BASIC DESIGN STUDY REPORT ON GROUNDWATER DEVELOPMENT PROJECT (PHASE— Ⅱ) IN SOUTHERN PROVINCE IN THE REPUBLIC OF ZAMBIA

JULY 1988

JAPAN INTERNATIONAL COOPERATION AGENCY

BASIC DESIGN STUDY REPORT
ON
GROUNDWATER DEVELOPMENT PROJECT (PHASE— Ⅱ)
IN
SOUTHERN PROVINCE
IN
THE REPUBLIC OF ZAMBIA

JULY 1988

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

In response to the request of the Government of the Republic of Zambia, the Government of Japan decided to conduct a basic design study on the Project for Groundwater Development in the Southern Province (Phase-II) and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Zambia a study team headed by Mr. Keiji Abe, Deputy Director, Water-works Bureau of Kagawa Prefecture, from March 13th to April 8th, 1988.

The Team had discussions on the Project with the officials concerned of the Government of Zambia and conducted a field survey in Lusaka and Southern Province.

After the Team returned to Japan, further studies were made and the present report has been prepared.

I hope that this Report will serve for the development of the Project and contribute to the promotion of friendly relations between the two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Republic of Zambia for their close cooperation extended to the Team.

July 1988

Kensuke Yanagiya

Kensuke YANAGIYA
President
Japan International Cooperation Agency

LOCATION MAP OF THE PROJECT AREA

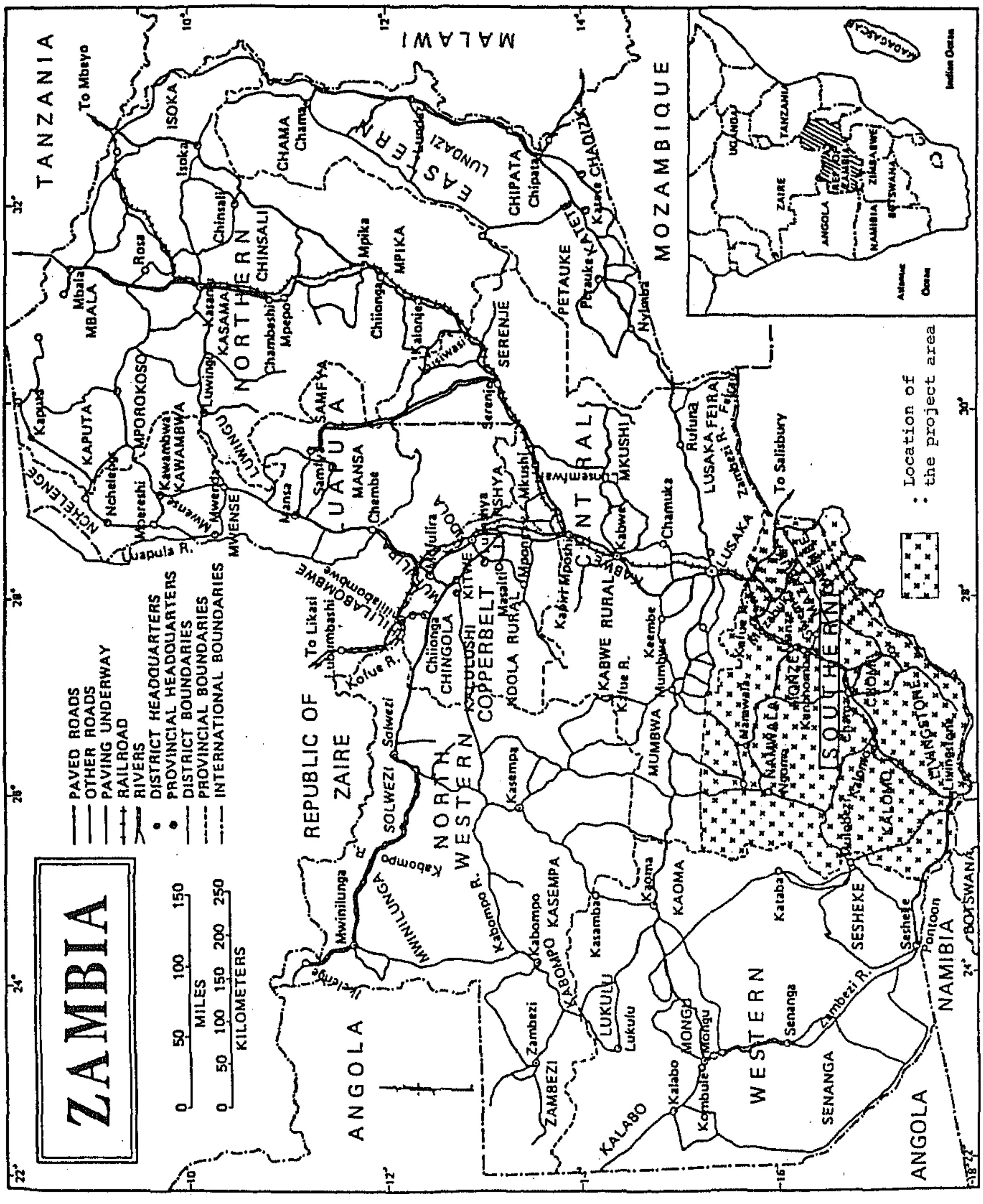


TABLE OF CONTENTS

APPENDIX:

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

IMF	:	International Monetary Fund
FNDP	:	First National Development Plan
SNDP	:	Second National Development Plan
TNDP	:	Third National Development Plan
GDP	:	Gross Domestic Products
LUA	:	Large Urban Areas
SUT	:	Small Urban Township
RT	:	Rural Township
RA	:	Rural Areas
DC	:	District Council
MOH	:	Ministry of Health
BD	:	Building Department
DWA	:	Department of Water Affairs
WB	:	World Bank
EEC	:	European Economic Community
UNDP	:	United Nations Development Programme
GRZ	:	Government Republic of Zambia
GOJ	:	Government of Japan
E/N	:	Exchange of Notes
ADB	:	African Development Bank
ADF	:	African Development Fund
JICA	:	Japan International Cooperation Agency
MAWD	:	Ministry of Agriculture and Water Development
WHO	:	World Health Organization

SUMMARY

SUMMARY

The Republic of Zambia (hereinafter referred to as Zambia) is a landlocked country in south central Africa and is located at 8° to 18° S latitude and 23° to 34° E longitude. The country, consisting of nine provinces, covers an area of 752,615km^2, is approximately twice the size of Japan, and has a population of about 5.7million (in 1980). Lusaka is the capital. Zambia gained its independence from England in October 1964.

Zambia is mostly a plateau savanna that rises to 1,000 - 1,300 meters. The climate is clearly divided into dry and rainy seasons. Precipitation decreases from the north to the south; there is more than 1,500mm per year in the northern part and 750mm per year in the southern part.

The flat plateau consists of metamorphic rock, plutonic rock, and hard deposit rock of the pre-Cambrian, and the Paleozoic and Mesozoic periods. From a hydrogeological viewpoint, the aquifers of the plateau are the fissure zone, the fractured zone, and the weathered zone.

The Water Supply Administration of Zambia is classified into three areas: large city areas, small city areas, and rural areas. 70% of the people in large cities and 45% of people in small cities receive their water supply from pipe lines. In rural areas, however, only 32% of the 3.2 million residents have access to safe water sources; other residents rely upon water sources that are either remote or on types that dry up during dry seasons. The occurrence rate of diseases resulting from unstable water supply conditions and the use of unsuitable drinking water sources is very high. As an example, about 830,000

children (29.9% of all the children in the country) were treated in hospitals for diarrhoea caused by drinking insanitary water during the year 1982. Of that number, 411 (0.014%) of the children died.

Unstable water supply conditions and insanitary water jeopardize living conditions in rural areas, and, in turn, have become a major factors in hampering their social and economic development. For this reason, in 1979 the Government of Zambia began pressing forward with its rural water supply plan on a nation-wide scale.

From 1981 to 1983 Zambia's Southern Province experienced an unbroken three-year drought during which many wells and streams dried up. Therefore, in 1983, the Government of Zambia established the Groundwater Development Project (Rural Water Supply Project) in the Southern Province which essentially called for the construction of 880 new deep wells. However, the Department of Water Affairs of the Ministry of Agriculture and Water Development, the administrative organization of the Project, had difficulty in implementing the Project due to budgetary problems.

In response to the request made by the Government of Zambia for aid in implementing the Project, the Government of Japan, in 1985, undertook the Groundwater Development Project (Phase I) in the Southern Province under a grant aid cooperation programme to construct 102 deep wells for emergency relief. The Project was completed in 1987.

It was become possible for approximately 30,000 residents to secure safe drinking water throughout the year from the deep wells constructed under the Phase I project. It has been a relief for the people

not having to worry any longer about using insanitary drinking water and unstable water sources that dry up during drought seasons.

The Government of Zambia greatly appreciated the grant aid cooperation provided by the Japanese Government for the implementation of the Phase I project.

