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United Nations
High Commissioner for Refugees

Commissioner for Refugees
Ministry of the Interior
The Democratic Republic of Sudan

REFUGEE RESETTLEMENT PROJECT IN EAST-CENTRAL SUDAN PRE-INVESTMENT STUDY

Appendices

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Elstree Way
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in association with

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and
Shankland Cox and Partners

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APPENDIX A

TERMS OF REFERENCE

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PART I

TASKS INVOLVING PHASE I ONLY

Hunting Technical Services shall carry out the following tasks exclusively during Phase I, which will commence on 1 April 1976 and terminate at the latest on 15 May 1976.

1. Refugee Concentration

(a) Conduct in co-ordination with competent Government agencies a detailed study of refugee concentrations in the Kassala Province (excluding the Qala en Nahl refugee settlement), in order to determine the demographic, occupational and social characteristics of those refugees who are likely to be moved to the proposed settlement or settlements.

(b) Report to the Government and UNHCR on (a) above before 30 April 1976.

2. Settlement Sites

Examine the relative merits of establishing refugees in Gedaref, Showak, Jebel Maharigat or, should the need arise, in the alternative sites of Abu-Rakham and Wad-el-Shaeer, bearing in mind that more than one site might be desirable, and to report thereon to Government and UNHCR by 15 May 1976. Advise on location(s) suitable for cultivation during the next rainy season in the neighbourhood of these sites.

TASKS COVERING PHASES I AND II

Hunting Technical Services shall carry out the following tasks throughout the 3-month duration of the pre-investment study from 1 April to 30 June 1976.

3. Agricultural Production Schemes

Examine the relative merits of alternative forms of organisation and locations for crop and livestock production. For crop production these should include the following systems:

(a) centrally organised only;

(b) combination of central organisation on a nucleus estate model as well as family holdings;

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(c) family holdings only.

Report thereon and advise on location(s) to Government and UNHCR not later than 15 June 1976. Following decisions taken by Government and UNHCR draw up by 30 June detailed, costed plans for an agricultural scheme or schemes.

4. Field Team for Refugees

In co-operation with the Commissioner for Refugees and the UNHCR Representative, advise on the structure and functions of a Field Team for Refugees.

5. Qala en Nahl

(a) Perform a detailed study of the social and economic features of the existing refugee settlement at Qala en Nahl as well as of the agricultural production and marketing in the area.

(b) Draw up a detailed plan and budget for an agricultural production scheme at Qala en Nahl, and

(c) Advise on the settlement's capacity to absorb further refugees.

(d) Determine the food relief needs of the settlement during the coming rainy season.

(e) Report to the Government and UNHCR on (a), (c) and (d) by 15 May 1976.

6. Employment and Income

(a) Conduct in co-ordination with competent Government offices a survey of the agricultural labour market in Kassala, Blue Nile and Gezira Provinces and draw up recommendations.

(b) Elaborate proposals for an agency to find employment for refugees that seek seasonal or permanent employment.

(c) Study existing and proposed construction projects with a view to placing refugees in employment in these projects.

(d) Work out anticipated individual and family income resulting from employment and agricultural activities.

7. Jebel Maharigat

Carry out a topographical survey at Jebel Maharigat.

(c) family holdings only.

Report thereon and advise on location(a) to Government and UNHCR not later than 15 June 1976. Following decisions taken by Government and UNHCR draw up by 30 June detailed, costed plans for an agricultural scheme or schemes.

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In co-operation with the Commissioner for Refugees and the UNHCR Representative, advise on the structure and functions of a Field Team for Refugees.

5. Gala on Nabi

(a) Perform a detailed study of the social and economic features of the existing refugee settlement at Gala on Nabi as well as of the agricultural production and marketing in the area.

(b) Draw up a detailed plan and budget for an agricultural production scheme at Gala on Nabi, and

(c) Advise on the settlement's capacity to absorb further refugees.

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7. Jebel Mabarigat

Carry out a topographical survey at Jebel Mabarigat.

TASKS TO BE UNDERTAKEN DURING PHASE II ONLY

Further to the decisions taken as a result of Phase I Hunting Technical Services shall carry out the following tasks as Phase II only from 15 May to 30 June 1976.

8. Settlement Sites

Prepare plans for the settlement of refugees at the site or sites selected. Due attention will be paid to health and public safety provisions as required by Government. The work carried out will include:

(a) Surveying

Mapping and detailed plans of the proposed layout of the settlement(s).

