ARAB AUTHORITY FOR AGRICULTURAL
INVESTMENT and DEVELOPMENT

FEASIBILITY STUDY FOR A FEEDLOT COMPLEX PROJECT IN WESTERN OMDURMAN - SUDAN

Volume 3

THE PROJECT

ARAB ORGANIZATION FOR
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VOLUME III

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CHAPTER 1

OBJECTIVES AND PROJECT COMPONENT

1. OBJECTIVES AND PROJECT COMPONENTS :

1.1 PROJECT OBJECTIVES :

The project presented is thought of as an integrated cattle trading and finishing operation that can be managed within the existing infrastructure. Improvement of the profitability of the project will be achieved through investment in modern techniques of cattle finishing and export of deboned meat cuts.

Finishing operations are currently being practised in the Khartoum area which is the major meat market of both domestic consumption and export. The project envisaged is essentially suitable for short term financing and fast maturity, and can also provide a framework for expansion and replication.

The project will include the following operations. :-

- The purchase of maximum 160,000 animals and the establishment of five holding grounds within the vicinity of the important traditional cattle markets in the Western and White Nile Provinces. The main objectives of the holding ground is to solve the problem of seasonality of marketing in order to provide the feedlot with a continuous supply of cattle.

- Trekking 130,000 animals through cattle route and transferring 30,000 animals by block trains to the feedlot complex located at Omdurman. The complex contains central assembly area, a feedlot, a feed mill and an abattoir. Animals will be kept in the complex for a period of 90 days and then slaughtered. A total number of 32,000 animals will be sold live after an average fattening period of 45 days.

- Production of rations required for the feedlot by the project feed mill.

- Slaughtering and processing about 128,000 animals, and preparing the meat for export in the form of deboned cuts.

The projected outputs of the project at maximum level (year 4) are :-

- about 10,000 tons of meat for export ;
- 32,000 live animals, plus edible offals and nonedible by-products for the local market ;
- 240,000 m^3 of manure in the form of dry waste.

1.2 PROJECT COMPONENTS :

The project will include two major components :-

- five provincial holding grounds ;
- a meat production complex.

The provincial holding grounds will be located in selected sites within the low rainfall savannah belt, where most of the livestock population is concentrated in the Western and the White Nile Provinces and according to the actual vegetation measurements carried out in January 1982. The selected sites are :-

- Nyala, South Darfur	- 40,000 head
- El Merum, South Darfur	- 30,000 head
- Dea'n South Darfur	- 40,000 head

- El Tibune, South Kordofan - 20,000 head
- Kosti, white Nile - 30,000 head

The meat production complex will be located at Omdurman and will contain besides the administration building, workshops and staff accommodation facilities, the following components :-

- A central assembly area and feedlot with a total capacity of 55,000 head. Cattle will be kept in open yards of 1,000 head designed on the corral system to facilitate replication and reduce construction costs.

- A feed mill with maximum capacity of 124,000 tons of pelleted feed per year to provide the feed requirements for both the central assembly area and the feedlot at a lower cost.

- An abattoir of maximum slaughtering capacity of 500 head/24 hours equipped with cattle slaughter hall, meat cutting plant and a refrigeration block.

1.3. PHASING :

The implementation period of the project can be divided into three phases, defined as follows :-

Phase I - Pre-operational Phase (PY 0)

During this phase, no cattle will be purchased. The year will be devoted to the establishment of two holding grounds at Nyala and El Merum, commencement of the construction of the meat production complex at Omdurman (central assembly area, feedlot, feed mill, and abattoir), adequate preparation of infrastructure and training of local staff to operate the feed mill.

Phase II - Operational Phase (PY 1- Py 3)

Forty thousand head of cattle will be purchased in Year 1 in the two established holding grounds starting in July. These animals will be transferred to the meat production complex at Omdurman where the central assembly area and feedlot will be ready to receive them, and the feed mill should be producing the required feeds. During this year, also, a third holding ground will be established at Dea'n. The Government abattoir at Kadero will be used for slaughtering the project's animals until the end of this year when the project's own abattoir will be completed and its staff trained.

In the next two years, PY 2 and PY 3, the other two holding grounds will be established at Tibun and Kosti. The holding grounds at Dea'n and Tibun will be in operation, increasing the cattle purchasing capacity of the project to 80,000 head and 120,000 head in PY 2 and PY 3 respectively. Animals will

be slaughtered in the project's abattoir starting PY 2.

Phase III - Full Operation (PY 4)

All of the five holding grounds will be used at the maximum capacity of 180,000 purchased animals. The full capacity of the feedlot complex is expected to be utilised, and the project is expected to attain its steady state in this year.

CHAPTER 2

PROVINCIAL HOLDING GROUNDS

2. PROVINCIAL HOLDING GROUNDS

This proposal will involve the establishment of five provincial holding grounds in livestock production areas (Western and White Nile Provinces) within the vicinity of the important traditional cattle markets. A central assembly area together with a feed mill and feedlot will be established in Western Omdurman for fattening of the livestock brought from the provincial holding grounds, and these should aim to maintain a regular and sufficient supply of livestock throughout the season to meet the designed capacity of the feedlot which will amount to 160,000 head per year when the project will be operating at full capacity in the fourth year. The central assembly area, west of Omdurman, will be the storage centre for livestock arriving from the provincial holding grounds, as well as regulating the provision of the stock needed to operate the feedlot which is estimated to amount to 15,000 head per month so as to provide the slaughterhouse with a regular supply of 500 head per day.

2.1 OBJECTIVES OF THE PROVINCIAL HOLDING GROUNDS

The main objectives of the provincial holding grounds are summarised in the following points :-

- To solve the problem of continuity of livestock production which is currently constrained by the traditional system of livestock management and seasonality of marketing. Thus provincial holding grounds were designed of such a capacity that will permit the purchase of extra stock toward the end of the rainy season (October, November, December) before the nomadic stock moves south. This extra purchased

stock will be stored to meet the requirements of the feedlot during the critical period of the dry season (January, February , March) when there is a shortage in the traditional markets.

- To be used as feeding centres in which stock, after being purchased from the traditional stock markets, will be grazed till they are sent to the main assembly area west of Omdurman.

- Movement of purchased livestock inside and outside the provincial holding grounds will be coordinated with the purchasing schedule which was designed mainly to satisfy the estimated capacity of the feedlot at a rate of 16,000 head every 90 days period during each ten months, or a total of 160,000 head per year when the project reaches its full capacity in the fourth year.

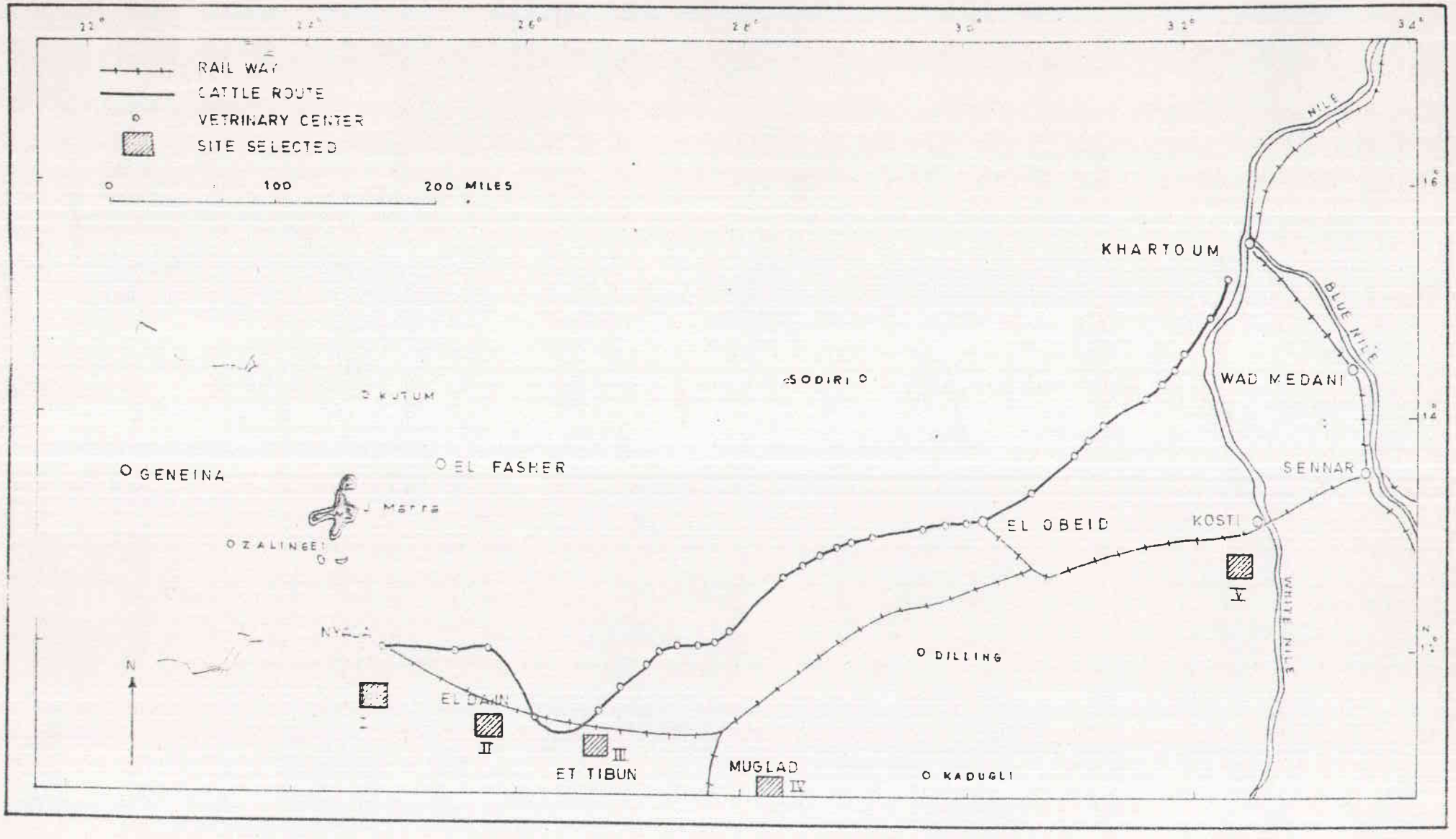
- To make available veterinary treatment for purchased stock prior to their entry to the provincial holding grounds and during their movement along the cattle route to Omdurman.

2.2. SITE SELECTION AND JUSTIFICATION

According to the field survey carried out during January 1982 by Range Management specialists, five sites were selected for the establishment of the provincial holding grounds located as follows (Map No. 2.1.).

- Nyala (South Darfur)
- Dean (South Darfur)
- El Tibune (South Kordofan)

LOCATION OF PROVINCIAL HOLDING GROUNDS



- El Merun (South Darfur)
- Kosti (White Nile Province)

The selection of these sites can be justified by the following reasons :-

- All are located within the low rainfall savannah belt between latitudes 10°, 14° N and Long. 22°, 36° which fall in a rainfall zone ranging between 400 - 800 mm. This zone is characterised by rich valuable grazing resources and other potential areas currently not under use which are available for a project oriented toward the development of livestock production.

- Most of the livestock population is concentrated in the Western and White Nile provinces where the provincial holding grounds exist.

- According to the actual vegetation measurement carried out by the range specialist in January 1982, the selected sites maintain high forage production. The carrying capacity determination is relatively high compared to other areas (Table 2.1.).

- The selected sites are all located within the vicinity of the important cattle markets thus facilitating the purchase of stock required to operate the feedlot during the rainy season as well as during the critical dry season, which will contribute in solving the problem of seasonality of marketing.

- The selected sites are located close to the traditional cattle route and the Western railway line so that both will be used for the extraction of purchased stock stored at the

TABLE 2.1. CARRYING CAPACITY OF SELECTED SITES

Selected site	Carrying capacity (Sq. mile/AV/240 days)	Carrying capacity (AC/AV/240 days)
Nyala	0.0133	8.50
Dea'n	0.0133	8.50
Tibune	0.015	9.60
El Merum	0.010	6.40
Kosti	-	-

Source : Survey Recording Sheets.

provincial holding grounds to the central assembly area west of Omdurman.

2.3. CRITERIA FOR SITE SELECTION :

- Proposed sites were selected in largely empty areas where grazing potential is rich and currently not under use by either the nomadic or sedentary populations of the area.

- Selected sites do not compete or contradict with the nomadic traditional routes of movement.

- Selected sites are located within a radius of not more than 15 - 20 miles from the traditional cattle markets and lie close to commercial cattle routes and railway lines.

- The two sites selected at El Merum and Kosti are located close to the railway line so that during the summer time the stored stock can be transported by train to the central assembly area at Omdurman.

- Acceptance by each local authority for the establishment of the provincial holding ground was acquired.

2.4. DESCRIPTION OF SELECTED SITES :

2.4.1. INTRODUCTION :

Site locations have been selected through actual reconnaisance surveys in Southern Darfur and Southern Kordofan during the period 21 to 29 January 1982. The survey permitted the assessment of range productivity, carrying capacity, and plant cover.

The sites were selected in the low rainfall savannah on sand, which is classified as tropical continental climate with a wet and dry trend. The average rainfall ranges from 280 - 600 mms and above. The wide range of the rainfall results in divers ecological situations and numerous plant communities as follows :-

- 280 - 450 mms rainfall where the acacia senegal occurs on large areas. In the drier parts the species Senegal is mixed with other acacia sp.

- The dominant grasses are Aristides sp, Cenchrus sp. and Erograstis sp.

- 450 - 600 mm rainfall where the non-thorny trees are dominant like Albizzia sp, Guiera and Combretum.

  The dominant grasses are Ctenium Elegans, Zornia Diphylla and Belpharis sp.

- Above 600 mms rainfall where Anogeissus sp, Selerocarya sp. and small parts of the Guiera sp.

  The dominant grasses are Andropogon gyanus, Ctenium Elegans and Belpharis sp.

Source : J. K. Jackson and Harrison - 1947 Ecological Classification of the Vegetation of the Sudan, P. P. 129 - 131.

In varying degrees all savannah vegetation exhibits adaptation to tolerance for drought and fire. Tolerance of fire is best developed in herbaceous plants, which probably accounts for their prominence in the savannah flora. Annual grasses and herbs are usually prominent relative to perennials in many situations.

The growth period of the savannah coincides with the rainy season, most herbaceous species maturing and going dormant as soil moisture disappears in the dry season. Thus, only mature dry herbage is available for several months. Annuals tend to mature first, often well before the end of the rainy season. In perennials, the growth period is usually larger making full use of the available moisture. Woody plants tend to have the largest growth period and show greenness in the dry season . Although the herbage is most nutritious during the growing season, much of it still remains palatable and usable when dry. Quality, however, varies greatly among species and localities.

The reconnaissance survey was carried out with the same techniques in the sites selected, four transects were done at random in each site. The readings were taken by 3/4" hoop at 50 cm intervals. All the species were recorded in a data sheet. The outcome is the composition of the vegetal cover, range condition of the site and % of bore soil.

Square foot (9.6) hoop was used to get the carrying capacity of the site. The hoop thrown randomly in any direction harvested the herbage inside the hoop which was weighted in term of grasses. The weight is multiplied by 10 to get lb/AC. After getting the average , then the carrying capacity of the site was calculated.

Soil types are stabilised soft dunes (QOZ) in the north portion of the zone. The sand absorbs all the rainfall and has better moisture relations and better vegetation than clays where rainfall is limited.

2.4.2. DETAILED DESCRIPTION OF SELECTED SITES :

(a) Nyala Site

1. Location

The site is located in latitude 11° 37' and longtitude 25° 43' E, about 55 km south of Nyala with only one dirt truck road to Buram on the right to the site. The major market is at Nyala where purchasing occurs between July and October and during the two following months. The major sales take place at Nyala in October. Then the cattle are trekked on hoof from Nyala to Khartoum thus avoiding the difficulties associated with the railway.

2. Vegetation, Soil and Rainfall

The site area is almost stabilised sand dune (QOZ), with high holding moisture capacity and vegetation better than clays. Precipitation is 550 mm annually. The rainy season extends from June to September.

It is clear from the plant association that there is a considerable diversity of species. Trees are widely distributed. The major tree species (overstony) are : Dalbergia melanoxylon Combretium Kordofanum, Selerocarya Birra, Guiera Senegalensis and Albizzia Sericocephala.

The understony are composed of Eragrostis Termula, Belpharis Linarifolia Cassia Memoides, Oldlandia Herbacca and Fimbristylis Dichotoma.

3. Range Production

On the basis of actual weight of herbage harvested inside the loop (9.6 square feet) the forage production is expressed in pounds per acre (lb/AC). The carrying capacity is based on a daily requirement of 20 lbs air-dried forage per animal unit, regardless of the nutritive value of the forage. The site production of forage is 560 gram, average 5 samples 112 lb/AC.

(b) El Dea'n Site

1. Location

The site is located in latitude 11° 37' N and longitude 25° 43' E, about 60 km west of El Dea'n and about 10 km south of Suleia (railway station). The main market for livestock is at El Dea'n with purchasing done through the same period as that for Nyala. The sales are based on condition, age and size of the animal.

2. Vegetation, Soil and Rainfall

It has deep sand soil stabilized with good vegetation cover, rainfall occurs from July to September and is approximately 490 mms annually. Scattered palatable shrubs were noticed on the site. The present community is relatively homogenous, being made up of few species. The major tree species are : Acacia Nubica, Zizphus Spina christii Bassica Senegalcusis, Acacia Senegal, Acacia Nellifera. The understony

are composed of : Eragrostis Termula, Ctenium Elegans, Chloris Gayana, Fimbristylis Dichotoma, Bracharia Ob Stifolia.

3. Range Production

The production of the site is 560 lbs/AC. The estimation was carried out by the loop (9.6 feet) method . Herbage was harvested inside the loop weighted and multiplied by 10 for five different samples from different localities in the site and the average of 5 samples was found to be 112 lbs/AC.

(c) Babanusa (El Tibun Site)

1. Location

The site is located between latitude 11° 8' and longitude 27° 25', about 25 km south of El Tibun. The main market for livestock during the rainy season is Tibun ; most of the nomads stay in the surroundings of the town to sell their cattle (mostly young bulls), and purchasing is done on a direct sale basis.