In view of the similar background and problems as for the Phase I project, such as the high occurrence rates of diseases related to insanitary drinking water, the chronic drought damages, the lack of funds for the water supply development projects, the Government of Zambia requested grant aid cooperation from the Government of Japan for the Groundwater Development Project (Phase II) in the Southern Province to construct 120 deep wells, to rehabilitate 100 malfunctioning wells, and to procure the necessary equipment and materials.

The Government of Japan investigated the request and decided to conduct the Basic Design Study for the Project. Based on this decision, the Japan International Cooperation Agency sent a study team to Zambia headed by Mr.Keiji Abe, the Sub Director of the Kagawa Prefecture Waterworks Bureau, for 27 days from 13 March to 8 April 1988.

The Study Team conducted field surveys for the purpose of understanding the background of the request and the contents of the Project, to investigate the propriety of the Project under the grant aid cooperation of the Government of Japan, and to determine the optimum content and scale of the Project. The Team also held a series of discussions pertaining to the Project with the officials concerned of the Government of Zambia, and the

Minutes of Discussions that included the confirmed and agreed upon basic items were signed by the representative of the Zambia Government officials and the leader of the Basic Design Study Team. Based on the results of the field surveys and the Minutes of the Discussions, further analyses were made in Japan.

As a result of the field surveys, a series of discussions with Zambian officials, and the analyses made in Japan, the following aspects were clarified:

(1) In the Southern Province -- the concerned Study Area -- the number of diarrhoea cases resulting from drinking insanitary water is very high. In 1986, the number of outpatients was 27.7% (186,081) of the entire population. Inpatients amounted to 0.868% (5,829), and the number of deaths was 0.0170% (114).

(2) Precipitation in the Southern Province is less than in other provinces of the country. Since 1981, the annual precipitation has often been less than the average annual precipitation for the previous 30 years. As a result, frequent droughts have occurred.

(3) The Project Area is located on the flat plateaus that belong to the hard rock zone of pre-Mesozoic metamorphis rock, plutonic rock and deposit rock. Groundwater development in the area has been made to obtain water stored in cracks developed in the weathered rocks. Most of the aquifers are confirmed at depths of 20 to 35m.

(4) After the completion of the Project wells, it is expected that the water shortage problems occurring during dry and drought seasons will be alleviated, and that the diseases related to insanitary drinking water will be reduced

substantially. As a result, the Project will contribute greatly to the stabilization of the rural people's livelihood, to the improvement of the living conditions and public health and sanitary environment, to inducing people to settle in the area, and to releasing people from the nonproductive heavy labour of obtaining water. The Project will also help to expand agricultural production and activate rural economies. For these reasons, Project implementation, when taking into account all other Zambian projects, has a very high priority and urgency.

(5) The groundwater development projects in the Study Area that have been undertaken with foreign aid are well arranged by the Zambian Government so as not to be overlapped by more than one donor.

(6) The budget of the Department of Water Affairs -- the Project's implementing agency -- has to be utilized for working expenditures. Allowances for new development projects are almost nil. Thus the Government of Zambia has to rely on foreign aid for the development of new projects. It would be extremely difficult for the Government of Zambia to implement the Project on its own.

(7) The requested Project Area covers the entire seven districts of the Southern Province. It has an area of 85,282 km^2 (approximately the same size as the Japanese island of Hokkaido). The requested items include the construction of one hand pump operated deep well at each of 120 sites, and the rehabilitation of one malfunctioning hand pump well at each of 100 sites that are located throughout the seven

districts. These 220 well sites are widely distributed; the distances between each site is quite far. People in these areas urgently need safe drinking water. The total population in the 220 site areas is 158,974.

The above aspects are clear and the Project's necessity, urgency, and appropriateness is quite evident.

After examining the contents of the Project, the optimum basic design was made.

Boreholes numbering 649 would be required to supply drinking water at the 220 site areas if Zambian rural water supply design standards were to be adopted. Judging from the recent continuous droughts and water supply situations during dry seasons, Project implementation is extremely urgent. However, the construction and rehabilitation of 649 deep wells would require a large sum of money and take a great deal of time.

To solve the present water supply shortage problems with a limited amount of funds and within a limited period of time, it will be necessary to provide the minimum amount of water required by the rural people. To accomplish this, at least one deep well shall be secured under the Project at each of the 220 proposed site areas.

The objectives of the Project are to reduce the number of diseases related to insanitary drinking water, to minimize damages during drought seasons, to stabilize the livelihoods of rural people, and to improve social conditions by providing reliable, safe drinking water that will not be depleted throughout the year.

The features of the Project are as follows:

- Target year: 1991
- Number of beneficiaries:
  - Normal season: 55,000 persons
  - Drought season: 158,974 persons
- Water supply rate:
  - Normal season: 30 liters/person/day
  - Drought season: 5 liters/person/day
- Planned hand pump pumping rate: 7,500 liters/day
- Average number of beneficiaries per deep well: 250 persons/well
- Project wells:
  - Construction of new deep wells (average depth of 50 m) at 120 sites
  - Rehabilitation of malfunction hand pump wells: at 100 sites

The equipment and material plan for the Project was made based on the assumption that the two drilling machines and related equipment and materials provided under the Phase I project and the equipment and materials to be provided under the Project will be utilized for Project implementation.

The necessary equipment and materials to be provided under the Project are as follows:

- Supporting vehicles: 8 units
- Various testing equipment: one or two sets
- Wireless communications equipment: 1 set
- Repair tools: 1 set
- Air compressor: 4 units
- Hand pump service vehicles: 4 units
- Spare parts: 1 set
- Hand pumps: 220 sets
- Casing pipe: For 140 boreholes
- Screen pipe: For 140 boreholes

- Guide pipe: For 140 boreholes

The responsible agency for the Project is the Ministry of Agriculture and Water Development (MAWD). Project implementation will be undertaken by the Department of Water Affairs of MAWD.

After signing the Exchange of Notes, the term required for Project completion will be approximately two and half years including the one and half year actual construction period. Except for the time needed for processing the Japanese grant aid, procurement of equipment and material, transportation, and setup, the actual construction period for the Japanese side will be six months.

During the planned period, the Japanese side will provide the necessary equipment and materials, construct 32 new boreholes, rehabilitate 40 malfunctioning wells, and provide technical guidance, advice, and construction supervision to the Zambian project team.

The Zambian side will provide the necessary personnel for Project implementation and the materials that will not be provided by the Japanese side. Further, after the completion of the Japanese side's work, the Zambian team will construct the other 88 new boreholes and rehabilitate 60 malfunctioning wells. They will do this by utilizing the equipment, materials, and transferred techniques provided by the Japanese side.

The present maintenance and management system of the existing wells is not adequate due to the insufficient number of service vehicles. After the implementation of the Project, the Department of Water Affairs (DWA) shall periodically conduct

inspection, repair, maintenance, and management of the completed deep wells and those which were constructed under the Phase I project to ensure the supply of clean, safe ground water.

DWA shall provide the residents with the guidance necessary for them to develop a sanitary environment and for establishing a well maintenance and management system in which the residents, as a village unit, will be able to participate in and be responsible for.

The DWA Monze Office owns a warehouse and a repair shop. The equipment and materials provided under the Phase I project are maintained fairly well -- and are effectively used -- at the Monze Office. Thus, no maintenance and management problems should arise concerning the equipment and materials provided during and after Project implementation. However, as the Zambian engineers are not quite familiar with the inspection, repair, and management of equipment made in Japan, the Japanese engineers must ensure the transfer of techniques so that careful maintenance can be given to the provided equipment and materials to extend their service lives over a long period of time.

The Zambian team learned basic drilling techniques from Japanese engineers during the cooperative construction period of the Phase I project construction. Their capability to apply the various drilling methods under different geological condition is, as yet, not sufficiently adequate. It will, therefore, be necessary not only to substantiate the Zambian facilities by providing equipment and materials, but, also, to provide continuous guidance to upgrade the Zambian team's technique application capability.

The cost borne by the Government of Zambia for the project is estimatated to be approximately 2,310,355 kwachas (40,385,000 yen). The necessary maintenance and repair costs for the 220 wells are estimated to be 225,781 kwachas (3,946,000 yen) per year.

