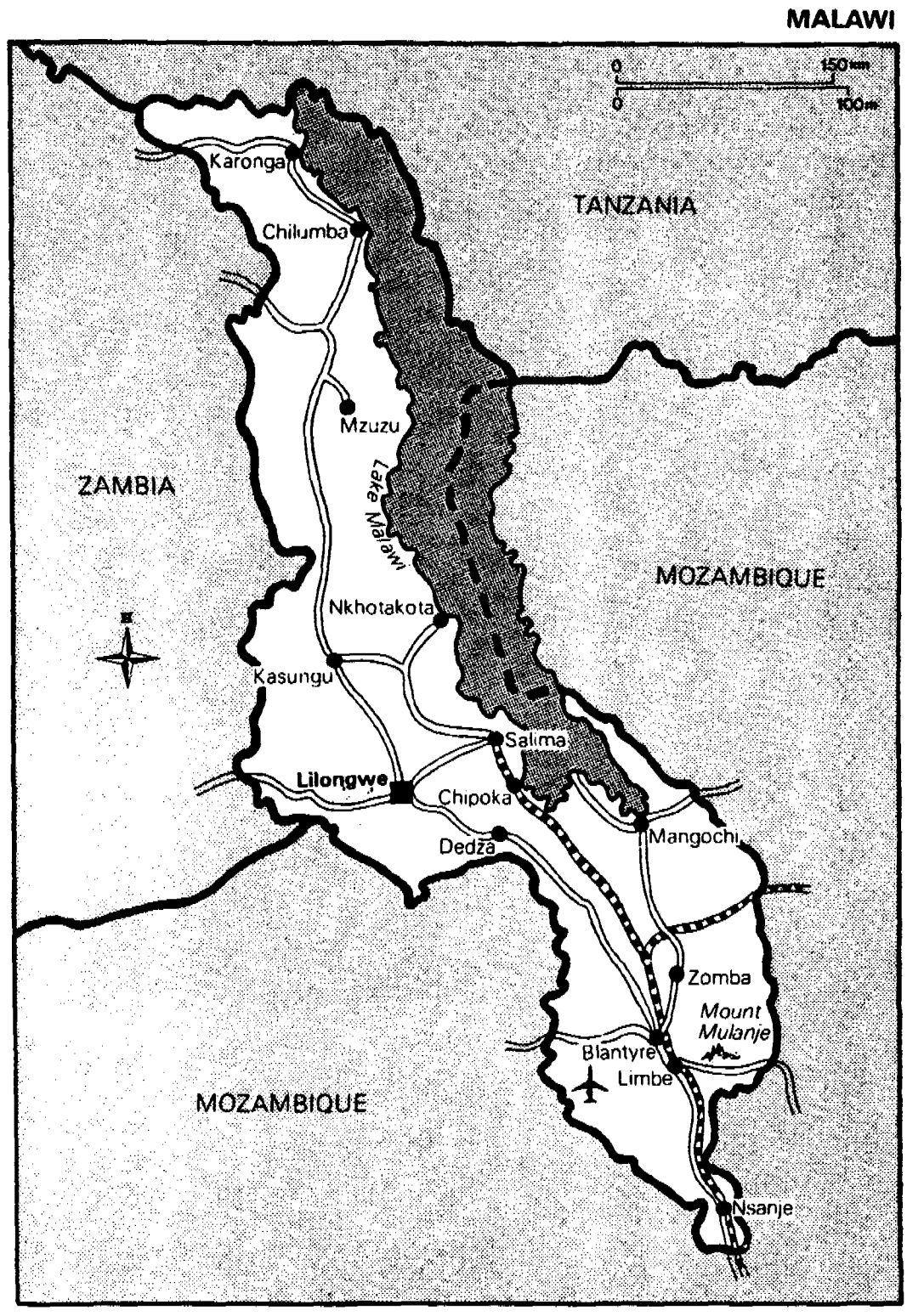
shallow wells (about 2,000) may be put out of service. Forty percent of existing boreholes (about 3,500) are unproductive and need rehabilitation, many because of inoperative pumps. Although pump problems are not in all cases related to the drought, more serviceable boreholes are important for increasing yields. Surface flow measurements indicate that perhaps more than 30 percent of gravity-piped systems also will be shut down, compared to over 15 percent last year.

Urban supplies are less critical, but conservation may be required nonetheless. No cutbacks in allocations to irrigated facilities, which are not of major economic importance in Malawi, have yet been noted. Mass unemployment, as a consequence, has not occurred to date. Any substantial migration, however, could be expected to adversely affect the already high incidence of HIV sero-positives within the population. A problem of lower priority is that water levels in Lake Malawi are approaching lows recorded in 1983-84.