2. Vegetation, Soil and Rainfall

Rainfall is about 600 mms annually, occuring during July and September, Atmour is the dominant type of soil in the site. The most dominant species are : aZornia Diphylla and Eragrostis Termula which indicate occasional burning. Few plant species were recorded to indicate homogenous community. The most dominant species of the overstony are : Selerocarya Birra, Guiera senegalensis, Acacia Mellifera, Albizzia Sericocéphala, Dalbergia Melanoxylon.

The understony consists of Eragrostis Termula, Zornia Diphylla Sida Cordifolia, Oldlandia Herbacca, Dact, loctenium Aegyptiacum, Bracharia Obustifolia, Acanthospermum Hispidum.

3. Range Production

The same techniques were used to estimate forage production as for the previous sites, and the result was 490 lbs/AC with average 5 samples is 98 lbs/AC.

(d) El Merum (Muglad Site)

1. Location

This site is located in latitude 11° 06' E and longitude 27° 56' N, about 55 km north east of El Merum and 25 km south east of El Muglad. The dry season is the time of sale at El Merum, because it is difficult to remove the animals from range to the consumption areas. During the hot dry season (March to June) most of the nomads are in Bahr El Arab, a long distance from the main markets, and therefore the prices are low due to the poor condition of the animals and lack of forage and water along the traditional routes.

2. Vegetation , Soil and Rainfall

The annual rainfall is over 600 mms. The site is characterised primarily by sandy loam soils and an undulating landscape. The most predominant trees are : Albizzia Sericocephala, Ziziphus Spina Christi and Cadaba Glandulosa. The predominant grasses are : Eragrostis Termula, Oldenlandia Herbacca, Aristida sp, Bracheria sp and Zornia Diphylla.

3. Range Production

The production of the site, 700 lbs/AC, was assessed by the same procedure followed on the previous sites with average of 5 samples at a rate of 140 lbs/AC.

(e) Kosti Site

1. Location :

This site is located in Longitude 32° 25' and latitude 12° 50'. Sales are conducted in the main market in Kosti town during the rainy season ; middlemen after purchasing cattle at bargain prices in outlying areas bring them to Kosti, where they can be sold at a much higher rate per individual animal. Transportation is either by the railway or the cattle route.

2. Vegetation, Soil and Rainfall

The Acacia Mellifera is the main dominant species in the overstony which occupies the clay areas in the region where in the blending zone mixed with Acacia Nubica. In understony the main dominant grasses in the QOZ are Cechrus Ciliaris, Aristida stipoides, where in the clay areas they are Aristida Funiculata and Aristida Mutabilis, Aristida Pallida. The QOZ is undulating with clay soils (light clays) forming a repeating pattern. The area receives about 450 mms rainfall annually during June to September.

3. Range Production

The assessment of range productivity was done by loop (9.6 feet). The estimated production was 700 grams with an average of 140 lbs/AC. The carrying capacity is estimated as 0.011 sq mile/AC/240 days.

(f) List of Trees, Shrubs, Grasses and Herbs of the selected Western Sites (Nyala, Dea'n , El Tibun and El Merum

(1) Trees

Selerocarya Birrea
Dalbergia melanoxylon
Combrotium Kordofanum
Albizzia sericocephala
Maba Abyssinca
Tamarindus indica
Balanites aegyptraca
Anogeissus Schimperi
Boscia senegalensis
Cordia Garaf

(2) Shrubs

Guiera Senegalensis
Acacia Senegal
Acacia Mellifera
Cadaba Glandulosa
Acacia Nubica
Combretum aculeatum

(3) Grasses

Cechrus Ciliaris
Eregrostis Termula
Chloris Gayana
Aristida Mutabilis
Bracharia Obustifolia
Digitaria Marginata
Ctenium Elegans
Sporoblus Festivus
Schoenefeldia Gracilis
Pennisetum Pedicellatum
Dactyloctanium Aegyptiacum

(4) Herbs

Fimbristylis Dichotoma
Belpharis Linariifolia
Oldlandia Herbacea
Ipomea Cardiosphala
Indigofera sp.
Zornia Diphylla
Sida Cordifolia
Waltheria Indica
Acanthospermum Hispidum

2.5. METHOD AND SCHEDULE FOR PURCHASES :

2.5.1. OPTIONS FOR PURCHASING CATTLE :

The project authorities can follow more than one way for its procurement of livestock from the production areas or from markets outside those areas.

One method is by the appointment of honest, hardworking staff, well experienced in livestock marketing with a fair knowledge of the area as well as having good contacts among the livestock producers. The permanent staff should be minimal and a seasonal temporary team could be drawn from the respective areas, should additional help be required.

A second method is to engage seasonal temporary agents who, according to the marketing flow of livestock in the producing areas, have close contact with all those engaged in the livestock trade, i.e. producers, brokers, traders, sub-agents, local merchants, exporters and wholesale butchers. These agents would be able to make available the numbers of cattle the project needs at any time.

The third method would be to make annual contracts with merchants or local traders for a regular supply of the cattle needed at scheduled times, with deliveries being made at the gate of the provincial holding grounds or at the gate of the central assembly area in Omdurman.

However, the project would have the option to utilise all three proposed methods at one time or just one method at a time according to circumstances. It is recommended that the project

should appoint a purchasing officer who could decide on the method most appropriate to each area.

2.5.2. SCHEDULE OF LIVESTOCK PURCHASES :

The purchasing schedule of livestock and their movement in and out of the provincial holding ground is coordinated with the designed capacity of the feedlot in Omdurman.

The feedlot capacity was determined as 100,000 head per year when the project reaches full capacity in year four. Since the length of the fattening period is 75 days for each lot, in addition to 15 days that animals will spend in the assembly area, the stock purchasing schedule and cattle movements in and out of the provincial holding ground is designed to permit for an average supply of 40,000 head every three months (90 day period).

Since the project is phased to be completed in four years' time with rising capacities from 40,000 head in the first year, 80,000 in the second year, 120,000 in the third year, and 160,000 at year number four when the project reaches its full capacity, then the establishment of the holding ground is phased to be completed in year four. The purchasing schedule of livestock and their movements in and out of the holding grounds is also designed to permit sending every three month period to the feedlot the portion of stock that suits its capacity during the four phases of the project as indicated below in Table 2.2.

The detailed descriptions of stock purchasing schedules and movements in and out of the holding grounds during the four phases of the project are illustrated in Tables 2.3, 2.4, 2.5, and 2.6. and 2.7.

According to the purchasing schedule, Nyala and El Merum holding grounds will be established in the first year, El Dea'n in the second year, El Tibun in the third year, and Kosti in year four. As indicated in the purchasing schedule, Nyala, Dea'n and Tibun will be utilised to purchase stock during the rainy season when most of the nomadic livestock is concentrated in the rainy season grazing area. Toward the end of the rainy season and before the nomadic southward movement starts, additional numbers will be purchased and stored in these holding grounds so as to ensure adequate supplies to the feedlot during the critical period (January, February, March) when the livestock are not available for purchase in the northern markets. The southern holding grounds at El Merum and Kosti will supply stock needed to operate the feedlot during the summer time, and they will be transported by railway due to shortage of forage and drinking water along the traditional cattle routes at this time.

The schedule of livestock purchase and their movement in and out of the provincial holding grounds in year four when the project reaches its full capacity is illustrated in Table 2.7.

2.6. DESIGN OF THE PROVINCIAL HOLDING GROUND AND THE PROPOSED MANAGEMENT SYSTEM :

2.6.1. SIZE :

The size of Provincial Holding Grounds was determined on the following basis :-

- Actual carrying capacities of each site as determined by the range specialist during the field survey ;

- Number of actual grazing days of stored stock as indicated in the proposed schedule of purchase (Section 2.5.2.).

Using these two bases, the size needed for five Provincial Holding Grounds to provide the stored stock with adequate grazing is illustrated in Table 2.8.

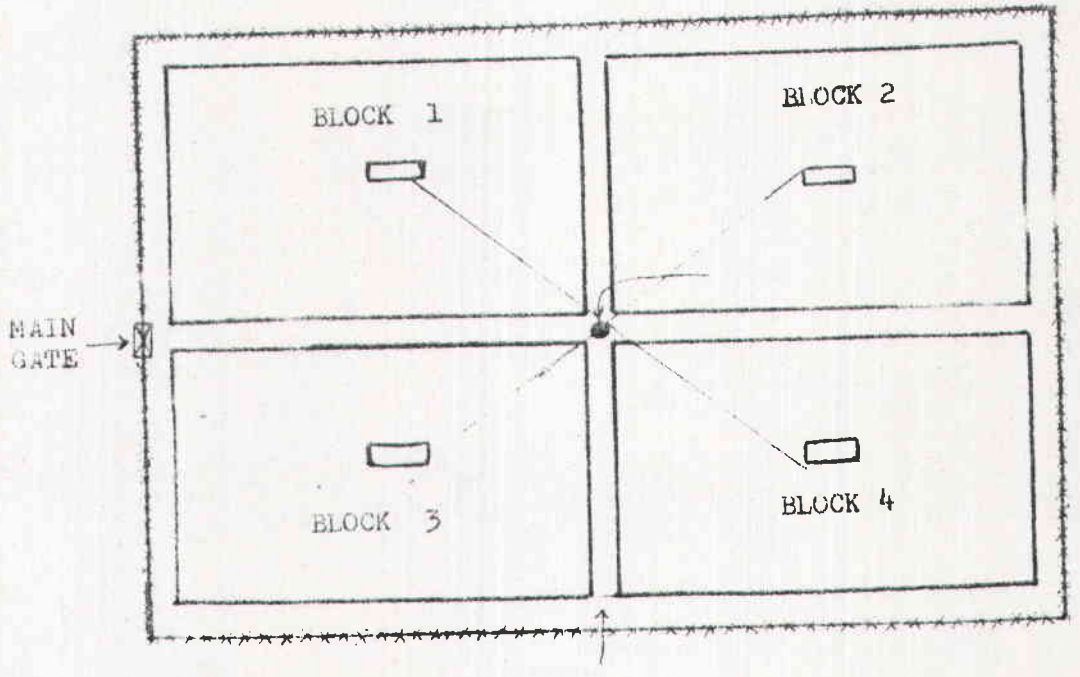
Table 2.8. is a summary that indicates the exact size and dimensions of the Provincial Holding Grounds when the project operates at full capacity in year four.

2.6.2. DESIGN AND PROPOSED GRAZING MANAGEMENT SYSTEM :

The Provincial Holding Grounds will be fenced using barbed wire and a combination of wood posts ($\frac{2}{3}$) and metallic posts ($\frac{1}{3}$). Each holding ground will be divided by fire breaks into four equal divisions or blocks (BL1, BL2, BL3, BL4), as indicated in the following sketch (Fig. 2.1.). Purchased stock entering the holding ground after being medically treated will be herded in sizable groups ranging between 200 to 500 head to graze the

FIG. 2.1 :

DESIGN OF THE HOLDING GROUND AND THE PROPOSED MANAGEMENT SYSTEM



(e) Haemorrhagic septicaemia

(f) Blackquarter

(g) Should be treated against trypanasomiasis

(h) Dosed against fascioliasis according to their areas of origin (especially from White Nile Province).

Directly after the cattle have been purchased the livestock market authorities should issue a permit indicating that the described cattle were purchased from the said livestock market.

After vaccination and treatment of the cattle (with some drugs) the veterinary authorities should issue a veterinary health movement permit indicating the vaccinations and treatment given. The cattle should be branded with the veterinary authorities month brand and the project purchase batch brand.

All animals are then allowed 1 - 2 days' rest somewhere nearby the livestock market, but if possible they should not be permitted to mix with other livestock in the vicinity. This rest time is necessary after vaccination and drug treatment.

2.7.2. VETERINARY SERVICES TO BE RENDERED AT THE QUARANTINE :

When the operations at the livestock market are completed, as described under 5.5.1. , and the animals have rested for 1 - 2 days, they will be driven to the nearest provincial holding ground, where, on arrival, the animals will be kept for 2 - 3 days inside the quarantine adjacent to the provincial ground. In the animal quarantine the following veterinary procedures will be adopted :-

(a) All animals will be put under strict observation for any signs of sickness or abnormalities.

(b) All will be dosed against internal parasites with Nilvern or the new drug with the broad spectrum known as Syspamex.

(c) All will be dipped or sprayed with ascaricide against ticks and biting flies with Gamatox, Asintol or the new drug in the market now called Delnav.

2.7.3. VETERINARY SERVICES TO BE RENDERED INSIDE THE PROVINCIAL HOLDING GROUND :

After keeping the animals for 2 - 3 days in the animal quarantine, they will be well inspected before allowing them to enter the provincial holding ground. Inside the provincial holding ground the following procedures will be followed :-

(a) Each batch will be kept separately.

(b) All animals will be kept under strict veterinary care and treated against wounds, abrasions, and non-infectious diseases that might arise during their stay.

(c) Immediately before moving the animals out of the provincial holding ground to start trekking across the cattle route, they are to be dipped or sprayed with ascaricide against ticks infestation and biting flies.

(d) The cattle will be issued with a movement health

certificate indicating the dates of vaccinations (vaccinations done at livestock market), the veterinary authorities month brand and the project batch purchase brand.

(e) After that the cattle will be allowed to move across the cattle route to the central assembly area in Omdurman, or to the nearest railway holding yard for loading on a train up to Soba railway terminal yard where the cattle are transported by trucks to the central assembly area across Burri and Shambat Bridges.

2.8. REQUIREMENTS FOR HOLDING GROUNDS :

All requirements necessary for the establishment and operations of the proposed five holding grounds are shown in the following tables.

2.8.1. FENCING :

A perimeter fence using barbed wire and metallic posts will be constructed to protect the proposed five holding grounds. In accordance with the estimated unit cost of standard fence (LS. 10/meter fence), the total cost of fencing the proposed five holding grounds is shown in table 2.10.

TABLE 2.5. (Contd.)

No. of Stock to be purchased	Months	Movement of purchased stock in and Out of the Holding Grounds			Actual Grazing Days
		In	Out	Balance	
(c) EL MERUM HOLDING GROUND					
4. 30,000	April	3,000	3,000	-	10
	May	12,000	12,000	-	10
	June	15,000	15,000	-	10
Total (c)		30,000	30,000	-	30
(d) EL TIBUN HOLDING GROUND					
5. 10,000	July	1,000	1,000	-	10
	August	4,000	4,000	-	10
	September	5,000	5,000	-	10
Total (d)		10,000	10,000	-	30
Grand Total (a) + (b) + (c) + (d)		120,000	120,000	-	-

TABLE 2.6. SCHEDULE OF STOCK PURCHASE AND MOVEMENT IN AND OUT OF THE FIVE PROVINCIAL HOLDING GROUNDS IN YEAR FOUR

Holding Ground	Schedule of Purchase in LS.	Movement of Stock In and Out of the Holding Ground			Actual Grazing days
		In	Out	Balance	
(a) Nyala 40,000	Same as in Table No. 3 (July - March)	40,000	40,000	-	270
(b) Dea'n 40,000	Same as in Table No. 3 (July - March)	40,000	40,000	-	270
(c) El Merum 30,000	Same as in Table No. 3 (April - June)	30,000	30,000	-	30
Grand Total (a) + (b) + (c)		110,000	110,000	-	-
(d) El Tibun 20,000	July	2,000	2,000	-	-
	August	8,000	8,000	-	-
	September	10,000	10,000	-	-
Total (d)		20,000	20,000	-	30

TABLE 2.6. (Contd.)

Holding Ground	Schedule of Purchase in LS.	Movement of Stock in and Out of the Holding Ground			Actual Grazing Days
		In	Out	Balance	
(e) Kosti 30,000	April	10,000	10,000	-	10
	May	10,000	10,000	-	10
	June	10,000	10,000	-	10
Grand Total (a) + (b) + (c) + (d) + (e)		160,000	160,000	-	-

TABLE 2.7. SCHEDULE OF STOCK PURCHASE AND MOVEMENT IN AND OUT OF THE FIVE PROVINCIAL HOLDING GROUNDS AT YEAR FOUR WHEN THE PROJECT IS AT FULL CAPACITY

No. of Stock to be Purchased and sent Every Three Months (90 days)	Month	Movement of Purchased Stock in and Out of the Holding Ground		
		In	Out	Balance
(1) 52,000	July	8,000	8,000	-
	August	20,000	20,000	-
	September	24,000	24,000	-
		52,000	52,000	
(2) 48,000	October	22,000	12,000	10,000 +
	November	18,000	9,000	19,000 +
	December	8,000	4,000	23,000 +
		48,000	25,000	52,000
(3)	January	-	10,000	13,000 +
	February	-	9,000	4,000 +
	March	-	4,000	-
			23,000	
(4) 60,000	April	20,000	20,000	-
	May	20,000	20,000	-
	June	20,000	20,000	-
Total		160,000	160,000	

Source : Calculated from Table Nos. 1, 2, 3, 4, 5 and 6.

TABLE .2.9. DETERMINATION OF SIZE AND DIMENSIONS OF THE PROVINCIAL HOLDING GROUNDS WHEN THE PROJECT OPERATES AT FULL CAPACITY (BASED ON CAPACITY AND PERIOD OF GRAZING)

Holding Grounds	Months				Grazing Period (Days)	Size of Grazing Land Required on Basis of Days of Grazing and Capacity	Dimensions
						(0.0133 Sq.m/AV/240 days)	
(a) NYALA	July	3,000	3,000	-	10	1.66 sq. mile	
	Aug	6,000	6,000	-	10	3.23 " "	
	Sept	7,000	7,000	-	10	3.80 " "	
	Oct	11,000	6,000	5,000	10 + 90	(3.32 + 25) = 28.32	
	Nov	9,000	4,500	4,500	10 + 60	(2.5 + 14.96) = 17.46	
	Dec	4,000	2,000	2,000	10 + 30	(1.10 + 3.32) = 4.42	
	Jan	-	5,000	6,500	10 + 30	(2.77 + 10.8) = 13.57	
	Feb	-	4,500	2,000	10 + 30	(2.49 + 3.32) = 5.81	
	March	-	2,000	-	10	1.10	
Total		40,000	40,000	-	-	80.37 sq. miles	(8.9 X 8.9)
(b) DEA'N	Purchasing Schedule and Grazing Capacity will be the same as in Nyala (July - March)				Same as Nyala		
Total		40,000	40,000			80.37 sq. miles	(8.9 X 8.9)

TABLE. 2.9. (Contd.)