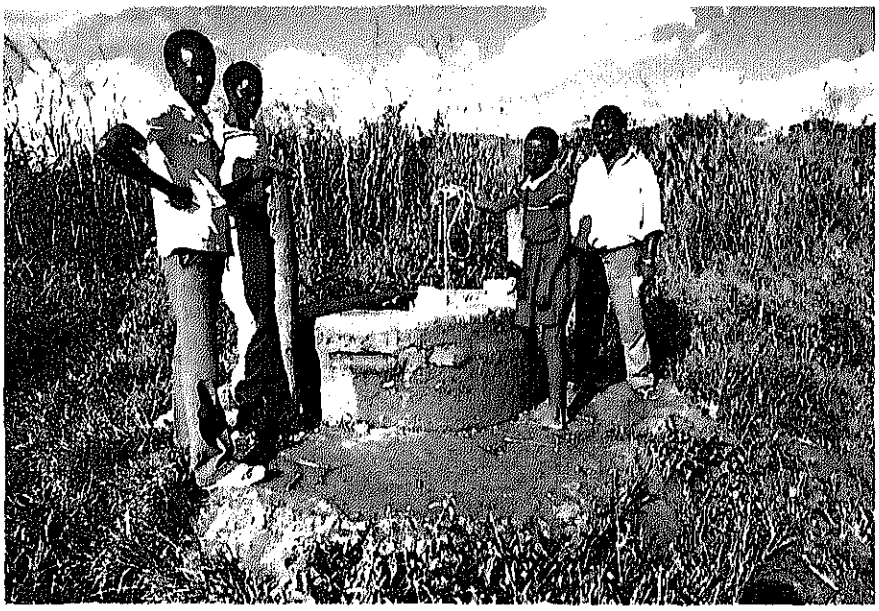
The direct effects of the Project will be to decrease diseases resulting from the use of insanitary drinking water, minimize drought damage, reduce household work by eliminating the need to carry drinking water from remote water sources during drought seasons, stabilize the people's livelihood, and improve social conditions in rural areas. Furthermore, after completing the Project, the Zambian side will be able to proceed on its own with the Rural Water Supply Plan that calls for the construction of 880 deep wells by utilizing the transferred techniques and the equipment and materials provided by the Japanese side. In so doing, the initial objectives of the plan will be accomplished.

In view of the points outlined above, it is deemed to be appropriate and extremely worthwhile to carry out the Project with grant aid cooperation from the Government of Japan.

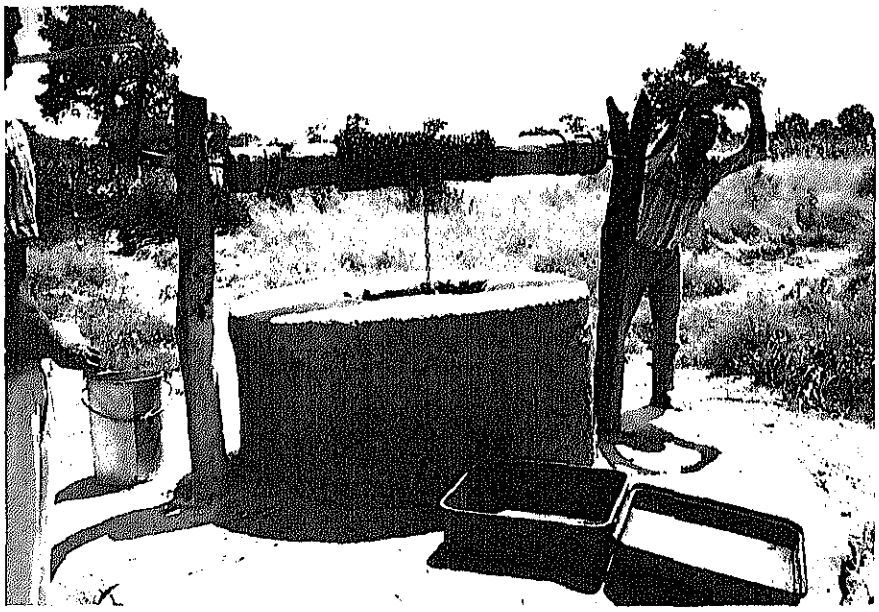
Hand dug pit near KAMBAZA village, MONZE district

Pond near SIMWAMI village, KALAMO district

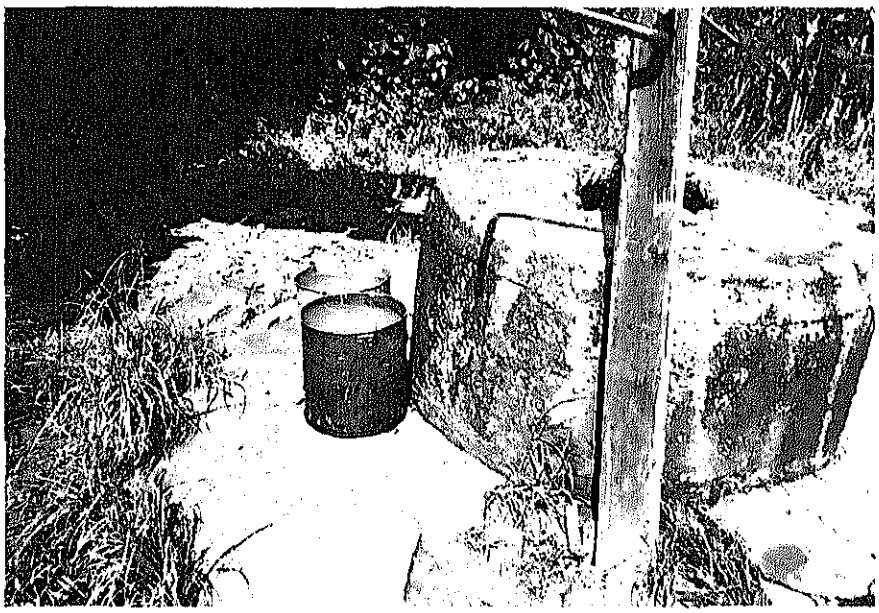
River near SIAZWELA school, CHOMA district



At CHEELO school,
CHOMA district



At MWANGWE village,
NAMWALA district



Near MUZOKA clinic,
CHOMA district

PRESENT CONDITION OF THE EXISTING BREAKDOWN DEEP WELLS
(BORE HOLES) WITH HAND PUMP

At CHING'ANG'ANKA
school,
MAZABUKA district

At MUZOKA clinic,
CHOMA district

At NAMUSONDE school,
NAMUWALA district

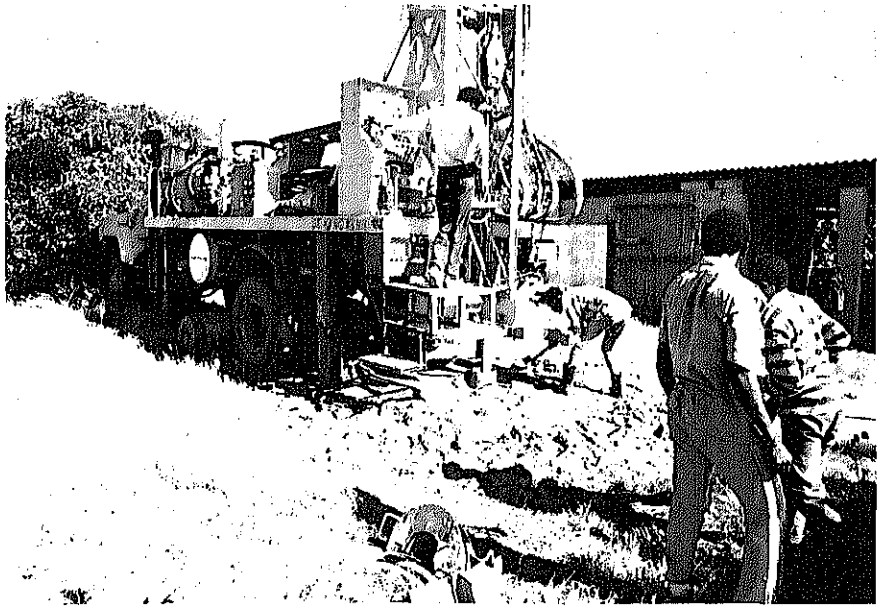
PRESENT CONDTION OF NEW DEEP WELLS (BOREHOLES) CONSTRICTED IN PHASE-I PROJECT

MoJ-1 at
KAMBAZA school,
MONZE district

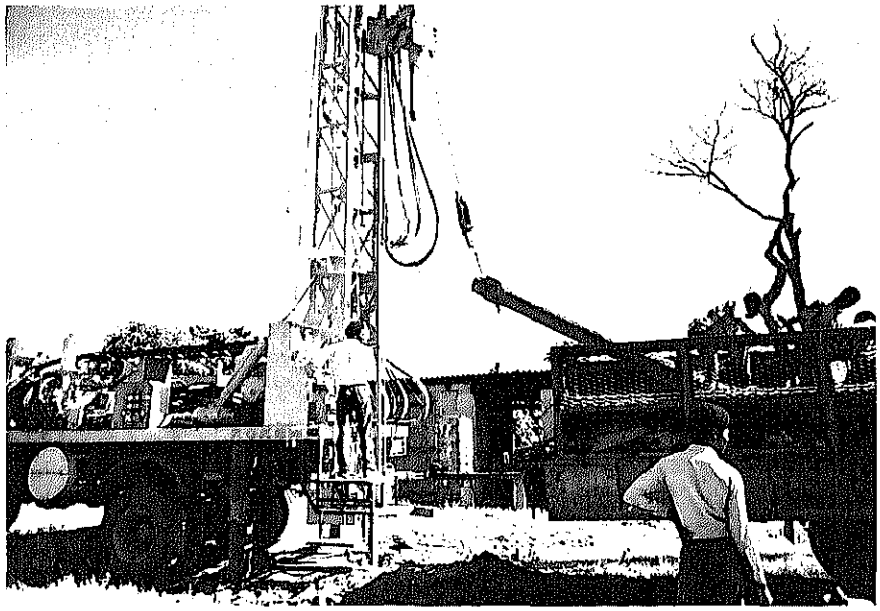
Protected fence
against animals'
entrence

