

**Basic Design Report
on
The Construction Project
of
Food Grain Storehouses
in
The Republic of Zambia**

February, 1986

Japan International Cooperation Agency

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of
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PREFACE

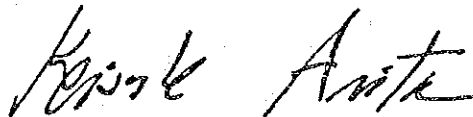
In response to the request of the Government of the Republic of Zambia, the Government of Japan decided to conduct a basic design study on the Construction Project of Food Grain Storehouses and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Zambia a study team headed by Mr. Seiichi Kanai, Deputy Head, First Basic Design Study Division, Grant Aid Planning & Survey Department JICA from 10th to 25th November.

The team had discussions with the officials concerned of the Government of Zambia and conducted a field survey in Chingola area. 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 our two countries.

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

February, 1986



Keisuke Arita

President

Japan International Cooperation Agency

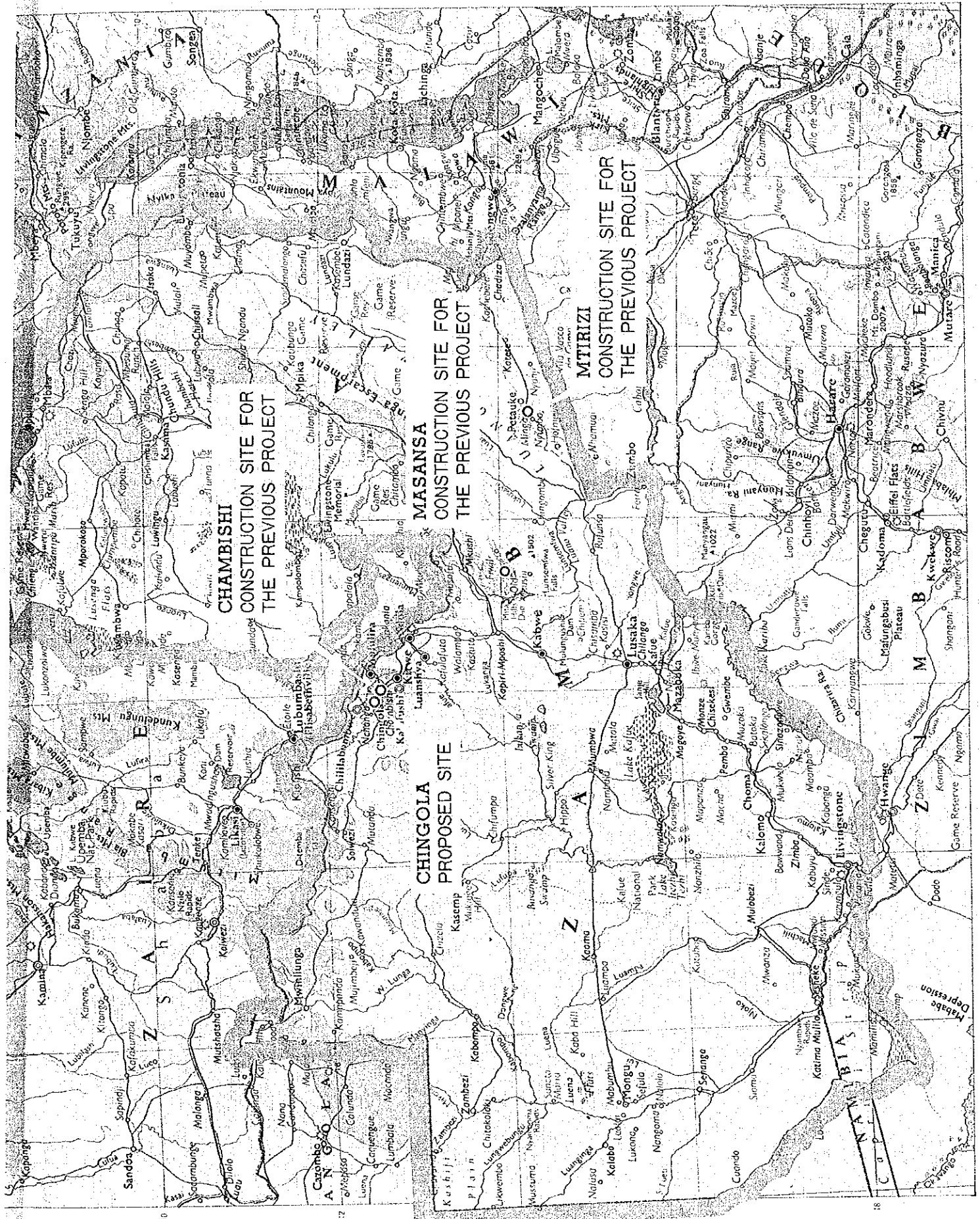
CONTENTS

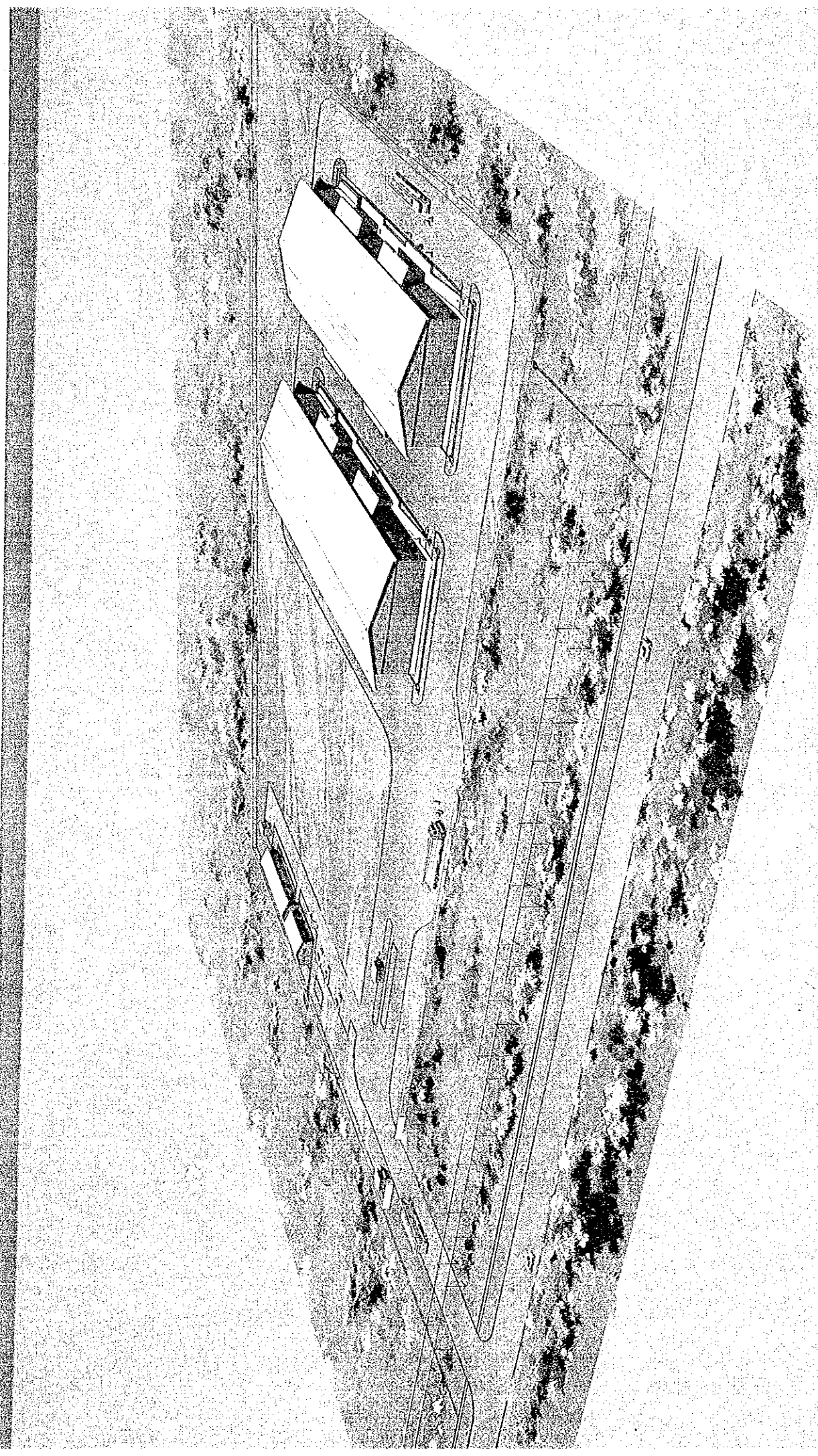
MAP	
BIRD'S EYE VIEW	
PHOTOGRAPHS OF PROPOSED SITE	
PREFACE	
SUMMARY	1
CHAPTER 1. INTRODUCTION	7
CHAPTER 2. BACKGROUND OF PROJECT	11
2.1 General Conditions	13
2.2 Agricultural Conditions	16
2.2.1 Production and import of food grain.....	16
2.2.2 Distribution of food grain and construction of storehouses	20
CHAPTER 3. OUTLINE OF PROJECT	27
3.1 Objectives of Project	29
3.2 Project Orientation	30
3.2.1 Conditions for project sites	30
3.2.2 Current grain distribution at proposed site and determination of storage capacity	31
3.2.3 Physical and geographical conditions of proposed site	39
3.2.4 Site plan for proposed site	41
3.3 Basic Design	45
3.3.1 Basic design policies	45
3.3.2 Storage and cargo handling plan	45
3.3.3 Facility plan	46
3.3.4 Equipment plan	53
3.3.5 Basic design drawings	55
3.4 Cost Estimation	77
3.4.1 Estimation conditions	77
3.4.2 Scope of work	78
3.4.3 Estimation of cost to be borne by the Government of Zambia	79

CHAPTER 4.	ORGANIZATION FOR IMPLEMENTATION OF PROJECT	81
4.1	Operation Organization	83
4.2	Construction Plan	83
4.3	Scope of Work	85
4.4	Work Schedule	85
CHAPTER 5.	EVALUATION OF PROJECT	89
CHAPTER 6.	CONCLUSION AND RECOMMENDATIONS	91

APPENDIX

1.	Minutes of Discussions	97
2.	Intent of Request by the Government of Zambia	101
3.	Organization of Members of the Study Team	102
4.	List of Officials Concerned	103
5.	Schedule of Basic Design Study	104





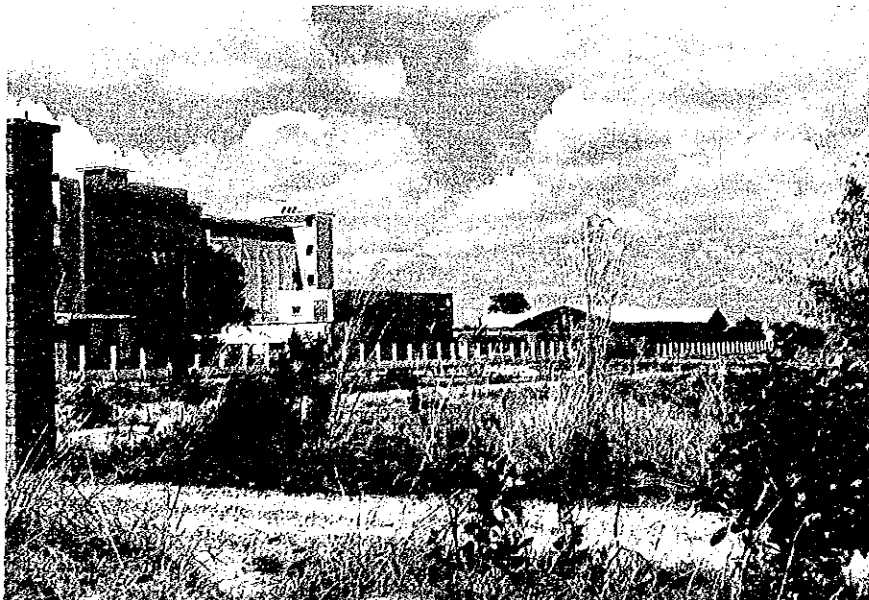
BIRD'S EYE VIEW



Whole View of
Proposed Site



Northern Part of
Proposed Site



Neighbouring Flour Mill

SUMMARY

SUMMARY

The Republic of Zambia established its political independence in 1964. The economy in Zambia, however, which relies on its copper industry has worsened rapidly due to the drastic fall of the international copper price in 1975. The Government of Zambia has inevitably changed its policies which depend on the economic structure centered around copper. Since then, it has been following a policy which places great importance on agriculture. In recent years, however, the food self-sufficiency rate has been decreasing under such unfavorable conditions as the rapid increase in urban population, insufficient investments in agriculture due to lack of foreign currencies, drought, etc. In Zambia, food grains are produced by traditional peasant farmers who are engaged in self-sufficient agriculture, emergent farmers who raise some cash crops and commercial farms which produce farm products on a large scale. Maize, which is the staple food of Zambia, accounts for about 80% of the grain consumption in that country and is mainly produced in Central, Eastern, and Southern Provinces.

Distribution of these food grains begins with the Cooperative Marketing Unions which buy them from farmers. To meet the demand within a province, the Cooperative Marketing Unions sell grains directly to the consumers. To meet demand from outside the province, the National Agricultural Marketing Board (Namboard) buys the grains from the Cooperative Marketing Unions, transports it outside the province and then sells it to the millers. During the above distribution processes involving transportation and storage, however, crops undergo large losses in both quality and quantity. This accelerates the fall of the food self-sufficiency rate.

In Zambia, the indoor storage facilities for food grains are insufficient. As a result, most of grains are stored outdoors piled up in the field. These undergo major losses in quality due to direct sunlight, rain, and moisture from the ground and in quantity due to such pests as insects and rats, as well as broken bags, etc.

Under such circumstances, the Government of Zambia is actively constructing all-weather type grain storehouses with the assistance of

foreign countries, such as Japan, Canada, the EC, etc., to achieve smooth grain distribution by reducing loss of grain during distribution.

As part of this project, the Government of Zambia has requested financial assistance from the Government of Japan to construct food grain storehouses. In response to the request, the Government of Japan decided to provide food grain storehouses, in the fiscal year of 1984, which can store a total of 19,000 tons in 3 sites: Chambishi in Copperbelt Province, Masansa in Central Province and Mtirizi in Eastern Province. At present, these storehouses are under construction, completion is expected by March 1986.

Canada, the country which has provided the largest amount of assistance to Zambia for food grain storehouses, has almost completed its project, as of the end of 1985. After Japanese assistance with the storehouses, which contain 19,000 tons of grain, is completed, indoor storage facilities for food grain will reach the remarkable total capacity of 404,700 tons, including the 110,700 tons of silo capacity, constructed before the independence of Zambia. Based on this remarkable achievement, the Government of Zambia is continuing its efforts to achieve its goal of storing all the marketed grain in indoor storage facilities. At this time, the Government of Zambia has requested construction of food grain storehouses in Chingola, in Copperbelt Province, the biggest consumption area.

In response to this request, the Government of Japan has decided to carry out a basic design survey for this project and the Japan International Cooperation Agency dispatched a basic design study team to the Republic of Zambia from Nov. 10th to 25th, 1985.

The study team discussed the concrete details of the request with the officials of the Republic of Zambia concerned and carry out field surveys on the proposed site. The study team analyzed the result of its findings after returning to Japan and completed the Basic Design for the construction of two food grain storehouses with a capacity of 5,000 tons each. The study team analyzed the result of its findings after returning to Japan and completed the Basic Design for the construction of two food grain storehouses with a capacity of 5,000 tons each.

Outline of the basic design is shown below.

1. STOREHOUSES,

Storage capacity 5,000 t x 2 buildings = 10,000 t
Building area 1,629.25 x 2 = 3,258.5 m²
Structure One-storied steel-frame structure

2. AUXILIARY BUILDINGS

	Office	Gatehouse	Truckscale house	Pump room
Area	192.50 m ²	8.75 m ²	8.32 m ²	9.00m ²
Structure	One-storied brick structure	Same as at left	Same as at left	Same as at left

3. EQUIPMENT

Truckscale, capacity 60t 1
Portable conveyor for grain handling 8
Platform scales 6
Sewing machines for grain bags 2
Grain inspection apparatus 1 set

This construction project of food grain storehouses requires a total of 15.5 months, including about 4 months for detailing of design, preparation of tender, selection of the construction company after the exchange of notes, and about 11.5 months for the construction work.

Construction of all-weather type grain storehouses in an important location in the largest consumption area in the country, are expected to help Zambia in the promotion of its agricultural policy by greatly reducing the losses caused during the process of distribution.

CHAPTER 1
INTRODUCTION

CHAPTER 1. INTRODUCTION

The Republic of Zambia established its political independence in 1964. The economy in Zambia, however, which relies on its copper has worsened rapidly due to the drastic fall of the international copper price in 1975. As a result, the Government of Zambia has inevitably changed its policies which depend on the economic structure centered around copper. Since then, it has been following a policy which places great importance on agriculture.

The Government of Zambia announced its "Operation Food Production" program in 1980 and has been trying to achieve self-sufficiency in food. The traditional storage method with grain piled outdoors causes significant quantitative and qualitative loss during distribution, making the food situation worse. Therefore, construction of all-weather type grain storehouses to reduce these losses in the distribution stage is urgent and has become one of the most important agricultural policy of the Government of Zambia.