(b) Public Utilities

The designing and costing of water and electricity supplies for the settlement as well as the drawing up of recommendations for a public sanitary service, sewage and waste disposal.

(c) Social Services

Prepare outline plans and costs for the following:

- primary schools for boys and girls as well as teachers' accommodation
- community centres
- health facilities
- office and accommodation for project staff
- police post

9. Services outside the settlement

In discussion with the provincial authorities, prepare outline plans and costs for improving higher order services in the towns of Gedaref and Showak in order to cater for the refugee population.

10. Plan and Budget for Implementation

Prepare a detailed plan and budget for the full implementation and running of the project(s) for the period 1 July 1976 to 30 June 1978. Submit a plan, budget and report to the Government and UNHCR by 30 June 1976.

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MID-TERM REPORT FOR THE PRE-INVESTMENT STUDY FOR SETTLEMENT OF REFUGEES IN KASSALA PROVINCE

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MID-TERM REPORT FOR THE PRE-INVESTMENT
STUDY FOR SETTLEMENT OF REFUGEES IN
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MID-TERM REPORT FOR THE PRE-INVESTMENT STUDY FOR SETTLEMENT OF REFUGEES IN KASSALA PROVINCE

INTRODUCTION

1.1 The terms of reference required that the following work should be completed by 15 May 1976.

Item 1 (a) Conduct in co-ordination with competent Government agencies a detailed study of refugee concentrations in Kassala Province (excluding Qala en Nahl) in order to determine the demographic, occupational and social characteristics of those refugees who are likely to be moved to the proposed settlement or settlements.

Item 2 Examine the relative merits of establishing refugees in Gedaref, Showak, Jebel Maharigat or, should the need arise, in the alternative sites of Abu Rakham and Wad el Shaer, bearing in mind that more than one site might be desirable.

Item 3 (a) Perform a detailed study of the social and economic features of the existing refugee settlement at Qala en Nahl as well as the agricultural production and marketing in the area.

(c) Advise on the settlement's capacity to absorb further refugees.

(d) Determine the food relief needs of the settlement during the coming rainy season.

REFUGEE CONCENTRATIONS

2.1 It is well known that accurate information on the number of immigrants is difficult to obtain. They are found at the officially sponsored settlements (Wad el Hileiwu, Qala en Nahl) as well as in urban areas (Gedaref, Kassala, Showak) and in villages in the countryside (Wad Kauli, Gereisha and Dokha). By their nature, immigrant populations are extremely mobile and remain in one place for relatively short periods of time and can be easily missed or counted twice. Whilst it is difficult to obtain numbers of immigrants, it is almost impossible to sub-divide this population on the basis of migrant workers, pastoralists, etc. and political refugees in need of assistance. The most up-to-date estimates available are in Table 1.

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MID-TERM REPORT FOR THE
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REFUGEES IN KASSALA PROVINCE

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Table 1. Estimate of Refugee Concentrations in Kassala Province

Wad el Hileiwu	15,000 to 20,000	Eritreans
Showak Area	3,000	"
Gedaref	3,500	"
	4,500	Ethiopians
Wad Kauli	3,500	"

2.2 If we distinguish refugees as those immigrants in need of assistance, it is reasonable to assume that, unless there have been good reasons to discourage them, such people will have moved spontaneously to official settlement areas (i.e. Wad el Hileiwu) where relief is available. It is assumed, therefore, that the great majority of Eritreans requiring assistance have moved to Wad el Hileiwu (or are receiving assistance in Khartoum from the Branch Office). For the purpose of planning a settlement project, we conclude that the total number of Eritreans involved will not exceed 25,000, i.e. the population of the Wad el Hileiwu and Esh Showak area, plus some of the refugees in Gedaref. The Eritreans from Kassala town have recently been moved to Wad el Hileiwu.

2.3 As far as Ethiopians are concerned, there are good reasons for them to remain in Gedaref in so far as the only official refugee centre in Kassala Province at Wad el Hileiwu is dominated by Eritreans. It is clear that the Ethiopian refugees cannot be expected to move to the proposed new settlement at Jebel Maharigat or Qala en Nahl and alternative arrangements need to be made for them.

2.4 The provincial authorities intend to re-settle the Ethiopian refugees in Gedaref and Wad Kauli in one or two centres outside Gedaref and away from the border. Up to 8,000 people are likely to be involved. Two sites are being considered; one for the refugees presently in Gedaref and another for the refugees at Wad Kauli. No firm plans have yet been drawn. In the remaining half of this survey, there will be no time to draw up detailed plans for the settlement of these refugees.