MoJ-9 at
Galli school,
MONZE district

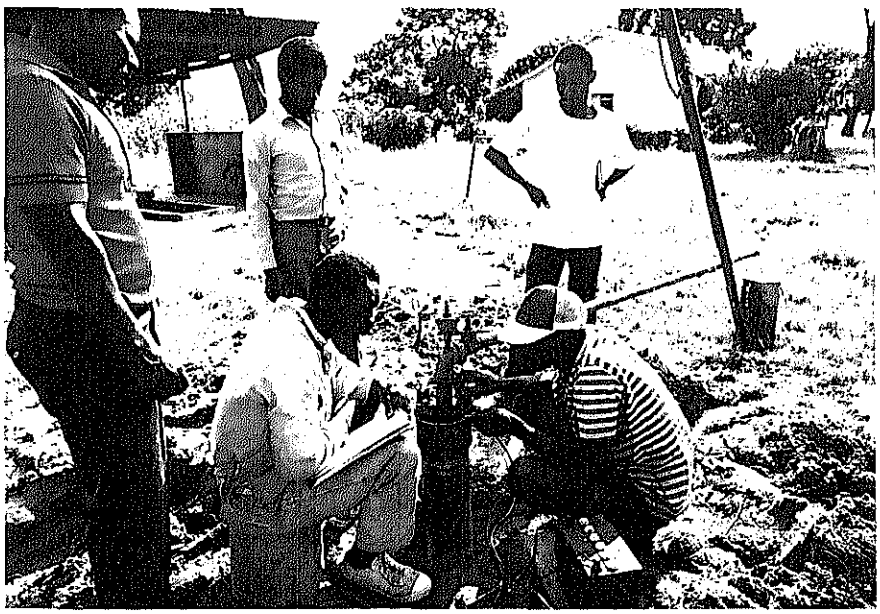
PRESENT CONDITION IN USE OF THE EQUIPMENTS PROVIDED IN PHASE-I PROJECT



Drilling work



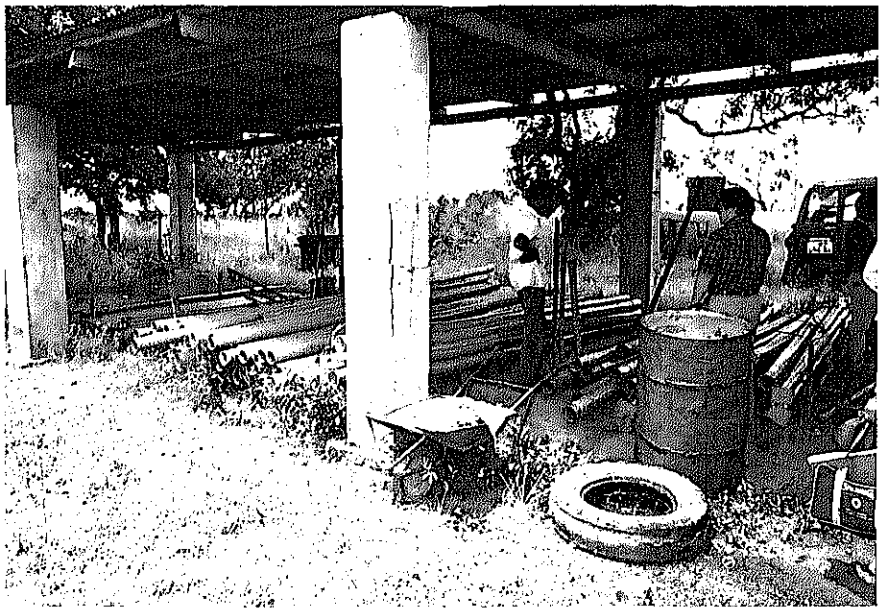
Casing work



Pumping test

STORAGE CONDITION OF THE EQUIPMENTS AND MATERIALS PROVIDED IN PHASE-I PROJECT, MONZE OFFICE

Spare parts in storehouse



Materials shed for casing, screen pipe, etc

Compound of MONZE office

CHAPTER 1. INTRODUCTION

CHAPTER 1 INTRODUCTION

Zambia's rural population is approximately 3.2 million which is about 56% of the country's entire population (about 5.7 million per 1980 census). About 1.02 million of these people have drinkable water sources near their residences. Other residents in the rural areas rely on water sources that are either remote from their homes or on sources that dry up during dry seasons.

The diseases attributable to the unstable water supply conditions, the use of unsuitable drinking water sources, and the poor sanitary environment further jeopardize the residents' living conditions and have become the main factors hampering social and economic development in the rural areas. For this reason, the Government of Zambia has, since 1979, been pushing forward with the Rural Water Supply Plan on a nation-wide scale.

The country's Southern Province experienced a three-year continuous drought (1981-83) and many wells and streams became dry. Therefore, in 1983, the Government of Zambia established the Groundwater Development Project in the Southern Province that calls for the construction of 880 new deep wells.

In 1985, the Government of Japan undertook Groundwater Development Project (Phase I) in the Southern Province under grant aid cooperation to construct 102 deep wells for emergency relief. The Project was completed in 1987. The Government of Zambia greatly appreciated the grant aid cooperation provided by the Japanese Government for the implementation of the Phase I project. In view of the similar background and problems as for the Phase I project, such as the high occurrence rates of diseases related to insanitary drinking water, the chronic drought damages, the lack of funds for the water supply development projects, the Government of Zambia requested grant aid cooperation from the Government of Japan for the Groundwater

Development Project (Phase II) in the Southern Province to construct 120 deep wells, to rehabilitate 100 malfunctioning wells, and to procure the necessary equipment and materials. The Government of Japan studied the request and decided to conduct the Basic Design Study for the Project. Based on the Government's decision, the Japan International Cooperation Agency sent to Zambia a Study Team headed by Mr. Keiji Abe, Sub Director of the Kagawa Prefecture Waterworks Bureau, for 27 days from 13 March to 8 April 1988.

The Study Team held a series of discussions on the Project with the officials concerned of the Government of Zambia and conducted studies through field surveys and collected data in the Project area which were necessary for the basic design as well as for understanding the background of the request, the objectives and contents of the Project, and the water supply situations in the Area.

The major points agreed upon as a result of the discussions and field surveys were written up as the Minutes of Discussions. On 22 March 1988, the document was signed by Mr. Namukolo Mukutu, the Permanent Secretary of the Ministry of Agriculture and Water Development, and Mr. Keiji Abe, the Study Team leader (see Appendix).

Upon returning to Japan, the Study Team conducted the Project analysis based on the field survey results and examined the propriety and contents of the Project, the equipment and materials that need to be provided, and the Project implementation plan. As a result, the optimum basic design was made and this report, the "Basic Design Study for the Groundwater Development Project (Phase II) in the Southern Province of the Republic of Zambia," has been prepared.

CHAPTER 2. PROJECT BACKGROUND

CHAPTER 2 PROJECT BACKGROUND

2.1 DESCRIPTION OF ZAMBIA

2.1.1 General Condition

Zambia is a landlocked country in the southern part of Africa. It is located at 8" to 18" S latitude and 23" to 34" E longitude. The country has an area of 752,615 km^2 and is approximately twice the size of Japan. The population of Zambia is about 5.7 million (in 1980). Lusaka is the country's capital.

Zambia gained its independence from a British protectorate, Northern Rhodesia, in October 1964. The following nine provinces make up the country: Central; Copperbelt; Eastern; Luapula; Lusaka; Northern; Northwestern; Southern; Western.

The name Zambia was derived from the 2,740 km long Zambezi River.

The Victoria Great Falls, famous the world over, is located near Livingston in the Southern Province.

For the most part, the country is a flat plateau savanna having elevations of 1,000 to 1,300 m. In the eastern part there are mountain ranges that are more than 2,000 m high. Along the Zambezi River valley, which forms a part of the south and southeastern border, the land elevation is less then 600 m.

The climate can be roughly divided into three seasons: the cool dry season from May to August (9.7° to 25.8°C); the hot dry season from September to November (14.8° to 31.7°C); the hot rainy season from December to April (15.2° to 26.7°C). Precipitation increases from the south to the north and is about 750 mm per year in the southern part and exceeds 1,500 mm per year in the northern part.

The population of this "multi-tribe" country is about 5.7 million (in 1980). The predominant tribes are the Benba in the eastern region, the Ngoni in the southeastern region, and the Tonga and Loji in the southern region. However, in all, there are approximately 73 tribes. Each tribe has its own language, but English is widely used throughout the country as one of the official languages. Most of the people believe in their own traditional primitive religions, but, in city areas, there are some who are either Christian, Hindu, or Islam.

The country's data is shown int he Appendices.

2.1.2 Population

According to the census taken in 1980, the population of Zambia was 5,661,801 of which 2,769,995 were males and 2,891,806 were females. The population distribution and density, by province and by sex, are shown in Table 2-1-1.