Under the above circumstances, the Government of Zambia is currently constructing storehouses with the financial assistance of Canada, the EC, Australia, etc. As a part of this program, it has also requested financial cooperation from the Government of Japan in constructing food grain storehouses.

In response to this request, the Government of Japan decided to provide storehouses of a total capacity of 19,000 tons in the 3 locations of Chambishi, Copperbelt Province (consumption area), Masansa, Central Province (production area), and Mtirizi, Eastern Province (production area) in the 1984 fiscal year. At present, their construction is underway with completion expected in March, 1986. In addition to the above projects, the Government of Zambia has requested the construction of food grain storehouses in Chingola, Copperbelt Province (consumption area), this year (1985) as an extension of the above project.

Although the proposed site in Chingola has been listed in the previous request, it had not been a subject of the earlier survey according to the order of priority and urgency.

In response to the request, the Government of Japan has decided to conduct a basic design for this project and the Japan International Cooperation Agency dispatched a basic design study team headed by Mr. Seiichi Kanai, Deputy Head, First Basic Design Study Division, Grantaid Planning & Survey Department, the Japan International Cooperation Agency, from Nov. 10 to Nov. 15, 1985.

This construction project is considered as Phase II of the construction project for the food grain storehouses which is presently under way. General conditions, nation-wide grain distribution and construction conditions in Zambia, has been described in detail in the previous report. Therefore, the study of the above is here limited to the changes since the last report and supplemental surveys. The surveys conducted by this study team are the situations of grain distribution and construction at the proposed site. Also, the economy of Zambia has recently been rapidly worsening, so a study of the effect of these economic changes on the construction cost, has been carried out. The study team has also held discussions with government officials concerned of the Republic of Zambia based on the results of the studies and have reached a mutual agreement on the basic matters necessary to execute this project.

Minutes of the discussions, organization of the study team, officials of the Government of Zambia concerned and the survey schedule are included in the appendix.

The contents of discussions and of the field survey, collected information and materials have been analyzed, and the effect of this project on improvement of grain distribution conditions in Zambia has been evaluated. A proposed basic design has been prepared with the most appropriate scale and conditions for the facilities.

CHAPTER 2
BACKGROUND OF PROJECT

CHAPTER 2. BACKGROUND OF PROJECT

2.1 General Conditions

Natural conditions, social conditions, economic situation, administrative organization, national plans, etc., in the Republic of Zambia, have been stated in detail in the "Basic Design Report on the Construction Project of Food Grain Storehouses in the Republic of Zambia", which was prepared in September, 1984. Therefore, only major economic changes which affected Zambia following the previous study will be stated in this report.

The economy in Zambia is mono-cultural dependent on copper exports for 90% of its foreign currency revenue. In the past, shifts in the copper export business have directly affected the nation's economy. During the time when copper exporting was in good condition, Zambia enjoyed a relatively prosperous economy among African countries. After the sudden drastic drop of the copper price in 1975, Zambia could not modify its imports downward and the Government of Zambia has tried to get out of this difficult situation by external borrowing. As a result, Zambia's external debt has accumulated to about 2.6 billion dollars at present (1984). The Government of Zambia has signed IMF standby credits totalling 436.5 million SDR in April 1983 and July 1984 to cope with the rapid increase of external debt. Zambia also executed various policies to rebuild the domestic economy following the conditions laid down by the IMF at the time each agreement was signed.

However, amid the economic rehabilitation policy has not yet shown remarkable effect, the IMF has requested strongly that Zambia introduce either another devaluation of Zambian currency or a foreign currency auction system.

In response to this IMF suggestion, the introduction of an auction system was announced by President Kaunda on Oct. 4th, 1985. It has been in effect since Oct. 11th, 1985. Under this system, a person who desires a foreign exchange allocation applies to the Bank of Zambia through a city commercial bank, providing an application

which states the amount of foreign exchange allocation desired, the desired exchange rate, the purpose of its use and a check in domestic currency equivalent to the foreign exchange amount. A foreign exchange auction council holds an auction (at first, every Friday, since changed to Saturday). After examining the purpose of use, the council then allocates foreign exchange to the highest exchange rate bidder. The exchange rate for the following week is determined according to this winning bid. As a result, the officially announced exchange rate for the kwacha (Zambian currency) against the U.S. dollar has been devalued sharply down to between 1/2 and 1/3 of its earlier value since the auction system began.

Imported goods have been directly affected by the devaluation, causing severe inflation, and the prices of daily necessities increased by 50% to 150% in the first month and a half after the auction system started. The inflation rate prior to the beginning of the auctions showed an annual rise of 30% which was the highest in the past several years. Also, due to the repeated price increases after the beginning of the auction system, the annual inflation rate by the end of the year is expected to be 130% to 180%, with these severe price increases expected to continue in future.

The foreign exchange rate of the kwacha against the U.S. dollar, before and after the initiation of the auction system, is shown in Fig. 1.

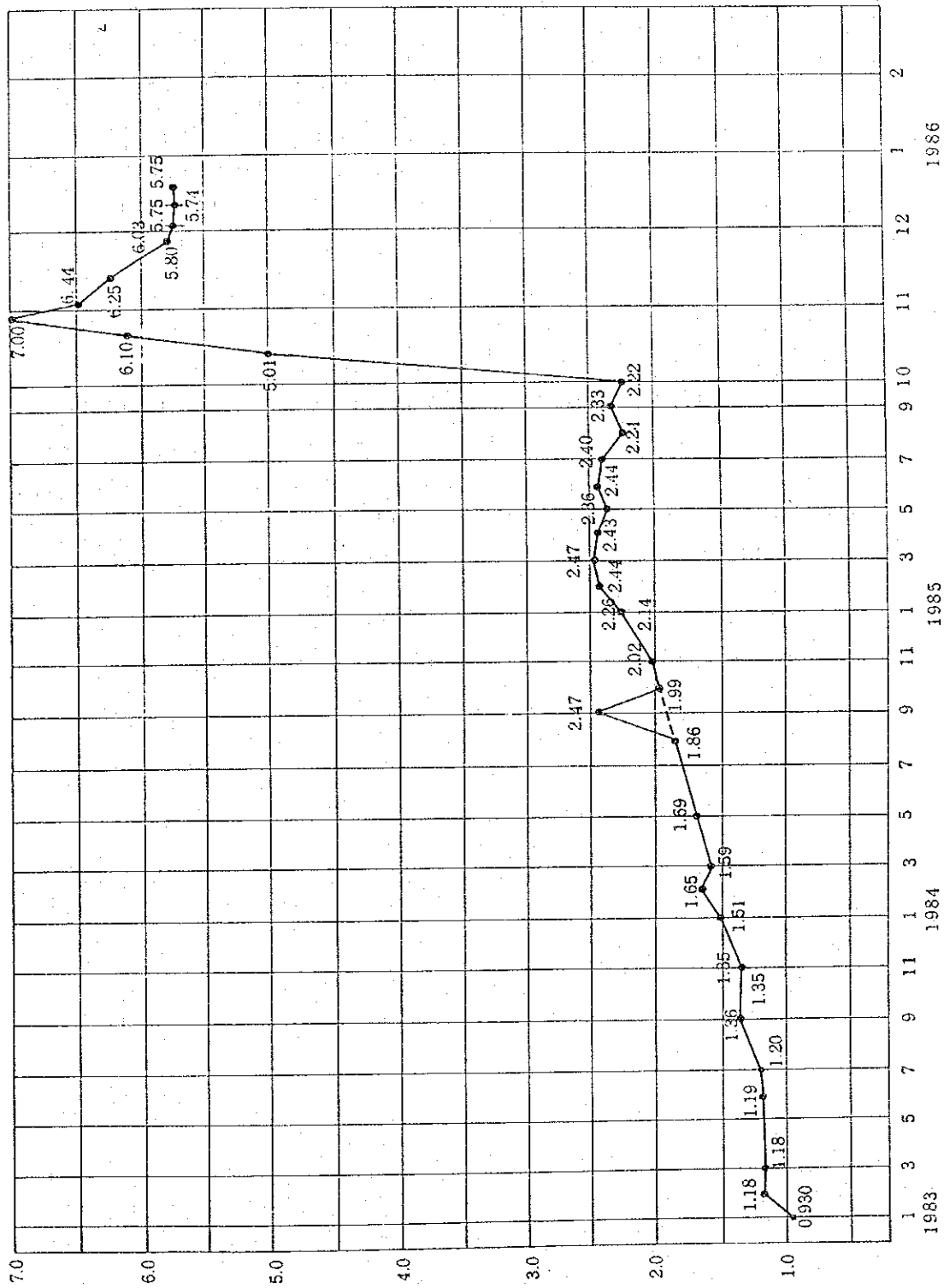


Fig.1 Fluctuation of the Foreign Exchange Rate of the Kwacha Against the U.S. dollar. U.S.\$/KW

2.2 Agricultural Conditions

A thorough investigation was conducted on agricultural conditions in Zambia by the previous Basic Design Study and is described in detail in the Design Study Report. Therefore, the investigation by this basic design study is limited to the changes which have occurred since the last report and to a supplemental investigation.

2.2.1 Production and import of food grains

The major crop in Zambia is maize, with groundnuts, sunflower seeds, millet, sorghum, cassava, pulse, tobacco, cotton, etc., also being produced. Livestock raising also thrives. Maize is the major cash crop as well as the main self-support crop, accounting for about 80% of the national grain consumption, as the staple food of Zambia. Its by-product is also important as feed for livestock.

The Government of Zambia has taken a policy which emphasizes agriculture to make Zambia free from the economic structure dependent upon copper production. However, the low food price policy undertaken as a countermeasure to cope with the sharp increase in urban population, and the shortage of agricultural materials such as chemical fertilizers, etc., caused by the scarcity of foreign currency, combined with the dry weather which affected areas all over Africa in recent years, together have generated a shortage of food. Zambia, which was originally a grain exporting country, became a grain importing country in 1979.

However, in the rainy season last year (Dec. 1984 - March 1985), Zambia was blessed with a great deal of rain in many years and maize production sharply revived, as shown in Table 2. The recovery in crop production is especially remarkable in Southern Province where the dry spell had its most severe effects. Although, there is pressure from the rapid increase in population

(annual rate of 3.1%), if Zambia invests in irrigation facilities, etc., the future of agriculture in Zambia which has vast areas of arable land, estimated at about 40% of the nation's total land, will be bright. The improvement of the economy is an urgent matter and assistance from foreign countries is desirable for this Zambian agricultural investment.

Table 1. Marketed Production of Some Selected Crops

Year ending 30th April (1)	Maize (2) ('000 bags)	Tobacco		Sugar- cane (3) ('000 tonnes)	Seed cotton ('000 kg)	Sunflower (4) ('000 bags)	Shelled Groundnut (5) ('000 bags)
		Virginia Flue-cured ('000 kg)	Burley ('000 kg)				
1970/71	2,791	4,805	255	322	5,446	-	45.0
1971/72	1,388	6,248	389	331	12,675	-	84.7
1972/73	6,539	5,532	385	397	8,349	2	81.4
1973/74	6,367	6,222	471	488	5,225	20	40.2
1974/75	4,290	6,201	430	570	2,173	70	45.3
1975/76	6,491	6,466	502	768	2,602	129	81.2
1976/77	8,334	6,262	212	780	3,885	319	118.3
1977/78	7,734	5,588	312	691	8,928	266	93.3
1978/79	6,463	3,704	264	775	8,430	151	27.9
1979/80	3,733	4,591	381	888	14,916	238	34.2
1980/81	4,247	4,127	554	920	22,913	365	25.4
1981/82	7,704	2,319	665	893	16,752	384	16.5
1982/83	5,672	1,869	704	1,010	12,786	426	9.6
1983/84	5,902	2,337	537	1,086	31,230	609	13.0
1984/85	6,348	2,620	501	1,179	40,915	808	14.5

(1) The marketing year begins in May and ends on 30th April of the following year.

(2) A standard bag of maize weighs 90 kgs.

(3) The year ends on 31st March.

(4) A standard bag of sunflower seed weighs 50 kgs.

(5) A standard shelled groundnut bag weighs 80 kgs.

* Provisional

Source: Monthly Digest of Statistics, Central Statistical Office

However, as stated above, even though Zambia has the latent agricultural productivity, present conditions of food supply and demand are urgent and Zambia is dependent on imports of large amount of food grains.

Zambia had formerly exported maize, from 1973 to 1978. Later, Zambia had poor crops due to dry weather and the country became an importer of food grains. The amount of imports has been increasing year by year, as shown in Table 3 "Imported Amounts of Major Grains", and the quantity imported in 1984 had increased by nearly 50% above that of 1980.

Table 2. Forecasted Maize Marketed Production 1985 and Actual Marketed Production 1984 and 1983 (in 90 Kg Bags)

Province	Forecast 1985	Actual 1984	Actual 1983
Central	2,300,000	2,117,778	2,236,714
Southern	1,800,000	1,075,013	962,823
Western	90,000	89,444	50,618
N/Western	80,000	57,141	51,263
C/Belt	180,000	136,424	90,220
Luapula	80,000	71,091	40,155
Eastern	2,000,000	1,849,239	1,599,568
Northern	800,000	750,552	653,035
Lusaka	200,000	193,155	217,428
TOTAL	7,530,000	6,347,637	5,901,824

Source: Statistical department of the Ministry of Agriculture and Water Development.

Table 3. Imported Amount of Major Grains (Unit: ton)

Item Year	Maize		Wheat		Rice		Total
	Commercial base	ODA base	Commercial base	ODA base	Commercial base	ODA base	
1980	43,178	58,729	52,054	17,540	4,990	3,669	180,160
81	59,860	33,666	54,000	57,100	-	2,190	206,816
82	60,511	8,268	75,000	43,794	-	6,458	194,031
83	41,373	84,624	32,957	23,152	-	8,624	190,730
84	29,853	69,640	54,722	90,722	-	10,583	255,520

Source = WFP

Note: ODA includes both donation and Government loans.

When the detailed contents of these imports are studied, it can be seen that at the beginning, the ratio was roughly half and half of imports on ODA base and imports on a commercial basis, but in 1984, the ratio of imports by donation had greatly increased.

Table 5 Imported Amount of Major Grains

Grain classification	Commercial base	ODA base	Breakdown of ODA base		Total
			Donation	Government loans	
	Tons	Tons	Tons	Tons	Tons
Maize	29,853	69,640	49,640	20,000	99,493
Wheat	54,722	90,722	60,722	30,000	145,444
Rice	-	10,583	10,583	-	10,583
Total	84,575	170,945	120,945	50,000	255,520

Countries and organizations which gave donation of grains are the EEC (the major donor), followed in order by the U.S.A., Australia, Japan, the Netherlands, WFP and the Red Cross.

It is expected that Zambia will have to be dependent on quite large quantities of grain obtained from overseas in the future.

2.2.2 Distribution of food grains and construction of storehouses

Distribution of maize which is the major food grain in Zambia, is handled by the Cooperative Marketing Unions and the Namboard (National Agricultural Marketing Board) which is organized under the Ministry of Agriculture and Water Development. Maize gathered from medium and small farms, is collected in buying depots in the production areas, then later it is gathered at the district depots which are located in each district together with other maize shipments from large-scale farmers and temporarily stored. Buying depots and district depots are run by the Cooperative Marketing Unions. The district depots store maize for sale inside the province and for purchase by Namboard.

Maize shipped from the district depots is collected at province depots belonging to Namboard. Province depots are of two kinds: one is the depot located at a major point in a production province, as a connection between the production area and consumption areas, and the other is the depot located in a major consumption area, which facilitates supply of raw material to mills, necessarily controlling a large amount of operation stock. Therefore, the latter have larger storage facilities. The food grain storehouses in Chingola, for which construction is now being planned, are for a depot in a consumption area.

The traditional storage method for maize is outdoor storage, a method called "open hard-standing" where maize in jute bags is piled up on a concrete floor with a ground clearance of 30-50 cm. Bags are covered with tarpaulin sheets. Another method involves laying logs crosswise on the ground, then piling jute bags of maize on top of the logs. Loss of both quantity and quality is great during storage using these methods.