2.5 Since the great majority of refugees to be resettled are in Wad el Hileiwu, we have concentrated our attention on determing their number and occupation (before arriving in Sudan). In the time available, this has meant verifying

Table 1. Estimate of Refugee Concentrations in Kassala Province

Wad el Hileiwa	15,000 to 20,000	Eritreans
Showak Area	3,000	"
Gedaref	3,500	"
	4,500	Ethiopians
Wad Kenik	3,500	"

previous work done in the area. There have been three basic questions to be resolved:

How many refugees are there at Wad el Hileiwu?

How many will be moved to the proposed new settlement?

How should the settlement be planned to accommodate the different groups, tribes etc.?

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2.7 The second question relating to the number of people that will move to a proposed settlement away from the border is impossible to forecast accurately. We estimate that, in view of the stated preferences of many of the refugees for the Wad el Hileiwu area, many of the people who presently have employment (about 50 per cent), when faced with the prospect of leaving for a new settlement area, will forgo their status of refugees (i.e. their entitlement for food relief) and disappear into the long established immigrant communities in the area. It is difficult to see how this can be prevented, or indeed whether it should be prevented. We conclude that the maximum number of people to be catered for in a first phase settlement programme is 15,000 people.

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previous work done in the area. There have been three basic questions to be resolved:

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How many will be moved to the proposed new settlement?

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2.9 For the purpose of estimating the likely settlers we have assumed that the unemployed will be in the majority. Those tribes/groups which have the most unemployed are the Sawarta, Christians and Beni Amer. Of these the Christians have the majority in the non-agricultural group. See Table 2.

Table 2. Ethnic and Occupational Composition of Likely Settlers

Tribe/ Group	Percentage of total population Wad el Hileiwu	Percentage non-agricultural in the tribe	Percentage unemployed in the tribe	Total unemployed in the tribe
Beni Amer	18	37	58	2633
Sawarta	27	28	72	4410
Christian	32	57	60	3992
Mariya	10	42	62	1650
Total	87	42	63	12085

Source: Community Development Department Survey.

2.10 The Community Development Department survey identified eleven groups altogether. Of these many are insignificant in number and unlikely to form an important component of any future settlement. A good example are the West Africans, numbering 2,297. Of the sample of 188, only 2 declared themselves unemployed. This coincides with Gaymans' conclusion that the West Africans did not wish to be considered refugees.

CHOICE OF SETTLEMENT SITE

3.1 The questions to be resolved in the preliminary part of the survey were as follows:

- whether one large settlement would be better than several smaller ones
- what site or sites would be most suitable.

3.2 The alternatives were a large settlement at Jebel Maharigat or an expansion of existing settlements at Qala en Nahl, Gedaref and Showak. At the outset, it was agreed that Wad el Hileiwu could not be considered as a permanent settlement in view of its proximity to the border.

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3.3 In view of the existing problems at Qala en Nahl, we have concluded that, although there appears to be scope for settling additional refugees, it would be inadvisable to go ahead with expanding the settlement until these problems have been overcome. At least two seasons are needed to re-establish the community as a viable, self-supporting settlement. To attempt to increase the population in the area in the immediate future would inevitably increase existing tensions and delay progress.

3.4 It is possible that with a concerted effort it would be technically feasible to settle up to 20,000 more people at Qala en Nahl. Effort would have to be concentrated on increasing the efficiency of the water supply system, demarcating village sites and cultivation areas. It would also be necessary to ensure that the settlement pattern was dovetailed to reduce social tensions between existing settlers and the newcomers.

3.5 Whilst this solution may be technically feasible and economically attractive, it ignores important conclusions reached in the pre-feasibility study. These may be listed as follows:

(a) The refugees have expressed their dislike of the humid conditions at Qala en Nahl during the wet season, conditions which are very different from their homeland.

(b) Qala en Nahl is remote from non-agricultural, dry season employment and also from the homeland with which the refugees wish to maintain contact.

(c) The settlement scheme at Qala en Nahl is known to be unpopular with the refugees at Wad el Hileiwu.

For the above reasons we conclude that grave difficulties would be encountered in attempting a mass movement of the inhabitants of Wad el Hileiwu to Qala en Nahl. There is a lot to be said for making a new start at Jebel Maharigat and at the same time attempting the improvement of the situation at Qala en Nahl in order to encourage the present inhabitants to remain there.