Table 2-1-1 POPULATION, POPULATION DENSITY AND AREA BY PROVINCE AND SEX (1980)

Province	Male (Numbers)	Female (Numbers)	Total (Numbers)	(%)	Area (1,000km2)	Population (Population/km2)
Central	257,434	254,471	511,905	9.0	94	5.4
Copperbelt	642,431	608,747	1,251,178	22.1	31	40.4
Eastern	304,143	346,759	650,902	11.5	69	9.4
Luapula	200,674	220,292	420,966	7.4	51	8.3
Lusaka	352,005	339,049	691,054	12.2	22	31.4
Northern	319,703	355,047	674,750	11.9	148	4.6
Northwestern	144,079	158,589	302,668	5.4	126	2.4
Southern	328,342	343,581	671,923	11.9	85	7.9
Western	221,184	265,271	486,455	8.6	126	3.9
Total	2,769,995	2,891,806	5,661,801	100.0	753	7.5

The composition of the population shown in Table 2-1-2 reveals the large percentage of the younger generation.

Table 2-1-2 POPULATION PERCENTAGE BY AGE (1980)

	Under 10	10-19	20-29	30-39	40-49	50-59	60-69	Over 70	Non Specified
Population Percentage	35.5	24.1	14.1	9.4	6.9	4.3	2.7	1.7	1.3

About 2.4 percent of the population are foreigners (from the 1980 census).

The population distribution by province as well as by urban and rural areas is shown in Table 2-1-3.

Table 2-1-3 POPULATION IN URBAN AND RURAL AREAS (1980)

Province	Total (Numbers)	Rural		Urban	
		(Numbers)	(%)	(Numbers)	(%)
Central	511,905	360,486	70.4	151,419	29.6
Copperbelt	1,251,178	221,275	17.7	1,029,903	82.3
Eastern	650,902	588,010	90.3	62,892	9.7
Luapula	420,966	366,024	86.9	54,942	13.1
Lusaka	691,054	139,687	20.2	551,367	79.8
Northern	674,750	556,475	82.5	118,275	17.5
North-Western	302,668	261,819	86.5	40,849	13.5
Southern	671,923	505,368	75.2	166,555	24.8
Western	486,455	404,137	83.1	82,318	16.9
Total	5,661,801	3,403,281	60.1	2,258,520	39.9

Table 2-1-3 reveals that about 60% of the population live in rural areas and about 40% live in urban areas. However, in the Copperbelt and Lusaka provinces that have large urban populations, about 80 to 83 percent of the people live in urban areas, and 17 to 20 percent lie in rural areas. In other provinces, the urban population rate is 10 to 30 percent and the rural population rate is 70 to 90 percent.

The population increase rate is shown in Table 2-1-4. During the period from 1969 to 1980, the population increased 39.6%. The average annual population increase rate was 3.1%. As the average annual increase rate was 6.9% in the urban areas and 1.1% in the rural areas, it can be understood that the population tends to concentrate in the urban areas.

The Central Statistical Office has forecasted that by 1990 the country's population would be 8.073 million.

Table 2-1-4 CHANGE OF POPULATION AND ANNUAL POPULATION INCREASE RATE BY PROVINCE

Item		Census				Average Annual Population Increase Rate		
		1980	1974 (Sample Census)	1969	1963	1969-1980 (%)	1969-1974 (%)	1963-1969 (%)
Total		5,661,801	4,677,000	4,056,995	3,490,170	3.1	2.9	2.5
Province	Central	511,905	397,000	358,655	309,407	3.3	2.1	2.5
	Copperbelt	1,251,178	1,046,000	816,309	543,465	3.9	5.1	7.0
	Eastern	650,902	570,000	509,515	479,866	2.3	2.3	1.0
	Luapula	420,966	321,000	335,584	357,018	1.9	-0.9	-1.0
	Lusaka	691,054	522,000	353,975	195,757	6.3	8.1	10.4
	Northern	674,750	584,000	545,096	563,995	2.0	1.4	-0.6
	Northwestern	302,668	242,000	231,733	211,189	2.4	0.8	1.6
	Southern	671,923	534,000	496,041	466,327	3.0	1.5	1.0
	Western	486,455	460,000	410,087	362,480	1.6	2.3	2.1
Urban Area		2,258,519	1,663,000	1,192,116	715,020	6.7	6.9	8.9
Rural Area		3,403,282	3,014,000	2,864,879	2,774,484	1.1	1.0	0.5
% of Urban Area		39.9	35.6	29.4	20.5			

2.1.3 Politics and Economy

Zambia gained its independence from England in October 1964. Since its independence, the United National Independence Party (UNIP), headed by His Excellency President Dr. Kenneth David Kaunda, has governed the country on its own socialistic path by setting a goal of "One Zambia, One Nation."

The economy of Zambia has been supported by copper which is produced abundantly in Copperbelt Province. In 1974, copper-related industries represented about 30% of the country's gross domestic product (GDP), and copper exports accounted for more than 90% of the country's total export value. The economy of Zambia is monoculture relying on copper.

In 1975, world copper prices plummeted. Since that time, the price has not recovered, and the GDP changed to a negative growth rate in the mid 1970's. The price recovered slightly by the end of the 1970's, but the country's economy remains in a stagnated condition.

Since gaining its independence, the Zambia Government's objective has been to get away from the monocultural economic condition that is based on copper. In the Third National Development Plan (1979-1983), the government made strenuous efforts to (1) revise the economy that was overly inclined towards copper, (2) to stress labor intensive industries to increase employment opportunities, (3) to develop agriculture, and (4) to drive forward with rural development.

In 1984, the copper-related industries accounted for approximately 14% of the GDP, but the copper exports were still 88% of the country's total export value.

Due to changes in the international situation, the government devalued the country's currency by 69.3% during the October 1985 through October 1986 period. As a result, the country's external debts and transportation costs increased in inverse proportion to the depreciated currency value. In spite of the currency devaluation, the export of industrial and agricultural products did not increase as initially planned. Therefore, the already depressed financial position of the country declined even further. Furthermore, the retrenchment economic policy and the foreign exchange auctioning system had negative effects on the economic development causing consumer prices to soar 60% in 1986.

Inflation rate changes, foreign exchange rates, and current account balances are shown in Table 2-1-5.

Table 2-1-5 CHANGE OF INFLATION RATE, FOREIGN EXCHANGE RATE AND CURRENT ACCOUNT BALANCE

	Inflation Rate	Foreign Exchange (For 1 US Dollar)	Current Account Balance	
1981	13.6 %	0.88 K	(Million K)	(Million K)
1982	12.6	0.93	-578.9	
1983	19.4	1.23	-295.0	
1984	20.1	1.79	-317.0	(-317)
1985	36.8	2.38	-429.2	(-671)
1986	60.0	7.51	-2,345.7	(-2,345)
1987	41 (1986.10 ~ 1987.10)	8.00 (April 18.35 ~ May 8.00)	-817.6	(-482) Estimation
1988	-	8.00		(-1,319) Supposition
Source	Country Profile 1985 and Economic Report 1987 (1988.1)	Date from Bank of Zambia fix K8.00 per US$1.00 from 1987 May	Zambia in Figures (1985, 86, 87)	New Economic Recovery Programme (1987. 7)

In April 1987, the foreign exchanges rate was 18.35 kwachas to 1 U.S. dollar. In May 1987, the Zambian Government halted the programme of the International Monetary Fund (IMF) and fixed the exchange rate at 8.00 kwachas per 1 U.S. dollar to stabilize the economy.

In July 1987, the government established a new economic recovery programme, the "Interim National Development Plan."

2.1.4 National Development Plan

As international copper prices and the country's copper production greatly influences Zambia's economy, it has been the objective of the government to get away from the monocultural economic condition based on copper. For this reason, the government established and implemented a series of development plans -- the Urgency Plan in 1964-65, the Tentative Plan in 1965-66, the First National Development Plan (FNDP) in 1966-70, the Second National Development Plan (SNDP) in 1972-76, and the Third National Development Plan (TNDP) in 1979-83. Currently, the government is in the midst of preparing the Fourth National Development Plan.

The main development objectives mentioned in the three development plans, FNDP through TNDP, were to extricate the country from the monocultural economic condition and to diversify the country's economy as summarized in the following eight items:

(1) To diversify the copper inclined industries into various new industries to meet domestic demands.

(2) To develop other types of mining in addition to copper mining.

(3) To expand industries that utilize domestic raw materials.

(4) To increase employment opportunities.

(5) To implement rural development projects in order to direct the rural production elements towards the country's economic and social development, thus eliminating the economic imbalance between rural and urban areas.

(6) To raise educational standards in order to develop the country's human resources.

(7) To supply facilities necessary for upgrading the standard of living.

(8) To reorganize infrastructures, the foundation of economic development.

In order to cope with the recent changes of international environment and the worsened domestic economy, the government launched the Interim National Development Plan (July 1987 to December 1988). The Plan is now in progress.

The primary target of the plan is to stabilize the country's economy by controlling inflation. The plan, therefore, focuses on:

(1) Directing the country's scarce foreign exchange into reactivation of selected high priority development projects by restraining imports and foreign debts.

(2) Activating the economy by promoting exports.

(3) Stabilizing the economy by controlling inflation.