Table 6. Grain Storage Facilities Owned by Namboard and their Capacities

Location	Open Hard-standing	Silo	Shed by CIDA	Shed by Japan
	ton	ton	ton	ton
Southern Livingstone	55,800			
Choma			40,000	
Monze	32,400	14,400	20,000	
Kaleya			20,000	
Lusaka Lusaka	58,500	14,400	50,000	
Central Chisamba	45,000	22,500		
Mumbwa			10,000	
Natuseko	31,500	22,500		
Kapiri-Mposhi	28,800		25,000	
Mkushi				5,000
Masansa				
Copper Belt				
Bwana Mkubwa	50,400	22,500		
Kitwe		14,400		
Chambishi	54,000			10,000
Western Mongu	16,200		10,000	
Kalabo			5,000	
Eastern Chipata	18,000		20,000	
Katete			5,000	
Lundazi			15,000	
Petauke			5,000	
Sinda			10,000	
Chadiza			5,000	
Mtirizi				4,000
Northern Mwenzo			10,000	
Isoka			5,000	
Kasama	9,000		10,000	
North Western				
Solwezi	3,600		5,000	
Luapula Mansa	14,580		5,000	
Total	417,780	110,700	275,000	19,000

Source: Namboard. CIDA: Canadian International Development Agency

Table 7 Number of Storehouses Provided by CIDA and their Capacities

LOCATION		MAIZE		FERTILIZER	
		5,000 M/T	CAPACITY IN TONS	3,500 M/T	CAPACITY IN TONS
PHASE 1					
Lusaka	Lusaka	10	50,000		-
Central	Mumbwa	2	10,000		-
Southern	Choma	8	40,000	5	17,500
Eastern	Chipata	2	10,000	2	7,000
"	Katete	1	5,000	2	7,000
"	Lundazi	1	5,000	1	3,500
"	Petauke	1	5,000	1	3,500
PHASE 2					
Southern	Kaleya	4	20,000		-
"	Mazabuka		-	2	7,000
"	Monze	4	20,000	2	7,000
Central	Mkushi	5	25,000	5	17,500
"	Natuseko		-	2	7,000
"	Mpika		-	1	3,500
North-Western	Solwezi	1	5,000	1	3,500
Luapula	Manza	1	5,000	1	3,500
Northern	Kasama		-	1	3,500
PHASE 3					
Northern	Mwenzu	2	10,000	1	3,500
"	Isoka	1	5,000		-
"	Kasama	2	10,000		-
"	Mbala		-	1	3,500
Eastern	Sinda	2	10,000		-
"	Chadiza	1	5,000		-
"	Lundazi	2	10,000	1	3,500
"	Chipata	2	10,000		-
Western	Mongu	2	10,000		-
"	Kalabe	1	5,000		-
TOTAL (IN TONS)		55	275,000	29	101,500

SOURCE: Namboard, CIDA: Canadian International Development Agency

Table 8 Capacities of Storehouses Provided by EC

PROVINCE	LOCATION	FERTILIZER CAPACITY IN TONS
Southern	Namwala	7,000
Central	Shibuynji	2,500
	Mumbwa	2,500
	Mulilima	2,500
	Kakwelesa	2,500
	Liteta	2,500
	Muchenje	2,500
Northern	Kasama	3,500
Western	Kaoma	2,500
Total		28,000

SOURCE: Namboard

The Government of Zambia has been actively constructing all-weather type grain storehouses to reduce these losses at the storage stage with the assistance of foreign countries such as Japan, Canada, the EC, etc. Canada which has provided the greatest amount of assistance for grain storehouse construction (EC has supplied fertilizer warehouses only), will complete most of its project by the end of 1985. After the grain storehouses with total capacities of 19,000 tons, now under construction, are completed in March this year (1986) by Japan's assistance, Zambia will have a total capacity of 404,700 tons of indoor grain storage facilities including existing silos, a great achievement.

The staple food in Zambia is white maize milled into flour and cooked into paste. Maize flour is produced in mills scattered all over the country and the maize as the raw material is supplied mainly by the previously mentioned province depots owned

by the Namboard. Large scale flour mills include Indeco Milling, National Milling, etc. The total number of flour mills in Zambia including medium and small mills, is over 100 and are concentrated mainly in Lusaka Province and Copperbelt Province which are the major consumption areas. The following table shows the actual record of sales by the Namboard to mills in this crop season (1985).

Table 9. Sales of Maize by Namboard for the 1985 Crop Season
(90 kg bag)

Province	July	Aug.	Sept.	Oct.	Total
Lusaka	115,405	100,916	100,744	104,496	421,561
Central	23,516	58,825	50,188	50,453	182,982
Southern	71,107	65,176	67,747	78,724	282,754
Western	21,327	19,218	18,041	19,701	78,287
N/Western	3,224	8,770	8,075	6,990	27,059
Luapula	3,041	4,313	17,313	25,320	49,987
Northern	15,917	8,831	16,478	15,760	56,986
C/Belt	331,983	282,350	310,458	308,883	1,233,594
Eastern	7,926	10,000	3,470	13,650	35,046
Totals	593,366	558,399	592,514	623,977	2,368,256

SOURCE: Namboard

Table 10. Sales of Maize by the Namboard in Each Province (1975 - 1984)

Unit: 90 kg bag

Province	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Southern	571,900	673,425	612,211	717,886	755,395	885,421	645,487	440,108	497,209	459,957
Central	2,350,561	2,412,595	2,471,729	954,016	85,768	816,874	731,061	448,827	19,313	64,563
Lusaka	*	*	*	1,853,566	1,753,285	1,462,305	1,408,137	1,342,053	1,331,451	1,486,286
C/Belt	2,183,312	2,512,002	2,650,722	3,004,556	2,754,892	2,482,865	2,705,750	2,974,647	2,819,698	3,047,460
Eastern				88,823	120,138	189,976	103,004			11,752
Northern				63,514	94,636	118,032	50,944			1,610
Luapula		91,470	196,591	269,305	285,234	271,246	201,377	141,939	119,212	77,723
N/Western		19,028	90,554	91,582	143,770	123,981	146,171	105,505	82,992	62,425
Western		35,430	60,724	122,516	165,163	209,030	236,760	235,879	253,855	217,616
Others	627,983**			70,127**						
TOTAL	5,653,764	5,743,950	6,090,531	7,243,891	6,923,281	6,551,730	6,228,691	5,688,950	5,123,730	5,430,392

* Lusaka included in Central Province

** Breakdown unknown.

**CHAPTER 3
OUTLINE OF PROJECT**

CHAPTER 3. OUTLINE OF PROJECT

3.1 Objectives of Project

Since independence, Zambia's economy has largely depended on the mining industry, mainly copper. Due to continual fluctuations in international copper prices in recent years, however, it was unavoidable for Zambia to switch from a reliance on copper. Under such circumstances, the Government of Zambia believes that an agricultural promotion policy is one of the most important items in achieving economic self-sufficiency in its Third National Development Plan (1979-1983). In 1980, furthermore, it announced the Operation Food Production Program (1980-1990) to achieve self-sufficiency in food, as a basic policy, and for agriculture to earn foreign currencies.

Nevertheless, production amount decreased significantly being affected both by the population increase in Zambia and by the drought which recently hit the whole of Africa. As a result, Zambia has to import a considerable amount of maize, which has been its major crop, to cover the insufficiency of domestic production. In addition, since most crops are stored outdoors in Zambia, large losses of grains have occurred both in quantity and quality thus this has become an obstacle to the supplying of grain. It is necessary to improve the grain distribution system by decreasing the losses which occur during storage in order to achieve self-supply of foods and the objectives of the agricultural policy.

To achieve this objective, the Government of Zambia has been carrying on the construction of all-weather type grain storehouses with the assistance of foreign countries such as Canada, the EC, Australia, Japan, etc. and has achieved a remarkable result. The Government of Zambia has continued its efforts to achieve the goal of storing all the marketed grain indoors and this project will form a part of the above-mentioned objectives.

3.2 Project Orientation

3.2.1 Conditions for project site

Selection of project sites requires consideration of conditions related to the food supply demand, distribution and construction. Grain storehouses can be divided by their geological and physical conditions into storehouses in production areas and storehouses in consumption areas. This project is for storehouses in a typical consumption area located in Chingola which is the third largest city in Copperbelt Province, the most densely populated area in Zambia.

The objective of constructing a storehouse in a consumption area, is to maintain a stable supply of foods for the nearby area of consumption. For this purpose, the storehouse should store grain as the adjustment stock which is brought in from the production areas without causing deterioration in quality. Therefore, the selection requirements for the project site for a storehouse in a consumption area depend on the amount of consumption in nearby areas and transportation conditions, etc.

For the setting of scales, it is ideal to construct a storehouse with a capacity to meet the estimated annual maximum necessary storage volume, as stated in the previous section. In the process of the project for indoor storage of the total domestic distribution volume, and considering the investment effect, the capacity for storehouses will be set so that they will be large enough to store the total volume handled in the depot in the rainy season after December, the same as the previous project.

Since all the storehouses built by the previous project were inside existing depots, the determination of scale was done using the volume of grain handled by the depot. However, this project involves construction of a completely new depot, so the total monthly volume in and out (deliveries and shipments) for all depots in the area was surveyed, then the volume to be handled in

this depot was estimated. The analysis of grain distribution in the area of the proposed site and the determining of scale, are stated below.

3.2.2 Current grain distribution at proposed site and determination of storage capacity

i) Grain distribution

Chingola where construction of grain storehouses is requested, has a population of 150,000 and is the third largest city in Copperbelt Province, Zambia's major consumption area. Namboard has divided Copperbelt Province into the areas of Ndola and Kitwe and located a branch office in each area for control of grain distribution in this province. Chingola is in the Kitwe area.

At present, there are 2 depots owned by Namboard in the area of Kitwe.

a. Kitwe Depot

12 concrete silo bins, total capacity 14,400 tons
Capacity of one bin 1,200 tons

These are regular silo facilities which can handle grains in bulk for shipping built by British before the independence of Zambia.

b. Chambishi Depot

This depot only has open hard-standings which can store 600,000 bags (54,000 tons) and is one of the largest depots in the country.

Two storehouses with a capacity of 5,000 tons each (total capacity of 10,000 tons) are being constructed now under the grant aid by the Government of Japan and are expected to be completed in March next year (1986).

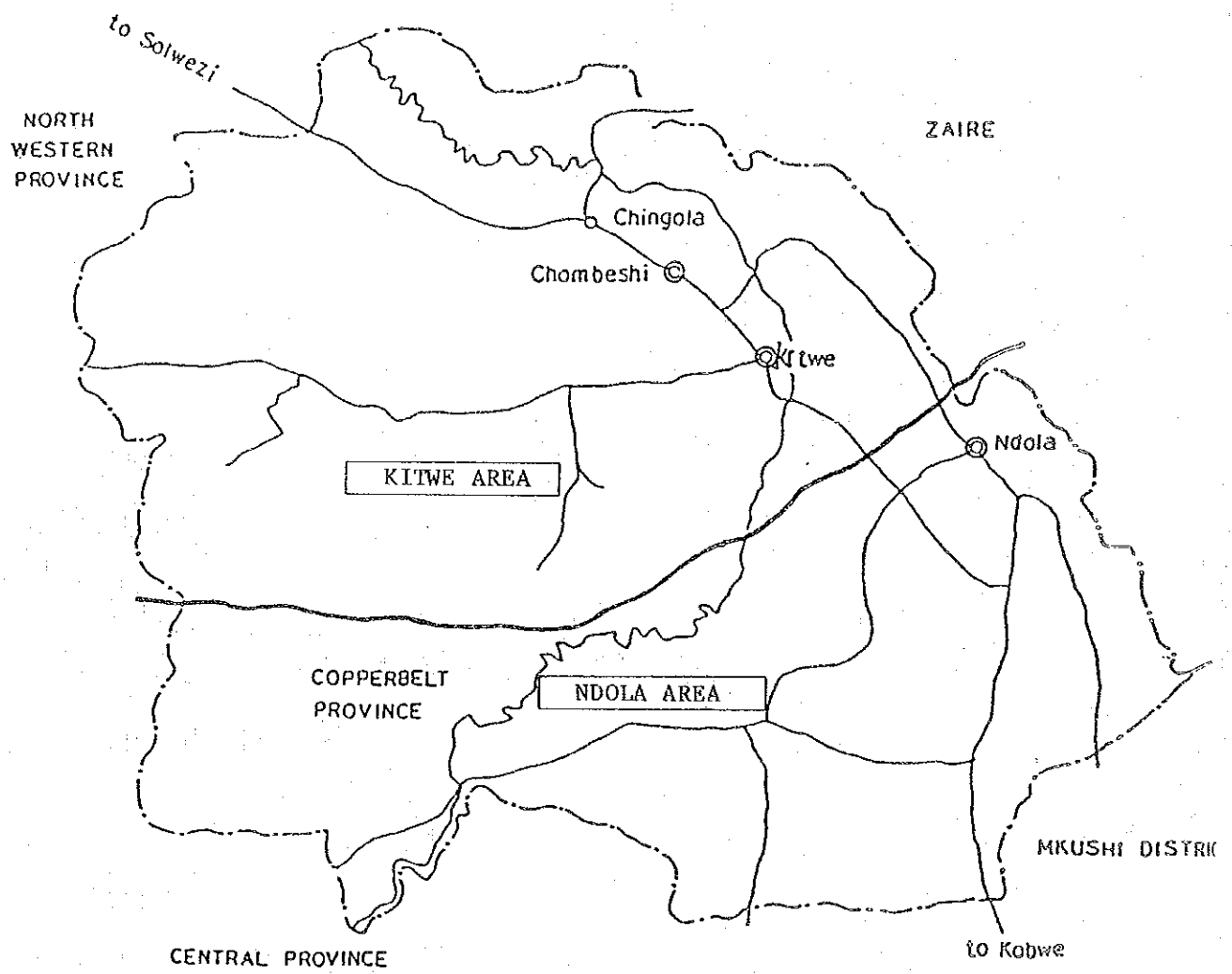


Fig. 2 Copperbelt Province Existing Marketing Storage Depot

Since Copperbelt Province is a major consumption area, arrival and shipment of maize are made continually throughout the year. Both of the above depots have railway sidetracks. Shipping in and out is done both by freight car and by truck.

Demands of the flour mills in the area have been filled by these two depots. There are 10 major flour mills in the area. Their capacities and actual sales records of maize from Namboard are shown in Table 11 and Table 12.

Table 11 Millers Production Capacity Per Day

(Unit: 90 kg bags)

Name	Location	Production
United Milling	Chingola	2,730
Jamas Milling	Kitwe	2,500
Olympic	Mufulira	2,000
Asbestors	Kitwe	500
C.N.C. Milling	Kitwe	500
Nkana Milling	Kitwe	500
Chico Milling	Kitwe	1,500

SOURCE: Namboard

Table 12. Maize Sales to Millers from July - October, 1985
(in 90 kg bags) (Namboard sales only)

C/Belt Province	July	August	Sept.	October
Olympic Milling	45,600	37,800	42,400	39,502
Jamas Milling	56,816	44,880	52,710	53,611
Asbestos	359	167	236	437
Chico	5,703	3,604	15,501	4,624
C.N.C.	1,614	284	383	2,443
Nkana	4,286	3,434	3,259	4,459
N.B.L. Kitwe	4,283	3,109	6,793	5,041
NBL-Mufulira	2,494	2,155		2,420
N.B.L.				
Chililabombwe	1,880	1,150		2,200
United Milling	39,462	37,667	28,387	42,961

Of the millers listed above, United Milling in Chingola is the biggest in the area and was completed in August, 1983, as a large-scale flour mill with the newest facilities. The milling operation is gradually becoming organized. The raw material maize for this mill has mainly been supplied from Chambishi Depot, whose sales to the mill are shown below.

Year	Kitwe Depot tons	Chambishi Depot tons	Total tons
1983	0	3,012	3,012
1984	1,190	28,430	29,620
Jan.-Oct. 1985	870	35,670	36,540

In addition, about 4,000 tons of maize have been shipped annually from these 2 depots to Solwezi, the capital of the neighbouring North-Western Province.

Table 13. Maize Despatches to Solwezi North Western Province 1984 (in 90 Kg bags)

	Chambishi Depot	Kitwe Silo	Total
January	1,800	4,620	6,420
February	9,290	2,600	11,890
March	2,200	3,400	5,600
April	-	700	700
May	2,200	4,100	6,300
June	800	2,987	3,787
July	-	2,500	2,500
August	-	-	-
September	1,040	1,490	2,130
October	4,350	1,510	5,860
November	-	-	-
December	-	-	-
Total	21,680	23,907	45,187

As stated above, these 2 depots in Kitwe Area of Copperbelt Province satisfy the demands of flour mills in the area and of Solwezi in neighbouring North-Western Province. Therefore, that this third grain storage depot constructed in Chingola will mainly fill the demands of Chingola Area and North-Western Province, is very efficient in view of saving on distribution costs. In addition, multiple operation of the grain distribution as an adjustment storage can also be considered to contribute greatly to the stable supply of maize.

ii) Determination of storage capacity

The storage capacity of a food grain storehouse will be determined basically using factors related to arrivals and shipping of grain. For instance, arrivals and storage of grain are related to the actual demand and supply situation including production, imports, distribution and reserve stock of food; government policies, transport conditions, capacity of existing storehouses, operating capability of storehouse administrative organizations, etc. On the other hand, shipping is related to population, dietary level, sales and transport conditions, etc.

Ideally, the storage capacity of a food grain storehouse has to be determined by studying the various factors stated above including future plans and forecasts. However, this project is not related to the improvement of administrative techniques or means of transportation extending over the whole of grain distribution, but to the reforming of storage conditions. Therefore, judging from the above factors, it is the most practical method of determining the necessary capacity by analyzing past distribution conditions of maize at the project site, considering that the related factors will not change in the future.

Realistically, the construction of a new depot in Chingola by this project will mean the transfer of a part of the function of Chambishi depot. Therefore it is considered to be appropriate that the method to determine the capacity is to investigate the

monthly volume of arrivals and shipments at Chambishi depot and then to set up the volume which cannot be stored indoors in Chambishi. This volume will be the capacity of the storehouses to be constructed at this new depot.

The actual record of arrivals and shipments for Chambishi depot in the past 3 years, is shown in Table 14.