The Water Task Force of the Drought Response Technical Committee has collaborated in an intensive effort to identify the dimensions of the problem and to set priorities and action targets. Although the estimates may be conservative and more work is required, a reasonable and logical plan is in place. The immediate program calls for an investment of $13 million for new borehole-handpump development (60 percent), borehole rehabilitation (30 percent), gravity-piped systems upgrading (6 percent), and shallow well construction (4 percent). This investment would enable the government to reach its design specifications for rural service levels for the severely affected population.

To target the most severely affected areas (primarily in the South), IBRD has proposed reprogramming funds under an existing project for the rehabilitation of 1,050 boreholes in the North and Central regions. Although it has no direct implementation capability, UNICEF will apply a supplementary appropriation of $1.5 million primarily to new borehole development in Mangochi and Nsanje districts, two high-priority areas. The United Nations High Commission for Refugees (UNHCR) has been addressing water supply in refugee areas through Save the Children/U.K. and other NGOs. Certain NGOs that have been active in the water sector in Malawi have technical capabilities and operational infrastructure. However, financing has been limited.

The government recognizes that the proposed investment program is beyond its implementation capacity. The capital stock of the Ministry of Works is aging and its personnel resources, especially for middle-level technical expertise, are dwindling. Moreover, the government understands that significant donor response to the drought will be delayed several months. To mount immediate action, establishment of a Humanitarian Relief Advisory Committee within the Ministry of Works is strongly being considered. The committee could fast-track limited funds and provide no-cost technical assistance. The government would like to use such funding in an NGO-implemented pilot project for the development of 10 to 15 boreholes in one location.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Dedza
Zomba
Mount Mulanje
Blantyre
Limbe
MOZAMBIQUE
Nsanje

Recommendations

- USAID should strongly and immediately encourage the government to implement and closely monitor the proposed pilot project. It is a potential model for the reprogramming of existing funds allocated to safe water development.
- USAID should immediately invest in a shallow well development project with an experienced NGO that could produce measurable results within four months for less than $50,000. This program niche has not been addressed by other donors, nor is it a regular component of government operations. Yet it would address a small portion of the rural water infrastructure that is most severely affected in the Shire River alluvium. Technical specifications requiring some refinement have been informally presented to USAID/Lilongwe by the Drought Assessment Team.