(4) Promoting the economy by expanding the domestic demands through the use of domestic raw materials and by the reinvestment of capital in selected sectors.

(5) Diversifying export items.

(6) Restructuring production and consumption patterns.

(7) Increasing employment opportunities through the activation of the rural economy.

(8) Increasing the government's economic management capability.

(9) Setting up suitable objectives to prevent the stagnation of the economy.

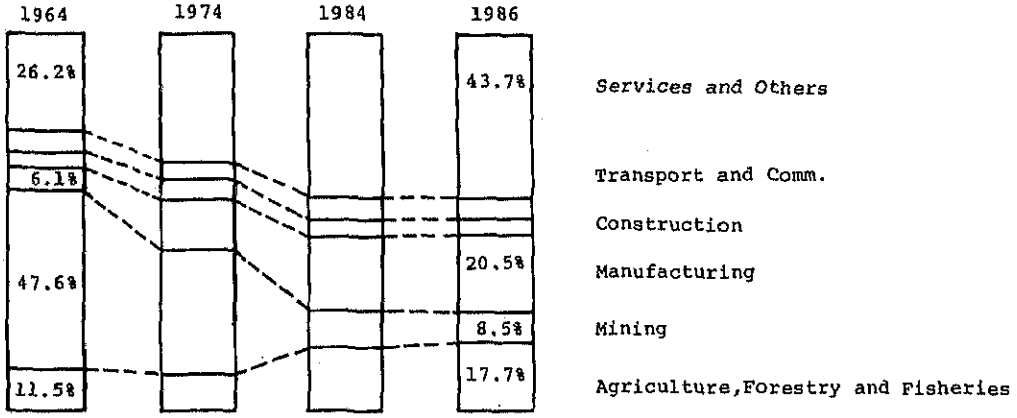
2.1.5 Industries, Employment, and Public Health Situations

Zambia's industrial structure and changes thereto can be examined by the ratio of GDP as shown in Fig. 2-1-1. The mining industry that had occupied about 50% of the GDP since the country gained its independence decreased continuously after the 1975 copper price fall -- in 1986, it was only about 8.5% of the GDP. To compensate for the decrease in the mining sector, rates of the service sector, industries other than mining, agriculture, forestry, and fisheries have increased. However, the monetary value of the GDP (based on 1977 values) has remained at about the same level and the magnitude of the entire economy has not increased. It can be judged that only the rates of the service sector, other industries, agriculture, forestry and fisheries have increased reciprocally to those of the mining sector.

Following are the situations of major industries, employment, and public health:

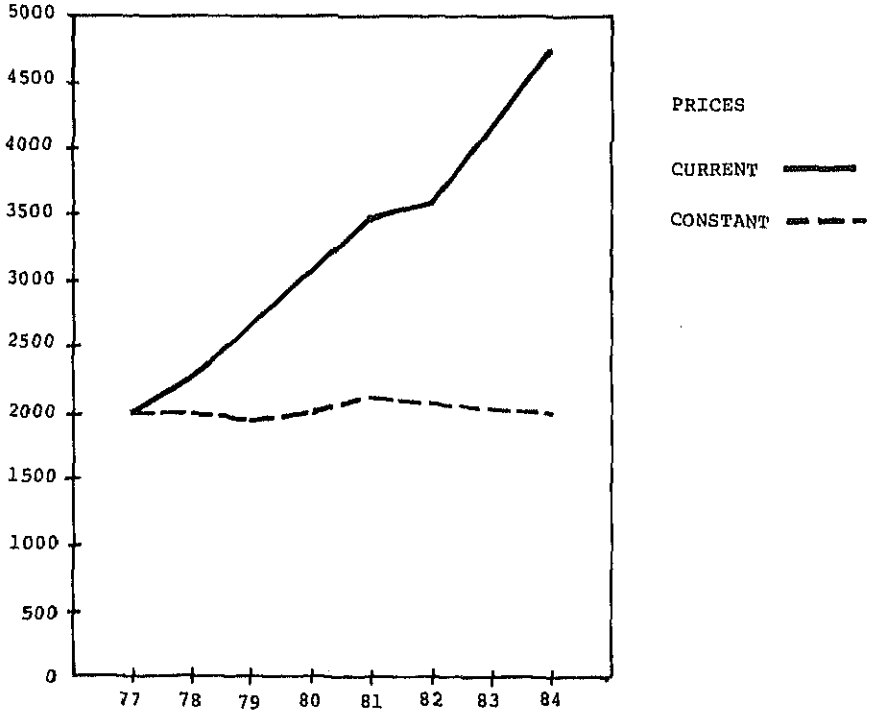
Fig. 2-1-1 STRUCTURE OF INDUSTRIES AND GROSS DOMESTIC PRODUCT

(1) Structure of Industries with the Changes
(by gross domestic product)



Monthly Digest of Statistics,
New Economic Recovery Programme 1987

(2) GROSS DOMESTIC PRODUCT
(K'MILLION)



1 Agriculture

57% of the Zambian population live in rural areas -- about 2/3 of all households are engaged in agriculture. In 1978, about 722,000 households engaged in the traditional self-sufficient agriculture; there were about 1,600 commercial farms.

About 7% of the country's land is arable; 78% of this land is occupied by self-sufficient farmers. Irrigated farm land is less than 1% of the total amount of arable land, and Zambian agriculture relies almost completely on precipitation. Consequently, drought directly affects agricultural products and inflicts serious damage.

The main cultured farm products include maize, rice, wheat, millet, sorgham, and cassava for staple crops, and sugar cane, cotton, coffee, tea, groundnuts, sunflower, soybeans, and tobacco for cash crops.

2 Mining

From the time of the country's independence in 1964 and up through 1975, mining was the largest, sole industry of Zambia that shared 35% of the GDP, 45% of government revenues, and 95% of the total export value. At its peak in 1969, Zambia produced 12% of the world's copper, and ranked third amongst the world's copper producing countries. However, during the 1974-75 period, after the oil crisis, copper prices fell 40% and the mining sector's GDP rating decreased sharply -- it fell to 12.1% in 1978 and to 8.5% in 1986. Yet, the total export value of mining was 97% in 1969, 84% in 1980, and 88% in 1984.

3 Manufacturing Industries

Since gaining its independence in 1964, the government of Zambia has promoted sugar refining, cement, tobacco, beer, textile, and canning industries that use domestic raw materials in order to reduce the number of imported items. The purpose of this is to extricate the country from a monocultural economy that is based on mining.

Expressing the industrialization trend by the ratio Total output of manufacturing industries / GDP, it was 6.1% in 1964, 12.7% in 1971 and 17.1% in 1978. From this, it can be seen that the country's industrialization has gradually been making progress. However, by looking at the manufacturing industries share of the GDP, its 1974 index was 108.4 in comparison to its 1973 index of 100. After 1974, its share declined until 1984. In 1987 its index stood at 112.3.

Among the manufacturing industries, the progress of the food, beverage, tobacco, textile, clothing, paper and paper products industries was higher than the average for all manufacturing industries. Other manufacturing industries have been stagnant.

4 Employment Situations

According to the Formal Sector, the number of employed persons in Zambia was 387,000 in 1974 and 365,000 in 1984. From 1972 through 1984, the number of employed either decreased or remained unchanged. The highest level of employment was in 1975 when it reached 394,000.

In 1974, 90.9% of the country's work force was comprised of Zambians; the remaining 9.1% was made up of foreigners. The percentage of foreigners in the work forces fell to 3.8% in 1984 -- about one half of 1974's figure.

Persons employed in each industry are as follows:

	1974 x 1,000	1984 x 1,000
Agriculture, Forestry, and Fisheries:	34 (8.7%)	35 (9.6%)
Mining:	65 (16.8%)	58 (15.9%)
Manufacturing:	44 (11.4%)	48 (13.2%)
Construction:	71 (18.3%)	34 (9.4%)
Total	387 (100%)	365 (100%)

From the above table it can clearly be seen that the employment situation, as well as the economy, has suffered setbacks since the copper price fall of 1975. In particular, the number of employed persons in the construction industry was cut in half during the 10 years from 1974 through 1984.

Details of the employment structure and the number of personnel employed are listed in the Appendix.

As the industrial structure changed, the employment structure also changed. Employment in the tertiary industries has increased.

Data related to consumer prices and infrastructures is listed in the Appendices.

5 Public Health

Causes of diseases and death in Zambia are largely related to the country's public health environment.

Table 2-1-6 shows the outline of water supply and sanitation services. The table reveals that clean, safe drinking water is supplied to only 46% of the people, and sanitation services are provided to 37% of the people.

The predominant diseases in Zambia are listed below:

Respiratory diseases
Diarrhoea
Malaria
Malnutrition
Measles
Pneumonia

As for diarrhoea, a disease directly related to public health conditions, in 1982, about 828,000 children (under the age of 15) treated at hospitals and clinics. Of the total number of outpatients, this figure was the second highest. About 10,000 of the children were hospitalized (about 5% of the total number of inpatients), and 411 of them died (3.2% of total child death) (see Table 2-1-7 through 2-1-10). In the same year, 733 persons (this includes adults) died from diarrhoea. This figure was 4.1% of all death cases. Diarrhoea ranks 8th as a leading death cause.