Table 14 Monthly Volume of Arrivals and Shipments
at Chambishi Depot

Year and month	Opening Stock	Arrivals	Shipment	Stock at end of month	Closing Stock
	ton	ton	ton	ton	ton
1983/Jan.	15,800	7,600	10,900	12,500	
Feb.		6,600	11,000	8,100	
Mar.		11,200	11,000	8,300	
Apr.		7,200	10,000	5,500	
May		10,600	8,300	7,800	
June		12,400	7,100	13,100	
July		11,000	7,100	17,000	
Aug.		8,000	9,300	15,700	
Sept.		9,700	9,700	15,700	
Oct.		4,100	6,100	13,700	
Nov.		4,200	5,700	12,200	
Dec.		7,900	8,300	11,800	11,800
Total		100,500	104,500		
1984/Jan.	11,800	7,600	9,500	9,900	
Feb.		5,900	7,600	8,200	
Mar.		8,600	8,500	8,300	
Apr.		17,400	7,600	18,100	
May		1,500	8,900	10,700	
June		4,800	9,700	5,800	
July		5,600	6,800	4,600	
Aug.		11,100	7,600	8,100	
Sept.		8,500	7,500	9,100	
Oct.		5,900	8,400	6,600	
Nov.		9,300	10,400	5,500	
Dec.		9,500	7,900	7,100	7,100
Total		95,700	100,400		
1985/Jan.	7,100	7,300	9,800	4,600	
Feb.		12,300	9,000	7,900	
Mar.		9,900	12,000	5,800	
Apr.		8,500	11,500	2,800	
May		12,300	13,000	2,100	
June		10,500	9,500	3,100	
July		17,900	13,200	7,800	
Aug.		16,000	9,200	14,600	
Sept.		13,300	10,000	17,900	
Oct.		5,400	4,500	18,800	18,800
Total		113,400	101,700		

The above table shows the facts that the monthly volume of arrivals and shipments is not only inconsistent, but it is also impossible to find any clear pattern throughout the year, therefore, stock at the end of each month shows such great fluctuation that it is impossible to find a seasonal pattern for stocks. However, the total amount of annual arrivals and shipments is constant within a certain range.

Chambishi depot is located in a consumption area and the timing of arrivals is not necessarily connected with the harvest season, as in the depots in production areas. Also, the time of arrivals is not fixed, for incoming imported grain. In addition to the above, insufficient means of transportation and of management create difficulties in the organizing of access to storage. Maximum stock at the end of month in each year were 17,000 tons for August 1983, 18,000 tons for April 1984, 18,800 tons for October 1985. It is impossible to predict which month will have the maximum amount of stock.

Stored grain suffers the most severe damage in the rainy season between December and March in Zambia. The maximum month-end stock in the year 1985 occurred around the rainy season. Even between 1983 and 1984, under the previously stated impossible circumstances for systematic stock control, there was still a strong possibility of the condition of maximum stock occurring in the rainy season. In other words, it is appropriate to plan to store the year's maximum month-end stock during the rainy season.

When the past 3 years were reviewed, the maximum storage was seen to be 18,800 tons in October 1983, which means that even when the storehouses which is now under construction in Chambishi Depot (with a capacity of 10,000 tons) is completed, there are still 8,800 tons which could not be stored safely.

The scale needed for the storehouses in Chingola Depot can only be expected to increase, not decrease, due to the large increase in demand for food paralleling the population increase in

Copperbelt Province. The regular scale of operation of the newly established large-size flour mill near the proposed site at Chingola, is a direct reason. Therefore, the scale of storehouses which will be constructed in this project, has been set at 10,000 tons as a reasonable capacity which includes some estimated increase of demand in future as well as the 8,800 tons of capacity which is urgently needed at present.

When both storehouses in Chimbishi and Chingola are completed, with a total storage capacity of 20,000 tons, the annual utilization rate will be 51%, as shown in Table 14. This is quite similar to the 45% average utilization rate for grain storehouses in the advanced country of Japan, so, from this viewpoint the scale chosen for the new storehouses should be efficient and reasonable.

3.2.3 Physical and geographical conditions of proposed site

This proposed site is located in the city of Chingola, the third largest city in Copperbelt Province, a copper production area. The site faces a trunk road in the city, and is next to the previously mentioned United Milling, a semi-governmental corporation. The whole area is nationally owned and the provincial government is sub-dividing the lots for the Namboard.

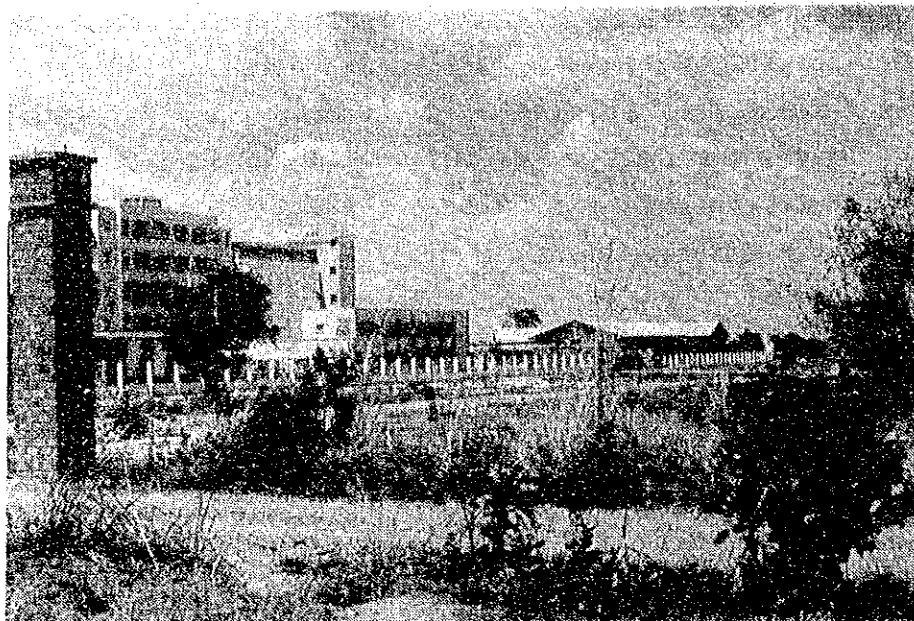


Fig. 3 Complete View of Neighbouring Flour Mill

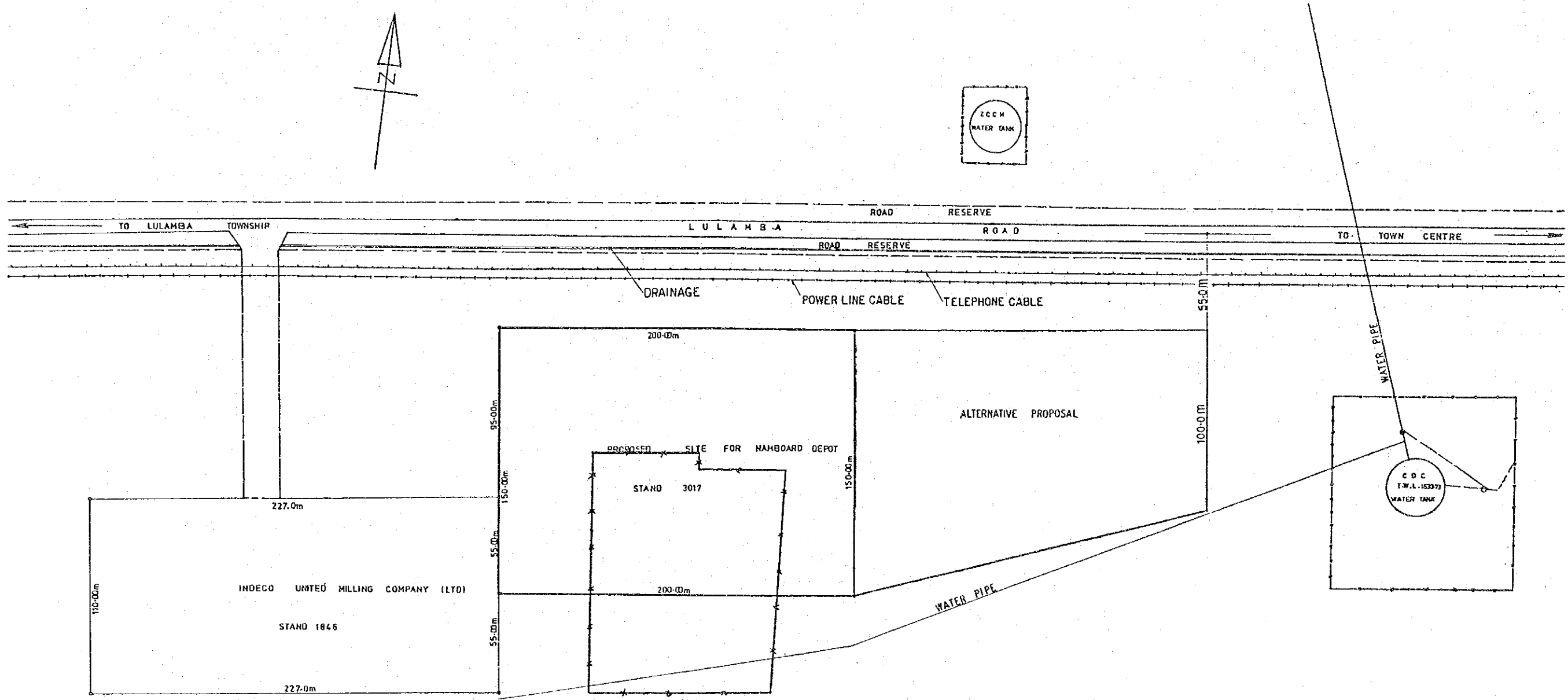
The proposed site is located along a trunk road which runs east-west. It is a trapezoid with the 200 m width, the 100 m upside and the 150 m base. The site is covered with shrubs and is gently sloped toward the road with a maximum level difference about 2 m. A high-voltage cable and a telephone cable run along the road and a public water supply pipe runs along the back of the site. Therefore, electric power, telephone service and water supply are available. Transportation of construction materials and equipment is convenient because the site faces a trunk road. Although removal of shrubs and grading of the land to flatten the site are necessary, the site is basically in a very good environment for construction.

The bearing capacity of the soil is now being investigated by a local soil research company at the request of the Namboard. Ground conditions seem very good, however, so that the allowable load bearing capacity of the soil of 15t/m^2 will probably be secured.



Fig. 4 View of West Boundary of Site, from the Boundary
Peg in the North-Western Corner

3.2.4 Site plan for proposed site



SITE PLAN

3.3 Basic Design

3.3.1 Basic design policies

As stated in the previous sections, this project involves the construction of food grain storehouses for maize with a total capacity of 10,000 tons in Chingola, Copperbelt Province.

The food grain storehouses presently under construction have gained acceptance by the officials concerned of the Government of Zambia and there have been no problems whatsoever in construction. Therefore, two storehouses to be constructed will be exactly the same as the those with the capacity of 5,000 tons which are now under construction at Chambishi in Copperbelt Province and at Masansa in Central Province. The basic design policy for storehouses has been thoroughly described in the previous basic design study report, so this report will state only distinctive problems related to this project.

3.3.2 Storage and cargo handling plan

Maize, the staple food in Zambia, has been distributed in jute bags holding 90 kg each and the transaction between the Namboard depots in consumption areas and the flour mills is done by weight. At a depot not equipped with a truckscale, platform scales are used to weigh the bags by sampling, for determining the volume of maize traded. Therefore, problems with the amount of maize traded, sometimes occur between the depot and the flour mill. Because of such situations, the Zambian side have requested installation of a truckscale in this project.

Among depots in Kitwe Area of Copperbelt Province where Chingola, the proposed site, is located, Kitwe depot owns silos equipped with hopperscales, whereas, the Chambishi Depot does not have any such facilities and also does not have a truckscale. The furnishing of a truckscale in this project is considered to be very appropriate for the achievement of smooth transaction.

Both incoming and outgoing maize is weighed while loaded on the truck, and the truck is also weighed when empty. The weight of the grain is calculated from the difference between these two weights. Therefore, even if the truckscale is perfectly adjusted, basically, the same scale should be used to weigh the truck at both entry to and exit from the depot. The Zambian side have requested 2 truckscals, but the installation of two truckscals would mean that 2 access lanes would have to be set up for the double scale system. However, when the size of this depot and the flow of trucks is considered, 2 truckscals are not appropriate, therefore, only one truckscale will be furnished. The truckscale model selected is a mechanical type considering ease of repair and maintenance, and the on-site circumstances, avoiding the use of electronic equipment.

For loading and unloading in the buildings, a conveyor system identical to the previous system is planned with the same specifications and the same number of conveyors as were supplied previously for the Chambishi Depot.

Considerations of necessity are described in the previous report.

Truckscale	Capacity, 60 tons	1
Portable stacker conveyor	ℓ=8.0 m	2
Portable slat conveyor	ℓ=7.0 m	4
"	ℓ=6.0 m	2

3.3.3 Facility plan

1) Site layout

This proposed site is a trapezoid, with the 150 m base, the 100 m upside and the 200 m width. For the most efficient use of site, the longer side of the storehouses are arranged parallel to the short side of the site, and 2 storehouses are to be arranged side by side along the base of the trapezoid, with a service road surrounding both storehouses, as was done previously.

The flow of traffic will be planned taking the location of the truckscale into account. There are two types of traffic. One carries in grain from the production area and the other comes in from the flour mill to pick up grain. These trucks are weighed by the truckscale as the time of entry to and exit from the storehouse, and the weight difference becomes the arrival quantity or the shipping quantity. Since space for lane changing by trucks is required both before and after the truckscale, the gate is planned for the opposite side of the storehouses. In the busy season, number of trucks entering and going out of the depot is expected to be large and a waiting area becomes necessary. A waiting area will be provided for the outgoing trucks between the service roads around the storehouses and the truckscale and entering trucks will wait on the connecting road.

In this project, since the depot will be newly constructed, an administration office and a gatehouse are necessary. The office building is planned in a location near the entrance, but which is also separated from noise, etc. along the road. (See attached site layout on page 57).

2) Building plan

a) Storehouse units

Storehouses with the same specifications as the storehouses presently under construction, will be constructed.

Outline of the buildings is given below.

Capacity 5,000 tons x 2 = 10,000 tons

Area 24.5 m x 66.5 m = 1,629.25m² x 2 =
3,258 m²

Roof Locally produced corrugated asbestos
cement sheets with FRP corrugated
sheets for skylight

External walls .. Locally produced brick masonry

Floor Reinforced concrete construction coated with a dustproof finish for ease of cleaning and avoidance of dust. Expansion joints will also be provided at appropriate positions to prevent cracking due to thermal expansion or contraction, or to differential settlement of the ground.

Entrance and..... Steel hanger doors, H = 4.000 x W = exit 5.000

Openings Continuous opening will be placed under the eaves for ventilation. Steel bird screens will cover the openings to prevent invasion by birds and rats.

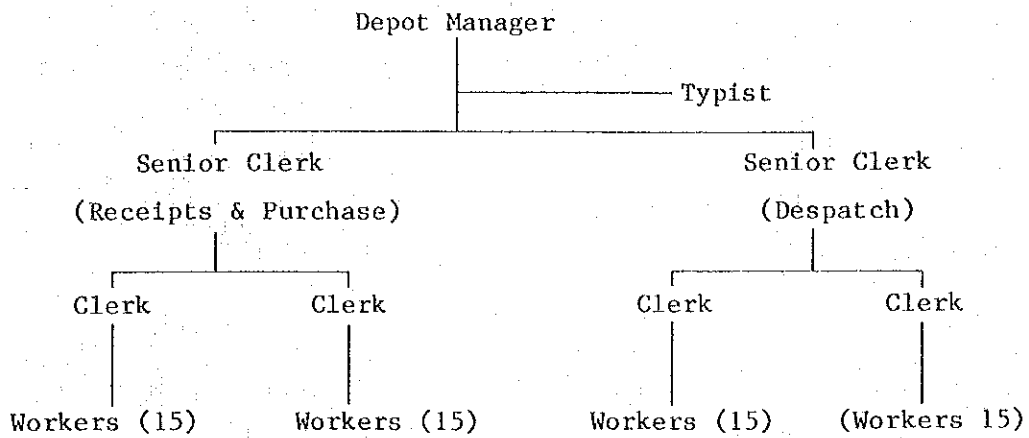
Foundation Reinforced concrete construction.

Refer also to the previous Basic Design Study Report for the building plan, structural plan, applicable design standard, material standards, etc.

b) Office building and other auxiliary buildings

All of the construction site in the previous project are in existing depots, therefore, existing facilities such as offices, etc., can be used for the new storehouses. Since the depot is to be newly built in this project, an administration office to control arrivals and shipments of grains as well as controlling of stocks and the workers who load and unload. A room for scale indicator for the truckscale and a pump room to supply water to the office buildings, are also needed.

The Zambian side have indicated the following staff organization.



The above organization is considered to be appropriate in the light of the organization of personnel for the existing depots, which was surveyed during the previous basic design study. (See P. 129 in the previous report). The office building includes a room required for each official above the level of clerk and the inspection room for the test apparatus to be furnished. In addition to these rooms, a shower room for workers, their waiting room, a toilet are provided in a separate unit. Building specifications are nearly the same as for the existing Namboard office. Descriptions of each building are as follows:

Office Building

Floor area	192.50 m ²
Roof	Locally produced corrugated asbestos cement sheets, steel trusses
External wall	Locally produced brick masonry, fair faced.
Floor	Reinforced concrete base floor
Foundation	Reinforced concrete strip footing
Interior floor	Mortar, non-metallic floor hardener
Wall	Mortar with metal trowelled finish, V.P.