4.9 Zambia

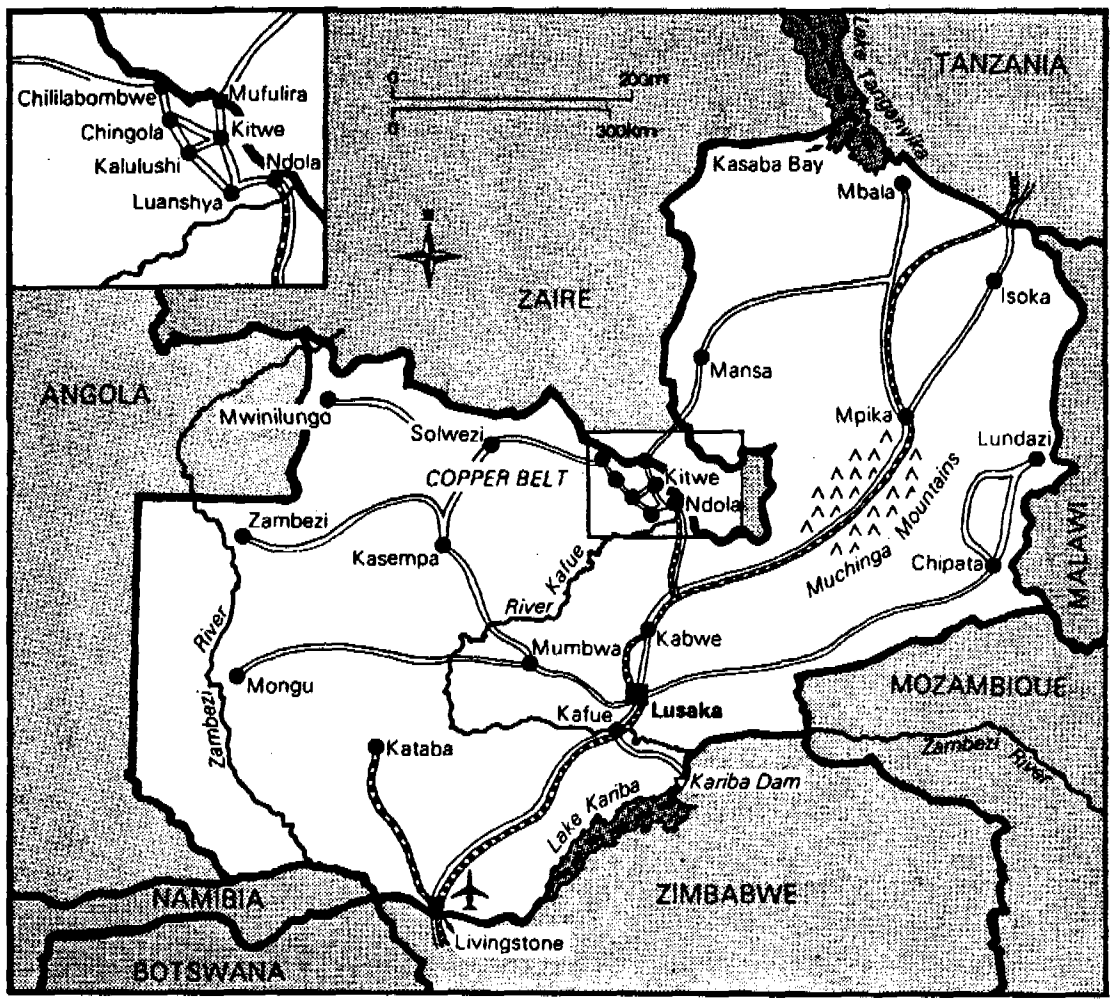
Findings

Except for precipitation, very little data have been recorded about the impact of the drought on rural water supplies and sanitation. Anecdotal reports of shallow wells and boreholes drying up are relatively common. No systematic groundwater monitoring has ever been conducted in Zambia. In spite of recent rains, surface flows are below normal, although flow records are not yet available to the Assessment Team. It is noted that the Department of Water Affairs is currently conducting a countrywide survey, but no formal report has yet been produced. Informed sources indicate that the most severely affected areas correspond approximately to the maize-growing areas, below 13 degrees south latitude. Kalomo, Choma, Monze, and Mazabuka Districts of the Southern Province are most affected. Eastern and Lusaka Provinces could be ranked next, followed by Central Province. Western Province and Gwembe District of Southern Province deal with chronic water shortages and, in general, service levels in those areas—although below average—are not considered to have as critical a drought-related impact as in the other locations.

It is too early to predict accurately the impact of the drought on urban water supplies. Major surface water sources are now flowing at approximately their normal end-of-dry-season lows. Demands of at least 40 percent above the average normal dry season peak (Lusaka) are expected to stress urban systems substantially. Nevertheless, considerable potential exists for conservation in urban areas. For example, the average per capita consumption in Lusaka is approximately 300 liters per day. While there is wide variation, this figure is quite high, representing 10 percent of the total population of Zambia.

Urban sewerage and waste treatment systems are in poor condition, although rehabilitation works have begun. Still, sewer line blockages, common in the dry season, are expected to be exacerbated this year, increasing health risks. Densely populated peri-urban areas not widely

ZAMBIA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Kasaba Bay
Mbala
ZAIRE
Isoka
Mansa
ANGOLA
Mwinilunga
Solwezi
Mpika
Lundazi
COPPER BELT
Kitwe
Ndola
Zambezi
Kasempa
Kafue River
Muchinga Mountains
Chipata
MALAWI
Zambezi River
Mumbwa
Kabwe
Mongu
MOZAMBIQUE
Kafue
Lusaka
Kataba
Zambezi River
Kariba Dam
Lake Kariba
NAMIBIA
ZIMBABWE
Livingstone
BOTSWANA

served by sewerage or other safe alternatives are of particular concern. Rural sanitation will be evaluated during the current field trip, but it is not expected to be accorded as much attention as the urban problem.

Other impacts related to water include reduction of hydroelectric potential, leading to a loss of export capacity and imports from Zaire, and stress on livestock grazing capacity. The latter has been alleviated somewhat by the recent rains, but is still a problem.

The government estimates that approximately 70 percent of the urban population and 33 percent of the rural population—47 percent of the overall population—have access to safe water. Approximately 43 percent of urban dwellers and 30 percent of rural inhabitants—37 percent of the overall population—have access to adequate sanitation. (These figures may be slight overestimates.)