Holding Grounds	Months				Grazing Period (days)	Size of Grazing Land required on Basis of Days of Grazing and Capacity	Dimension
(c) EL MERUM						(0.01 sq, m/AV/240 days)	
	April	3,000	3,000	-	10	1.25 sq. miles	
	May	12,000	12,000	-	10	4.99 "	
	June	15,000	15,000	-	10	6.24 "	
						21.58	(3.6 X 3.6)
(d) EL TIBUN						(0.015 sq.m/AV.240 days)	
	July	2,000	2,000	-	10	1.25 sq. miles	
	Aug.	8,000	8,000	-	10	5.00 "	
	Sept.	10,000	12,000	-	10	6.25 "	
		20,000	20,000			12.50	(3.5 X 3.5)
(e) KOSTI						(0.011 sq.m/AV/240 days)	
	April	10,000	10,000	-	10	4.6 miles	
	May	10,000	10,000	-	10	4.6 "	
	June	10,000	10,000	-	10	4.6 "	
		30,000	30,000			13.8	(3.7 X 3.7)
Ground Total		160,000	160,000			199.62 sq. miles	

2.8.2. BUILDINGS :

TABLE 2.10 TYPES AND NUMBERS OF BUILDINGS REQUIRED FOR THE HOLDING GROUNDS

Item	No. of Buildings Required					
	Nyala	Dea'n	El Tibun	El Merum	Kosti	Total
Senior Type Houses	4	4	-	-	-	8
Junior Type Houses	4	4	4	4	4	20
El Suki Type	6	6	6	6	6	30
Labour Sector (Drivers, and Herder + Seasonal Labour (1)	1	1	1	1	1	5
Veterinary Crush	1	1	1	1	1	5
Veterinary Laboratory	1	1	1	1	1	5
Stores	1	1	1	1	1	5
Workshop (Room)	1	1	1	1	1	5
Sheds for Machinery and Vehicles	1	1	1	1	1	5
Total	20	20	16	16	16	88

(1) Note : Labour Sector will be constructed using straw huts as designed by the Consultant Engineer to accommodate Drivers, Herders and Seasonal labourers.

2.8.3. MACHINERY AND EQUIPMENT :

TABLE 2.11 TYPES AND NUMBERS OF EQUIPMENT NEEDED FOR THE HOLDING GROUNDS

Item	Requirements for All Holding Grounds					
	Nyala	Dea'n	El Tibun	El Merum	Kosti	Total
Tractors (76 H.P.)	2	2	1	1	1	7
Mower	2	2	1	1	1	7
	2	2	1	1	1	7
Set of Equipment for Workshop (Standard)	1	1	1	1	1	5
Trailer	2	2	1	1	1	7
Boiler	2	2	1	1	1	7
Blades	2	2	1	1	1	7
Seed Drill	1	1	1	1	1	5
Plough	1	1	1	1	1	5
Generator Set	1	1	1	1	1	5
Spray	1	1	1	1	1	5
Vet. Equipment (Lab. Set)	1	1	1	1	1	5
Weighing Scale (Stock)	1	1	1	1	1	5

Note : Generator, Spray and Veterinary equipment to be specified by Engineer and Livestock Veterinary Specialist.

2.8.4. VEHICLES :

TABLE 2.12 TYPES AND NUMBERS OF VEHICLES NEEDED FOR THE HOLDING GROUNDS

Item	Requirements for All Holding Grounds					
	Nyala	Dea'n	El Tibun	El Merum	Kosti	Total
Landrover (Pick-Up)	2	2	1	1	1	7
Lorries (5 Tonner)	2	2	1	1	1	7
Total	4	4	2	2	2	14

2.8.5. STAFF AND LABOUR

TABLE 2.13 STAFF AND LABOUR FOR THE PROVINCIAL HOLDING GROUNDS

I t e m	Required Numbers for the Five Holding Grounds					
	Nyala	Dea'n	El Tibun	El Merum	Kosti	Total
Range Management Officer (Manager)	1	1	-	-	-	2
Animal Husbandry Officer	1	1	-	-	-	2
Purchasing Officer	1	1	-	-	-	2
Technical Assistant (Range, Husbandry, Veterinary, Purchase)	4	4	4	4	4	20
Clerk	1	1	1	1	1	5
Store Keeper	1	1	1	1	1	5
Mechanic (Machinery and Vehicles)	1	1	1	1	1	5
Mechanic (Water Pump)	1	1	1	1	1	5
Assistant Mechanic	1	1	1	1	1	5
Electrical Engineer	1	1	1	1	1	5
Drivers	6	6	3	3	3	21
Herders	48	48	30	30	30	186
Seasonal Labour	100	100	50	50	50	350
Head Labour						
Total Working Staff	168	168	93	93	93	651

TABLE 2.14 VETERINARY STAFF FOR PROVINCIAL HOLDING GROUNDS

Year	No. of Provincial Holding Grounds	No. of Vets.	No. of Vet. Assistants	No. of Stockmen	No. of Vet. Attendants
Year 1	2	2	2	4	4
Year 2	3	3	3	6	6
Year 3	4	4	4	8	8
Year 4	5	5	5	10	10

2.9. COSTS :

TABLE 2.15. NYALA HOLDING GROUND (1)

No.	Item	Foreign Component LS X1000	Local Component LS X1000	Total LS X 1000
1.	Perimeter Fencing	230	346	576
2.	Staff Housing	255	382	637
3.	Office, Workshop and Stores	26	40	66
4.	Spray Race	35	15	50
5.	Water Supply	609	261	870
6.	Electric Power Supply	210	90	300
7.	Machinery and Equipment	130	14	144
8.	Transport	76	8	84
	Total	1571	1156	2727
	10% Contingency	157	116	273
	Total	1728	1272	3000

9. Running cost/year = LS. 372,000
10. Wages and Salaries = LS. 75,612

(1) El Dea'n Holding Ground costs are similar to Nyala.

The trucks will be equipped with VHF radio/telephone with a base set at the feedlot to organise the operation. A 4 wheel drive van will be provided as a mobile workshop and the servicing of the trucks will be done at the central workshop of the project. The herders for handling the loading and unloading of the cattle will be drawn from the central assembly area and the feedlot.

3.4. TRANSPORTATION OF FATTENED ANIMALS TO KADERO ABATTOIR :

The project's own slaughterhouse will still be under construction during the first operational year, so it is planned that the fattened animals will be slaughtered and processed at the Kadero abattoir during this period. The projected number (40,000 head in PY1) will be taken from the feedlot to Kadero at the rate of 250 head/day which is its present capacity.

The same transport fleat as discussed in 3.3. will be utilised in the movement of the fattened cattle. The trailer will carry 30 head of 400 kg weight. The round trip feedlot/Kadero/Feedlot totalling 92 km will take 3 hours and so 3 round trips (9 hours) for 3 trucks per day will have to be made to transport the cattle. When this activity coincides with the transportation of cattle from Soba to the feedlot then a second crew shift will be required.

After the project's own slaughterhouse has been completed then the same prime movers can be used for towing refrigerated containers or animal feed trailers.

3.5. VETERINARY SERVICES RENDERED DURING TREKKING ACROSS THE CATTLE ROUTE OR DURING RAILWAY TRANSPORTATION :

3.5.1. SERVICES ALONG THE CATTLE ROUTE :

During the journey from the provincial holding grounds across the cattle route to the Central Assembly Area in Omdurman (40 - 60 days) veterinary services are available at the established veterinary inspection stations (veterinary check point) which are components of the Cattle Route Project. These stations are run by qualified veterinarians, technicians and veterinary assistants. If a batch of cattle is sufficiently large then a veterinary stockman, equipped with a first aid box, will accompany the herd between the veterinary check points so as to deal with wounds, abrasions, accidents and non-infectious diseases.

3.5.2. VETERINARY SERVICES DURING TRAIN JOURNEY :

If cattle are intended to be transported from the provincial holding grounds by train to Soba terminal yard and then to the central assembly area at Omdurman, the procedure will be as follows :-

- The same veterinary services in the animal quarantine and inside the provincial holding grounds should be performed as under sections 5.5.2. and 5.5.3.

- Then the cattle will be driven to the nearest Railway Holding Yard owned by the livestock and Meat Marketing Corporation at Nyala, Dea'n, El Merium, Babanoussa, El Obeid or Kosti, where loading will take place. The journery is supposed to take 2-5 days.

- The veterinary services at the railway holding yards are the joint responsibility of the LMMC and the veterinary authorities of the area, so that anything requiring veterinary attention can be dealt with promptly before loading.

- During the train journey from any of the railway holding yards up to the RTY at Soba, south of Khartoum, the unloading point, the on-train veterinary services will be the joint responsibility of the LMMC and the veterinary authorities as usually veterinary stockmen accompany the livestock train.

- After unloading at Soba railway terminal yard, the cattle will be transported immediately by special vehicles across the Burri and Shambat bridges to the Omdurman central assembly area which is an animal quarantine adjacent to the feedlot compound.

- Any veterinary services required at the Soba railway terminal yard will be made available by their own veterinary authorities.

3.6. REQUIREMENTS OF TRANSPORTATION :

- 6 truck/trailer cattle transporters
- 1 4 wheel drive van
- 7 UHF radio/telephone units
- - Tools and fuel tanks
- 6 Drivers
- 6 Assistant Drivers

3.7. COSTS :

3.7.1. COST OF TREKKING AND RAILWAY TRANSPORTATION FROM THE PROVINCIAL HOLDING GROUNDS :

Table (3.2.) shows the costs of transportation from the provincial holding grounds to the feedlot complex in Omdurman as well as the rail costs from El Merium to Soba Railway Terminal Yard.

TABLE 3.2. COSTS OF TRANSPORTATION FROM P. H. G.

	Year 1		Year 2		Year 3		Year 4	
	Number	Cost	Number	Cost	Number	Cost	Number	Cost
Trekking Cost (1)								
Nyala - Khartoum	30,000	432.000	30,000	432.000	40,000	576.000	40,000	576.000
Dea'n - Khartoum	-	-	30,000	240.000	40,000	320.000	40,000	320.000
El Tibun - Khartoum	-	-	-	-	10,000	116.000	20,000	232.000
Kosti - Khartoum	-	-	-	-	-	-	30,000	159.000
Railway Cost (2)	10,000	307.000	20,000	614.000	30,000	921.000	30,000	921.000
Total	40,000	739.000	80,000	1286.000	120,000	1933.000	160,000	2208.000

(1) From P. H. G. to Feedlot complex.

(2) From Meirum to Soba Terminal.

3.7.2. COSTS OF TRANSPORTATION FROM SOBA RAILWAY TERMINAL YARD TO FEEDLOT COMPLEX AND FOR TRANSPORTING FATTENED ANIMALS TO KADERO(1) :

(a) Capital Costs :	Unit Price £S X 1000	Total £S X 1000
- 6 trucks/trailer transporters	160	960
- 2 trailers	100	200
- Mobile workshop van plus spare parts		112
- Tools plus 7 radio/telephone units		57
- Sheds		9
Total		1338 (2)
(b) Running Costs		
1st Year :		
- 28,000 km from Soba to Feedlot	1	28
- 23,000 km from Feedlot to Kadero	1	23
Total		51 (3)
2nd Year		
- 55,000 km from Soba to Feedlot	1	55 (3)
From 3rd Year onwards		
- 83,000 km from Soba to Feedlot	1	83 (2)

(1) Fattened animals will be transferred to Kadero abattoir in project year 1 only

(2) 80% FC and 20% LC

(3) 10% FC and 90% LC

CHAPTER 4

CENTRAL ASSEMBLY AREA

4. CENTRAL ASSEMBLY AREA

4.1. CAPACITY AND DESIGN :

The system is designed so as to hold animals for 15 days where they will receive intensive veterinary services and be fed on a medium plan of nutrition. On average about 8000 head will enter the central assembly area every 15 days and the same number will be moved out to the feedlot.

The central assembly area will consist of 15 yards in corral design, each yard containing 10 pens capable of holding 100 animals. The size of the pen is 12 X 70 m = 840 m^2 giving an average spacing of 8.4 m^2/ animal. Five pens will be on each side of a yard with animal passage of 2.00 m width in between. Shaded water troughs are to be placed between every two adjacent pens on the other side of the feed troughs which are going to be located on each side of the feed lane between two yards. The feed trailer will lay the feed on both sides as it passes along. Table (4.1) shows the total number of animals in the Central Assembly Area during the fourth year of the project.

4.2. FEEDING AND MANAGEMENT :

The operation of the central assembly area is based on holding the animals for 15 days. Animals are expected to average approximately 275 kg liveweight (250 - 300 kg).

Animals will be fed on a moderate plan of nutrition and consume about 8 kg feed / head/ day from ration A (Table 4.2.). About 52% of the total ration will come from sugar cane

TABLE 4.1. TOTAL NUMBERS OF ANIMALS IN THE CENTRAL ASSEMBLY AREA DURING THE FOURTH YEAR OF THE PROJECT ('000 HEAD)

Month	Day	In	Out
January	1	5	-
	15	5	5
February	1	4.5	5
	15	4.5	4.5
March	1	2	4.5
	15	2	2
April	1	6.5	2
	15	6.5	6.5
May	1	11.0	6.5
	15	11.0	11.0
June	1	12.5	11.0
	15	12.5	12.5
July	1	4	12.5
	15	4	4
August	1	10	4
	15	10	10
September	1	12.0	10
	15	12.0	12
October	1	6	12
	15	6	6
November	1	4.5	6
	15	4.5	4.5
December	1	2.0	4.5
	15	2.0	2.0
January	1	-	2.0
		160.000	160.000

TABLE 4.2. COMPOSITION (%) AND NUTRITIVE VALUE OF RATION (A)FEED IN THE CENTRAL ASSEMBLY AREA

INGREDIENTS	%	Nutritive Value %	
		Digestible Protein	Total Digestible nutrients
Bagasse(1)	40	0.0	16.8
Molasses	12	0.0	6.48
Groundnut Cake	15	6.0	11.25
Wheat bran	15	1.8	11.25
Sorghum	15	1.56	12.00
Calcium carbonate	2	-	-
Salt and mineral mixture	1	-	-
	100	9.36	57.78

(1) Bagasse could be replaced by groundnut hulls.

- Dipping or spraying with acaricide against ticks and biting flies.

- Dosing against internal parasites with broad spectrum drugs.

4.4. REQUIREMENTS FOR CENTRAL ASSEMBLY AREA :

4.4.1. VEHICLES :

TABLE 4.4. VEHICLES REQUIRED FOR THE CENTRAL ASSEMBLY AREA .

Number	I t e m	Total Cost LS.
4	75 H. P. Tractor	73,200
4	Trailer	40,000
2	Yard Scraper	4,000
2	Tanker	8,000
1	Car	11,000
1	Pickup	10,000
	Total	146,200

hulls (Table 5.11) and bagasse (Table 5.12) should not be more than 25% of the total ingredients. This is partly due to the lower digestibility and nutritive value of bagasse and groundnut hulls compared to sorghum stalks. A mixture of these three ingredients (Sorghum stalks, bagasse and groundnut hulls) with a ratio of 1:1:1 could be used when a limited amount of each material is available. (Table 5.13).

- In the suggested rations, the level of fibre content, digestible protein, and total digestible nutrients are compatible with the allowable levels in fattening rations.

5.2.2. MANURE DISPOSAL :

Each pen in the feedlot will be cleaned every 75 days before fresh animals are brought into the pen. Waste collection will be done by a yard scraper and tanker, each being rear-mounted on a 75 H.P. tractor. About 20 pens will be emptied each day (10 - hour operation). The feedlot will be emptied 4 times per year. Two tractors, two yard scrapers and two tankers will be required for manure disposal from the feedlot.

The expected amounts of manure disposal as solid waste from the feedlot is about 200,000 m^3 per year (1.25 m^3/animal/ 75 days).

5.2.3. VETERINARY MEASURES :

It is assumed that all animals entering the feedlot will be entirely clean i.e. free from infectious and contagious diseases, in fine shape and good bodily condition. Therefore,

TABLE 5.7. THE RATION SUGGESTED FOR FATTENING OF BULLS IN CASE OF AVAILABILITY OF LIMITED AMOUNTS OF GROUNDNUT CAKE

Ingredients	%	Nutritive value % Digestible Protein	Total digestible nutrients
Sorghum stalks	35	.7	18.55
Molasses	10	-	5.4
Groundnut cake	15	6.0	11.25
Sorghum grains	26	2.7	20.8
Wheat bran	10	0.9	6.5
Urea	1	2.5	-
Ca CO_3	2.0	-	-
Salt & Mineral mixture	1.0	-	-
Total	100	12.8	62.39

TABLE 5.10. THE RATION SUGGESTED FOR FATTENING OF BULLS IN CASE OF AVAILABILITY OF LIMITED AMOUNT OF WHEAT BRAN

Ingredients	%	Nutritive value %	
		Digestible Protein	Total digestible nutrients
Sorghum stalks	35	.7	18.55
Molasses	10	-	5.4
Groundnut cake	25	10.0	18.75
Sorghum grains	17	1.77	13.6
Wheat bran	10	0.9	6.5
Ca CO_3	2	-	-
Na C/ & Mineral mixture	1	-	-
Total	100	13.37	62.80

TABLE 5.11 THE RATION SUGGESTED FOR FATTENING OF BULLS IN CASE OF AVAILABILITY OF GROUNDNUT HULLS

Ingredients	%	Nutritive value %	
		Digestible protein	Total digestible nutrients
Groundnut Hulls	25	-	10.25
Molasses	10	-	5.4
Groundnut cake	20	8	15.00
Sorghum	22	2.28	17.6
Wheat bran	20	1.8	13
$Ca\ CO_3$	2	-	-
Salt & Mineral mixture	1	-	-
Total	100	12.09	61.25

TABLE 5.12 THE RATION SUGGESTED FOR FATTENING OF BULLS IN CASE OF AVAILABILITY OF BAGASSE

Ingredients	%	Nutritive value %	
		Digestible Protein	Total digestible nutrients
Bagasse	25	-	11
Molasses	10	-	5.4
Groundnut cake	20	8	15
Sorghum grain	22	2.29	17.6
Wheat bran	20	1.80	13
Ca CO_3	2	-	-
Salt & Mineral mixture	1	-	-
Total	100	12.09	62

TABLE 5.13. THE RATION SUGGESTED FOR FATTENING OF BULLS IN CASE OF AVAILABILITY OF LIMITED AMOUNTS OF ROUGHAGES.