Ceiling Mineral acoustic tiles

External fixtures.. Locally produced steel doors and windows

Interior fixtures.. Wooden doors and windows

Auxiliary buildings (gatehouse, truckscale house, pump room)

Area	Gatehouse	8.75 m ²
	Truckscale house	8.32 m ²
	Pump room	9.00 m ²
	Total	17.07 m ²

Roof Locally produced corrugated asbestos cement sheets, steel trusses

External walls Locally-made brick masonry, fair faced

Floors Reinforced concrete base floors

Foundations Reinforced concrete strip footing

Entrance/exits ... Locally produced steel doors and windows

3) Facilities plan

a) Electrical facilities

Electrical power taken from the power transmission line, passing in front of the site will be supplied to each building through the substation at the north-western corner of the site. All the electrical equipment inside the site the power transformer to the including lighting fixtures, receptacles, wirings, etc., will be furnished by Japan. Power lines between the existing high-voltage cable and the transformer, and supply of power are the scope of the work to be done by Zambia. Specifications and necessary facilities are shown below.

Primary electrical power .. 11,000 V, 50 c/s 3-phase,
3 wires

Secondary electrical power 380 V, 50 c/s, 3-phase,
 for motor power supply ... 4 wires
 Secondary electrical power 220 V, 50 c/s single
 for lights, hot water phase, 3 wires
 heater, etc.

Necessary facilities

Storehouses: Power outlet ... Power outlets for simul-
 for conveyors taneous use of 3 con-
 (380 V) veyors, will be installed
 at each entrance.

Power outlet Power outlets at various
 for sewing places in the buildings.
 machine (220 V)

Indoor Fluorescent tubes.
 Illumination Illumination on floor
 level will be 50 Lux.

Outdoor 2 x 40 W fluorescent
 Illumination ... lamps will be installed
 in 12 locations on the
 outer wall of each
 building.

Office building ... Power supply to fluorescent lamps for
 illumination, wall outlets and hot
 water heater in shower room and
 kitchenette

Gatehouse Indoor illumination only

Truckscale house .. Indoor illumination, wall outlets,
 and a drain pump

Pump room Indoor illumination and supply of
 power for pumps

b) Telephone facilities

Telephone will be installed only in the office building. A telephone exchange unit for 3 circuits and a telephone receiver for each room (8 locations) will be installed. However, telephones will not be installed in the separate unit for workers.

c) Plumbing for water supply, sewage and sanitary plumbing

Water supply can be obtained from the public water supply pipeline located at the back of the site (on the south side). Since the water pressure is low, a water tank and a water pump will be installed and pressurized water will be supplied to the toilets, kitchenette and shower room.

Disposal of waste water can be done either by open ditches or by drain pipes into the public drain ditch which runs along-side the road.

Soil water will be treated by a local type septic tank comprizing insitu reinforced concrete, then drained into the regular sewer.

4) Outdoor facilities

Security in Zambia have been deteriorated in recent years, especially in Copperbelt Province, where the proposed site is located, being adjacent to the border between Zaire and many cases of burglary have occurred. Therefore, crime prevention is one of the most important matters for this project.

Gates and fences are basically the work borne by the recipient country under the Japanese grant aid system. However, if construction of the gate and fences is delayed after completion of the depot, the intended function as a grain depot may be impossible to achieve. Considering these circumstances, the construction cost for the gate and fences will be borne by Japan and is included in the items to be

furnished along with the cost of the approach road to the site.

As was mentioned in the section on site layout, the insite roads will be provided for truck traffic. Since the soil condition is excellent, paving will be simple without the special road shoulder treatments such as curb-stones and side ditches.

3.3.4 Equipment plan

The platform scales and sewing machines for bags which were requested by Zambian side, will be supplied along with a truckscale and conveyors, as was stated in Section 3.3.2 "Storage and cargo handling plan". Hand carts, hand driven winnowers and inspection apparatus of the same quality and specifications as provided previously to Chambishi Depot will also be furnished. For consideration of necessity, refer to the previous report.

1) Platform scale

Since the amount of grain for transaction is generally weighed by the truckscale, the platform scales will be used as supplemental equipment in case of breakdown of the truckscale. In that case, "sample weighing" of grain is carried out and a large-sized platform scale will be needed. A platform scale which can weigh 10 bags at one time will be furnished for that "sample weighing".

A platform scale of this capacity (1000 kg) is difficult to move by human power alone and quite a large space is needed for its installation. It is judged that one scale per building will be sufficient considering the platform scales is supplied basically as supplemental equipment to the truckscale. In addition to this scale, other platform scales with a capacity of 150 kg, will be provided for checking the re-bagging of broken bags.

2) Sewing machines for bags

All the jute bags for the maize are imported, mainly from Bangladesh, consuming precious foreign currency. Therefore, the jute grain bags are very precious materials and are used so repeatedly that broken bags often occur during handling. Sewing machines to sew the tops of bags will be furnished for re-bagging when damage of bags happens.

The types and quantity of equipment to be furnished are as shown below.

(1) Cargo handling equipment

Portable stacker conveyor	8 m,	2
Portable slat conveyor	7 m,	4
Portable slat conveyor	6 m,	2
Hand cart		6

(2) Measuring instruments

Truckscale (capacity 60 tons)		1
Platform scale (capacity 1,000 kg)		2
Platform scale (capacity 150 kg)		4

(3) Supplementary cargo handling equipment

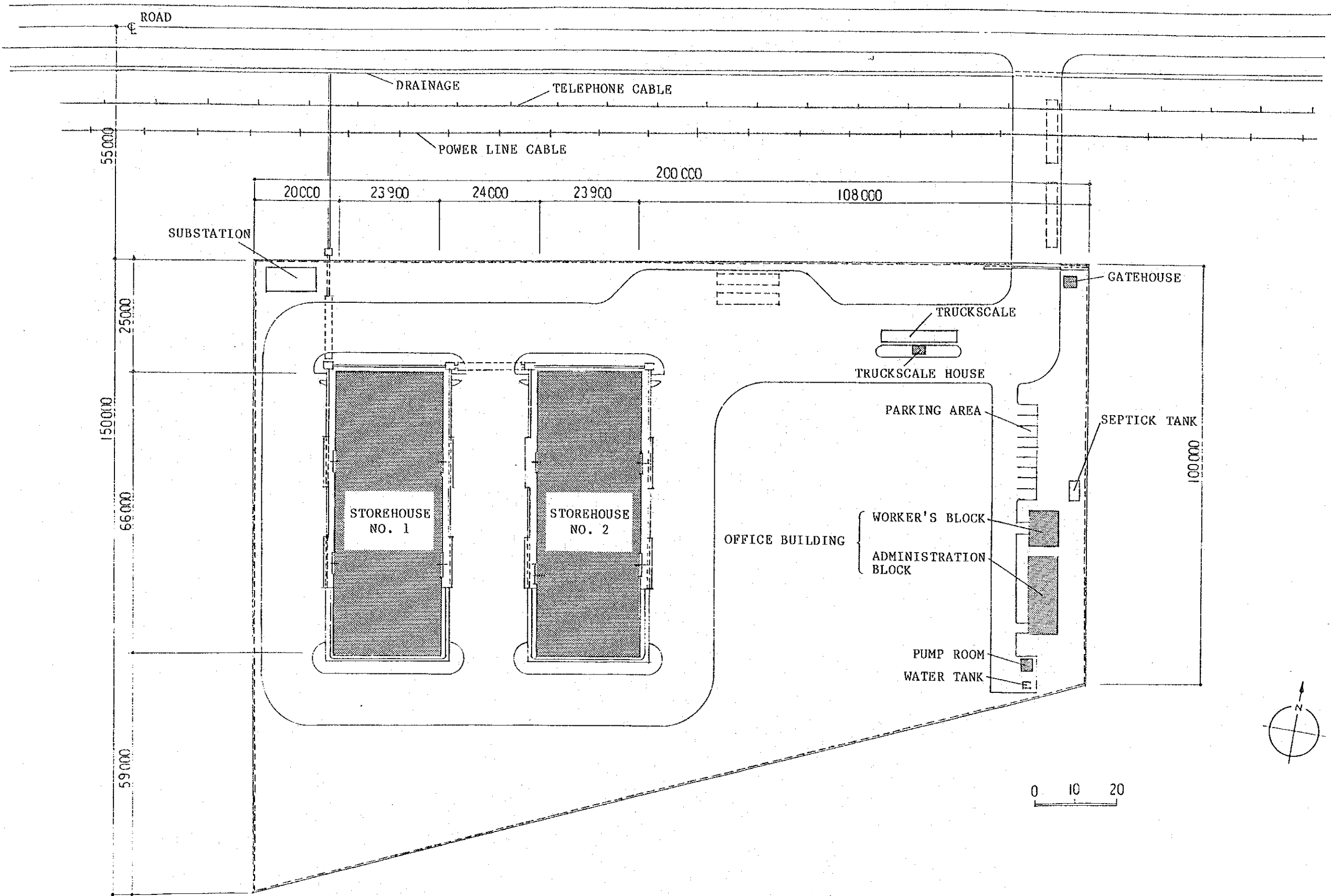
Hand driven winnower		2
Sewing machine for bags		2

(4) Inspection apparatuses

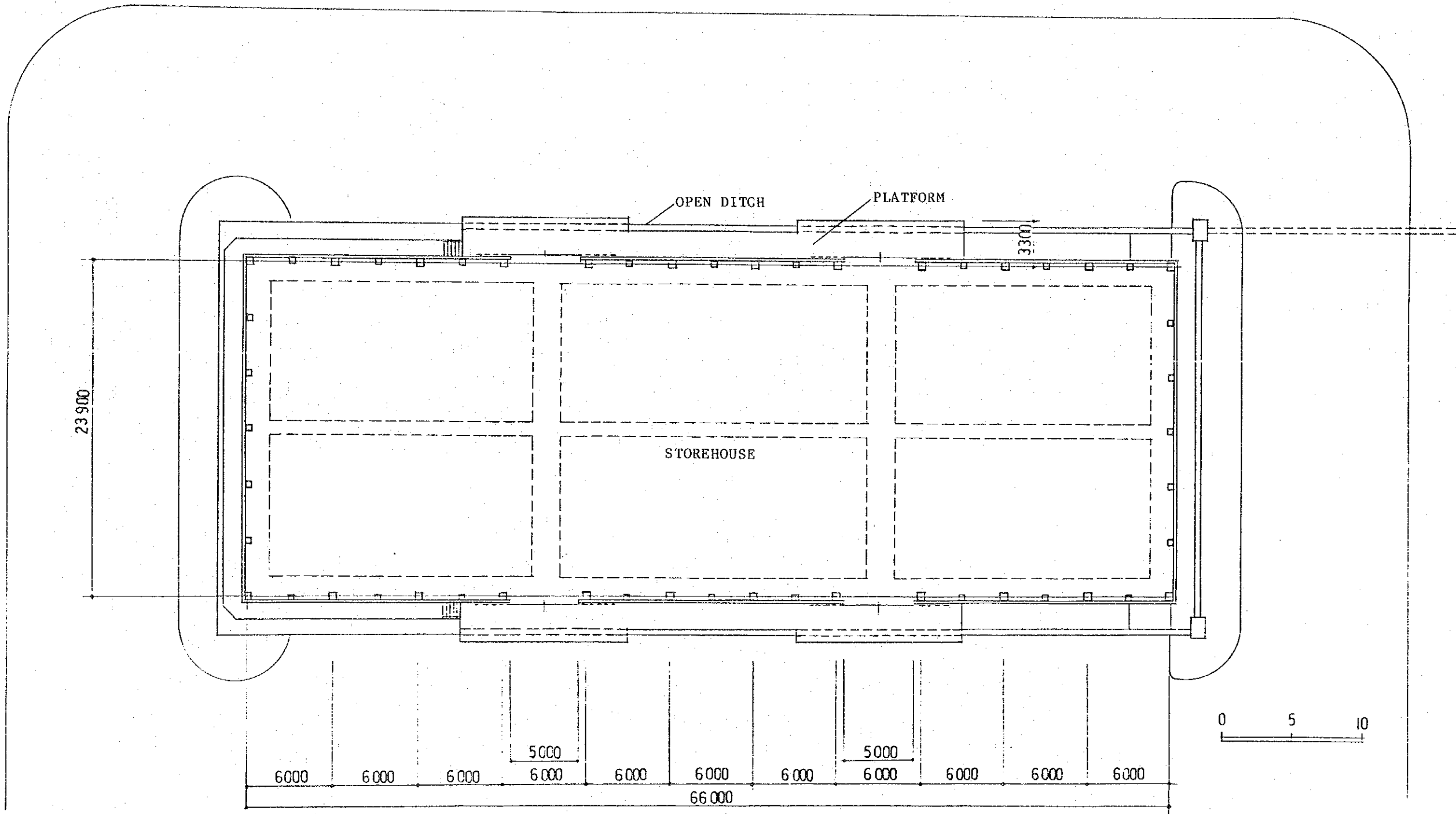
① Moisture meter		2
② Rough balance		1
③ Sieve for maize		3 sets
④ Sample pan (large)		3
⑤ Sample pan (small)		50
⑥ Grain thermometer		6
⑦ Grain probe		3

3.3.5 Basic design drawings

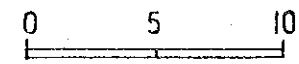
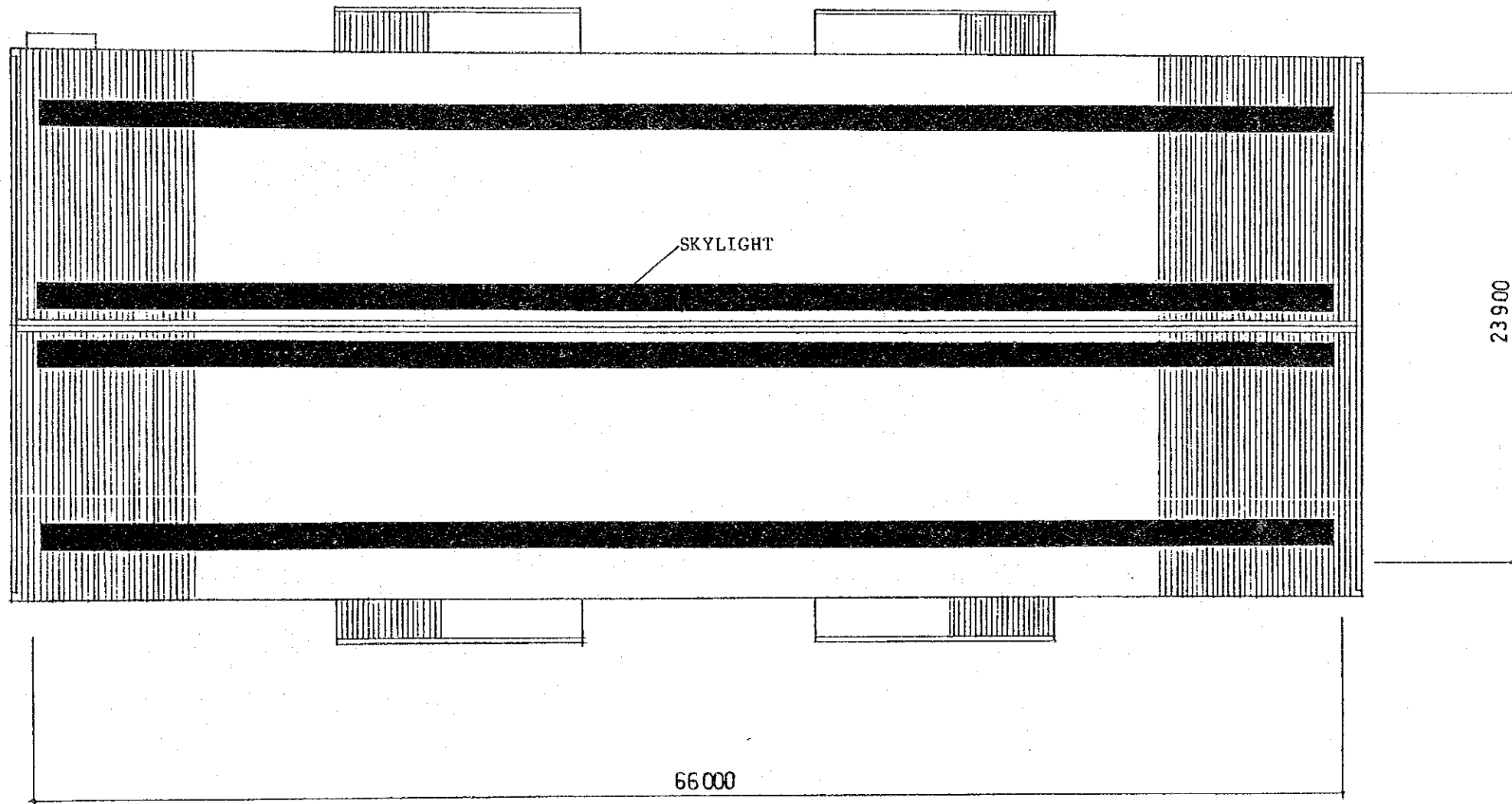
1. Site layout
2. Storehouse: Plan
3. Storehouse: Roof Plan
4. Storehouse: Elevation
5. Storehouse: Elevation and Section
6. Office Building: Plan
7. Office Building: Elevation and Section
8. Gatehouse: Plan, Elevation and Section
9. Truckscale House: Plan, Elevation and Section
10. Pump Room: Plan, Elevation and Section