3.6 With regard to Gedaref, the provincial authorities are already concerned about existing refugees in the neighbourhood of the town. The authorities are very reluctant to see an increase in the existing urban refugee colony. Any settlement at Gedaref would have to be wholly urban as there is no reserve of unused cultivable land.

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When the above reasons, we conclude that grave difficulties would be encountered in attempting a mass movement of the inhabitants of Wad el Hileiwa to Qala en Nahl. There is a lot to be said for making a new start at Debel Mabruk and at the same time attempting the improvement of the situation at Qala en Nahl in order to encourage the present inhabitants to remain there.

3.6 With regard to Gedaref, the provincial authorities are already concerned about existing refugees in the neighbourhood of the town. The authorities are very reluctant to see an increase in the existing urban refugee colony. Any settlement at Gedaref would have to be wholly urban as there is no reserve of unused cultivable land.

3.7 The site at Showak does not have the capacity to absorb a large increase in numbers. The existing settlement is in a hollow in the Kerrib land and any new settlement would spill over onto the clay plain. The movement of several thousand Eritrean refugees into the area adjacent to the town would be very unpopular with the local people. They would not readily accept the pressure on the agricultural resources of the area - land and pasture.

3.8 We conclude that Jebel Maharigat is the site which offers the most advantages. It is presently uninhabited. A settlement there would be accessible to both agricultural and non-agricultural employment. Topographically it is suitable because it is an elevated, well drained site above the level of the clay plain and thus acceptable to the Eritreans. No serious objections have been raised by the local population. In fact, this site has been suggested by them. Stone and building materials are available at the site. The major disadvantage of the site is the cost of piping water from the Atbara reservoir, or the Gedaref/Showak water main, but we consider this to be outweighed by the other advantages.

3.9 We recommend that a pre-investment survey for a major settlement at Jebel Maharigat should continue. The purpose of the settlement would be to serve as a centre for Eritrean Refugees in Kassala Province until such time as they can return to their homeland. The major source of income would be from seasonal employment outside the settlement and every effort would be made to facilitate the employment of refugees on construction projects, agricultural production schemes and in services in neighbouring towns. Opportunities should be provided for subsistence production on clay soils about 5 kilometers to the west of the settlement area. This would be in the Presidential Decree Area and would involve disturbing a small number of existing producers. Qala en Nahl offers more scope for those wishing to engage in commercial agriculture and farmers wishing to cultivate large areas should be encouraged to go there.

3.10 It should be made clear to the refugee settlers at the outset, that the site and services, plus any food relief in the initial years, represent Government's contribution to their welfare. They in turn will be expected to take advantage of the employment opportunities in the Province.

3.11 UNHCR are concerned about two aspects of the proposed settlement; namely the attraction it might hold for long established settlers at Qala

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en Nahl and secondly its capacity for expansion, should the number of refugees from Eritrea increase. With respect to the first point, it can be said that in order to prevent widespread desertion of the Qala en Nahl project, much can be done to improve the apparent cause of discontent - namely the agricultural aspects. This in turn might result in 1975 refugees opting for settlement there. With regard to the expansion of the settlement at Jebel Maharigat, a lot will depend on water supply available and the costs involved. Conclusions on this topic have yet to be reached. It is likely that the supply can be planned for a population of 20,000 but there are doubts about a greater capacity. Further the physical planners advise that although the site could accommodate 30,000 by the inclusion of several unsurveyed Jebel areas, the design for a town of that size would be based on different premises and present considerably different problems regarding sewage, services and so on. We recommend that the first phase should be planned with a population of 15,000 in mind, but that the water supply should, if possible, be designed for 20,000. Any extension of the site to accommodate more refugees should be the subject of investigation, if and when the situation arises. In the economic analyses, the economic implications of alternatives will be considered.

QALA EN NAHL

4.1 The survey has concentrated on answering three questions:

- How many people are living in the settlement now and how many can be expected to return during the cultivating season?
- What are the subsistence needs of the population and what action is needed to produce these requirements in the coming cultivating season, commencing 1 July, this year?
- How many more refugee settlers can the project area absorb?

4.2 A preliminary survey of the settlement has revealed that the population is principally made up of women, widows, old and handicapped people. The able-bodied members of the community were absent and employed in Gedaref, New Halfa and in other agricultural schemes. They were expected to return at the beginning of the cultivating season to prepare their land for sowing.

4.3 According to records at the project office at Um Saqata, the population of refugees is 18,278. The present population is about 7,500 (mid-April).