Ingredients	%	Nutritive value %	
		Digestible Protein	Total digestible nutrients
Sorghum stalks	10	.20	5.30
Bagasse	10	-	4.4
Groundnut hulls	10	-	4.1
Molasses	5	-	2.70
Groundnut cake	22	8.8	16.5
Sorghum grains	20	2.08	16
Wheat bran	20	1.8	13
$Ca\ CO_3$	2.0	-	-
Na Cl & Mineral mixture	1	-	-
		12.88	62.00

they will be expected to respond favourably to the special feed offered and make the maximum weight gains.

The animals here are only expected to be treated for wounds, abrasions, typany, and any other non-infectious diseases.

After the 75 days stay in the feedlot the animals will be transported by special vehicles directly to the abattoir at Kadero, or others nearby.

Cost of vaccinations and treatments per animal can be summarized as follows :-

At the Feedlot	:	Estimated cost of drugs used for all animals passing through the feedlot per annum	... £S. 20,000

CHAPTER 6

FEED MILL

6. FEED MILL

The following information was obtained from the study prepared by SWECO for the Sudan Government who made the study available to AAAID.

6.1. DESCRIPTION :

The project aims at the construction of a feed mill to fulfil the feeding requirements of the central assembly area and the feedlot animals. Locally produced ingredients such as sorghum, wheat bran, groundnut cake, bagasse, molasses etc. will be used in formulating different rations according to availability and price. The main objectives of the feed mill are :-

(a) to secure feed requirements for both the central assembly area animals and those of the feedlot all year round ;

(b) to reduce feeding costs through manufacturing than purchasing concentrate feed.

6.1.1. LOCATION :

West Omdurman is chosen as the location for the plant under study within the complex area about 300 metres from the feedlot. It is suitable for the following reasons :-

(1) Availability of water and transport.

(2) Most of the raw materials for operating the plant

are either available on site or within easy reach, e.g., wheat bran, groundnut cake, groundnut hulls, dura etc. Thus raw material supplies are secured at minimum transportation costs.

(3) Availability of skilled and unskilled labourers.

(4) The area is linked with other parts of the country by various means of transport, so this will facilitate the flow of raw material and the finished products in and out of the plant.

(5) The Ministry of Industry encourages the establishment of industry outside Khartoum in order to create industrial development in the rural areas.

The proposed feed plant will occupy an area of 15 feddans (60,000 sq. metres) to guarantee enough space for production buildings, services buildings, stores etc. and to allow for any future extension of the plant.

6.1.2. LAYOUT :

(a) Feed Mill

The feed mill is a two storey building with a five-storey tower for the elevator and machinery. The construction is 30 m. high.

The base structure of the feed mill is 400 m^2. Vertical access within the building is by one steel staircase and one elevator. Each floor is planned with an erection opening to secure the transport of machinery to each floor level.

The foundation consists of a floating reinforced concrete slab, 1.0 - 1.2 m thick. The structure above this foundation is made of steel framework.

All floors are made of steel chequered plate. The walls are built up of profilated steel sheets on purlins and are not insulated. Internal walls around the staircase and lift consist of fireproof light wall elements, and so the staircase will serve as a fire escape. Walls around the control room and electrical room are made of light masonry work.

The proof is built up with insulated steel sheeting (profilated) on purlins and covered with bitumen felt.

All windows are aluminimum framed, one-glass type. All doors are made of steel.

The bins inside the feed mill are planned to be made of steel elements with plain sheets on both sides and supporting profiles between them.

The feed mill is connected to the intake building, the silo and the warehouse by a concrete culvert below the ground level to enable a direct and easy flow of materials between the buildings . Furthermore, a conveyor bridge of steel connects the feed mill and the silo.

(b) Storage

The grain silo serves as storage for raw materials. It consists of 6 silo bins in two rows with accentrum distance of 15 m., each bin having a volume of about 1700 m^3. The six

together could store 10,000 tons. The raw material is transported to the silo from the feed mill by conveyors which are placed on a steel gallery above the silo construction. The gallery is clad with profilated steel sheeting.

The silo bins are made of steel, either of self-supporting flat steel sheets or corrugated sheets with vertical supports. Each silo has a diameter of 12 m. and a self supporting conical roof. The silos are bolted to the foundation on a reinforced concrete slab.

A conveyor tunnel for the reclaim conveyor is placed in the centre of the slab.

- Intake building :

The intake building is sited in immediate connection to the feed mill. The structure is steel framework clad with profilated steel sheets. The steel columns are supported by concrete footings to which they are bolted.

Two steel intake hoppers, 4.0 X 10 m. are placed on concrete foundation in the building and they are covered with a steel grating supported by steel beams. The grating is designed to allow truck traffic. One of the hoppers is located in the raw material warehouse and is used for emptying bags. A conveying tunnel of concrete connects the intake hoppers with the feed mill.

- Bulk Loading :

The bulk loading building is sited between the feed mill and the warehouse. It is a steel structure clad with profilated

steel sheeting standing on single concrete footings.

The bin system is so designed that one part of the bins is used for the bagging off stations in the warehouse. The bins are made of steel and are planned to be the same type as those inside the feed mill.

One truck scale, 3.0 X 16.0 m is beside the gatehouse. The scale platforms are made of reinforced concentrate double T - slabs, which are placed in concrete pits that support the load cell system for the scales. The control station for the truck scale is inside the control room in the gate house.

- Ware houses :

The warehouse for raw materials and bagged finished products is placed in connection with the bulk loading building. The building has a base area of about 7,500 m^2. Most of the finished products will be stored in 6 silos with a capacity of 10,000 m^3. These silos are provided with hoppers to load trailers for transport to feedlots.

The raw material warehouse is placed in connection with the bulk intake building. The building has a base for the storage of bagged raw materials. It is built in three independent sections to allow infestation control. A conveyor tunnel for transporting raw material connects the warehouse with the feed mill.

The carrying system consists of truss beams of steel supported by steel columns bolted to single concrete footings. Roof and external walls are covered with profilated steel

'sheeting on purlins.

The offices are built up with fibre boards on wooden studs.

The floor inside the warehouse is made of concrete slab planned to enable traffic by fork lifts. Manual sliding steel doors canalize the traffic in and out of the building. Inside doors are made of steel in wall clad with steel sheeting and of wood in the offices and toilets. The offices have one-glass framed windows.

- Auxiliary Buildings :

- Technical Building

The technical building is planned to house a high tension room, a low tension room and space for two transformers. It will also have facilities for an electrical workshop, processing workshop, and a spare parts room. The free height inside is 4.0 meters.

- Office, Laboratory and Personnel Building

This is an insulated one-storey building with an indoor free height of 3.0 meters. It is of the same type as the office and administration building.

- Platform Scale and Gate House

For the platform scale there is a concrete pit of 3 X 16 meters, 1.0 meter deep. A house of 16 m^2 is needed for running the scale.

- Parking Lot

This is a simple shed consisting of a corrugated iron sheet roof.

- Electrical Installation

The total required power for the plant is 2000 KVA which will be provided by the central power plant.

The main distribution switchboard is placed close to the generator giving power to certain sub-switchboards and larger motors such as hammer mills etc.

- Power Distribution

The low voltage power will be distributed to motors, lighting and other installations from special switchboard rooms located at the main consumption points. These rooms hold contactors and overload relays of motors and other equipment which should be centralised . Thus, the most vital parts of the equipment are protected.

- Control Panels and Contractor Cabinets

The machines will be controlled and indicated from control panels. The control panels consist of a mimic showing the plant. Monitoring from the mimic diagramis carried out by activating control switches in or near the different symbols. From the control panel, parts of the processing plant can be remote controlled.

The mixing plant is controlled by punch cards. In places

where rapid and frequent re-setting of the distribution is a necessity, this process will be completely remote controlled.

The contractor cabinets are placed in combination with the control panels and include fuse elements, contractors, overload relays, main switches etc.

- Cable Installation and Installation Material

The major part of the cable installation will be installed as a system of vertical and horizontal cable shelves. The cables will be drawn in a special fire protection installation floors where this is possible.

All apparatus will be totally enclosed in order to obtain dust-proof connection of the cables. The lighting installation consists largely of fluorescent tubes.

Motors will be provided with emergency switches or emergency push buttons, and certain units will be provided with devices for individual drive.

- Telephone Communication

An automatic telephone system will be installed for internal communication between the important parts of the plant.

- Fire Alarm System

Manual and electric fire alarm system are installed in the production area.

- Emergency Lighting Installation

Important places, where cases of emergency might exist, are equipped with emergency lighting installation.

- Lighting Installation

Important places of the production building will be equipped with lighting installations.

- Electrotechnical Norms and Standards

The electrical installations will be carried out in accordance with LEC (International Electro-technical commission).

- Spare parts

A sufficient amount of spare parts e.g. motors, contractors, overload relays etc. will be provided.

6.2. CAPACITY AND REQUIREMENTS :

6.2.1. FEEDS :

Feeds required by the central assembly area and the feed-lot operations were estimated at 124,600 tons per annum by the end of the fourth year when the scheme is at full capacity. It is recommended therefore to establish a 30 ton/hr feed mill to produce 144,000 tons/annum . The feed mill will work two shifts (16 hours/day) for 300 days annually. If need arises for more feedstuffs it could operate for 3 shifts (24 hours/day) to reach a maximum capacity of 216,000 tons/ annum.

TABLE 6.2. TOTAL FEED INGREDIENTS REQUIRED FOR FEEDING THE ANIMALS DURING THE FIRST FOUR YEARS OF THE PROJECT

('000 MT)

Feed Ingredients	Year 1			Year 2			Year 3			Year 4		
	Central Assembly Area	Feedlot	Total	Central Assembly Area	Feedlot	Total	Central Assembly Area	Feedlot	Total	Central Assembly Area	Feedlot	Total
Bagasse	1.920	7.125	9.045	3.840	14.25	18.09	5.760	21.375	27.133	2.680	26.29	33.97
Molasses	.576	2.850	3.426	1.152	5.7	6.852	1.728	8.55	10.298	2.304	10.51	12.81
Groundnutscake	..720	5.700	6.420	1.440	11.4	12.840	2.160	17.1	19.26	2.880	21.03	23.91
Wheat Bran	.720	4.275	4.995	1.440	8.55	9.99	2.160	12.825	14.99	2.880	15.78	18.66
Sorghum	.720	7.695	8.514	1.440	15.39	16.83	2.160	23.088	25.25	2.880	28.40	31.28
Calcium Carbonate	.096	.570	.666	.192	1.14	1.332	.288	1.71	2.00	.384	2.103	2.487
Common Salt Mineral Mixt.	.048	.285	.333	.096	.57	.666	.144	.855	1.00	.192	1.05	1.242
Total	4.800	28.500	33.3	9.60	57	66.60	14.40	85.5	99.9	19.20	105.17	124.36

+ In Year 4 about 32,000 head will be finished after 45 days only and the rest will be finished after 75 days.

6.2.2. VEHICLES :

1 Fork lift (2 ton)
1 Pickup
1 Car

6.3. OPERATIONS :

The manufacturing process for the feed mixture is presented in Diagram (6.1) which shows material flow graphically. The feed processing consists of five major phases as summarised below.

6.3.1. HANDLING OF RAW MATERIAL :

In this section bulk deliveries of ingredients could be received through an intake hopper with conveyor to the processing building. However, as the major part of the grain and oil cakes will be received in bags for many years to come, raw materials in bags are stored in separate warehouses, the raw material warehouse and in approximately one half of the warehouse in the mill building. The grain is then transported to the silos after cleaning through sieving and magnetic traps and weighing. Molasses stored to the cleaning process do not exceed 2%.

6.3.2. PROPORTIONING AND WEIGHING

Ingredients are conveyed directly from the warehouse to the proportioning bins. According to the feed formula desired, ingredients are mixed proportionally by weight by means of proportioning long hopper weighing scales automatically controlled by the specific formulas.

The main machine units such as hammer mills, weighing scales, pellet mills have been doubled so that production can continue at reduced capacity in the event of a temporary breakdown of one machine.

The plant will be controlled from an operational centre where all material flows and processes can be monitored. All conveyers are remote controlled. The proportioning and mixing process is program-controlled. The stock of materials in different parts of the plant is automatically controlled.

6.3.4. HANDLING OF THE FINISHED PRODUCT :

The feed plant is designed for both bulk and bag deliveries. As most of the finished product will be utilized by the organisations of the central assembly area and feedlot animals, it is expected that only a small portion of the finished material will be bagged. When distributing in bulk, lorries will be filled with feed and the weight will be measured by an automatic weighing scale. A weigh-bridge is installed at the gate for checking weight.

When distributing in bags these are filled and manually stacked on pellets which are handled by electric forklift trucks in the warehouse for finished products.

6.4. STAFF, LABOUR AND TRAINING :

6.4.1. STAFF AND LABOUR (1)

(a) Administration

Manager	1	
Senior Accountant	1	
Accountant	4	
Book-keeper	6	
Secretary	4	
Personnel Officer	4	
Weighing Bridge Operator	2	22

(b) Technicians

Production Manager	1	
Production Engineer	3	
Maintenance Engineer	2	
Electrical Engineer	2	8

(c) Services Staff

Reception Staff	2	
Storekeeper	2	
Assistant Storekeeper	3	
Fork Lift Driver	3	
Boiler Operator	2	
Drivers	20	32

---

(1) The Staffing to cover 2 shifts.

6.5. COSTS :

6.5.1. FEED MILL COST :

Fixed Cost

Item	Local	Foreign	Total
Electromechanic Equip. incl spare parts (10%)	426,000	2,779,000	3,205,000
Prefabricated steel structures for silo buildings and warehouses (2½%)	388,000	2,752,200	3,140,200
Civil Works (2½ %)	1,233,000	822,000	2,055,000
Metal Buildings erection including commissioning Expenses (5%)	805,000	344,900	1,149,900
Prices of Machines Erection Including commissioning Expenses (10 %)	975,000	417,900	1,392,900
Electric Supply (only cables (5%)	4,800	43,200	48,000
Total	3,831,800	7,159,200	10,991,000
Cost of Cars and Vehicles			27,000 LS.

6.5.2. COST OF INGREDIENTS :

Prices of ingredients, particularly Dura, are not stable with demand and supply fluctuating throughout the year. However, the prices given in Vol. I Table (3.7) are optimal for the year round after averaging prices collected from commercial feed manufacturers, local animal producers, and Government authorities ; transport is included in the price. Table (6.3.) gives the cost of feed ingredients required for processing the pelleted rations (A, B) is the feed mill during the first four years of the project. Total operating costs are given in Chapter 10.

TABLE 6.3. COST OF FEED INGREDIENTS REQUIRED FOR PROCESSING OF THE PELLETED RATIONS IN THE FEED MILL DURING THE FIRST FOUR YEARS OF THE PROJECT (£S. '000)

Feed Ingredients	Year 1	Year 2	Year 3	Year 4
Bagasse	180.90	316.80	542.70	679.20
Molasses	102.78	205.56	308.34	256.40
Groundnut Cake	1014.36	2028.72	3043.08	3777.78
Wheat bran	499.50	999.90	1498.50	1866.00
Sorghum	1262.25	2524.50	5786.75	4692.00
Calcium Carbonate	66.6	133.2	199.8	248.70
Salt	49.95	99.90	149.85	157.50
Total	3176.35	6308.58	11529.02	11677.58

CHAPTER 7 .

ABATTOIRS

7. ABATTOIRS

7.1. OPTIONS :

In its fourth year of production, the project is assumed to attain its full capacity, i.e. slaughtering annually 130,000 head of cattle. Projected output is 22,478 tons carcase meat or 18,100 tons deboned meat.

Two options are given :-

- Absolute dependence on Kadero abattoir.

- Construct a new abattoir at the site of the project.

When the first or the second option is chosen, the project is going to depend on Kadero abattoir during its first year of operation when 40,000 head of cattle will be killed.

7.2. KADERO ABATTOIR :

After completion of the new extensions to the abattoir, its maximum capacity will be as follows :-

Chilling Rooms	-	100 tons
Cold Storage	-	100 tons
Freezing Tunnel	-	10 tons
Frost Store	-	50 tons
Meat Cutting Plants	-	50 tons

However, if the project is going to depend absolutely on the Kadero abattoir, the following improvements should be made in order to increase the throughput of the plant :-

1. A water reservoir with a capacity of 170,000 gallons should be constructed.

2. Two extra lairages with a total capacity of 200 head of cattle should be laid out.

3. The cattle race must be narrowed.

4. The standard box type stunning pen with drop bottom and rising side should be installed as a replacement for the one presently in use.

5. Additional equipment to that already being added under Extension III might be necessary, e.g. viscera inspection table with a moveable top, a dehiding machine, pneumatic platforms, etc.

6. Another boiler to increase the production of steam should be installed.

7. A new - dry melter, a bone-grinder and other accessories are required to increase the capacity of the dry-rendering plant.

8. The capacity of the meat cutting plant needs to be doubled.

9. A sufficient supply of spare parts for all machinery and equipment should be obtained immediately.

7.3. PROJECT ABATOIR :

7.3.1. JUSTIFICATION :

Building a new abattoir near the feedlot can be justified if we consider the following points :-

- Cost of transport of livestock from the feedlot to Kadero.

- Total cost of investment required for improvements to Kadero abattoir will be paid by the project.

- Service fees charged annually by Kadero abattoir will range from 1.5 to 2 million pounds, including the inedible by products confiscated by the abattoir authorities.

- All the abattoir's facilities will be fully occupied by the project to the total deteriment of other exporters : the Government might not agree to such a monopoly arrangement.

- Being a public utility, the abattoir is often confronted by many constraints and obstacles, any of which might jeopardize the interests of the project. It does not seem credible therefore to depend absolutely on Kadero abattoir, since the project cannot take over the management of the plant.