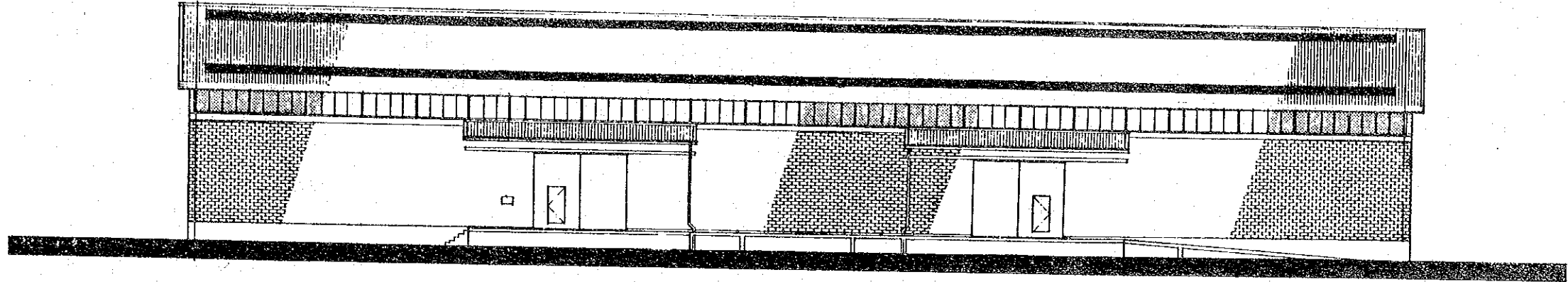
SITE LAYOUT



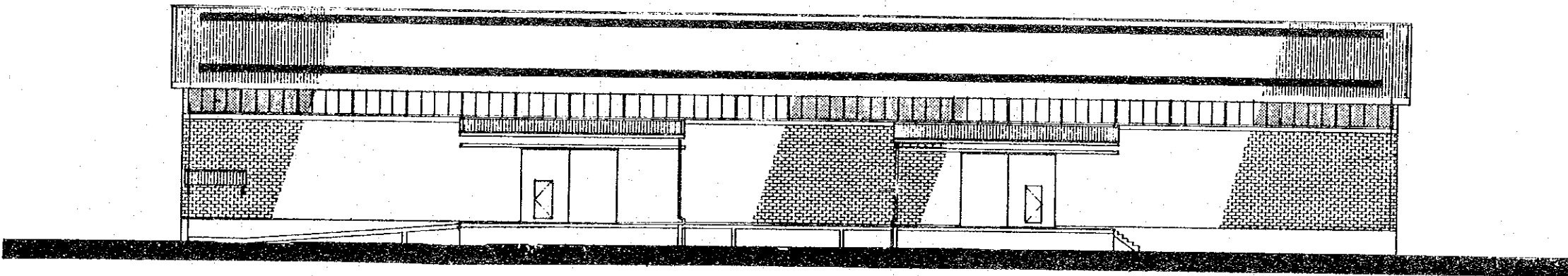
STOREHOUSE
PLAN



STOREHOUSE
ROOF PLAN



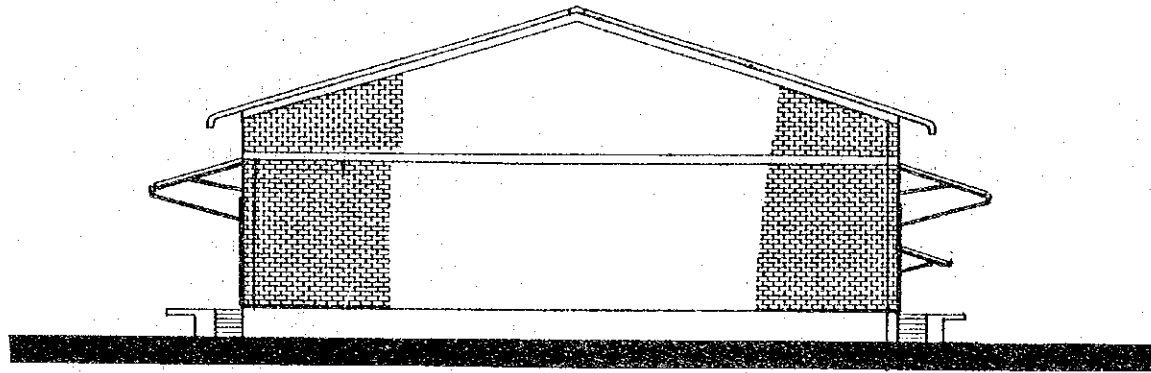
EAST ELEVATION



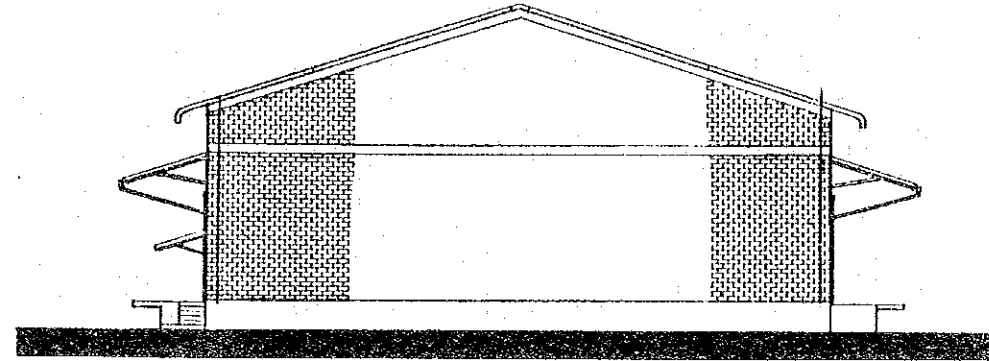
WEST ELEVATION

STOREHOUSE
ELEVATION

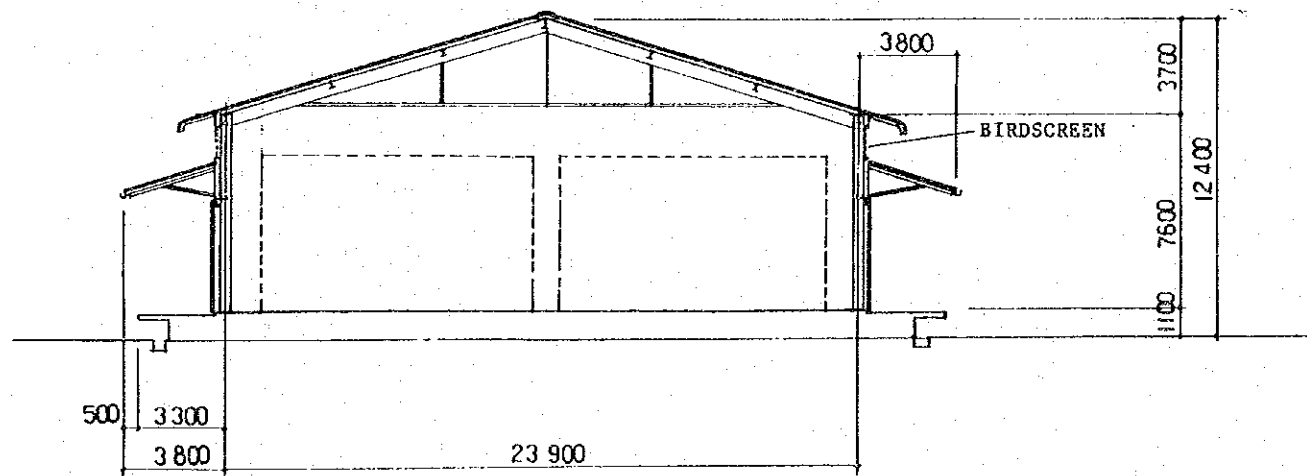
4



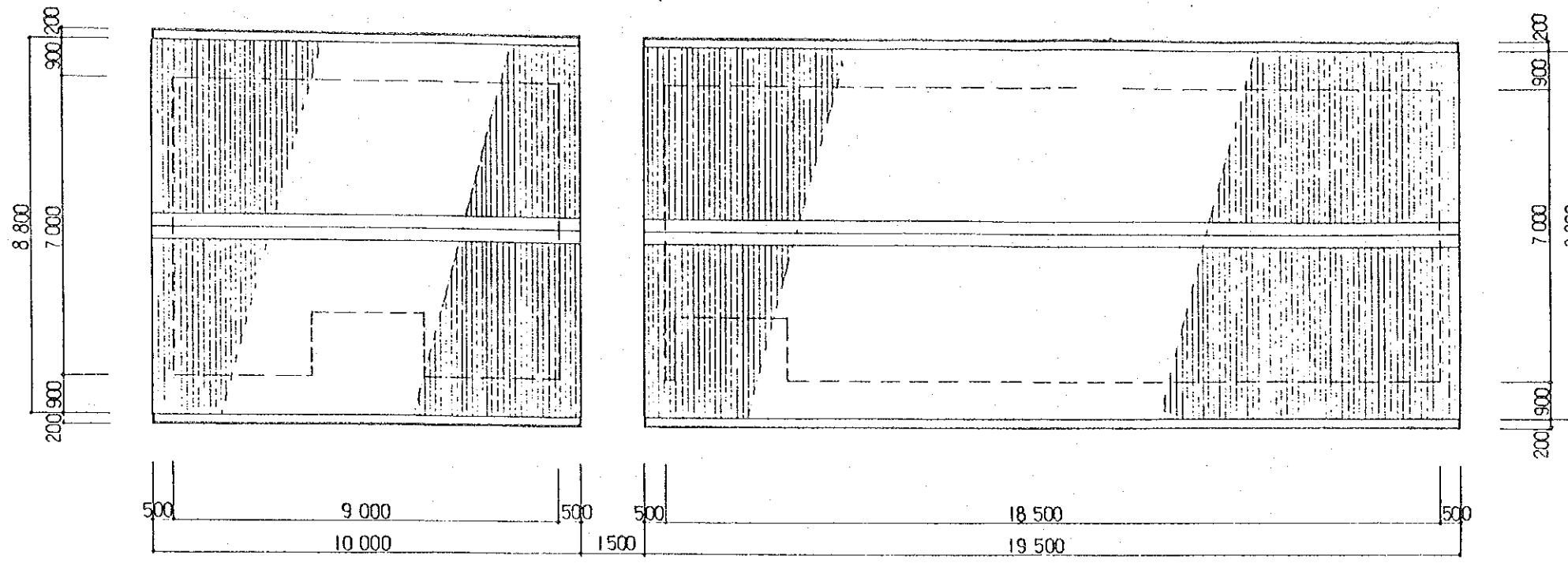
NORTH ELEVATION



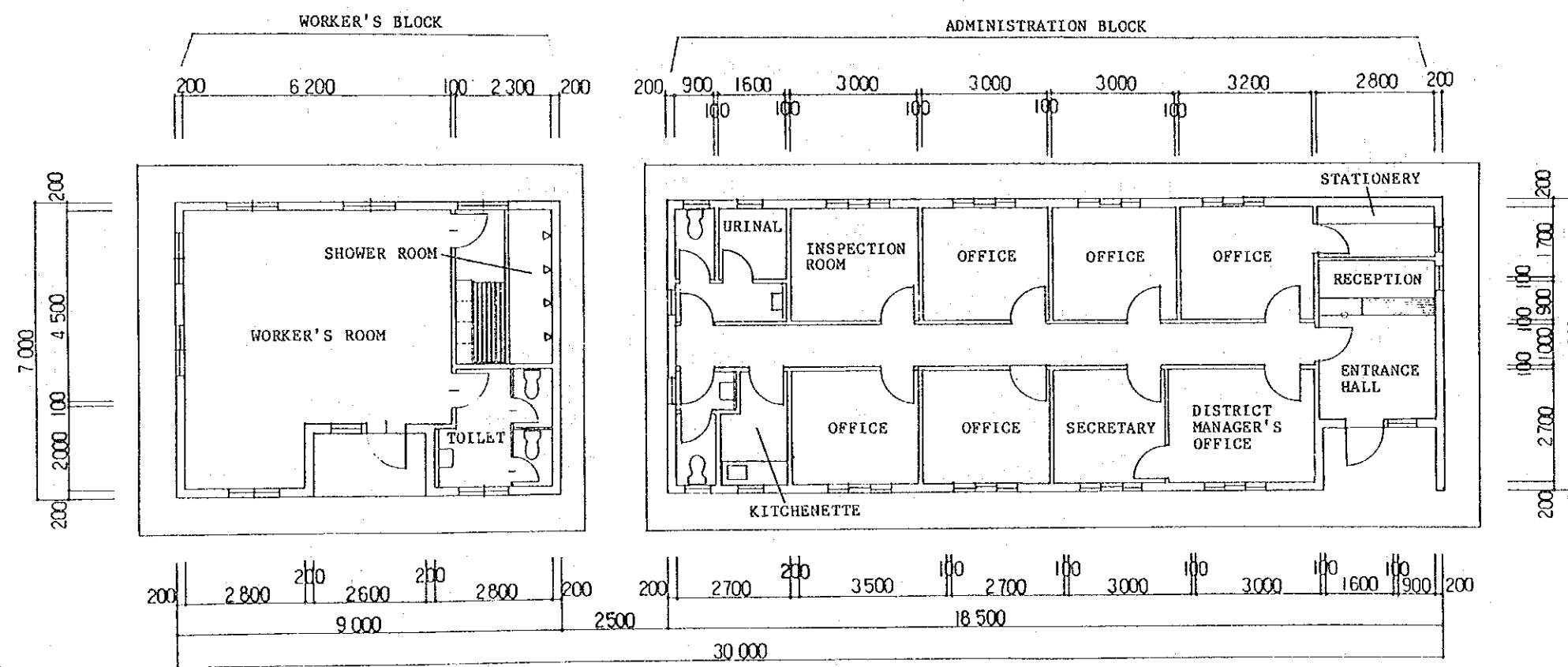
SOUTH ELEVATION



SECTION



ROOF PLAN

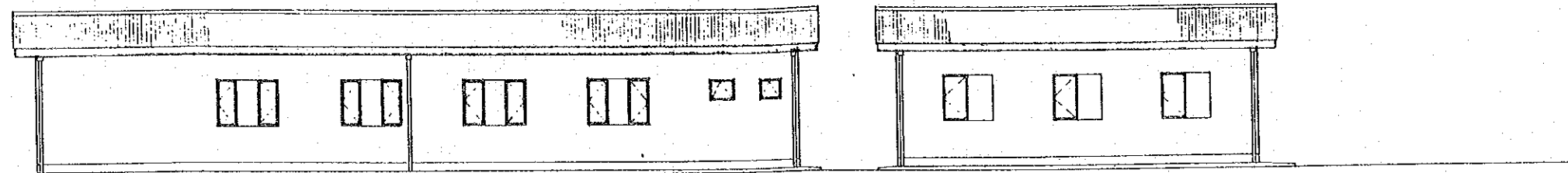


PLAN

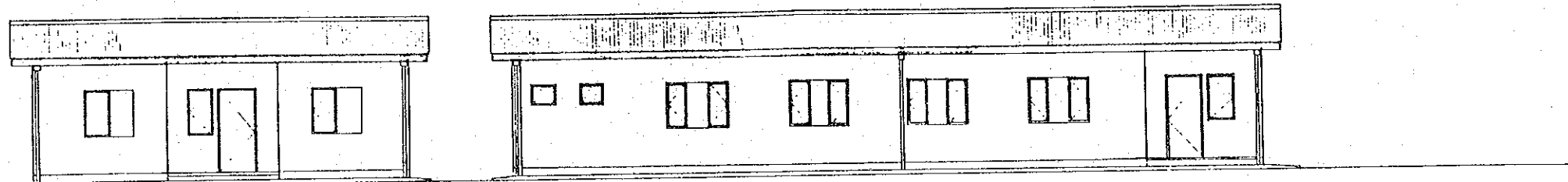


OFFICE BUILDING
PLAN & ROOF PLAN

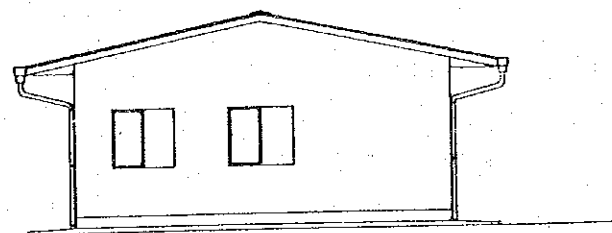
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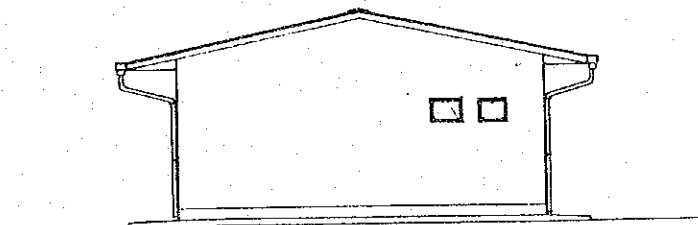
EAST ELEVATION