The water and sanitation sector in Zambia is disorganized. It is characterized by fragmented responsibilities and no clear policy. A sanitation policy is non-existent. No less than five ministries share responsibilities and functions with district councils for sector planning, construction, and operation and maintenance. Little or no coordination exists among ministries or between ministries and local councils. Although the government recognizes the need for sector reorganization, attempts since 1987 to achieve this goal have met with little success. A Program Coordination Unit in the Ministry of Local Government has been formally designated to take the lead role in restructuring. However, the status of this Unit is itself currently in doubt. Therefore, in the water supply and sanitation sector, a coordinated government response to the drought has not yet been formulated. A specific task force has not even been organized. Nevertheless, the Minister of Energy and Water Affairs has expressed the need for such an entity. Perhaps the potential for such an organization may be found within the Social Action Program in the Ministry of Local Government. Among other initiatives, this program incorporates a water and sanitation component given legitimacy by the Minister and supported by expatriate staff (GTZ).

Donor support amounts to over 90 percent of the annual capital budget, or approximately 300 million *kwatcha*. GTZ/KfW and NORAD provide more than two-thirds of this amount, with the Netherlands, Japan, Ireland, UNDP, and the European Economic Community (EEC) contributing the remainder. The World Bank and African Development Bank (ADB) have considerably reduced activities, although ADB has recently agreed to major funding of urban water supply and sanitation rehabilitation. (Implementation has yet to begin.) Both GTZ and NORAD place great importance on bolstering government capacity to formulate and coordinate policy and agree that an effective individual in centralized control of implementation is required before new large-scale capital investments are made. GTZ appears ready to take the lead in coordinating *donor* support, although UNDP has also been discussed as a likely candidate. Donors agree that the current drought crisis actually affords an excellent opportunity that should not be missed to resolve overarching issues. Following institutional restructuring, economic sustainability of capital infrastructure looms as the major issue.

Recommendations

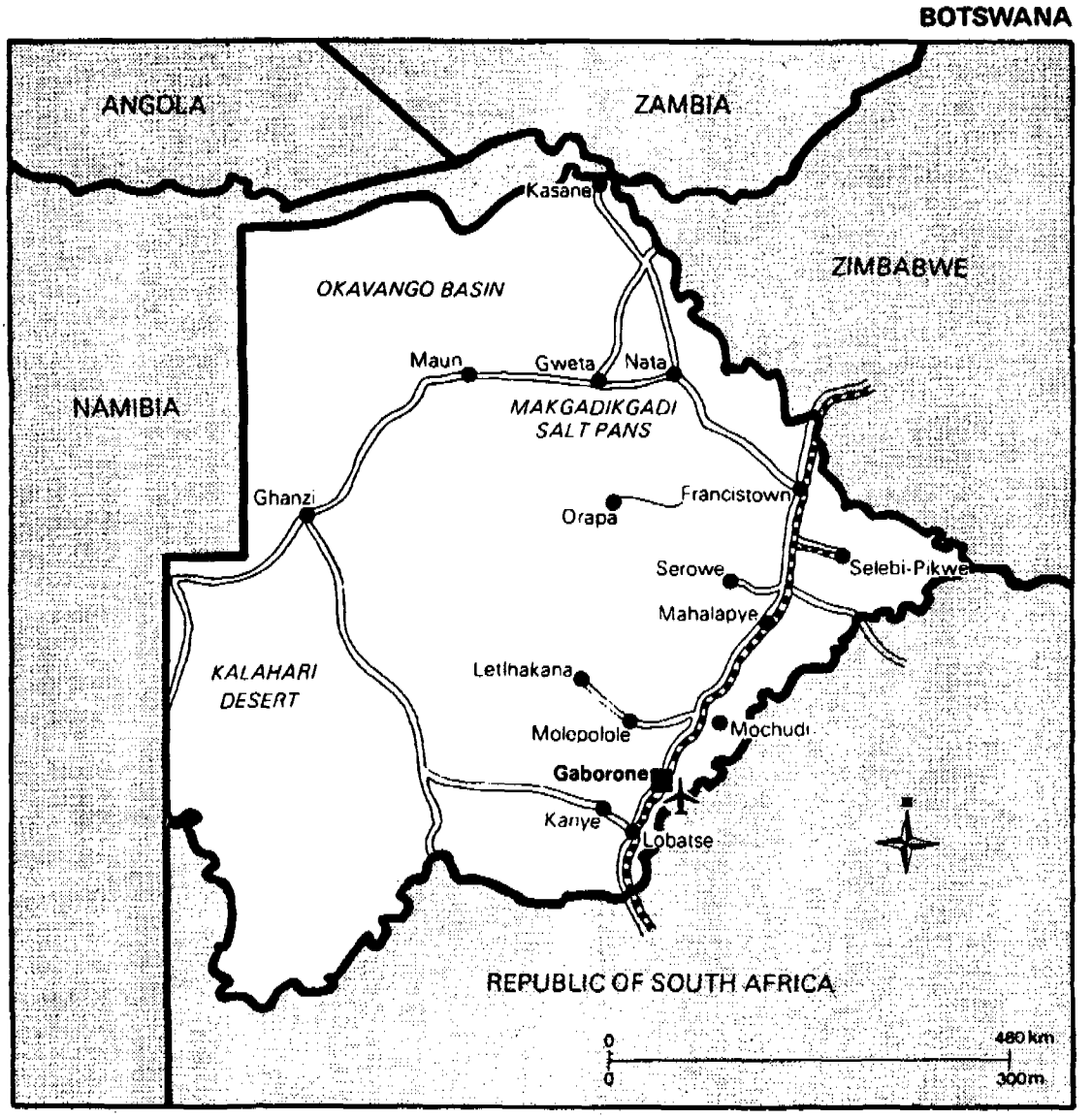
- Provide counterpart funds for a public information and education campaign for water conservation, administered by the Lusaka Water and Sewerage Company, and a campaign for energy conservation administered by ZESCO.
- Provide support for free distribution of low-cost water conservation devices.
- Provide support for a more detailed but rapid assessment of actual needs in the most affected districts, including rehabilitation of existing infrastructure.
- Conduct an evaluation of the logistics of private sector contract drilling, *if required,* including importation of contracting capacity.
- Provide counterpart funds for support of institutional development of a drought action water subcommittee, including government staffing, possibly through the water component of the Social Action Program.
- Provide funding for drought-related emergency livestock vaccination.
- Provide counterpart funds for public information and education motivation to control burning of grazing lands and for other conservation measures.