Table 3 Population at Qala en Nahl Refugee Settlement

Village	Official Population	Present Population
Um Burush	2,832	1,600
Deheima	1,213	400
Adingerar	2,513	650
Salmin	4,091	2,000
Zarzur	4,000	850
Um Saqata	3,629	2,000
Total	18,278	7,500

4.4 At present, there is no way of accurately determining the number of refugees that will return to the settlement to cultivate during the rains. It is proposed that a census is conducted during August in order to determine the occupance of the scheme during the cultivating season. In the meantime, and in the absence of other information, it is prudent to assume that the population of the six villages will approach 20,000.

4.5 It is recommended that the objective of the agricultural scheme should be to ensure that the refugee population can obtain their minimum subsistence requirements by making agricultural machinery and seed available for the sowing of at least one feddan per head of population - i.e. 20,000 feddans. Settlers who wish to cultivate larger areas should not be discouraged from doing so, but there is no good reason for subsidising the production of surpluses. Settlers have hired tractors before and they will no doubt find it worth their while to do so in future. If the management succeeds in cultivating one feddan per head (which should yield a minimum of two sacks of sorghum), then it will achieve a substantial improvement in 1975 production (see Table 4). Settlers can be expected to obtain the bulk of their income from dry season employment outside the scheme.

4.6 The target of 20,000 feddans is dependent on the rainy season population reaching 20,000 people. If it is only 15,000 by August 1st, then only 15,000 feddans should be cultivated.

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Table 4 Cultivated Area 1971-1975

1971	13,353	feddans
1972	28,723	"
1973	39,395	"
1974	22,395	"
1975	6,775	"

Source: Project Records, Um Saqata Office

4.7 If 20,000 feddans are to be cultivated this season, the following must be completed before the 1st July:

(a) Overhaul of 12 Massey Ferguson tractors
(b) Procurement of fast moving spares
(c) Procurement of diesel oil and lubricants
(d) Recruitment of competent staff (drivers and mechanics)
(e) Negotiate a contract for the hire of 4 additional tractors
(f) Make available 2 4-wheel-drive vehicles

4.8 In the short time available, this is likely to be a formidable task, in view of the diffuse management structure under which the scheme presently operates with responsibility being effectively shared between two parties; the Commissioner for Refugees and the Ministry of People's Local Government. Both these have executive powers but few technical and financial resources to carry out the task in hand. The party which is most likely to be affected by the success or failure of the scheme - namely the people themselves, appear to be unable to help themselves.

4.9 Any long term solution of the problem requires the existence of clear lines of authority, an adequate budget and the maximum involvement of the refugees in the planning and implementation of the actions required to improve their productivity and satisfy their needs.

4.10 It would appear that at least 4 tractors will have to be hired this coming season to augment the 12 Massey Ferguson tractors which are to be overhauled. The estimated unit and total costs of mechanised pre-sowing cultivation of 20,000 feddans are in Table 5.

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provided with food by their employers. In view of the crop failure in 1975, grain stores are empty and food assistance should be provided, since a settler with no savings will find it impossible to work on his own account.

Table 5 Budget for Cultivation of 20,000 feddans - 6 month season

	Item	Unit	Unit Cost L.S.	No. of Units	Cost L.S.
1.	Overhaul of 12 MF tractors, fast moving spares	set		1	10,500
2.	Fuel & Lubrication	Tractor/ hour	1.25	7000	8,750
3.	Tractor Hire	Hour	5.0	1800	9,000
4.	Tractor Drivers (24)	man/ month	50.0	72	3,600
5.	Assistant Drivers (12)	"	20.0	36	720
6.	Mechanic (1)	"	50.0	6	300
7.	Assistant Mechanic (1)	"	20.0	6	120
8.	4-wheel drive vehicles (2)	km	0.10	20,000	2,000
9.	Drivers (2)	man/ month	40.0	12	480
10.	Assistant Drivers (2)	"	20.0	12	240
11.	Farm Manager (1)	"	83.3	6	500
12.	Clerical Assistant (1)	"	41.6	6	250
Total					LS 36,460

4.12 In distributing food relief it is difficult to distinguish between the deserving and less deserving cases. It is recommended that each village is given a quota based on its population and that distribution is made the responsibility of the sheikhs. If possible they should be instructed to distribute the food on a "food for work" basis. Alternatively they might be asked to recover the quantity of grain distributed at harvest time. The

Table 5 Budget for Cultivation of 20,000 feddans – 6 month season

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5. Assistant Drivers (12)	"	20.0	36	720
6. Mechanic (1)	"	50.0	6	300
7. Assistant Mechanic (1)	"	20.0	6	120
8. 4-wheel drive vehicles (2)	km	0.10	20,000	2,000
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standard ration of 500 gm dura, 30 gm dried milk and 30 gm soya, plus an oil ration would appear satisfactory.