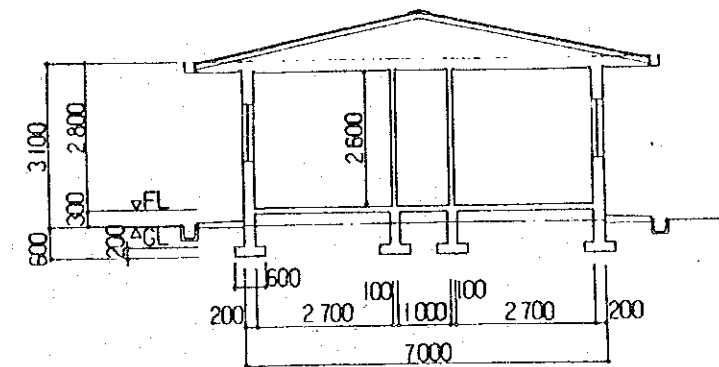
WEST ELEVATION



NORTH ELEVATION

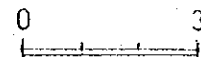
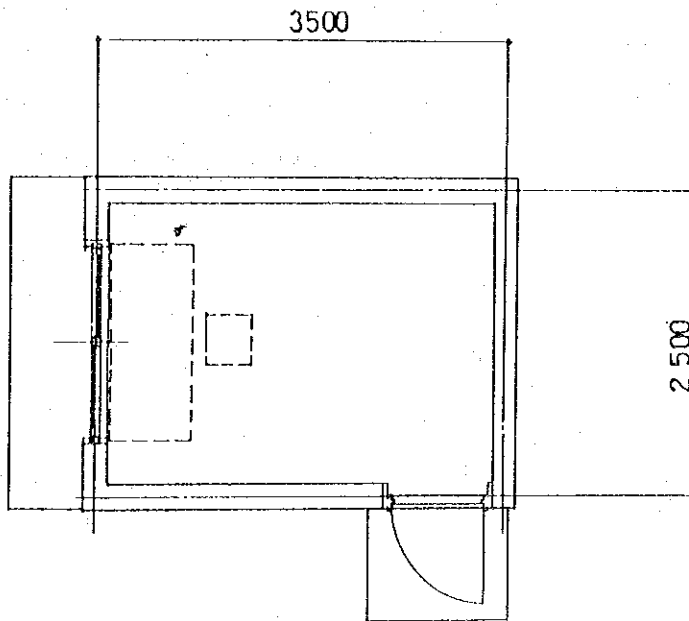
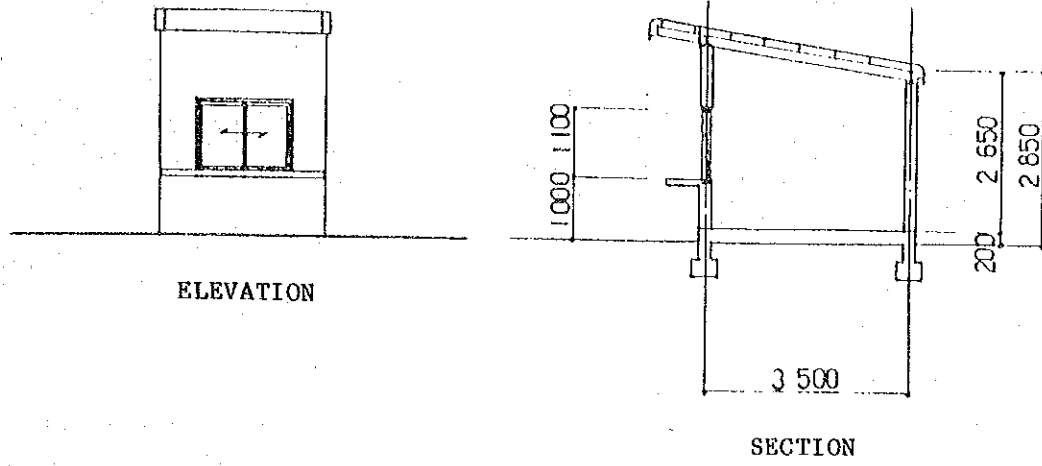


SOUTH ELEVATION



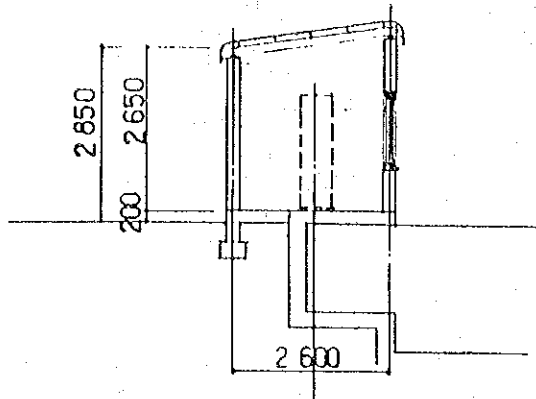
SECTION

OFFICE BUILDING
ELEVATION & SECTION

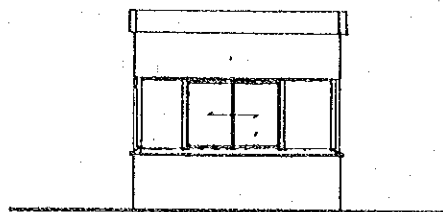


GATEHOUSE
PLAN • ELEVATION & SECTION

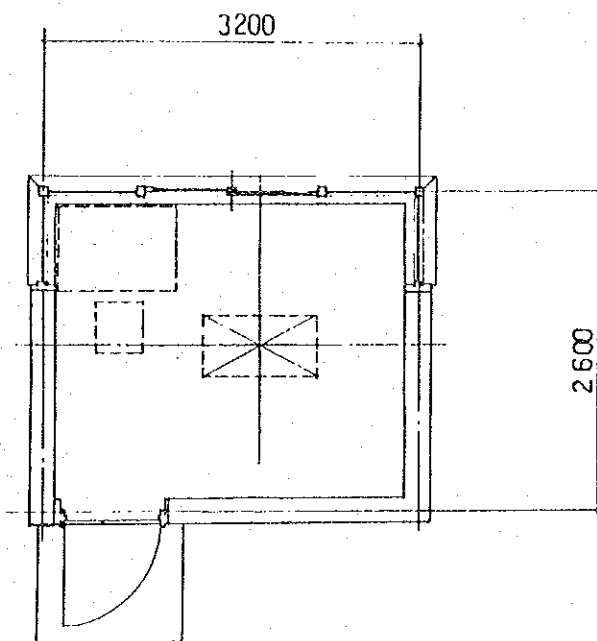
8



SECTION



ELEVATION

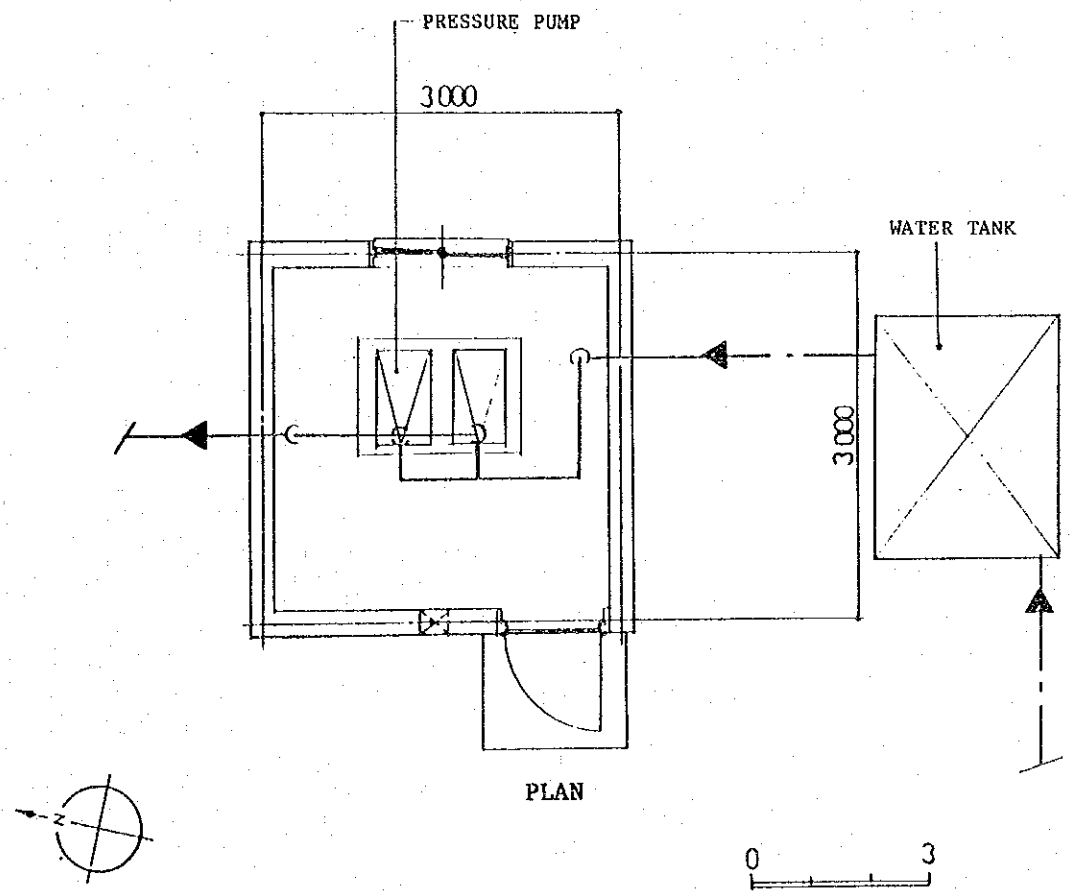
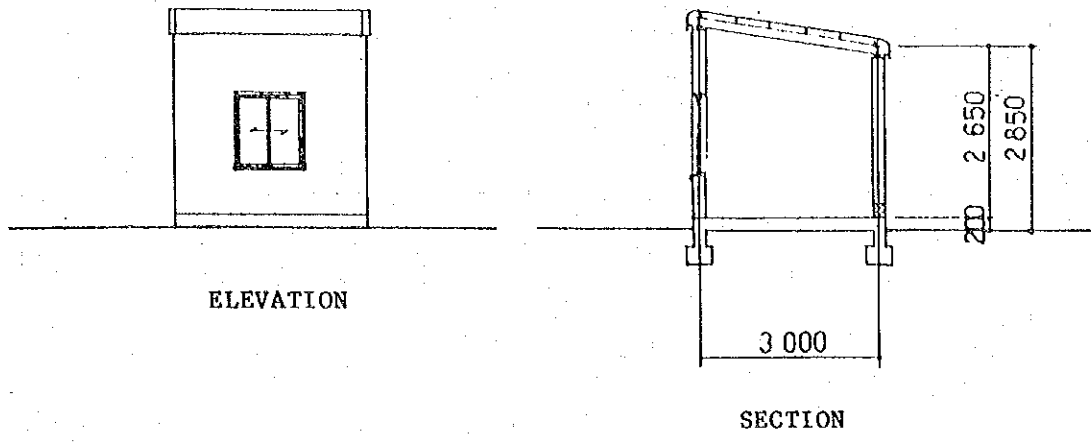


PLAN



TRUCKSCALE HOUSE
PLAN • ELEVATION & SECTION

9



PUMP ROOM
PLAN • ELEVATION & SECTION **10**

3.4 Cost Estimation

3.4.1 Estimation conditions

Based on experience with grain storehouses which are now under construction and expected to be completed in March, 1986, the following classifications for procurement of materials have been determined. Basic principles are the same as in previous project.

Materials to be Gravel, sand, cement, reinforcing bars, procured in Zambia bricks, corrugated asbestos cement sheets, lumber, sheet glass, steel fixtures other than large steel hanger doors and bird screens for storehouses, etc.

Materials to be procured from a nearby third country Steel structure for storehouses.

Materials to be Large steel hanger doors for storehouses, bird screens, FRP corrugated sheets, all materials and equipment for electrical work and plumbing work, all the equipment to be furnished such as cargo handling equipment, grain inspection instruments, truckscale, etc.

As was stated in 2.1 "General Conditions", a foreign currency auction system was introduced in October 1985 and as a result, the foreign exchange rate of the Zambian kwacha against the U.S. dollar, has dropped suddenly to 1/2 to 1/3 of its previous level, triggering severe inflation. Under these circumstances, it was impossible to study the prices of construction materials and labour costs after the auction system started.

Therefore, the probable exchange rate of yen-kwacha shown below has been set based on the exchange rate in September 1985, just before the auction system began, adding the probable rise of price up to the time of construction which will be a year later.

1 U.S.\$ = 6 Kw, 1 U.S.\$ = 205 yen, therefore, 1 kacha = 205 yen
Therefore, 1 kwacha = 35 yen

The inflation rate from Sept. 1985 to the time of construction is estimated as 100%.

Therefore, project cost, in yen will be,
Project cost in kwacha in Sept. 1985 x 35 yen x 200%

3.4.2 Scope of work

- 1) Items whose costs should be borne by the Government of Japan
 1. Architectural work for storehouses, gatehouse, truckscale house and pump room
 2. All electrical work inside the site from the transformer inward.
 3. Construction for water supply, sewage and sanitary facilities within the site.
 4. Service road within the site and approach road.
 5. Construction of gate and fences.
 6. All equipment to be supplied, such as cargo handling machinery, truckscale, grain inspection equipment, etc.
- 2) Items whose costs should be borne by the Government of Zambia
 1. Site preparation work (removal of trees, grading and filling of land, etc.)
 2. Removal of existing objects which become obstacles to the construction work prior to the commencement of construction.

3. Installation of electric power line, telephone cable and water supply to the site boundary.
4. Supply of electrical power and water for construction and temporary installation of telephones during construction.
5. Furniture, kitchen utensils, curtains, carpets, etc.
6. Various legal procedures required for this construction project.

3.4.3 Estimation of costs to be borne by the Government of Zambia

Total	27,000,000 yen
1. Site preparation work	23,000,000 yen
2. Installation work for electrical power supply, water supply and telephone cable to the site	1,000,000 yen
3. Temporary supply of electrical power and water	3,000,000 yen

CHAPTER 4
ORGANIZATION FOR IMPLEMENTATION OF PROJECT

CHAPTER 4. ORGANIZATION FOR IMPLEMENTATION OF PROJECT

4.1 Operation Organization

This grain depot will be operated by the Namboard, which has 14 branches and grain depots in 24 locations. Since the establishment of the Namboard in 1969, the Namboard has been the public corporation which exclusively handles grain distribution. The Namboard is considered to have sufficient capability to operate this grain depot based on its extensive experience in grain marketing. Therefore, there is no need for Japan to provide special staff training. However, instructions of the handling of the equipment furnished and short-term guidance (for about a week) on grain quality inspection using this equipment will be given.

The personnel plan for this grain depot, as outlined by the Namboard, is as shown on Page 49.

4.2 Construction Plan

The storehouses under this project will be undertaken by the one who was selected by tender from among several Japanese companies with abundant experience in overseas works and sufficient capability to see the project through to its completion.

In Zambia, there are a considerable number of constructors with a considerable working capability who have been nurtured since it was under British reign. As local subcontractors, those who are the most appropriate for this project will be selected by the Japanese constructor.

In the light of the experience from the previous project, and in consideration of the siting requirements for the construction sites and of conditions for maintenance after start-up, locally produced construction materials and local construction methods will be used as far as possible, thus enabling Zambia to procure necessary materials and to carry out repair work locally.

Zambia is located in southern Africa, far from Japan. When construction equipment and materials are transported by ship to Dar Es Salaam port in Tanzania and then transported by freight train on the Tan-Zan railway for nearly 2,000 km., the transportation term is nearly 2 months and delivery is unreliable. If the large, heavy steel structures for the main frames which were adopted in consideration of efficient utilization of the storehouse, are fabricated in Japan, it takes more than 6 months for them to arrive at the construction site including time for procurement of materials and fabrication. This makes it too difficult to keep the work schedule.

The fabrication capability of Zambian manufacturers is somewhat inferior and all steel materials used in Zambia are dependent on imports. As a result, the price of steel materials in Zambia includes transportation costs, importing expenses, customs tariffs, etc. It will be advantageous, from the viewpoint of steel prices, for these items to be procured in a nearby third country. The main steel structures for the storehouses which are now under construction, were fabricated in Zimbabwe. Consequently, in this project, the main steel structures, which do not require much maintenance other than painting once constructed, will also be procured in a third country. The large steel doors for entrances of the storehouses, are somewhat difficult for the processing capability of local manufacturers. Therefore, these large steel doors, which will be used in the latter half of the construction period, will be procured in Japan. In addition to the above considerations, the Zambian foreign currency reserves have been worsening in recent years and all imported materials are expensive, as well as scarce and difficult to obtain. Considering this situation, all the materials and equipment for electrical work, plumbing work will be procured in Japan and transported to the site.

In Zambia, the rainy season lasts from December to March and there is a considerable amount of rainfall in this season, when drawing up the construction schedule, carrying out outdoor work and transportation of large quantity of materials and particularly, such

work which involves earth, as earth works, foundation works, etc., in consideration of soil which mainly consist of laterite, should be avoided as far as possible in this season.

Meanwhile, the production areas in Zambia of those materials which can be used in permanent buildings are limited. In this project, the points will include the transportation in Zambia of domestically produced materials and securing of skilled laborers as well as the adjustment of the timing of carrying in the materials to be procured in a third country.