TABLE 2-1-6 LEVELS OF COVERAGE OF WATER SUPPLY AND NIGHT-SOIL TREATMENT (1980)

	Water Supply		Night-soil treatment		
	Population	Population Percentage against Total Population of Zambia	Population	Population Percentage against Total Population of Zambia	Kind of facility
Large Urban Areas	1,330,192	23 %	988,144	17 %	Flush toilet
Small Urban Areas and Rural Townships	267,000	5	166,000	3	Flush toilet
Rural Areas	1,021,000	18	971,817	17	Pit latrine
Total	2,618,192	46	2,125,961	37	

TABLE 2-1-7 MAJOR TEN CAUSES OF OUTPATIENTS IN HOSPITALS AND HEALTH CENTERS AMONG CHILDREN (UNDER 15 YEARS), 1982

Major Ten Causes	Cases Treated	Percent of Total OutPatient (%)
Upper Respiratory, Track Infections	1,234,422	18
Diarrhoea	828,349	12
Malaria	640,534	9
Injuries	546,846	8
Diseases Eye	472,123	7
Diseases Ear	150,765	2
Diseases Tooth	61,219	0.9
Ulcers (Skin)	62,175	0.9
Bilharzia	55,124	0.8
Scabies	41,046	0.6
Total	4,092,603	59.2 %

Source: Ministry of Health: Statistics Unit.

Table 2-1-8 TEN MAJOR CAUSES FOR HOSPITALIZATION OF CHILDREN (UNDER 15 YEARS OF AGE) 1982

Major Causes	Admissions	%
Malaria	34,667	17.8
Measles	15,824	8.1
Malnutrition	14,231	7.3
Pneumonia	12,543	6.4
Acute Upper Respiratory Infections	10,780	5.5
Other Causes of Preinatal Morbidity and Mortality	9,858	5.1
Enteritis and Other Diarrhoeal Diseases	9,746	5.0
Anaemia	8,133	4.2
Infections of Skin and Subcutaneous Tissues	7,893	4.1
Accidental Falls and Accidents Caused by Fires	6,941	3.6
Total Ten Major	130,616	67.1
Total Admissions	194,735	100.0

Table 2-1-9 MAJOR CAUSES OF MORTALITY AMONG CHILDREN (Under 15 years of Age in Hospitals) 1982

Major Causes	Deaths in Hospitals	%
Malnutrition Other Nutritional Deficiencies	2,788	22.0
Disorder of Newborn and Prenatal Period	2,394	18.9
Pneumonia	1,281	10.1
Measles	1,112	8.8
Gastroenteritis and Other Diseases of the Digestive System	1,111	8.8
Malaria	742	5.9
Anaemia	624	4.2
Enteritis and Other Diarrhoeal Diseases	411	3.2
Anoxic and Hypoxic Conditions	333	2.6
Meningitis	298	2.4
Total Ten Major	11,094	86.9
Total All Causes	12,647	100.0

Table 2-1-10 TEN MAJOR CAUSES OF TOTAL HOSPITAL MORTALITY

Major Causes	1982	
	Number of Deaths	% to Total
Malnutrition and Anaemia	3,693	20.6
Disorders of New-born Prenatal Period	2,394	13.4
Pneumonia	1,571	8.8
Measles	1,126	6.3
Malaria	919	5.1
Diseases of Heart	811	4.5
Gastroentritis	810	4.5
Dysentery/Entritis and Other Diarrhoeal Diseases	732	4.1
Accidents and Injuries	677	3.9
Malignant Neoplasm and Leukamia	507	2.8
Ten Major Causes	13,240	74.0
Total Deaths	17,887	100.0

The number of hospitals, hospital beds, doctors, and other related data are shown in the Appendices. Data concerned with the country's education and international cooperation are also listed in the Appendices.

2.2 GENERAL DESCRIPTION OF WATER SUPPLY PROJECTS

2.2.1 Government and Department of Water Affairs Budgets

To obtain a general idea concerning expenditures for water supply projects, and the budgets of the Zambian government, the Ministry of Agriculture and Water Development (MAWD), and the Department of Water Affairs (DWA) are tabulated in Table 2-2-1.

Table 2-2-1 EXPENDITURE ESTIMATES OF ZAMBIA, MAWD AND DWA

Estimates of Expenditure		1986	1978	1988
Total Zambia	(x1,000,000K) (A)	5,383.60	7,228.94	8,303.15
Total MAWD	(x1,000,000K) (B)	232.45	431.52	437.79
	B/A x 100 (%)	4.3 %	6.0 %	5.3 %
Total DWA	(x1,000,000K) (C)	49.48	65.28	49.53
	C/B x 100 (%)	21.3 %	15.1 %	11.3 %
Capital Expenditure of DWA	(x1,000,000K) (D)	38.64	52.14	28.34
	C/D x 100 (%)	78.1 %	79.9 %	57.2 %
Foreign Aid Expenditure	x 100 (%)		(83 %)	(84 %)
Foreign Exchange Rate (Against 1 US$)		K 7.51	K 8.00	K 8.00

The government's 1987 budget was about 7.2 billion kwachas (approximately 117.47 billion yen; 1 U.S. dollar = 130 yen = 8.0 kwachas. 1 kwacha = 16.25 yen). MAWD's budget in the same year was about 430 million kwachas (approximately 7.0 billion yen), and represented 6% of the government's budget. DWA's budget was about 65 million kwachas (approximately 1.06 billion yen), and represented 15.1% of MAWD's budget.

About 52.14 million kwachas (850 million yen) of DWA's budget was allocated to the development investment budget. This figure was 79.9% of DWA's

total budget. About 83% of the development investment budget relys on foreign aid.

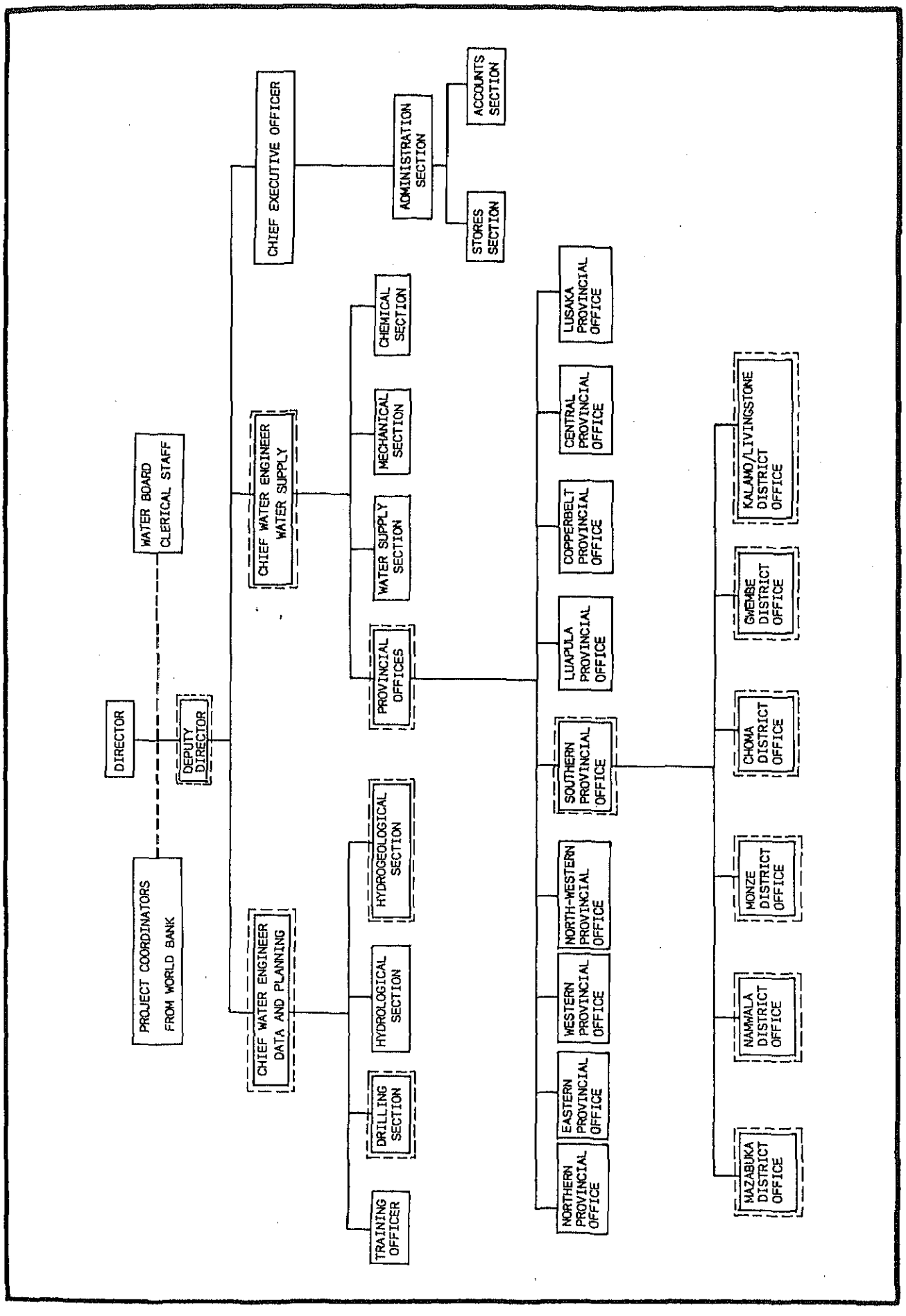
The District Council of each province allocates a portion of its budget to the development investment budget. The District Councils also rely on foreign aid.