All the above points and many others (e.g. cost of a new abattoir, operating costs of a new abattoir) will be discussed during various stages of this study.

7.3.2. TYPE AND SIZE :

The abattoir proposed is of the complete factory type. This denotes employment of regular wholetime slaughtermen to deal with all the livestock, and this ensures economic handling of the by-products which include hides, offals, glands, blood and condemned meat. This type of abattoir also reduces the overhead charges on buildings, equipment and labour.

The abattoir is expected to be located close to the feedlot in a fenced area of 15 - 20 feddans. Water and electricity shall be supplied from the main water and power stations.

Layout, design, buildings, machinery and equipment will all conform to EEC and USDA standards. The slaughter-house will comprise the following buildings :-

- Lairages
- Cattle slaughterhall including a guttery and tripery and a pluck trimming department
- A hide and skin store
- A laboratory
- An isolation block and an emergency slaughterhall
- A refrigeration block including corridors
- A meat cutting plant and a dispatch hall
- A dry rendering plant
- Administration block
- Social facilities block - guard houses, carport, etc.
- A building for refrigeration machinery, electricity panels, air compressors, etc.

Total built area would be approximately 500 - 600 m^2.

7.3.3. CAPACITY :

Anticipated capacities will be as follows :-

- Lairages - 500 head of cattle, staying for 18 - 24 hours.

- Isolation block and emergency slaughterhall, capacity 5 head per day.

- Cattle slaughterhall - built in a stunning pen, lifted at rear foot, bled on bleeding overhead rail, then rear feet taken off and hung over an automatic chain conveyor, where dehiding, evisceration, splitting and inspection follows.

- Hide and Skin store - capacity one day kill. Salting facilities provided.

- Cutting and tripery - capacity one day kill. Here panches are evacuated and contents shot to rendering plant pneumatically where it is dried, sterilised and packed for animal feed. Paunches are cleaned in paunch washing machines and in paunch boiling machines. Beef runners and middles are produced in the casing cleaning plant.

- Pluck trimming department - capacity 500 sets, i.e. livers, hearts and kidneys. Heads are also split and tongues and brains produced in vacuum - packed plastic bags.

- Meat cutting plant - about 90% of the daily output is

deboned and vacuum-packed. Anticipated capacity is 80 tons per day. Sausages and other meat products can be produced from minced meat. Sausage production capacity will be 20 tons per day.

- Refrigeration block : this will comprise the following :

Unit	Temperature	Capacity
6 Chilling rooms	$0^{\circ}c$ - $2^{\circ}c$	15 tons each
2 cold stores	+ $2^{\circ}c$	100 tons (total)
1 freezing tunnel	- $40^{\circ}c$	10 tons
1 frost store	- $25^{\circ}c$	50 tons
1 viscera chilling room	+ $2^{\circ}c$	7 tons

- Inedible dry-rendering plant - capacity 13 tons per day producing 3 tons meat meal, moisture content less than 10% and fat content about 12%. Technical fat produced 1.5 - 2 tons, moisture content about 0.4% and free of solid material. Bone from the deboning department is processed producing bone meal, approximately 20 tons. Blood meal installation - capacity 6000 kgs. Blood meal is finally dried and sterilised.

- Waste water treatment plant- it is estimated that 100 kgs. slaughtered weight results in 0.5 m^3 waste water and 1 kg. BOD5. Daily waste water flow 450 m^3. Organic load 900 kg. BOD5. Waste water concentration will be 2 kgs. BOD5/ m^3 = 2000 mg. BOD5/l. As the treated water is expected to be used for irrigation

purposes, we suggest the following effluent quality :

BOD = 20 - 30
Suspended matter = 30 mg/l
Settleable solids = 0.5 mg/l

This requires almost 99% of organic matter to be removed. This can be obtained in an extended aeration plant.

- Refrigerated transport :

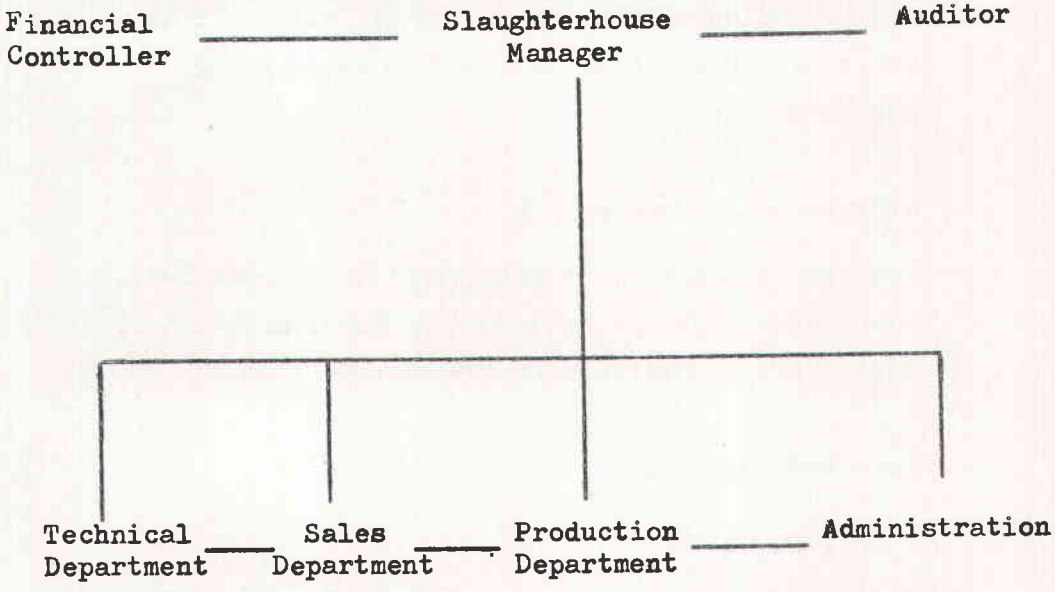
5 motor trucks with 10 refrigerated semi-trailers, each capacity 5 - 8 tons for the transportation of meat from the abattoir to the airport.

- Cars and vehicles :

4 big buses
3 lorries
6 saloon cars

7.3.4. MANAGEMENT :

The following arrangement is suggested :



The following units are proposed to come under the production department :-

- Meat hygiene and quality control
- Cattle slaughterhall and related edible by-products
- Meat cutting plant and refrigeration block
- Hides and skins
- Inedible dry-rendering plant.

The following units are proposed to come under the Technical Department :-

- Refrigeration machinery and air compressors
- Electricity panel and electrical installations
- Boilers and dry rendering plant
- Pumps and waste water treatment plant
- Water supply
- Workshop
- Cars and vehicles
- Maintenance of buildings and other civil works.

7.3.5. STAFF, LABOUR AND TRAINING :

(a) Staff and Labour

Total numbers of personnel required will be 185 persons, distributed as follows :-

Post	No. required
Plant Manager	1
Financial Controller	1
Auditor	1
Senior Accountant	1
Accountants	2
Chief Clerk	1
Clerks	2
Book-Keeper	1
Typists	2
Store-Keepers	2
Drivers	2
Messengers	3

Post	No. required
Gardeners	8
Guards	6
Superintendant	1
Secretary	1
Total	35

Production Department :

Production Manager	1
Meat Technologist (Expatriate)	1
Meat Hygiene & Quality Control	
Vet. Officer	1
Veterinary Meat Inspectors	3
Meat Inspectors	8
Slaughterhall supervisor	1
Foremen	8
Butchers and Skilled Labour	64
Non-Skilled Labour	18
Drivers	12
Total	117

Sales Department :

Sales Manager	1
Sales Officer	1
Purchase Officer	1
Assistants	2
Total	5

Technical Department :	No. required
Senior Engineer (Expatriate)	1
Refrigeration Engineer	1
Electrical Engineer	1
Refrigeration Technicians	2
Assistant Refrigeration Technicians	2
Electrical Technician	1
Mechanics	6
Assistant Technicians	6
Operatives	6
Drivers	2
Total	28
Grand Total	185

(b) Training

The following training programme will be organised both locally and overseas for the slaughterhouse personnel :-

1. Abattoir Manager :

3 months visits to different abattoirs and meat processing plants in Europe, North America or Australia. Training should include intensive courses on management of abattoirs and meat processing plants and similarly short study courses and visits to potential markets.

2. Production Manager :

3 months visits to meat plants and abattoirs in Europe and North America. Training should also include intensive courses on management, hygiene and quality control.

3. Senior Engineer, Refrigeration and Electrical Engineers :

3 months visits to factories producing different machinery and equipment used in the abattoir, including boilers, rendering plants, compressors, etc. Training should also include operating and maintenance of such machinery.

4. Butchers and Slaughterhouse Operators :

A meat technologist is requested to train different slaughterhouse personnel in meat cutting, meat processing and packing. An intensive training programme is also

requested on slaughterhouse hygiene, personnel hygiene, etc. All this training will take place locally.

5. Technicians and Operators :

Most of the training should take place during erection and commissioning of the plant. A slaughterhouse engineer is requested to train the personnel on operation and maintenance of the different machinery and equipment.

7.4. COSTS :

7.4.1. COST OF PRODUCTION OF BONE-IN MEAT AT KADERO ABATTOIR :

Service fees charged at Kadero to cover slaughter, dressing, chilling and transportation to the airport are :-

Cattle	-	LS. 6.00 per head
Sheep	-	LS. 2.50 per head

Extra charges are payable for cold storage facilities at LS. 5.00 per ton per day. Also LS. 5.00 per refrigerated trailer per hour is charged for extra journeys or for delays at the airport.

Each quarter of carcase requires 2 yards of cotton cloth (Domoria) for wrapping or packing, costing LS. 1.00.

10 labourers at LS. 5.00 per day each are required for wrapping, loading and unloading of the meat.

Incentives are usually paid to labourers and drivers at Kadero abattoir at the rate of LS. 0.75 per head of cattle.

It is assumed that 25% of the totaloutput shall be cold stored every day.

Assuming that one ton of meat is produced from 5.6 head of cattle, then cost of production of one ton would be as follows :-

Slaughter fees 5.6 X 6	-	LS. 33.6
Incentives 5.6 X 0.75	-	4.2
Cotton cloth for wrapping	-	22.4
Labour costs	-	0.5
Extra charges	-	1.25
Unforeseen	-	0.25
		LS. 62.2

Cost of production of bone-in meat at year 1 =
6,862.9 X LS. 62.2 = LS. 426,872

Cost of production of bone-in meat at year 2 =
13,725.8 X LS. 62.2 = LS. 853,744

Cost of production of bone-in meat at year 3 =
20,588.7 X LS. 62.2 = LS.1,280,617

Cost of production of bone-in meat at Year 4 =
22,972,9 X LS. 62.2 = LS.1,428,914

7.4.2. COST OF PRODUCTION OF BONELESS MEAT AT KADERO ABATTOIR:

In addition to the above service fees charged by the abattoir, extra fees paid by Seleit Food Production Ltd. for

their deboning activities at Kadero abattoir are as follows :-

Rent for room per working day - LS.25.00
Per head of cattle for deboning, packing, etc. - LS. 3.00

It can therefore be assumed that total cost of production of one time of deboned meat can be as follows :-

Slaughter fees 5.6 X 6	-	LS. 33.6
Deboning fees 5.6 X 6	-	22.4
Chilling, Freezing and Storage Charges	-	5.0
Packing material	-	140.0
Labour cost	-	1.5
Unforeseen	-	1.5
Total		LS.204.0

Cost of production of boneless meat at Year 1 =
6,862.9 X 204 LS. 1,400,000(1)

Cost of production of boneless meat at year 2 =
13, 725.8 X 204 = LS. 2,800,000

Cost of production of boneless meat in year 3 =
20,588.7 X 204 = LS. 4,200,000

Cost of production of boneless meat in Year 4 =
22,972.9 X 204 = LS. 4,686,472

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(1) This estimate will be used as operating cost of production of project year 1.

7.4.3. CAPITAL COSTS OF PROJECT ABATTOIR

The capital costs for the project abattoir suggested for this project are detailed in Table 10.15) of Chapter 10.

BUILDINGS AND INFRASTRUCTURE

8. BUILDINGS AND INFRASTRUCTURE

8.1. PROJECT SITES :

The project sites consist of the five provincial holding grounds at the cattle marketing centres, and the finishing grounds in the west of Omdurman area. The five holding grounds are located at Nyala, El Dae'n , El Tibun, El Meiram and Kosti and their designs and layouts are described in Chapter 3 of Volume III. The finishing grounds or the Meat Production Complex site covers an area of 1957 feddans and lies 15 km west of Omdurman as shown in Drawing No. 3.1. It contains the central assembly area, the feedlot, the feed mill, the slaughterhouse and the administration building. All the project sites are located in areas where no services are available as they lie between 10 - 20 km away from the nearest towns. As well as the site buildings the following services are discussed :-

- Potable water supply
- Electric power supply
- Roads and transport
- Sewage disposal
- Communications

8.2. BUILDINGS :

8.2 1. INTRODUCTION :

The structure for most buildings is either load bearing walls, reinforced concrete or steel frame. The roof is galvanised corrugated iron sheeting on steel or timber purlins. The walls are either of stone or brick. The floors are tiled,

or concrete with screed. The locally available materials such as stones, bricks and straw are used as much as possible in the construction in order to reduce cost. These factors will be considered in the detailed analysis required at the design stage. Costings of the buildings are given in terms of square metre of roofed area based on recent evaluations.

8.2.2. PROVINCIAL HOLDING GROUNDS :

The main project buildings in each of the five provincial holding grounds consist of the following.

- Perimeter fencing of barbed wire to prevent introducing animals from entering the holding area ;
- the central service area which comprises the administration offices, workshop and stores in addition to the power plant, water wells and tanks ;
- the staff village ;
- the spray race at the entrance of the holding area.

The layout of the central service area within the holding ground is discussed in Chapter 2 of Volume III. The office requirements for both Nyala and El Dae'n is estimated at 168 m^2 each, while for El Tibnue, El Merum and Kosti it is 120 m^2 each. Staff housing for the first two is estimated as 8 units for senior staff, 7 units for technicians , and 104 units for labourers ; for the three latter locations estimates are 4 units for senior staff, 6 units for technicians, and 58 units for labourers. Suitable spaces have been estimated for the workshops, stores and sheds (for the machinery) in each holding ground.

Building costs for the five provincial holding grounds are given in tables 8.1, 8.2, and 8.3.

8.2.3. MEAT PRODUCTION COMPLEX :

In the west of Omdurman complex other required buildings consists of the following :

- Perimeter fencing of barbed wire around the site ;
- the cattle corrals ;
- the central service area which comprises the administration offices, the central workshop and stores ;
- the staff village ;
- the feed mill which is described in Chapter 6 of Volume III ;
- the slaughterhouse which is described in Chapter 7 of Volume III.

(1) Perimeter Fencing

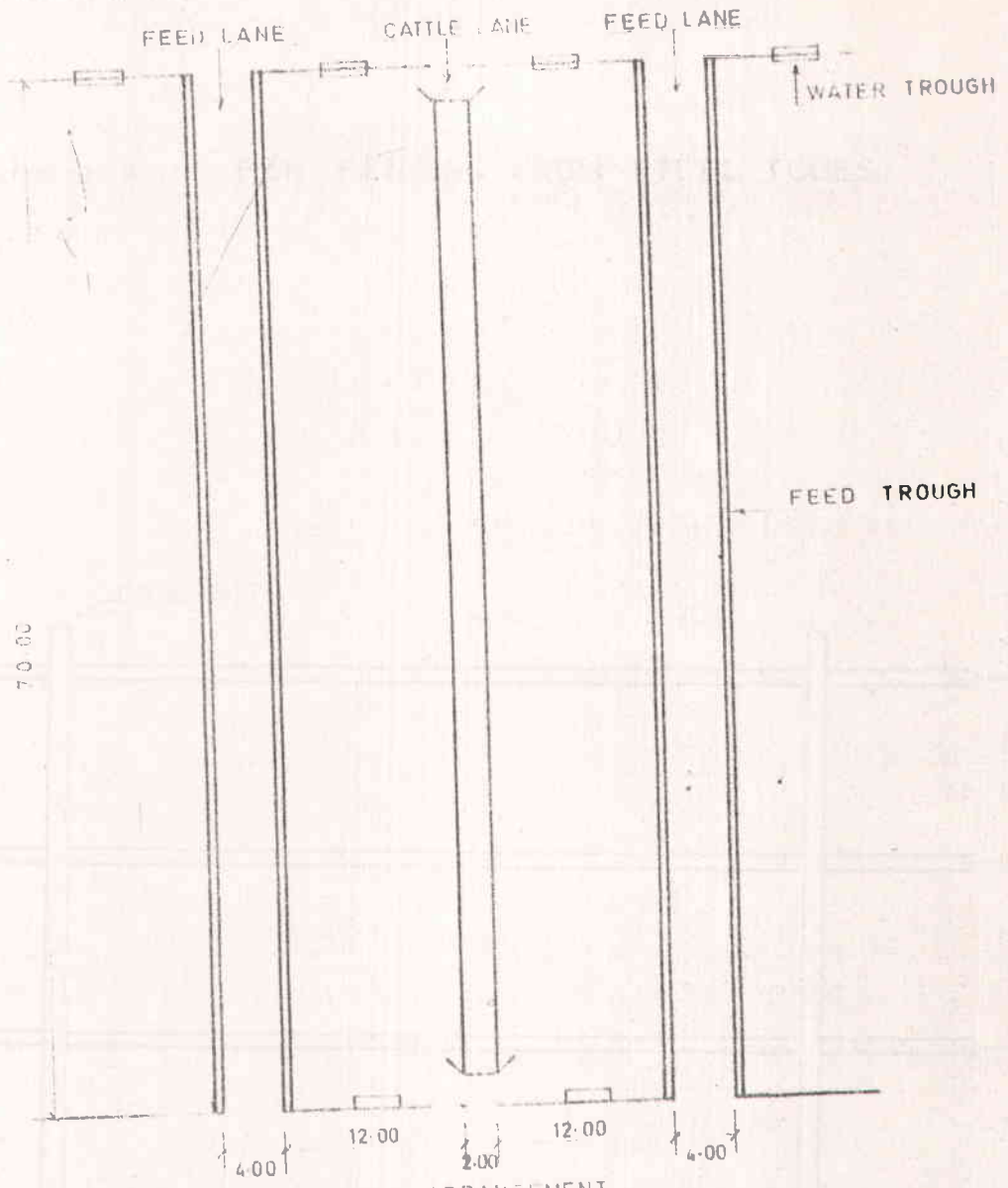
The part of the site which is utilised is fenced with barbed wire fixed to steel angle posts. This fence prevents other people's livestock from entering the project area, and the same system is adopted in the provincial holding grounds.