4.10 Botswana

Findings

During the 1987 drought, the government set up emergency water supply programs in 82 villages. This and previous experiences enabled central authorities to engage in organized planning for drought response in 1992. This process incorporates a strategy based on existing national development plans, rather than creation of special programs and implementing entities. In the water sector, the central policies now being considered include:

- Accelerate the implementation of water projects within the limits of absorptive capacity.
- Where feasible, use labor-intensive construction to generate local employment. Local purchasing power would be enhanced at the expense, to some degree, of speed of implementation.
- Channel financing to the district level, so that emergency measures reflect unique local decisions.
- Streamline tender procedures for private sector contracts by establishing uniform procurement rates.
- Target projects that serve the greatest population and have low per capita costs.
- Maintain subsidies where necessary to aid implementation.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ANGOLA
ZAMBIA
Kasane
ZIMBABWE
OKAVANGO BASIN
Maun
Gweta
Nata
NAMIBIA
MAKGADIKGADI
SALT PANS
Ghanzi
Francistown
Orapa
Serowe
Selebi-Pikwe
Mahalapye
KALAHARI
DESERT
Letlhakana
Molepolole
Mochudi
Gaborone
Kanye
Lobatse
REPUBLIC OF SOUTH AFRICA
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- Continue provision of safe drinking water in areas with existing schemes without concern for cost recovery.
- If necessary, bowser water at zero cost to the beneficiaries.
- If capacity allows, provide, as a safety margin, one extra borehole per village.

The government expected to complete its drought relief contingency plan by the end of April. Subsequently, the plan will be discussed with donors at a meeting for that purpose. As the measures envisioned may strain government funds, it is hoped that donor co-financing will be considered. A more significant constraint than financing, however, is the shortage of trained personnel, primarily at the lowest level of technical management/supervision. It is estimated that underused capability for construction and supervision exists within the private sector. This capability was strengthened during the last drought.

Quantitative estimates (e.g., affected population, financial requirements) of the drought's impact have not yet been developed. Most of the 18 villages visited and 70 percent of the total population rely on groundwater. The Okavango River is currently flowing about 20 percent above normal. However, since rainfall on the Delta has been low, potential recharge is expected to be nullified. The most severe impact may be on village water supplies in the river valleys on the edge of the Kalahari, an area with chronic water problems not associated with this drought. Maun (population 15,000) is one such center; it is chronically affected by seasonal shortages and saline groundwater. Still, from groundwater monitoring data, it appears that no significant countrywide effects on groundwater levels have yet been experienced from the current drought. Slow recharge rates in most cases cause average time lags of two to three years for groundwater levels. Areas dependent on annual recharge, however—such as Molepolole (population 37,000)—are currently affected. Two other villages in the southeast (Moshupa and Mochudi, combined population approximately 37,000) are also affected. There are plans for bowsering 250 m^3/day to Moshupa. Restrictions on watering of lawns, washing cars, and hose connections have been instituted in all major centers.

In sum, although the national declaration of drought came relatively late (March 29), coping mechanisms in the water supply sector are rapidly being mobilized at the central level to complement those in operation at the local level. Financial resources appear adequate to meet the additional requirements.