DWA is mostly responsible for the water supply projects in rural areas.

Fig.2-2-1 shows DWA's organization chart.

Fig 2-2-1 ORGANISATION CHART NOVEMBER,1986

DEPARTMENT OF WATER AFFAIRS



2.2.2 Boundaries of the Water Supply Administration and the Beneficiaries of the Water Supply

To better understand the present water supply situation in Zambia, the water supply areas that are divided into separate administrative sectors are described herewith. The responsibilities of the administrators of these sectors are also given. The water supply areas are classified into the following three groups:

1 Large Urban Are (LUA)
LUA is categorized as a city which has a population of more than 50,000. There are ten LUA in the country. District Councils are responsible for the water supply in the LUA.

2 Small Urban Townships (SUT) and Rural Townships (RT)
There are 87 townships (75 SUT and 12 RT) in the country. There is no population requirement for categorizing a township as a SUT or RT. However, most SUT and RT have populations of more than 1,000 (the smallest township has a population of 577).

Water supply projects in SUT and RT are mostly managed by DWA. Some projects are managed by District Councils. Mining and railroad companies take part in some water supply projects.

3 Rural Areas (RA)
In areas other than LUA, SUT, and RT, District Councils construct, operate, and in general, maintain the water supply facilities. However, DWA does operate and maintain some of the facilities.

The population in each water supply area is shown in Table 2-2-2.

Table 2-2-2 POPULATION OF ZAMBIA BY WATER SUPPLY AREA

Item	Nos.	Population	%
Large Urban Areas	10	1,900,276	33
Small Urban Townships	75	540,143	10
Rural Areas		3,239,389	57
Total		5,679,808	100

The average annual population increase in each water supply area is shown in Table 2-2-3.

The responsibilities of each water supply administrative group are shown in Table 2-2-4.

Table 2-2-3 PRESENT AND FUTURE POPULATION IN ZAMBIA

Category	Average Annual Growth Rates (%)		Population		
	1980-1990	1990-2000	1980	1990	2000
LUAs	4.4	4.6	1,900,000	2,922,500	4,582,200
SUTs	8.1	6.3	593,000	1,292,000	2,380,300
All Urban Areas	5.4	5.0	2,493,000	4,214,600	6,962,500
Rural Areas	0.4	0.3	3,187,000	3,316,800	3,417,700
Total	3.3	3.2	5,680,000	7,531,400 *	10,380,200

(DECADE 1985)

TABLE 2-2-4 SUMMARY OF SECTOR RESPONSIBILITIES

	Type of Water Supply						Sanitation			
	Large-scale Pipe Line		Small-scale Pipe Line		Well		Water-borne		Pit Latrine	
Task / Category	C	O/M	C	O/M	C	O/M	C	O/M	C	O/M
Large Urban Areas	DC	NIL	NIL	NIL	NIL	DC	DC	DC	DC	CC
Small Urban Areas	DC/DWA	DC/DWA	NIL	NIL	DWA	DC	DC/BD	DC/BD	DC	DC
Rural Areas	NIL	NIL	DWA	DC/DWA	DWA	DC	NIL	NIL	MOH	MOH

(DECADE REPOORT 1985)

C - Construction
O&M - Operation and Maintenance
NIL - No such scheme in category mentioned
OC - District Council
MOH - Ministry of Health
BD - Buildings Department (Ministry of Works and Supply)
DWA - Department of Water Affairs (Ministry of Agriculture and Water Development

2.2.3 Water Supply Situations

An outline of the water supply areas and the beneficiaries of the water supply during 1980 are shown in Table 2-2-5.

Table 2-2-5 SUMMARY OF LEVELS OF SERVICE (1980)

Item	Acceptable Water Supply			Unacceptable Water Supply*		
	Population	% Population Served	% National Population	Population	% Population Served	% National Population
Large Urban Areas	1,330,192	70	23	570,083	30	10
Small Urban Townships	267,000	45	5	326,000	55	6
Rural Areas	1,021,000	32	18	2,179,000	68	38
Total	2,618,192	-	46	3,075,083	-	54

Note: Communal taps at a distance of more than 100 m are considered as an unacceptable supply.

Table 2-2-5 reveals the following water supply situations: The census of 1980 indicated that the country's population was approximately 5.68 million. 33% of the population (about 1.9 million) lived in the ten large urban areas (LUA). 70% of the urban population (1.33 million) received their water supply from pipe lines. The remaining 30% of the people (about 570,000) did not have communal taps within a radius of 100 m from their houses.

In the 75 small urban townships (SUT) and the 12 rural townships (RT), approximately 10% (590,000 people) of the country's population reside. 45% of them (267,000 people) received their water supply from pipe lines. The remaining 55% (326,000 people)

did not have communal taps within a 100 m radius of their houses.

In rural areas (RA), approximately 3.2 million people (about 57% of the country's population) reside. 1.02 million (32%) of the rural population either had commercial taps, deep wells, or shallow wells with a radius of 100 m from their houses. The remaining 68% of the rural population (about 2.18 million people) did not have communal taps, deep wells, nor shallow wells within a radius of 100 m from their houses.

Some 3.08 million people (54% of the country's population) did not have communal taps, deep wells, nor shallow wells within a radius of 100 m from their houses. These people had to rely on distant communal taps or wells, or on surface waters from rivers, streams, lakes, or ponds for their drinking water.

About 2.62 million people (46% of the country's population) either had communal taps or wells with a radius of 100 m from their houses. The situations of those water supply facilities are described herewith:

- Water Sources

  Water sources in LUA and SUT consist mainly of surface water. Approximately 90% of the water sources in LUA are surface water, and 10% are groundwater. About 75% of the water sources in SUT are surface water and the other 25% are groundwater.

  In RA, 22% of the water sources are surface water and 78% are groundwater. The groundwater is supplied without any treatment. In LUA, surface water is supplied after being treated at purification plants. In most SUT, surface water is supplied after chlorine treatment and sand

filtration. However, in some SUT untreated surface water is supplied.

- Water Supply Method
  In LUA and SUT, water is supplied by pipe lines. Tables 2-2-6 and 2-2-7 show the levels of water supply in LUA and SUT.

  In RA having less than 500 residents, water is supplied by facilities having only shallow or deep wells. In some RA that have more than 500 residents, water is supplied through small-scale pipe lines in limited areas.

  Table 2-2-8 and 2-2-9 show water sources and water supply situations in RA.

The above description outlines the conditions of the acceptable water supply that provides water to 46% of the country's population.

Table 2-2-6 SERVICES LEVELS OF WATER SUPPLY IN 10 LUAs (1980)

Housing Category	Type of Service	Population	%
High Cost	Private Tap in Pilot	133,019	7.0
Servants Quarters	"	114,016	6.0
Medium Cost	"	95,014	5.0
Low Cost	"	570,083	30.0
Low Cost	Shared Taps	133,019	7.0
LC/Service Suit Unit*	Communal Taps	285,041	15.0
Squatters	Traditional Source (Unacceptable Supply)	570,083	30.0
TOTAL		1,900,276	100.0

(DECADE Report 1985)

Table 2-2-7 SERVICE LEVELS OF WATER SUPPLY IN 75 SUTs AND 12 RURAL TOWNSHIP (1980)

Housing Category	Type of Service	Population	%
High Cost	Water within Plot	15,000	2.5
Medium Cost	MT and ST	29,000	4.9
Low Cost	MT and ST	118,000	19.9
Low Cost	Shared/Communal taps with 100 m	84,000	14.2
Service Site	Water within Plot or within 100 m	21,000	3.5
Inadditional/Squatter	Communal taps/ traditional source (unacceptable supply)	326,000	55.0
Total		593,000	100.0

Note: Communal taps at a distance of more than 100m are considered as an unacceptable supply.

(DECADE Report 1985)

Table 2-2-8 TYPES OF RURAL WATER SUPPLY SYSTEMS IN USE IN 1980

Type of Supply	No. of Supplies	Population Supplied	% of Population	% Total Population
Protected Shallow Well	3,900	390,000	36	12
Borehole	1,800	450,000	42	14
Small Piped Water Supply	230	230,000	22	7
Total		1,070,000	100	33

(DECADE Report 1985)

Table 2-2-9 COVERAGE FOR RURAL WATER SUPPLIES

Province	Total Population (x1000)	Population Served (x1000)	% of Population Served
Central	327	115	35
Copperbelt	99	40	40
Eastern	589	208	35
Luapula	343	99	29
Lusaka	114	39	34
Northern	553	168	30
Northwestern	261	75	28
Southern	494	149	30
Western	420	128	30
TOTAL	3,200	1,021	32