(2) Cattle Corrals

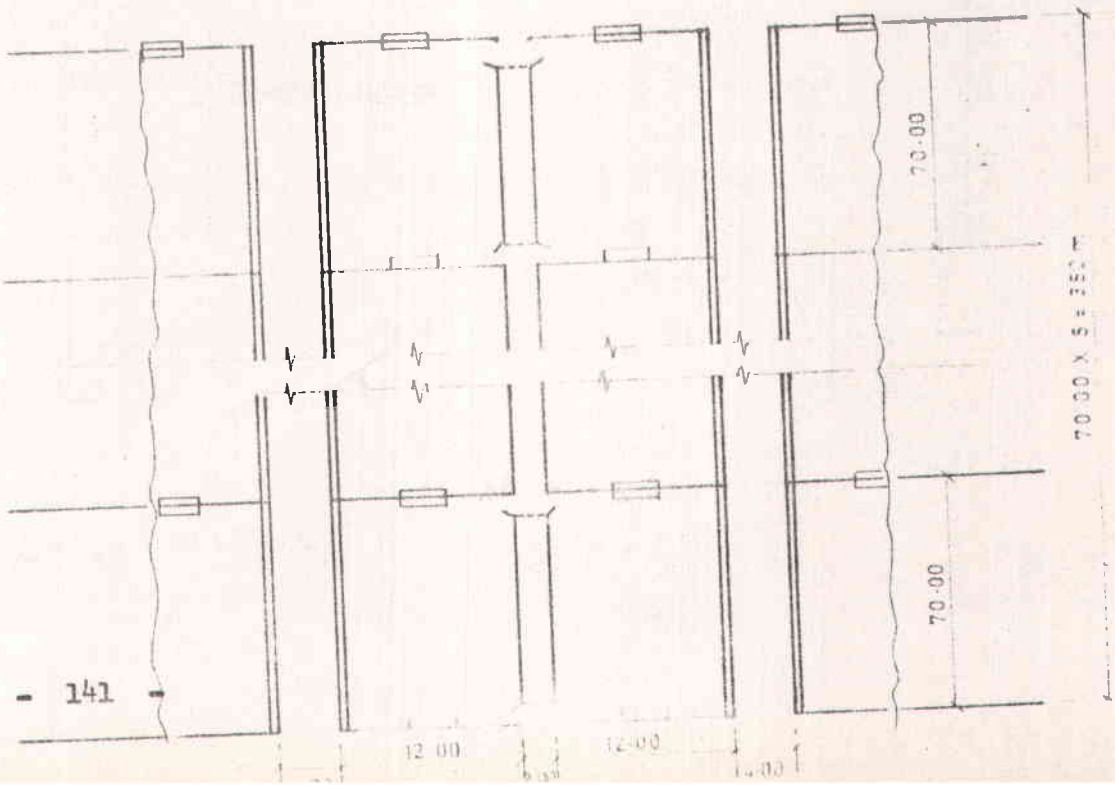
The sequence of livestock movement may be described as follows.

The incoming cattle, whether on hoof from the PHGs or by trailers from SRTY, are admitted to the reception area

Drawing 8.2 PEN AND YARD ARRANGEMENT



(A) PEN ARRANGEMENT



building accomodates the general manager, and his assistants, veterinarians, clerical staff and the laboratory. It also houses the radio system which facilitates communications with the five provincial holding grounds. The roofed area is estimated to be 220 m^2. The slaughterhouse and feed mill have their own administration offices for their managers and staff in the respective buildings, plus their own workshops and stores.

The central workshop is designed to repair and maintain the project's machinery and equipment and to help other units with any repair work as and when required. The machinery includes tractors, transport fleet of trucks, trailers, scrapers and cars. The stores are used for storage of spare parts, veterinary equipment and drugs. Roofed area for both the workshop and stores is estimated at 360 m^2.

(4) The Staff Village

The project provides housing for the staff whose work requires their presence on the project site. These are envisaged as 2 houses for senior staff, 6 middle class houses, and 60 units for the labourers.

Building costs for the meat production complex described above are given in Table 8.4.

TABLE 8.4. MEAT PRODUCTION COMPLEX BUILDINGS CAPITAL COSTS

Item	Unit	Unit Cost LS.	Total Units	F. C. LSX1000	F. C. LSX1000	Total LSX1000
Land Preparation	m^2	0.03	667000		20	20
Perimeter Fencing	m	8	9000	29	43	72
Central Administration Building	m^2	200	220	17	27	44
Central Workshop and Stores	m^2	150	360	21	33	54
Sheds for Machinery	m^2	140	50	3	4	7
Senior Staff Houses	m^2	300	2X 180	43	65	108
Technicians Houses	m^2	250	10X 120	120	180	300
Labourers Houses	m^2	250	52X 80	416	624	1040
Central Assembly Area Coralls (Incl. Reception, Detention Areas)	Yard	307970	19.2	2350	3563	5913
Spray Race				35	15	50
Feed Lot Area Corrals	Yard	307970	40	4928	7391	12319
Total				7962	11965	19927

8.3. INFRASTRUCTURE :

8.3.1. POTABLE WATER SUPPLY :

(1) Provincial Holding Grounds

Ground water resources are utilised to provide the water requirements of the provincial holding grounds. Water provision is based on the peak cattle demand at maximum stocking in each of the holding grounds according to the in-and-out balance of the purchasing system adopted. The quantity of water required in each case is calculated by applying consumption rate of 45.4 litres (10 Imp. Gall) per day per head. An extra allowance amounting to 15% of the quantity required is added to meet losses and domestic water supply requirements of the attendant staff. Water demands are estimated as follows:

WATER DEMANDS :

Provincial Holding Ground Site	Maximum No. of Cattle in Stock	Watering Demand M^3	15% Allowance M^3	Total Demand M^3
Nyala	24000	1090	165	1300
El Dae'n	24000	1090	165	1300
El Tibun	20000	910	150	1100
El Merum	30000	1360	200	1600
Kosti	30000	1360	200	1600

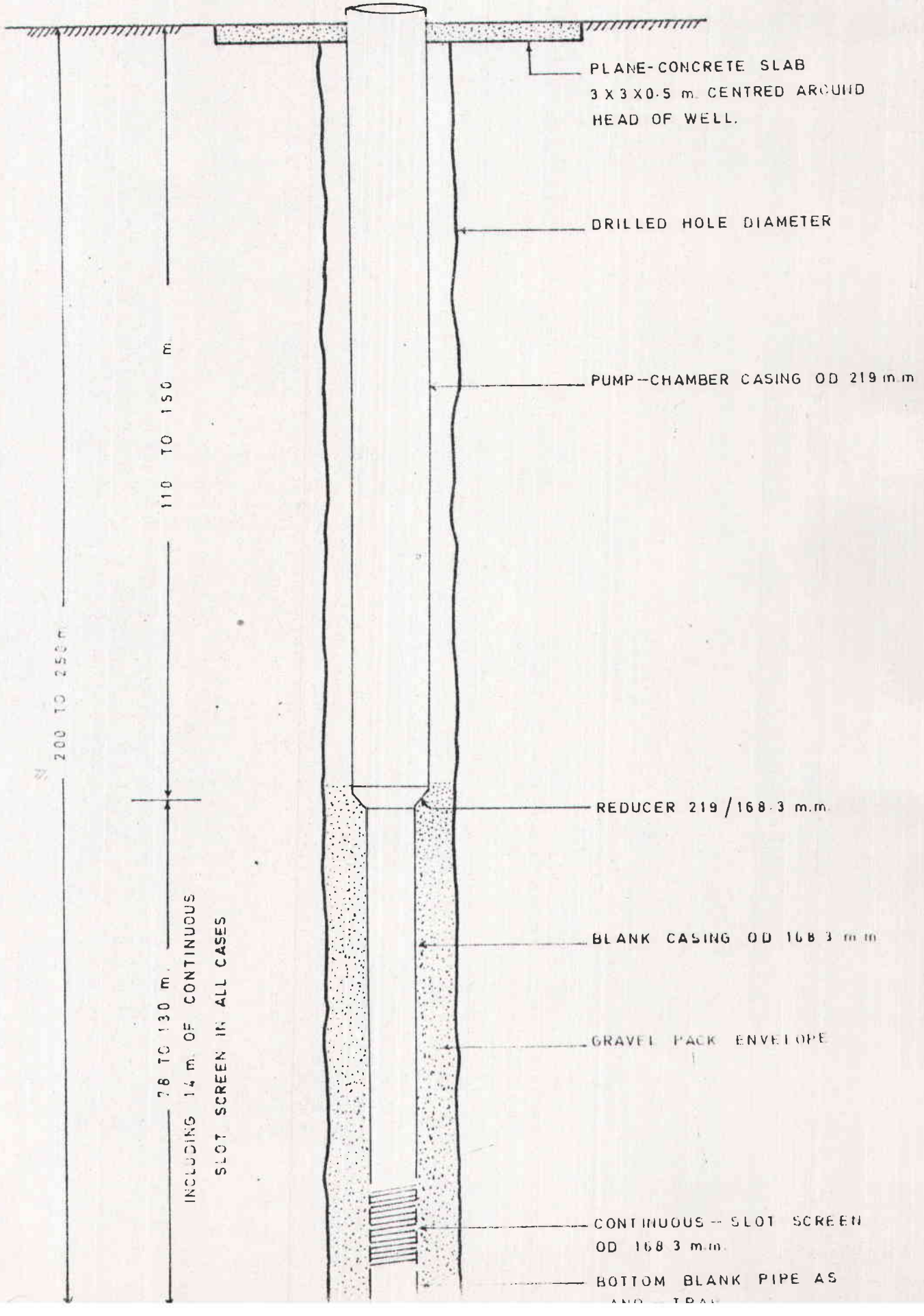
A telescopic design is adopted for the production tube wells. This design provides the optimum size and length of casing for both the pump-chamber and water entry section at minimum constructional costs, Drawing No. 8.4. Pump-Chamber casing of outside diameter (OD) 219 ($8^5/8$ in) is to be installed to such depth as to grant safe submergence of the pump in accordance with the expected pumping water level. The water entry section casing is of OD 168 mm ($6^5/8$ in) comprising pptimum screen length of continuous slot type having effective open area to minimise water entry losses. The design also includes the placing of appropriate size gravel envelopes throughout the water entry section.

Production tube wells are designed to give discharge rate of 25 m^3/h. The number of required wells and the main features of their design at each PHG is as follows :-

Provincial Holding Ground Site	Water Demand	No.of wells required (operated 10 h/d)	Total Depth of Tube Well M	Static Water Level M	Pumping water Level	Pumping Chamber Length	Water Entry Section Length (incl.14M of continuous solt screen M
Nyala	1300	6	220	80	100	122	98
El Da'ein	1300	6	200	80	100	122	78
El Tubiie	1100	5	250	70	120	150	100
El Merum	1600	7	250	70	90	120	130
Kosti	1600	7	200	60	80	110	90

DESIGN OF PRODUCTION TUBE-WELLS AT THE PROVINCIAL HOLDING GROUNDS

DRAWING N.º



Pump-Chamber casing Specifications are :-

Seamless pipes of OD 219 mm ($8^5/_8$ in) made to API (American Petroleum Institute) specification for standard round-thread casing of steel grade H-40 ; 28 lb weight per foot ; 0.304 in. wall thickness. The blank casing of the water entry section is of seamless pipes of OD 168.3 mm ($6^5/_8$ in) made to API specification for standard round-thread casing of steel grade H-40 ; 20 lbs weight per foot ; 0.288 in wall thickness. The screen section consists of continuous slot screen of OD 168.3 mm ($6^5/_8$ in) made from sta nless steel type 304 ; slot size 0.040 ins (1 mm) giving open area of 77 square inches per linear foot of screen ; of extra strong structure with threaded and coupled ends to tie in with API standard threaded casing of same OD.

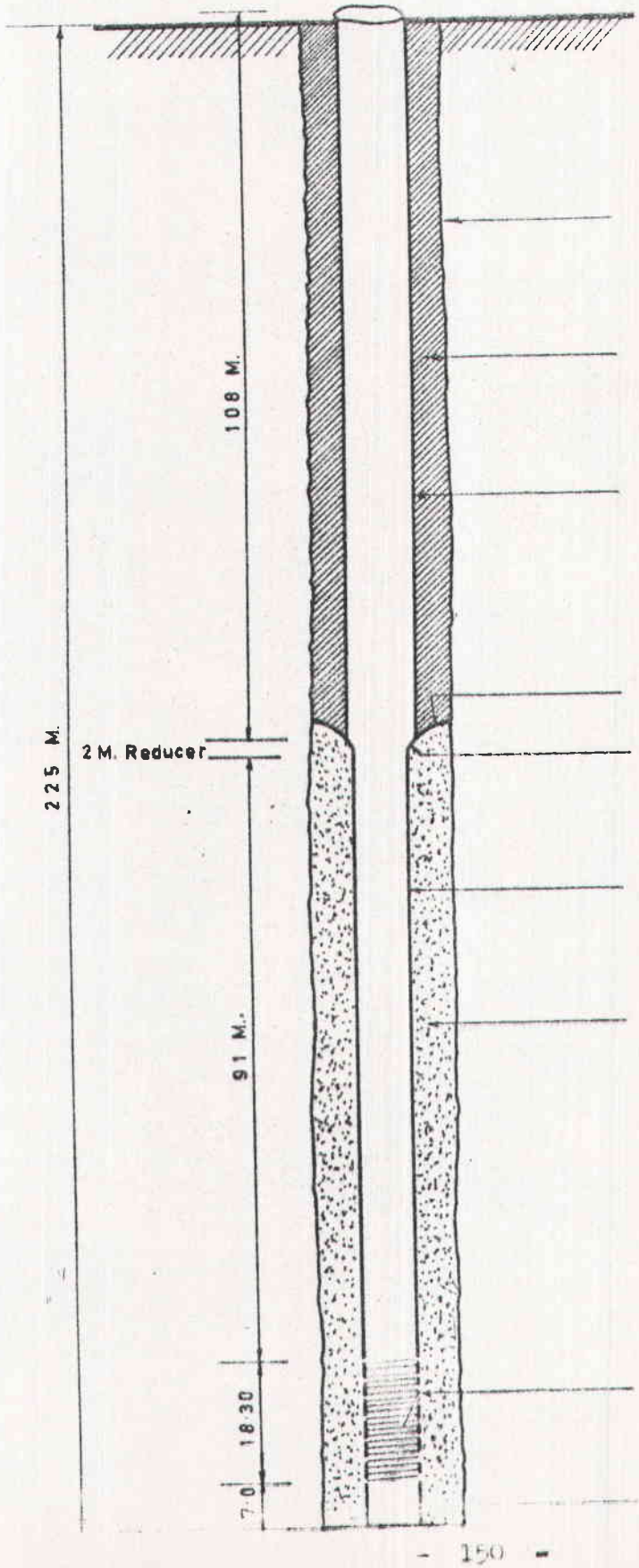
The wells at the provincial holding grounds are to be fitted with electric submersible pumps of discharge capacity 25 m^3/h at total manometric head of 150 m.

(2) Meat Production Complex

At the West of Omdurman Meat Production Complex site the lower aquifer in the Nubian formation at this site is utilised to meet the water needs of the various units. Water requirements at peak stocking in the central assembly area and the feedlot in addition to the feed mill and the residential area is estimated at 3000 m^3/ day. The daily water needs for the slaughterhouse complex is estimated to be 6000 m^3. The production tube wells are designed to give a discharge rate of 100 m^3/ hr. at pumping water level of about 80 m. Based on 15 hours pumping per day, 3 wells will be required

CENTRAL ASSEMBLY AND FEEDLOT SITE

WATER-WELL DESIGN



for the central assembly area and the feedlot, and 5 wells for the slaughterhouse including one standby well in each case. The expected depth of production wells is 225 m. Construction of the wells is according to telescopic design using pump-chamber casing of OD 273 mm ($10^{3}/4$ ins) and water entry section casing of OD 219 mm ($8^{5}/8$ ins) as shown in Drawing No. 8.5. According to this design the upper aquifer is sealed off by injection of cement slurry in the annulus around the pump-chamber to a depth of 106 m.

Specifications of the blank casing and screen required for the construction of these wells are as follows .

Pump-chamber casing of OD 273 mm ($10^{3}/4$ in) made to API specifications for standard round thread casing of steel grade H-40 ; 40.5 lb weight per foot and 0.400 in wall thickness. Water entry section blank casing of OD 219 mm ($8\ ^{5}/8$ bin) made to API specification of steel grade H-40 ; 28 lb weight per foot and 0.304 in wall thickness. Continuous slot screen of OD 219 mm ($8\ ^{5}/8$ in) made from stainless steel type 304 ; slot size 0.040 in (1mm) giving open area 100 square inches per linear foot of screen ; of extra strong structure and with threaded and coupled ends to tie in with API standard thread casing of same OD.

All wells are to be fitted with electric submersible pumps of capacity 100 m^{3}/h at 92 m total manometric head.

8.3.2. ELECTRIC POWER SUPPLY :

(1) Provincial Holding Grounds

In each of the five holding grounds there is an electric power generation facility to produce the necessary power for the water pumps, workshop, offices and domestic use. The power is generated from a 250 KVA water cooled, naturally aspirated diesel driven generator 415/240 V, 50 HZ with another similar unit as standby.

(2) Meat Production Complex

The power requirements for the complex is as follows :-

Feed Mill	-	2000 KVA
Slaughterhouse	-	1500 "
Water Pumps	-	400 "
Feedlot and assembly Area	-	200 "
Workshop & Offices	-	100 "
Staff housing	-	100 "
Total		4300 KVA

Since no power from the national grid is expected to be connected to the site for the coming few years each plant is designed to give full power now and used later as a standby when the main power becomes available. Six units 1000 KVA each are installed including the standby. The specifications are 415/240 V. 50 HZ Diesel driven generators including all the necessary transformers switchboards and transmission lines.