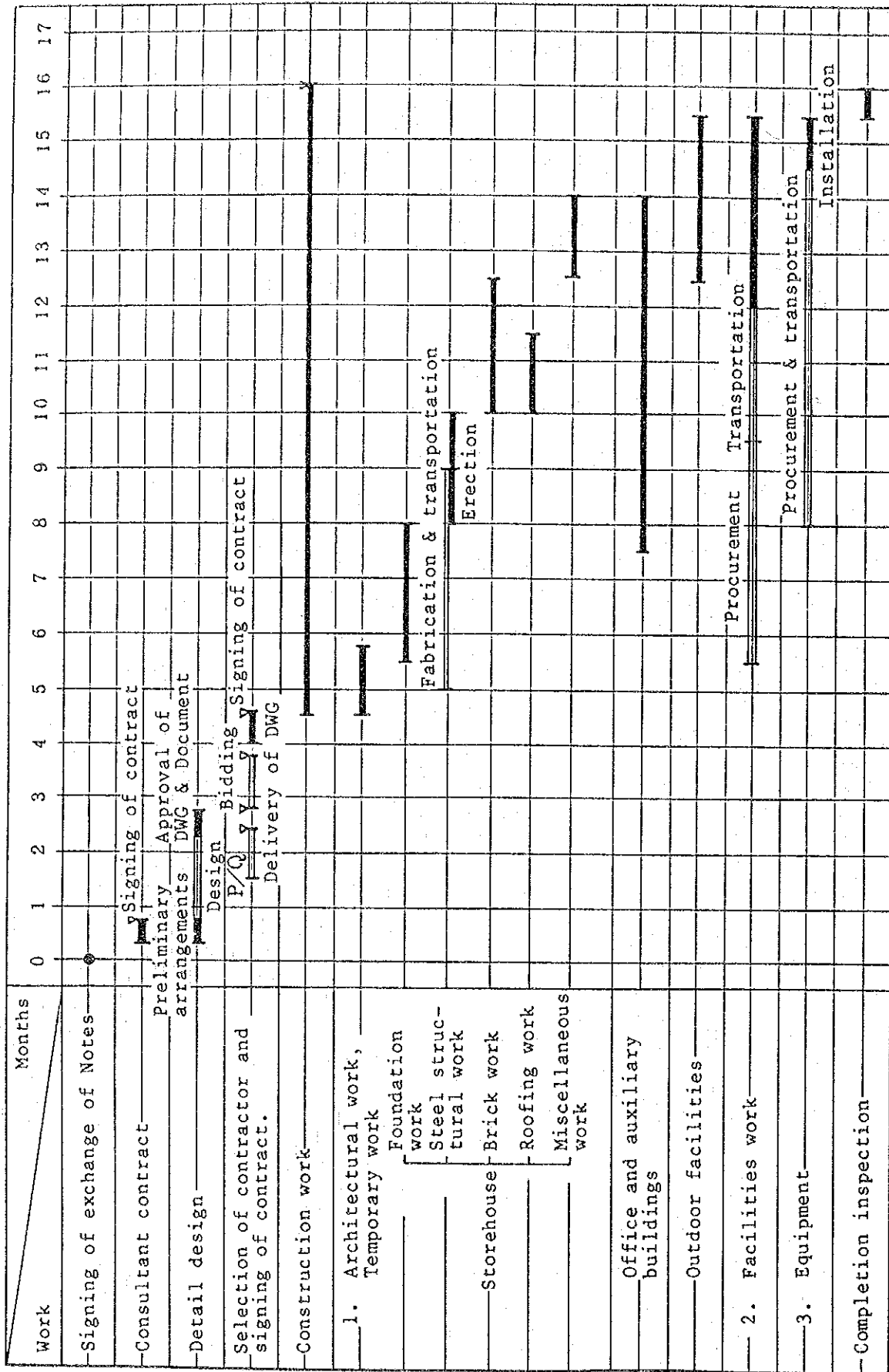
4.3 Scope of Work

The scope of work to be undertaken by the Japanese side and the Zambian side are specified in 3.4.2. "Scope of work". From among the works which the Zambian side is responsible for, the site preparation work including the removal of existing objects, etc. and the leading-in work of electricity, supply water and telephone lines should be over before the start of any construction work by the Japanese side.

4.4 Work Schedule

The detail of the work for the construction of the food grain storehouses are illustrated in the following chart.

WORK SCHEDULE



Operations in Japan
Operations in Zambia

CHAPTER 5
EVALUATION OF PROJECT

CHAPTER 5. EVALUATION OF PROJECT

A construction project of food grain storehouses has been planned by the Government of Zambia and is currently being implemented to reduce grain losses as much as possible at the distribution stage, in which grains have traditionally been stored outdoors. As a part of the above project, full-scale storehouses for maize which is the major marketed grain will be constructed in Chingola in Copperbelt Province, the largest consumption area in Zambia under this project.

Most of all-weather type storehouses which have mainly been constructed with the assistance of Canada and Japan, in major locations in Zambia, will be available for use in the next crop season (1986). But the capacity of these storehouses is not sufficient and it cannot really be said that the location of these sheds is well balanced to the local demands. Especially in Copperbelt Province which is one of the most populated areas, as well as Lusaka Province and forms the key point in the northern part of Zambia, greater demand for food is expected in future, and necessity of grain storehouses are very high. The construction of new grain distribution depots in such an area can be expected to contribute greatly to the improvement of grain distribution.

In this project, the storehouses to be constructed will have the same specifications as the ones which have already been constructed with the assistance of Japan. Since the function was thoroughly examined in the previous study and at the design stage, we believe these storehouses will provide smooth cargo handling functions and can store grain without any deterioration, as well as supplying good quality grain to consumers. Furthermore, due consideration has been made for the achievement of efficient and smooth operation of the grain trade, by the furnishing a truckscale.

CHAPTER 6
CONCLUSION AND RECOMMENDATIONS

CHAPTER 6. CONCLUSION AND RECOMMENDATIONS

The effects after this project has been carried out, has been outlined in the previous chapters. The grain storehouses whose construction is proposed in this project are indispensable facilities for the improvement of grain distribution in Zambia, and for the supplying of good quality food. Accordingly, it is judged to be appropriate that the construction of these storehouses should be carried out through the financial cooperation by the Government of Japan.

It is necessary that the cargo-loading machinery and inspection instruments to be furnished, be maintained in the best possible condition at all times as well as the establishment of appropriate personnel organization to operate this grain depot smoothly. We have scheduled the sending of an engineer to explain the handling of these machines and equipment to the local personnel, as a part of this project. The study team recommends that the Government of Zambia also provide training in the use of these cargo handling machines and have workers thoroughly learn the skills of inspection, by full use of this inspection equipment, to achieve storage in good condition without grain deterioration.

APPENDIX

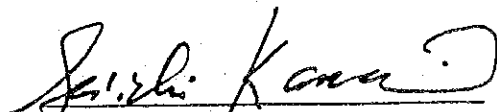
APPENDIX 1.

MINUTES OF DISCUSSIONS
ON
THE CONSTRUCTION PROJECT OF FOOD GRAIN STORAGEHOUSES
IN THE REPUBLIC OF ZAMBIA

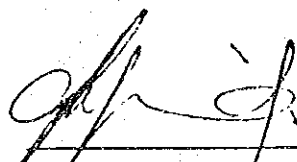
In response to the request made by the Government of the Republic of Zambia for assistance in constructing Food Grain Storagehouses (hereinafter referred to as "the Project"), the Government of Japan has sent through the Japan International Cooperation Agency (JICA), a Study Team headed by Mr. SEIICHI KANAI, Deputy Head, First Basic Design Study Division, Grant Aid Planning and Survey Department, Japan International Cooperation Agency, to conduct the Basic Design Study on the Project from November 12th to November 22nd, 1985.

The team held a series of discussions and exchanged views with the relevant authorities of the Government of the Republic of Zambia. As a result of the study and discussions, both parties have agreed to recommend to their respective Governments to examine the result of the survey attached herewith, toward the realization of the Project.

NOVEMBER 21st, 1985



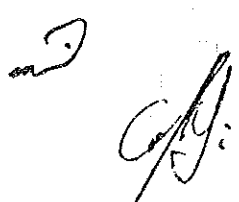
SEIICHI KANAI
TEAM LEADER
JICA STUDY TEAM



MAJOR GENERAL C.J. NYIRENDA (R.td)
ACTING GENERAL MANAGER
NAMBOARD

I. MAJOR POINTS OF UNDERSTANDING BY BOTH SIDES ARE AS FOLLOWS:

1. The objective of the Project is to provide Food Grain Storagehouses with appropriate storage capacity and equipment at Chingola for the National Agricultural Marketing Board (Namboard).
2. In view of the fact that at Chambeshi depot there are some 9,000 metric tonnes of maize stored on open hard standing, even after completion of two sheds at Chambeshi, the team is convinced that the construction of storagehouses at the proposed site will bring about remarkable effects in improving grain distribution in the region, and minimise post harvest losses.
3. The Japanese Study Team will convey the request of the Government of the Republic of Zambia to the Government of Japan, that the latter will extend Grant Aid for the construction of Food Grain Storagehouses within the scope of the Japanese economic cooperation in Grant Form.
4. The Japanese Study Team is assured of the justification and of the effects to construct the storagehouses at Chingola as a result of the recent survey on the maize distribution condition, peripheral environments and others, within the scope of the Japanese economic cooperation in grant form.
5. The optimum layout, scale and capacity, and structure will be formulated in Japan after analysing collected data and information, and it will be proposed in the Basic Design Study Report.
6. Equipment (as per the attached list) deemed necessary for the operation of the storagehouses will be taken up under the grant aid.
7. The Government of the Republic of Zambia will undertake the necessary measures (as described in II), on condition that the grant aid by the Government of Japan is extended to the Project.
8. Both sides have confirmed that the Japanese Study Team explained Japan's Grant Aid Programme, and that it was fully understood by the Zambian side.

Handwritten signature and initials in black ink, located at the bottom left of the page. The signature appears to be 'C. J.' with a flourish.

- II. Required arrangements to be undertaken by the Government of the Republic of Zambia.
1. To secure land necessary for the construction of the facilities and to clear, fill and level the site as needed before the start of construction.
 2. To provide facilities for distribution of electricity, telephone, water supply and drainage and other incidental facilities outside the building.
 3. To construct and prepare the access road to the Project site.
 4. To ensure prompt unloading, tax exemption and customs clearance at ports of disembarkation in Zambia and prompt internal transportation therein of construction materials and equipment purchased under the grant.
 5. To exempt Japanese nationals engaged in the Project from custom duties, internal taxes and other fiscal levies which may be imposed in Zambia with respect to the supply of the products and related training equipment and the services under the verified contracts.
 6. To accord without delay to Japanese nationals whose services may be required in connection with the Project under the verified contracts such facilities as may be necessary for their entry into Zambia and their stay therein for the performance of their work.
 7. To maintain and use properly and effectively the facilities constructed and equipment purchased under the grant aid.
 8. To bear all the expenses, other than those to be borne by the grant, necessary for the construction of the facilities.
 9. To undertake incidental civil works such as planting and fencing, if needed.
 10. To provide the space necessary for such construction as temporary offices, working areas, stock yards and others.
 11. To ensure that temporary electric power and water supply are made available for the construction and incidental activities relative to the Project.

LIST OF EQUIPMENT REQUESTED

1. STACKING MACHINES - ELECTRICALLY OPERATED - 380 VOLTS, 3 PHASE, 50N INDUCTION MOTOR DRIVER, DIRECT ON-LINE STARTING - 10 NOS.
2. PLATFORM SCALES - 10 BAGS (CAPACITY) - 10 NOS.
3. MOISTURE METRES - 10 NOS.
4. PROVISION FOR INTERNAL AND AREA LIGHTS INCLUDING SECURITY LIGHTS AT THE DEPOT.
5. OFFICE ACCOMMODATION.
6. PROVISION FOR WATER AND ELECTRICITY (3PH-POWER).
7. TOILET BLOCK FACILITIES - WITH SHOWER ROOMS.
8. SEWING MACHINES - ELECTRICALLY OPERATED - 220V - SINGLE PHASE - 5 NOS.
9. FENCING OF THE WHOLE DEPOT WITH GUARD ROOMS.
10. ROAD WEIGHBRIDGE - 60 TONS CAPACITY - TWO NOS.

S. K. Rao

[Signature]

APPENDIX 2.

NATIONAL AGRICULTURAL MARKETING BOARD
KITWE/CHAMBISHI BRANCH

STORAGE REQUIREMENTS

1. Proposed Shed at Chingola

The Branch has proposed the construction of two Sheds at Chingola which should be similar to Chambeshi ones. The reasons are that:-

- (a) The deterioration rate of maize stored on Hardstanding at Chambeshi Depot is quite high. Usually the first two layers of each stack get spoiled by moisture sipping from the ground if not well constructed. The Branch is lucky in that Zambia National Breweries have in the past accepted to purchase the undergrade maize at normal price and use it to produce opaque beer. Without such arrangements, the Board should have experienced serious loses.
- (b) The maize stored on hardstanding has to be covered with tarpaulins to protect it from rain and pests. These tarpaulins are just too expensive and have to be replaced every now and then. At the same time the Board has to look around for foreign exchange.
- (c) Maize stored at Chambishi requires frequent spraying and fumigation with storage pesticides which are also imported. The expenses on fumigation team are also very high as the fumigation department has not been decentralised.
- (d) Maize movements during rain season should be discouraged by constructing adequate storage sheds in places where market is readily available to avoid wastage while in transit due to poor conditions of the tarpaulin that are covered on wagons/trucks of the transporters.
- (e) Marketing is readily available in Chingola for maize as there is United Milling whose yearly allocation of maize is 376,000 x 50Kg bags.
- (f) These arrangements will ease up the congestion of wagons/trucks at both Chambishi and Kitwe Silo during pick periods for marketing season. This will help the Board to reduce costs on demurrage charges which are very high.
- (g) The congestion of trucks belonging to Millers will be reduced. Hence bring about efficiency which should be the aim of our National Planning.

APPENDIX 3.

- Organization of members of the study team -

Team leader		Seiichi Kanai	First Basic Design Study Division, Grantaid Planning & Survey Department, Japan International Cooperation Agency
Team member	Architectural Planner	Akira Takahashi	Daiken Architects and Engineers
Team member	Food Grain Marketing	Hideta Yokoyama	Overseas Merchandise Inspection Co., Ltd.

APPENDIX 4.

- List of Officials Concerned -

1. Officials of the Government of Zambia concerned

a. Ministry of Finance

Mr. L. Nkata	Director of Loans and Investment
Mr. C.S. Chileshe	Economist

b. National Agricultural Marketing Board (Namboard)

Lusaka Head Office

Major General, C.J. Nyirenda	Acting General Manager
Mrs. E. Haambote	Personnel Manager
Mrs. M.A. Sichali	Grains Marketing Manager
Mr. J.J. Lungu	Branch Manager, Engineering Service Branch
Mr. K.C. Nsokolo	Engineering Assistant

Witwe/Chambishi Branch

Mr. V.B. Mutale	Branch Manager
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c. Copperbelt Provincial Government

Mr. W. Mukelabai	Permanent Secretary
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2. Embassy of Japan

Mr. Matsutoshi Ota,	Ambassador
Mr. Yasufumi Kotake	Second Secretary
Mr. Kyohei Ishida	Second Secretary

APPENDIX 5.

- Schedule of Basic Design Study -

Nov. 10 (Sun.)	11:45	Departure from Tokyo
	18:40	Arrival in Paris
Nov. 11 (Mon.)	23:25	Departure from Paris
Nov. 12 (Tues.)	12:15	Arrival in Lusaka
	15:00	Visit to the Embassy of Japan, Preliminary discussion of study schedule, etc.
Nov. 13. (Wed.)	9:00	Meeting within the study team
	15:00	Visit to Namboard and explanation of purpose of survey, discussion of survey schedule with officials concerned.
Nov. 14 (Thrus.)	8:00	Departure from Lusaka
	12:30	Arrival in Ndola
	14:00	Visit to Copperbelt Provincial Government
	15:00	Departure from Ndola
	16:00	Visit to Kitwe Namboard Branch, discussion.
Nov. 15 (Fri.)	9:00	Visit to construction site for the grain storehouses in Chambishi
	11:00	Field survey of proposed site in Chingola
	14:00	Visit to the neighbouring flour mill
	17:00	Visit to Kitwe Namboard Branch, discussion.
Nov. 16 (Sat.)	9:00	Discussion at Kitwe Namboard Branch
	11:00	Departure from Kitwe
	18:00	Return to Lusaka
Nov. 17 (Sun.)	-	Meeting within the study team, sorting of reference material.
Nov. 18 (Mon.)	9:00	Visit to the Embassy of Japan. Report the results of survey and discussion.
	14:00	Survey of construction conditions
Nov. 19 (Tues.)	9:00	Visit to the Ministry of Finance
	10:30	Visit to CIDA (Canadian International Development Agency) local office.
	15:00	Visit to Namboard, meeting and discussion

Nov. 21 (Thurs.)	10:00	Official greetings, Ambassador Ota
	14:30	Signing of minutes of discussions.
Nov. 22 (Fri.)	9:00	Collection of reference material
	16:00	Visit to Namboard
	22.25	Departure from Lusaka
Nov. 23 (Sat.)	6:25	Arrival in London
Nov. 24 (Sun.)	12:10	Departure from London
Nov. 25 (Mon.)	14:45	Arrival in Tokyo

JICA