Recommendations

- The 1992 drought is an opportunity to accelerate progress in meeting design standards for water supply service. The principal consumption standard is set at 46.5 liters per capita per day. As of 1991, communities of 500 or more people with water supply systems averaged 26 liters per capita per day. According to the National Water Master Plan, the policy trend of extending the capability of District Councils to assume design and construction responsibilities for water supplies—in addition to operation and maintenance—should be supported. The gradual assumption of responsibility by

District Councils for populations less than 500—now under the authority of the Ministry of Agriculture—should also be encouraged.

Appendix A

PERSONNEL AND ITINERARY

The following persons comprised the coastal team:

Kate Farnsworth (OFDA)—Overall team leader

Chris Keppler (OFDA)—Coastal team leader

Dr. Ray Yipp (CDC)—Health specialist

Ron Stoddard (CDC)—Health specialist

Ron Parker (WASH)—Environmental engineer

Larry Meserve (REDSO)—West Africa Food-for-Peace officer

The coastal team itinerary was as follows.

Locale/Activity	**Dates**
Travel	March 22-March 24
Zimbabwe	March 24-March 26
Mozambique	March 26-March 31
Swaziland	March 31-April 2
RSA	April 2-April 6
Lesotho	April 6-April 9
Namibia	April 9-April 16
Angola	April 16-April 18
Zimbabwe	April 18-April 22
Travel	April 22-April 23

The following persons comprised the inland team:

Brian D'Silva (USDA)—Team leader

Mary Little (OFDA)—Famine mitigation specialist

Lowell Lynch (REDSO/ESA)—Food-for-Peace officer

Elizabeth Sullivan (CDC)—Health specialist

Frank Carroll (WASH)—Environmental health engineer

Paul Isaacson (US Embassy/Lilongwe)—Refugee coordinator

The team worked closely together, and, except for Mr. Isaacson (who is based in Malawi), traveled to the four inland countries as a group. The specific itinerary for the water and sanitation component was as follows.

Locale/Activity	**Dates**
Zimbabwe	March 25-30
Field Trip, Masvingo and Manicaland Provinces	March 28-29
Malawi	March 30-April 5
Field Trip, Southern Region	April 2-3
Zambia	April 5-12
Field Trip, Southern Province	April 9-10
Botswana	April 12-14
Zimbabwe	April 14-19
Field Trip, Bulawayo (Matabeleland, Southern Province)	April 14

Appendix B

PRINCIPAL CONTACTS—"INLAND TEAM" WATER SECTOR

Botswana

H. Handler	Director, USAID/Gabarone
D. Passage	U.S. Ambassador
P. Brahmbhatt	Engineer, USAID/Gabarone
J. Stoneham	Perm. Secretary, Min. of Finance & Development Planning
M. Sekwale	Director of Water Affairs, Min. of Mineral Resources and Water Affairs
F. van der Geest	Senior Water Engineer, Min. of Lands & Local Government

Malawi

C. Peasley	Director, USAID/Lilongwe
K. Rockeman	Agricultural Program Officer, USAID/Lilongwe
P. Isaacson	Refugee Coordinator, U.S. Embassy/Lilongwe
N. Chaya	Head, Rural Piped Water, Min. Works & Supplies (MWS)
R. Kafundu	Head, Groundwater Section, MWS
J. Farmer	Senior Civil Engineer, Rural Piped Water, MWS
K. McKenzie	Head, Water & Sanitation Section, UNICEF
E. Chisala	Asst. Project Officer, HHFS, UNICEF
Mr. Ahmed	Logistics Officer, UNICEF
(Representative)	UNHCR/Blantyre
(Field Rep.)	UNHCR, Mwanza District
(Director)	Chifunga Refugee Camp, Mwanza District
(Director)	Luwani Refugee Camp, Mwanza District
J. Chakumodzi	Executive Secretary, Council for NGOs in Malawi
R. Soli	Save the Children/U.K.

A. Kalawi	Head, Technical Services, World Vision International
I. Williams	Field Director, Concern Universal
P. Williams	Health Coordinator, Concern Universal
B. Ryan	Water Supply Engineer, Concern Universal
T. Nandolo	Director, Christian Services Committee
P. Jones	Field Engineer, Emmanuel International/Evangelical Baptists