8.3.3. ROADS AND TRANSPORT :

(1) Provincial Holding Grounds

In the provincial holding grounds firebreaks, which are paths cleared from vegetation and trees, can be used as roads for cars and machinery. At Nyala and El Dea'n two - 4 wheel drive pick-ups and one 3 ton truck are required for the transport of personnel and materials, while at the other three locations (El Tibune, El Mairam and Kosti) one 4-wheel drive and one 3-ton truck are required.

(2) Meat Production Complex

To facilitate traffic between the various functions of the complex, gravel roads are considered to be necessary for linking the project components. The total length estimated is 7 km., the carriage width being 5 m. and shoulders 2 m. Details of the thicknesses of the base and sub-base courses and other design data will be determined after the soil has been investigated.

The transport fleet for the cattle is discussed in Chapter 3 of Volume III, while the transport facilities are discussed in Chapter of the same volume.

8.3.4. SEWAGE DISPOSAL :

In both the provincial holding grounds and the meat production complex no sewage facilities exist. A system using a septic tank and soak away well will be employed for disposing of sewage.

TABLE 8.5. NYALA HOLDING GROUND INFRASTRUCTURE

CAPITAL COSTS

Item	Unit	Unit Cost	Total Cost	F. C. LS X 1000	L. C. LS X 1000	Total LS X 1000
Water Supply :						
- Water Wells	Well	60,000	6	180	180	360
- Pumps	Pump	25,000	6	120	30	150
- Tanks	Tank	30,000	4	100	20	120
- Distribution	Km.	12,000	20	209	31	240
Electric Power Supply	Job.	Job	Job	168	72	240
				777	333	1110

* El Daein Infrastructure costs are the same as Nyala.

TABLE 8.6. EL TIBUN HOLDING GROUND INFRASTRUCTURE

CAPITAL COSTS.

Item	Unit	Unit Cost	Total Cost	F. C. LS X 1000	L. C. LS X 1000	Total LS X 1000
Water Supply :						
- Water Wells	Well	67,500	5	196	142	338
- Pumps	Pump	25,000	5	100	25	125
- Tanks	Tank	30,000	4	100	20	120
- Distribution	Km.	12,000	8.1	80	17	97
Electric Power Supply	Job.		Job	168	72	240
Total				644	276	920

TABLE 8.7 EL MEIRAM HOLDING GROUND INFRASTURCTURE

CAPITAL COSTS

Item	Unit	Unit Cost	Total Units	F.C. LS X1000	L. C. LS X 1000	Total LS X 1000
Water Supply :						
- Water Wells	Well	67,500	7	284	189	473
- Pumps	Pump	25,000	7	140	35	175
- Tanks	Tank	30,000	4	100	20	120
- Distribution	Km.	12,000	8.1	68	29	97
Electric Power Supply	Job		Job	168	72	240
Total				760	345	1105

* Kosti Infrastructure Capital Costs are the same as El Merum .

TABLE 8.8 MEAT PRODUCTION COMPLEX INFRASTRUCTURE CAPITAL COSTS

Item	Unit	Unit Cost	Total Units	F.C. LSX 1000	L.C. LS X 1000	Total
Water Supply :						
- Water Wells	Well	60,000	3	120	60	180
- Pumps	Pump	20,000	3	48	12	60
- Tanks	Tank	30,000	4	84	36	120
- Distribution	Km	12,000	5	42	18	60
Electric Power Supply	Job		Job	5022	558	5580
Roads	m.	60	7000	-	420	420
Radio Telephone Equipment				52	5	57
				5368	1109	6477

9.1.4. SECOND OPTION - UTILIZATION OF HINDQUARTERS ONLY

Hindquarters are assumed to represent 50% of the cold dressed carcass weight. According to seleit Food Production Co. Ltd. :-

The overall yield of boneless

Meat = 74.75%

Primal cuts = 81.18%

Mince = 18.20%

Approximate percentage of the different primal cuts are as follows :-

Fillets	-	5%
Topside	-	16%
Silverside	-	18%
Striploin	-	13%
Rump	-	11%
Top Rump	-	10%
Mince	-	27%

(a) Projected Output at Maximum Production Level - Year 4

Annual production of carcass meat	=	22,972.9 Tons
Bone-in meat for local sale (50%)	=	11,486.5 Tons
Less 3% loss (344.5 Tons)	=	11,142 Tons
Hindquarters for further processing	=	11,486.5 Tons

Overall yield of bone-less meat (74.75%) = 8,586 Tons

From this yield :

Primal cuts	81.18 %	= 6,970.2 Tons
Mince	18.20%	= 1,562.6 Tons
Amount of bone produced	25.25%	= 2,900.3 Tons

Further breakdown of primal cuts :

Fillet	5%	= 348.5 Tons
Topside	16%	=1,115.2 Tons
Silverside	18%	=1,254.6 Tons
Striploin	13%	= 906.1 Tons
Rump	11%	= 766.7 Tons
Top Rump	10%	= 697 Tons
Mince	27%	=1,833.3 Tons

Projected output using second option at year 4 can be summarized as follows :-

Bone- in meat for local Markets = 11,142 Tons

Total minced meat = 1,562.6 + 1,833.3 tons = 3,395.9 Tons

Primal cuts = 5,136.9 Tons

Bone and sinew = 2,900.3 Tons

(b) Projected Output in Year 1

Annual production of carcass meat = 6,862.9 Tons

Bone-in meat for local sale = 50% = 3,431.5 Tons

Less 3% loss Hindquarters for further processing = 3,431.5 Tons

it will contain about 18% moisture and is known as steamed bone flout which is used as a fertiliser.

9.3.2. PROJECTED OUTPUT IN YEAR 1 :

Hides = 40000 pieces		
Average output in Kgs		
X (2)	= 1120000	Kgs
Blood meal	= 135	Tons
Meat and Bone meal	= 180	Tons
Technical fat	= 108	Tons

9.3.3. PROJECTED OUTPUT IN YEAR 2 :

Hides = 80000 pieces	= 224000	Kgs
Blood Meal	= 270	Tons
Meat and Bone meal	= 360	Tons
Technical fat	= 216	Tons

9.3.4. PROJECTED OUTPUT IN YEAR 3 :

Hides = 120000 pieces	= 3360000	Kgs
Blood meal	= 405	Tons
Meat and Bone meal	= 540	Tons
Technical fat	= 324	Tons

9.4. LIVE ANIMALS :

Starting from year 4, the full operational year a total number of 32000 animals averaging 340 kgs per animal, will be sold live in the local market during the period August to December. Price per kilogram of liveweight is estimated to be £S. 1.65.

9.5. MANURE :

The following amounts of manure will be produced annually in the central assembly unit and the feedlot :-

Year 1	-	60,000 m^3
Year 2	-	120,000 m^3
Year 3	-	180,000 m^3
Year 4	-	240,000 m^3

The manure will be produced in the form of solid waste and is assumed to be delivered at farm gate for selling a price of £S. 50 / m^3.

CHAPTER 10

PROJECTED COSTS AND REVENUES

10. PROJECTED COSTS AND REVENUES

10.1 PROJECTED COSTS :

This section puts together the cost estimates of the various components of the project. Costs are divided into foreign components and domestic components both expressed in terms of Sudanese pounds. Table (10.1) summarises the project capital costs which equal £S 86.8 million of which 62.2% is in foreign currency and the remaining 37.8% in domestic currency. The capital costs of the provincial holding grounds represent 13% of the total capital cost. The capital costs of the meat production complex represents 63.5% of which 32.5% are for the assembly area and feedlot , 12.7% for the feed mill, and 18.3% for the abattoir. Physical contingencies were calculated at 10% of capital costs and reach 7.6% price contingencies which reach 15.95% of total capital costs were calculated at 12% per annum on the basis of the phasing out of capital costs as shown in table (10.2).

It should be noted that the estimated of capital costs do not include any customs duties, as similar projects are being exempted according to the Encouragement of Investments Act, 1980. These estimates include however, post charges and handling fees as well as inland transportation for imported materials and equipment.

Table (10.2) shows the phasing of the project capital costs, where 59% of these costs are due at project year zero (PY0). The other 41% are due during the period PY 1- PY 3, where 21.1% are due at PY1, 9.8% at PY2, and 10.6% at PY3.

Table (10.3) shows the replacement costs of capital equipment, where moving equipment have to be replaced every five years, and other machinery and equipment every seven years. No replacements are required for the machinery and equipment in the feed mill or abattoir, as the spare parts and maintenance costs included in the operating costs will suffice to keep them in good condition during the lifetime of the project (20 years).

Table (10.4) shows a summary of the project's operating costs, divided into foreign and domestic components, both expressed in terms of Sudanese currency. Operating costs are divided according to the major operations performed by the project. These are provincial holding grounds, cost of cattle purchases, transport and trekking costs of cattle, central assembly area, the feedlot, feed mill, and the abattoir. Operating costs rise with the increase in scale of operations in the project from around £S. 15.4 million in PY1 to £S. 28.6 million in PY2, to £S 42.6 million in PY3 until they stabilize at £S. 55.2 at PY4 to PY 20. The major part of the operating costs (96.2%) are for domestic requirements and the rest (3.8%) represent the foreign requirements.

The details of the data shown in tables 10.1 and 10.4, relating to capital and operating costs of the various components and operations of the project, are shown in table 10.18. Tables 10.5 and 10.6 show the fixed and operating costs of the provincial holding grounds. Table 10.7 shows the cost of cattle purchases where part A shows the schedule of purchase and average price per head during the various quarters, while part B shows the annual cost of purchase. Table 10.8 shows the transport and trekking costs of live

animals. Tables 10.9 to 10.12 show the capital costs of the meat production complex, the phasing of capital costs, and the operating costs of the central assembly area and the feed-lot. Tables 10.13 and 10.14 show the fixed and operating costs of the feed mill. Tables 10.15 to 10.18 show the capital and operating costs of the abattoir .

10.2. MARKETING PRICES AND PROJECTED REVENUES :

10.2.1. MARKETING :

Two possible avenues are avilable for marketing the project's meat production ; the first is to sell it as bone-in meat at prices that can compete with other foreign competitors in the Arab markets close to Sudan. The second is to export the fresh meat in de-boned form, where various types of cuts are differentiated and packed.

The first avenue seems inappropriate to apply due to the relatively high cost of meat production, high levels of domestic meat prices, and the fact that it does not exploit Sudan's proximity to the lucrative markets of the Gulf and Libya.

The second avenue, on the other hand, seems more profitable as it gives Sudan an advantageous position relative to other competitiors in that segment of the market geared to high income groups. It will help also in obtaining high prices for the project's output, thereby increasing its profitability. Finally, it will help in reducing airfreight costs as weights will be reduced by 20% due to the de-boning and will also facilitate handling problems.

The marketing strategy of the project is thus built on trekking the cattle to Omdurman and fattening the most suitable. Culled cattle, unsuitable for fattening which are estimated at 20% of total purchased, will be sold live at the Omdurman central market, or through contracts with livestock traders.

Fattened cattle will be slaughtered, de-boned packed and airfreighted to export markets. About 15% of the carcass weight will be sold on the domestic market and the secondary products will also be marketed in Sudan.

10.2.2. PRICES :

Based upon the suggested marketing strategy, present day prices as at February 1982 for the various products of the project will be utilised to calculate the annual projected revenues, whether from export or domestic sales. No allowance will be made for possible inflation during that part of the project cycle that extends from thepresent feasibility study stage to the end of the implementation stage, as the cash flow will be represented in constant 1982 prices. These prices are shown in table 10.19.

It may be noted that there is some divergence between official prices and actual prices of meat with bone in the domestic market, where the latter usually exceeds the former by about 20 - 50% . In the calculation of projected revenues official prices will be used for the domestic sales of the project, after reducing it by the retail margin of 20%.

Prices of steak mince and primal cuts are based on export prices of the Seleit Project in October 1981 with adjustment

by 10% for inflation. Prices of edible offals and non-edible by-products are actual farm-gate prices at Khartoum in February 1982.

Prices of live cattle (average weight 340 kg/head) are wholesale prices, projected as a weighted price in July - December 1982, after excluding the marketing margins and fees (about 19.5%). The same inflation rate that existed during 1978 - 81, 30%, was utilised. Manure prices are based on personal communication with Kadero Karantena.

10.2.3. PROJECTED REVENUES :

Table 10.20. shows the projected outputs of the project during its assumed lifetime. Utilising the data of tables 10.19. and 10.20. , and the projected revenues of the project, in constant 1982 prices, can be reached. Table 10.22. shows the projected revenues during the assumed lifetime of the project.

TABLE 10.1 PROJECT CAPITAL COSTS

Project component	Foreign Component	Domestic Component	Total	%
Provincial Holding Grounds	6553	4518	11071	13
Meat Production Complex :				63.5
(a) Assembly Area Feedlot	14842	13388	28230	32.5
(b) Feed Mill	7159	3832	10991	12.7
(c) Abattoir	12993	2864	15857	18.3
Total	41547	24602	66149	76.5
Physical contingencies 10%	4155	2460	6615	7.6
Price contingencies (approx. 12% p.a.)	8288	5763	14051	15.9
General Total	53990	32825	86815	100
%	62.2	37.8	100	

TABLE 10.2. PHASING OF PROJECT CAPITAL COSTS

(£S. 000)

Project Component	PY 0		PY 1		PY 2		PY 3		Total	
	FC	DC	FC	DC	FC	DC	FC	DC	FC	DC
Provincial Holding Ground	2731	1906	1529	1138	1086	699	1207	775	6553	4518
Meat Production Complex	10489	7077	1523	2112	1429	2106	1401	2093	14842	13388
Feed Mill	5573	2765	1586	10667(1067)	-	-	-	-	7159	3822
Abattoir	9510	1992	3483	872	-	-	-	-	12993	2864
Total	28303	13740	8121	5189	2515	2805	2608	2868	41547	24602
Physical contingencies (10%)	2830	1374	812	519	252	281	261	287	4155	2461
Price contingencies (Approx. 12% p.a.)	3336	1603	2310	1346	1084	1168	1558	1645	8288	5762
Grand Total	34469	16717	11243	7054	3851	4254	4427	4800	53990	32825
%	59		21.1		9.3		10.6		100	

10.15 CAPITAL COST OF PROJECT ABATTOIR

(£S. '000)

Item	Local	Foreign	Total
Buildings & Civil Works	2054	2673	4727
Machinery & Equipment	-	8000	8000
Sea Freight & Insurance	-	270	270
Inland Transport	20	-	20
Erection and Commissioning	400	1600	2000
Training and Technical Assistance	50	50	100
Spare parts (5%)	-	400	400
Port Fees (3%)	340	-	340
Total	2864	12993	15857

TABLE 10.16 ANNUAL OPERATING COSTS OF PROJECT ABATTOIR IN YEAR 2

(£S '000)

Item	Local	Foreign	Total
Salaries and Wages	200	48	248
Fuels, oils & Lubricants for machinery & Equipment	10	-	10
Fuels and oils for cars and vehicles	25	-	25
Packing materials	884	667	1551
Protective clothes and boots	7	7	14
Chemicals and soaps	6	6	12
Sundry equipment	1.8	1.8	3.6
Stationary	2	-	2
Maintenance of Machinery and equipment	1	-	1
Maintenances of cars and vehicles	1	-	1
Maintenance of buildings and civil works	5	-	5
Others	15	15	25
Total	1158	740	1898

TABLE 10.17 ANNUAL OPERATING COSTS OF PROJECT ABATTOIR IN YEAR 3

(£S. '000)

Item	Local	Foreign	Total
Salaries and wages	294	48	342
Fuels, Oils & Lubricants for machinery and equipment	15	-	15
Fuels and oils for cars and vehicles	40	-	40
Packing materials	1326	1000	2326
Protective clothes and boots	10	10	20
Chemicals and soaps	9	9	18
Sundry equipment	2	-	-
Stationery	3	-	3
Maintenance of machinery and equipment	2	-	2
Maintenance of cars and vehicles	2	-	2
Maintenance of buildings and civil works	10	-	10
Others	20	10	30
Total	1733	1079	2812

TABLE 10. 18. OPERATING COSTS PY4 - PY 20

(£ S. '000)

I t e m	Local	Foreign	Total
Salaries and wages	244	48	342
Fuel and oil consumption :			
Fuels, oils & Lubricants for machinery & equipment	15	-	15
Fuels & oils for cars & vehicles	50	-	50
Packing material	1436	1084	2520
Protective clothes and boots	10	10	20
Chemicals and soaps	10	10	20
Sundry equipment	30	30	60
Stationery	30	-	30
Maintenance of machinery and equipment	20	-	20
Maintenance of cars and vehicles	20	-	20
Maintenance of buildings and civil works	20	-	20
Others	30	20	50
Total	1875	1175	3050

TABLE 10.19 OUTPUTS PRICES IN 1982

Commodity	Unit	Price
Meat with bone	Kg	1.25
Steak mince	Kg	3.30
Primal cuts	Kg	3.70
Edible offals ;		
Livers	Kg	2.00
Tongues	Piece	1.25
Hearts	Kg	1.50
Kidneys	Pairs	1.50
Brain	Piece	0.25
Afsha	Unit	5.00
Fat	Kg	0.70
Non-edible by-products		
Hides	Kg	0.06
Blood meal	Kg	0.30
Meat and Bone meal	Kg	0.30
Technical fat	Kg	0.50
Live animals	Head	450
Manure	M^3	

TABLE 10.20 PROJECTED OUTPUTS

Products		Year 1	Year 2	Year 3	Year 4
1. Main Products :					
(a) Meat with bone	(ton)	978	1956	2934	3273.7
(b) Steak mince	(ton)	1163.1	2326.2	3489.3	3892.4
(c) Primal cuts	(ton)	2976.8	5953.6	8930.4	9997.7
II. By-Products					
(a) Livers	(ton)	158.004	316.008	474.012	513.513
(b) Tongues	(piece)	36748	73496	110244	119433
(c) Hearts	(ton)	52.668	105.336	158.004	171.171
(d) Kidneys	(pairs)	39600	79200	118800	128700
(e) Brain	(piece)	36748	73496	110244	119433
(f) Afsha	(unit) (1)	36748	73496	110244	119433
(g) Fat	(ton)	427.680	855.366	1283.040	1389.660
III. Non-Edible By-Products					
(a) Hides	(ton)	1120	2240	3360	3640
(b) Blood meal	(ton)	135	270	405	450
(c) Meat & Bone meal	(ton)	180	360	540	600
(d) Technical fat	(ton)	108	216	324	360
IV. Live Animals	(head) (2)	-	-	-	32000
V. Manure	(m^3)	60000	120000	18000	240000

(1) Afsha including spleem

(2) Average live weight about 340 kg per head

TABLE 10.21 PROJECTED TOTAL REVENUE

Products	Year 1	Year 2	Year 3	Year 4
1. Main Products :				
(a) Meat with bone	1222.500	2445.000	3667.500	4092.125
(b) Steak mince	3838.230	7676.460	11514.690	12844.920
(c) Primal cuts	11014.160	22028.320	33042.480	36991.490
II. By-Products				
(a) Livers	316.008	632.016	948.024	1027.026
(b) Tongues	45.935	91.870	137.805	149.291
(c) Hearts	79.002	158.004	237.006	256.757
(d) Kidneys	59.400	118.800	178.200	193.050
(e) Brain	9.187	18.374	27.561	29.858
(f) Afsha	183.740	367.480	551.220	597.165
(g) Fat	299.376	598.758	898.126	972.762
III. Non Edible By-Products				
(a) Hides	67.200	134.400	201.600	218.400
(b) Blood meal	40.500	81.000	121.500	135.000
(c) Meat, Bonemeal	54.000	108.000	162.000	180.000
(d) Technical fat	54.000	108.000	162.000	180.000
IV. Live Animals	-	-	-	14400.000
V. Manure	900.000	1800.000	2700.000	3600.000
Total	18183.000	36366.000	54550.000	75868.000

CHAPTER 11

FINANCIAL AND ECONOMIC ANALYSES

11. FINANCIAL AND ECONOMIC ANALYSES

11.1. FINANCIAL ANALYSIS :

11.1.1. FINANCIAL RATE OF RETURN (FRR) :

The financial rate of return (FRR) has been calculated for the project from the data shown in tables (11.1, 11.2 and 11.3) where it equals 19% . This is a comparatively adequate figure and proves the financial feasibility by the project. In the calculation of the FRR, the following assumptions and parameters have been utilised.

- Net revenue has been calculated as the total of the domestic and foreign components, i.e. no special allowance has been made for the foreign currency funds generated by the project.

- Business profit taxes have been excluded from the net revenue starting PY 11. The Encouragement of Investment Act, 1980, exempts similar projects from these taxes up to a maximum period of 10 years. The present rate is 60% but the Sudanese Government is considering reducing it as an encouragement of business. The current rate has been utilised, however, for the calculation of tax payments for precautionary purpose. The tax base, profits before tax, is equal to total revenues, as shown in table (11.1.) minus operating costs and depreciation allowances shown in table (11.2). Tax payments reach £S. 15.315 m. annually from PY 11 to PY 20.

- The calculation of the FRR has been based on cash

has been used in spite of the recent move to utilise the parallel market rate US$. 1 = £S. 0.9 in all transactions, as the new rate does not seem to equalise demand and supply. The unofficial market rate is currently about US$ 1 = 1.3 and, thus, is even higher than the foreign exchange coefficient utilised here. The utilisation of this coefficient gives new estimates of total revenues as shown in table (11.4) and of total costs in table (11.3).

- Market wages have been utilised in the economic analysis , even for unskilled labour, as there is no adequate evidence for the existence of disguised unemployment in Sudan.

- Business profits taxes have not been excluded from net revenue, as these are considered as transfer payments from the economic point of view. There has been no problem with regard to customs duties, as the new Encouragement of Investment Act, 1980, exempts similar or projects from paying these duties, and thus they were not included, even in the financial analysis.

- Finally, net revenue of the project in the economic analysis represents not only the differenct between total revenues and total costs, after making the various corrections required by the economic analysis, but also the net revenue to the economy resulting from the project as the difference between the economic situation with and without the project. To achieve this latter correction it has been assumed

that without the project Sudan will be able to export half the amount of cattle purchased by the project. This is a rather optimistic assumption, but it will be used as a precaution. Based on this assumption , net revenues to the economy without the project have been estimated as shown in table (11.5). Having reached this estimate it has also been deducted from total revenues to reach total revenues in the economic analysis.

11.2.2. SENSITIVITY ANALYSIS :

The ERR has been calculated on the basis of some stringent alternative assumptions to ensure the economic feasibility of the project. The two alternative assumptions utilised are : an increase in total economic costs by 10%, and a decrease in total economic revenues by 10%. The values of the ERR under these alternative assumptions are shown below, where it can easily be seen that the project can face these situations, that may not be reasonably expected, yet remain economically justified.

Total Costs by ↑	Total revenues ↓ by 0%	Total revenues ↓ by 10%
0%	21.3	13.6

TABLE 11.1. CASH FLOW

Year	Fixed Cost		Operating Cost		Total Revenue		Total Cost		Net Revenue	
	FC	DC	FC	DC	FC	DC	FC	DC	FC	DC
0	31079	15073	-	-	-	-	31079	15073	(31079)	(15073)
1	9134	5731	356	15032	14852	3331	9490	20763	5362	(17432)
2	2815	3109	1241	27324	29705	6661	4056	30433	25649	(23772)
3	2909	3154	1826	40787	44557	9993	4735	43941	30822	(33948)
4	-	-	2104	53122	49836	26032	2104	53122	47732	(27090)
5	144	12	2104	53122	49836	26032	2218	53134	47618	(27102)
6	76	8	2104	53122	49836	26032	2180	53130	47656	(27098)
7	560	62	2104	53122	49836	26032	2664	53184	37172	(27152)
8	366	24	2104	53122	49836	26032	2470	53146	47366	(27114)
9	158	18	2104	53122	49836	26032	2262	53140	47574	(27108)
10	158	18	2104	53122	49836	26032	2262	53140	47574	(27108)
11	5194	1832	2104	53122	49836	26032	7298	43954	42538	(28922)
12	1116	491	2104	53122	49836	26032	3220	53613	46616	(27581)
13	868	524	2104	53122	49836	26032	2972	53646	46864	(27614)
14	674	486	2104	53122	49836	26032	2778	53608	47058	(27576)
15	158	18	2104	53122	49836	26032	2262	53140	47574	(27108)
16	158	18	2104	53122	49836	26032	2262	53140	47574	(27108)
17	114	12	2104	53122	49836	26032	2218	53134	47618	(27102)
18	76	8	2104	53122	49836	26032	2180	53130	47656	(27098)
19	275	30	2104	53122	49836	26032	2379	53152	47457	(27120)
20	168	18	2104	53122	49836	26032	2272	53140	47564	(27108)

TABLE 11.2. DEPRECIATION ALLOWANCES

Component	%	FC	DC	Total
Holding Grounds				
Perimeter Fencing	5	37	56	
Staff Housing	2½	24	36	
Offices, workshop & Store	2½	3	4	
Spray & Water Supply	5	152	65	
Electric Power Supply	5	53		
Machinery & Equipment	14	81	9	
Transport	20	53	6	
Sub Total		403	199	602
Meat Production Complex				
Land Preparation	2½	-	1	
Roads	2½	-	11	
Water Supply	5	15	6	
Electric Power Supply	5	251	28	
Central Assembly Area Fencing	5	119	179	
Feedlot Fencing	5	246	370	
Site Perimeter Fencing	5	1	2	
Central Assembly Area Machinery & Equipment	14	18	2	
Feedlot Machinery & Equipment	14	43	5	
Central Administration Building	2½	1	-	
Central Workshop and Stores Building	2½	1	1	
Staff Housing	2½	15	22	
Trucks	20	182	46	
Sub Total		892	673	1,565

TABLE 11.2 (Contd.)

Component	%	FC	DC	Total
Feed Mill				
Electric Equipment	10	43	278	
Steel Structures	2½	10	69	
Civil Works	2½	31	21	
Metal Building Erection	5	40	17	
Machinery Erection	5	98	42	
Cables	5	-	2	651
Sub Total		222	429	
Abattoir				
Civil Works	2½	67	54	
Machinery & Equipment	5	400	12	
Sea Freight	5	14	-	
Inland Transport	5	-	1	
Erection	5	80	20	
Training & Technical Assistance	10	5	5	
Spare parts	10	40	-	
Sub Total		606	92	698
GRAND TOTAL				3,516

TABLE 11.3 TAX PAYMENTS

Year	Total Revenue	Operating costs	Depreciation Allowance	Interest payments (1)	Net Operating profits	Taxes
0	-	-	-	2480	(2480)	-
1	18183	15388	2939	3500	(3644)	-
2	36366	28565	3224	3610	967	-
3	54550	42613	3516	3732	4689	-
4	75868	55226	3516	2683	14443	-
5	75868	55226	3516	2193	14933	-
6	75868	55226	3516	1290	15836	-
7	75868	55226	3516	1702	15424	-
8	75868	55226	3516	1212	15914	-
9	75868	55226	3516	723	16403	-
10	75868	55226	3516	233	16893	-
11	75868	55226	3516	52	17074	10244
12	75868	55226	3516	-	17126	10276
13	75868	55226	3516	-	17126	10276
14	75868	55226	3516	-	17126	10276
15	75868	55226	3516	-	17126	10276
16	75868	55226	3516	-	17126	10276
17	75868	55226	3516	-	17126	10276
18	75868	55226	3516	-	17126	10276
19	75868	55226	3516	-	17126	10276
20	75868	55226	3516	-	17126	10276

(1) See Table (11.8)

TABLE 11.4 PROJECT TOTAL REVENUE

(£S. '000)

	PY1	PY2	PY3	PY4
1. FINANCIAL ANALYSIS				
Domestic	3330.8	6661.7	9993	26032
Foreign (£S)	14852.390	29704.760	44557.170	49836
Total Revenue	18183	36366	54550	75868
2. ECONOMIC ANALYSIS				
Domestic	3331	6262	9993	26032
Foreign (1)	18565	37130.975	55696.463	62295.513
Total Revenue	21896	43392	65689	88327
Net Revenue without Project (2)	2327	4774	7017	9021
Total economic Revenue	19569	38618	58672	79306

(1) Unit of foreign currency = 1.25 of total domestic currency

(2) See table (11.5)

TABLE 11.5 PROJECTED NET REVENUE
WITHOUT THE PROJECT

(£S '000)

	Year 1	Year 2	Year 3	Year 4-20
Export value of live animals (1)	6703.2	13406.4	20109.6	26812.8
Trekking Costs to Omdurman (2)	369.5	643.0	966.5	1104.0
Transport cost to Port Sudan (3)	371.91	743.2	1115.73	1487.64
Purchasing Cost of animals (4)	4100	8200	12414	17004
Net revenue without the project	1861.79	3819.58	5613.37	7217.16
Correction by the foreign exchange coefficient (5)	2327.2	4774.5	7016.7	9021.5

(1) Based on export pirce about US$. 380/head which equals £S. 342/head and about 2% losses in live animals.

(2) Including trekking from local markets to Omdurman and railway transport costs from local markets to Omdurman.

(3) Based on tariff about £S. 18.975/head.

(4) Based on the purchasing prices of live animals at local markets which are used in calculation of project costs, with the assumption that 80,000 head only will be exported.

(5) The foreign exchange coefficient equals 1.25.

11.3. PROJECT FINANCING :

11.3.1. FINANCIAL REQUIREMENTS :

The financial requirements of the project are estimated on the basis of capital requirements including physical contingency, working capital required for the start-up of the project, price contingency (estimated at 12% constant rate of inflation), interest on loans and loan repayment during the investment period, and the income generated by the project during that period. Table (11.8) summarises the financial requirements of the project. It shows that investment expenditures are spread over four years, i.e. 1982 to 1986. Total financial requirements amount to £S. 89 million of which 62% or about £S. 55 million are in foreign currency.

11.3.2. THE FINANCIAL MODEL :

The model to be applied in estimating the structure of the project financing is a function of several factors which include, among other things, the expected profitability of the project, the financial position of the promoters, the prospective partners, the financial and investment environment prevailing in the country in which the project will be implemented, and the availability of infrastructure and supporting activities.

Taking all these factors into consideration, it is advised that the equity-loan ratio should not be less than 60 : 40. This relatively high ratio, though it will inversely affect the profitability of equity capital, will help the project to perform at financial ease. Decreasing the equity ratio to less than 60% could cause liquidity problems for the project. Furthermore, when implemented the project will be a legal entity with financial autonomy and will be financially

independent from AAAID. Thus its ability to attract long term loans will, to a great extent, be limited. For these reasons, the equity capital is estimated at £S. 55 million, i.e. 62% of the total finance required.

The project should benefit from suppliers' credit as much as possible since the interest paid on that type of credit financing is normally lower than the market rate. Accordingly, suppliers' credit, utilised to supplement the financing of the project, amounts to £S. 21 million i.e. 23% of total finance. The balance of finance required will be met by long term loans amounting to £S. 13 million, i.e. 15% of the finance needed (table 11.2.).

Since this project will produce one of the most important food security commodities, i.e. meat, and since it is geared mainly to the export market of the Arab world, AAAID should have some control in the Company to be established for implementing and running the project. AAAID should participate in the said company by taking up at least 51% of its equity capital. Sudan and other Arab countries should be induced to participate also in such an important meat producing project that is designed to help decrease the ever-widening gap between production and consumption of meat in the Arab world.

11.4. FINANCIAL ANALYSIS :

The financial analysis of the project is based on proforma financial statements, i.e. projected income statement, projected statement of sources, application of funds and projected balance sheet, and the following assumptions were utilised.

TABLE 11.8. FINANCIAL REQUIREMENT OF THE PROJECT

(£S. '000)

I t e m	1983	1984	1985	1986	Total
Provincial Holding Grounds	4.728	2.727	1.845	2.013	11.313
Meat Production Complex	17.389	3.779	3.540	3.499	28.207
Feed Mill	8.338	2.653	-	-	10.991
Abattoir	11.502	4.355	-	-	15.857
SUB TOTAL	41.957	13.514	5.385	5.512	66.368
Physical contingencies	4.195	1.351	539	551	6.636
Price contingencies	5.034	3.432	2.181	3.164	13.811
Start up costs	-	5.096	-	-	5.096
SUB TOTAL	51.186	23.393	8.105	9.227	91.911
Net internal cash generated	(3.184)	(2.607)	1.505	7.827	2.911
Total Financial Requirements	55.000	26.000	6.600	1.400	89.000

TABLE 1.9. SOURCES OF PROJECT FINANCE

Sources of Finance	£S ('000)	% of sub - total	% of total
EQUITY :			
AAAID	28.050	51	31.5
Others	26.950	49	30.3
Total	55.000	100	61.8
LOANS :			
Suppliers credit	21.000	62	23.6
Long term loans	13.000	38	14.6
Total Loans	34.000	100	38.2

- equity loan ratio is 61.8 : 38.2.

- suppliers credit long term loan ratio is 62 : 38.

- suppliers credit granted at 10% interest repayable in 16 semi - annual instalments with a 2-year grace period ;

- long term loans at 14% interest repayable in 8 annual instalments after a 2-year grace period ;

- tax exemption period is limited to its first five years of operation.

11.4.1. NET INCOME AND INTERNAL CASH GENERATION :

Project proforma income statement for the estimated 20 year life of the project is provided in table (11.10) . It shows that the project will realise positive income in its second year of operation but significant positive income will accrue only in the third year. Net income will increase steadily until it reaches the maximum, i.e. £S. 14.9 million in its fifth year of operation prior to the application of business profit tax. It then drops to about £ S. 10.2 annually.

Profitability of equity capital is assessed by calculating the percentage of net income to equity. This ratio increases from 2% in the second year of operation to 32% just before the application of BPT : then it drops to 12%. The average annual percentage amounts to 12%. If the project were to be exempted from BPT for a further period of 5 years, the average ratio would increase to 16%.

11.4.2. SOURCES AND APPLICATION OF FUNDS :

Project proforma statement of sources and application of funds is provided in table (11.11) which shows that sources of funds include equity capital which adds up to £S. 55 million in 1986, loans which add up to £S. 34 million in 1985, net internal cash generation which adds up to £S. 8.9 million in 1986, and overdraft amounting to £S. 5.5 million in 1986. These funds have been utilised to pay for fixed assets (£S. 86.8) starting costs, repayment of loans (£S. 6.6 million), and to provide for working capital adding up to £S. 4.8 million in 1986.

Table 11.11) also shows that the project produces surplus funds in all years except in 1985. Surplus funds, accumulated at the end of the economic life of the project, amount to £S. 148.5 million after providing for debt repayment, interest and tax payments amounting to £S. 61.9 million, and the replacement of fixed assets amounting to £S. 14 million. This means that the gross money generated by the project during its lifetime amounts to £S. 224.9 million or 2.6 as much as investment expenditures during the investment period.

The table also shows that funds generated by the project more than suffice the debt servicing, replacement of fixed assets and provision of working capital. The debt coverage ratio is reasonably above 1 in all years as of 1986.

TABLE 11.12 (CONTD.)

1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
51,131	54,096	62,855	71,829	81,035	91,225	101,415	111,655	121,937	131,998	142,178
6,322	6,322	6,322	6,322	6,322	6,322	6,322	6,322	6,322	6,322	6,322
57,453	60,418	69,177	78,151	87,357	97,547	107,737	117,977	128,259	138,320	148,500
59,194	62,704	60,795	58,671	57,315	54,975	49,635	46,245	42,813	39,602	36,272
116,647	123,122	129,972	136,822	143,672	150,522	157,372	164,222	171,072	177,922	184,772
375										
375										
55,000	55,000	55,000	55,000	55,000	55,000	55,000	55,000	55,000	55,000	55,000
61,272	68,122	74,972	81,822	88,672	95,522	102,372	109,222	116,072	122,922	129,772
116,647	123,122	129,972	136,822	143,672	150,522	157,372	164,222	171,072	177,922	184,772
38.3										

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