Zambia

F. Winch	Director, USAID/Lusaka
P. Downs	Project Officer, USAID/Lusaka
W. Whelan	Agricultural Program Officer, USAID/Lusaka
G. Scott	Minister of Agriculture, Food, and Fisheries
L.L. Mbumwae	Director of Water Affairs, Ministry of Energy and Water Development (MEWD)
R.B. Khuti	Deputy Director, Dept. of Water Affairs, MEWD
O.L. Sangulube	Senior Hydrogeologist, Dept. of Water Affairs, MEWD
Mr. Singh	Epidemiology Unit, Veterinary Services, MAFF
S. Shisala	Southern Province Water Supplies Engineer
Mr. Phiri	Engineering Asst., Monze District, Southern Province
Mr. Nyoni	Engineering Asst., Gwembe District, Southern Province
J. Hendrich	Managing Director, Lusaka Water and Sewerage Company
I.G. Hopwood	Area Representative, UNICEF
R.C. Lupenga	Projects Officer/Regional Planning, UNICEF
J. Mapulanga	Project Officer, HFES, UNICEF
S. Barron	Analyst, World Food Program
S. Hagen	Sr. Program Officer, Water & Transport Sector, NORAD
B. Jansen	GTZ Advisor, Ministry of Local Government
K. van Baar	Third Secretary, Royal Netherlands Embassy
C. Cadou	Civil Engineer/Kariba Hydroelectric Project, CIDA

B. Wilkerson	Representative, Volunteers in Technical Assistance
Mr. Getu	Assoc. Director Field Programs, World Vision International

Zimbabwe

T. Morse	Director, USAID/Harare
C. Scheibal	Engineering Program Officer, USAID/Harare
Mr. Matumbike	Chairman, National Action Committee (Water & San.)
R.M. Mbetu	National Coordinator for Rural Water Supply & San., Min. of Local Government, Rural & Urban Devel. (MLGRUD)
B. Majaya	National Coordination Unit, MLGRUD
J.K. Jonga	Director, District Development Fund, MLGRUD
P. Aarvedsen	Advisor, District Development Fund
K. Landing	Deputy Permanent Secretary, Min. of Energy & Water Resources Development (MEWRD)
G. Nanama	National Action Committee (Water & Sanitation)
Mr. Williams	National Action Committee (Water & Sanitation)
Mr. Choga	National Action Committee (Water & Sanitation)
Mr. Ziramba	National Action Committee (Water & Sanitation)
Dr. P. Taylor	Director, Training Centre for Water & Sanitation
S. Murugasampillay	Epidemiology and Disease Control Dept., Min. Health
Mr. Gumbo	Deputy Administrator, Masvingo Province
W. van Hardewijk	Masvingo Province Advisor, Water & Sanitation
E. Mutasa	Masvingo Province Coordinator, Water & Sanitation
J. Murapa	Masvingo Province Civil Defense Officer
Mr. M???????	Chiredzi District Administrator (Masvingo Province)
Mr. Mateko	Assistant District Administrator, Chiredzi
Mr. Shumba	Chiredzi District Coordinator, Water & Sanitation
Mr. Muhwati	Chiredzi District Resettlement Officer
Mr. Mamhare	Chiredzi District AGRITEX Extension Officer

S. Dube	Matabeleland Provinces Water Supplies Engineer
S.A. Fegan-Wyles	Representative, UNICEF
W. Fellows	Head, Water and Sanitation Section, UNICEF
S.J. Brushett	Senior Operations Officer, World Bank/Zimbabwe
E. Rice	Team Leader, World Bank Drought Relief Credit
D. Grey	Water Resources Consultant, World Bank
R. Harwood	Hydrogeology Consultant, World Bank
Dr. A.T. Obilana	Principal Sorghum Breeder, ICRISAT/Matopos
Dr. D. Rohrbach	Agricultural Economist, ICRISAT/Matopos
M. Gleditsch	Senior Programme Officer, NORAD
A. Kruger	Chief Engineer, NORAD Advisor, Water Development
Mr. van Rijkman	Royal Netherlands Embassy
K.M. Clements	Country Representative, Africare
E.M. Jassat	Senior Researcher, Lutheran World Federation
B.R. Burbridge	General Manager, Hippo Valley Estates
J.H. Manyakara	Human Resources Manager, Hippo Valley Estates
D.L. Rambo	Rambo Farms (Pvt.) Ltd.

Appendix C

PRIMARY REFERENCES—"INLAND TEAM" WATER SECTOR

Botswana

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Appendix D

WASTEWATER RECLAMATION PILOT PROJECT—LUSAKA

MEMO TO: Fred Winch
FROM: Frank Carroll, OFDA Team
DATE: April 15, 1992

During my discussions with the Lusaka Water and Sewerage Company (LWSC), Jeff Hendrich (Managing Director) briefly described a pilot project for Lusaka wastewater reclamation that LWSC is planning to pursue. I think that the pilot project is basically a very sound idea, with potential for upgrading and transfer to reticulated systems elsewhere in Zambia. The first task, however, is to conduct a feasibility study and detailed design. For this phase, LWSC would require technical assistance. Somewhat familiar with the centrally funded WASH project, Jeff queried me whether this is an area in which WASH may provide support. I responded affirmatively and wanted to brief you on the nature of the discussion and give you a broad outline of what LWSC has in mind. I believe that it would be a very good use of some of the "free" service that the Mission has at its disposal, as WASH has a unique ability to call on appropriate expertise in the water and sanitation sector. Should LWSC raise the issue with you, at least you will have some background.

LWSC maintains and operates two trickling filter (TF) sewage treatment systems and four oxidation ponds. All of the treatment plants receive flow by gravity, requiring no raw wastewater pumping. The design capacity of the TFs is 27,150 m^3/day serving a population of 166,000. The ponds are designed for 13,200 m^3/day and serve 146,000.

Located 15 km north of the city center, the Ngwerere ponds (4,600 m^3/day design flow, serving 54,000) were designed to relieve the Kaunda Square and Chelston ponds, along with portions now served by the Manchinchi TF. Engineering plans exist for rehabilitating this facility, but funding has not been available. Both the Kaunda and Chelston ponds are overloaded. A health risk problem exists at the Chelston ponds where residents continually block the main sewer line to divert raw sewage flows for crop irrigation. None of the ponds have security fencing.

A larger program looks at rehabilitation of the Ngwerere pond system, rather than construction of new works, as a first priority. Coupled with this program, LWSC is also having discussions with the environmental staff at the University of Zambia, Delft University, and the University of California, Redlands, regarding a pilot project. This pilot project would investigate the use of water hyacinth (Kariba weed) in the treatment lagoons serving the city. It would also investigate more appropriate alternatives for simpler treatment processes for the city. In addition, it would investigate the establishment of passive composting facilities for sewerage sludge disposal and organic wastes. It would look into the possibility of effluent reuse through spray irrigation. In bringing all these threads together, I believe that WASH assistance could be very useful.

Appendix E

WATER SUPPLIES IN MATABELELAND

The following are briefing notes from a conversation with Sibungilizwe Dube, provincial water supplies engineer, April 14, 1992.

It was estimated that approximately 60 to 70 percent of the total population of Matabeleland North and South have been adversely affected by the drought. The total population is about 65 percent rural and 35 percent urban. A much higher percentage of the rural population is believed affected than the urban and town populations. Press reports are judged unreliable, however, and no engineering survey of remote areas appears to have been conducted. Because conditions are not believed uniform, a dependable, rapid assessment is imperative. Given resource constraints, the most critical areas should be addressed first.

A review of some two dozen *reticulated* water supply schemes serving population centers in both Mat North and South indicated that about half have problems. The majority of affected systems are in Mat South. A brief summary of the reported status of town systems follows.

Victoria Falls/Hwange

No problems.

Dete

Three development centers served by six boreholes with average yield of 30 m^3/hr each, 26 km of pipeline; system currently effective.

Siansundu/Luvimbi/Siachilaba

Borehole yields affected by long-term lowering of water table.

Lupane

Served by Artesian wells; no problems.

Plumtree

Surface impoundments; adequate storage available.

Marula

Two-month supply remaining in reservoir.

Antelope

Served by large reservoir; adequate supply.

St. Joseph

Two of five boreholes have failed due to lowering of water table.

Kezi

Surface supply adequate.

Matopos

Two dry boreholes; Matopos Reservoir, serving small catchment area, has never filled since independence.

Beitbridge

12 m^3/month per household rationing in effect. Limpopo River at base flow; diversion channel for water supply intake is dry. Currently pumping total 200 m^3/hr demand from old water works upstream; will last until November.

West Nicholson/Colleen Brown

Both served by Silalabukwa Dam, which is "reasonably full." However, both have weirs that are silted up (maintenance problem).

Gwanda

12 m^3/month per household rationing in effect; reservoir supply will only last until September; alternative sources from mines have been investigated without much promise.

Mbalabala

Receives allocation from reservoirs serving Bulawayo. Adequate until September-October; possibility of rehabilitating boreholes.

Filabusi/Esigodini

12 m^3/month per household rationing in effect; served by Bulawayo reservoirs.

Shangani/Inyati

Borehole yields reduced due to water table lowering; alternative surface supplies available, however.

Nkayi

Abstraction from Kalahari surface sands; no problems.

It is thought that bowsering, which is approximately 50 percent more expensive than average surface water costs, could be required this year for Gwanda, Esigodini, and Matopos. At the current time, there is believed to be absorptive capacity within the private sector to meet these needs.