4.13 Until population data is available on the 1976 rainy season population of the settlement, the capacity of Qala en Nahl to absorb additional settlers must remain in doubt. The limiting factor appears to be the dry season water supply. The contour plan of the scheme (June 1970, Sudan Survey Department) shows an area of approximately 74,000 feddans, of which at least 50,000 should be cultivable.

APPENDIX C

ALTERNATIVE FORMS OF AGRICULTURAL PRODUCTION

1. Introduction

The objective of the brief study described in this appendix is to examine alternative systems of agricultural production, in order to assess their suitability for use in the refugee settlements and their implications in terms of family income. Their suitability has been evaluated on the basis of profitability, acceptability to the refugee farmers and certain other factors. Alternative forms of farm organisation are discussed in Chapter 4 of the Main Report.

Qala en Nahl and the Jebel Maharigat/Showak area are the two sites being considered for resettlement of the refugees who are the subject of this study. Additional refugees could be accommodated at the existing settlement some 40 km south of the town of Qala en Nahl. Here land is readily available and, despite operational problems in the past two years, rainfed farming is well established in the scheme. In the Showak area land is available in the immediate vicinity of Jebel Maharigat and in the Presidential Decree Area to the north and west of the jebel. Thus the alternative forms of agricultural production and management have been analysed in terms of conditions at the Qala en Nahl settlement area and Jebel Maharigat.

The two main types of farming which could be adopted at these sites are:-

(a) mechanised crop production, the predominant type of farming in this part of Kassala Province;

(b) manual crop production (the "bildat" system), the land being cultivated by hand instead of by tractor. Oxen ploughing has not so far proved to be feasible on the heavy clay soils of the area and is rarely used on these soils in Kassala Province.

For reasons given in Section 3, livestock enterprises have not been considered as a major production activity.

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2. Physical conditions for agricultural production

(a) Rainfall

Average rainfall at the two sites is approximately as follows:-

	Qala en Nahl Site	Jebel Maharigat
Average rainfall	600 mm	450-500 mm
Main rainy season	June - September	July - September

Although rainfall does fluctuate from year to year, it is normally sufficient for crop production. On the other hand, yields do vary considerably as a result of partial drought at crucial periods of the growing season and waterlogging and flooding caused by unusually heavy rainfall. Yields are higher at Qala en Nahl than in the Jebel Maharigat area, because of the higher rainfall. Dura yields at the former average over 500 kg (5 sacks) per feddan whereas at the latter they are usually in the range from 300 to 400 kg per feddan.

In terms of crop suitability, conditions at Qala en Nahl are adequate for both of the region's major crops, dura and sesame. At Jebel Maharigat, however, the rains start too late in the season for the production of sesame, in which case cropping would be based entirely on dura.

(b) Soils

As described in the Main Report, the soils of the Qala en Nahl and Jebel Maharigat areas both form part of the clay plains of East Central Sudan. They are heavy cracking clays of reasonable fertility, but are difficult to cultivate by non-mechanical means. They are remarkably uniform throughout the area, which obviates the need for detailed soil surveys to allocate holdings. Although fairly productive, their relatively low nitrogen content means that continuous cultivation for more than 4-5 years exhausts the soil and a fallow period of several years is usually necessary if yields are to be maintained; this fallow break is also needed to control weed infestation by Striga and other species.

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(a) Rainfall

Average rainfall at the two sites is approximately as follows:-

	Gala en Nahl Site	Jebel Mabrakat
Average rainfall	600 mm	450-500 mm
Main rainy season	June - September	July - September

Although rainfall does fluctuate from year to year, it is normally sufficient for crop production. On the other hand, yields do vary considerably as a result of partial drought at critical periods of the growing season and waterlogging and flooding caused by unusually heavy rainfall. Yields are higher at Gala en Nahl than in the Jebel Mabrakat area, because of the higher rainfall. Pure yields at the former average over 500 kg (5 sacks) per feddan whereas at the latter they are usually in the range from 300 to 400 kg. per feddan.

In terms of crop suitability, conditions at Gala en Nahl are adequate for both of the region's major crops, dura and sesame. At Jebel Mabrakat, however, the rains start too late in the season for the production of sesame, in which case cropping would be based entirely on dura.

(b) Soils

As described in the Main Report, the soils of the Gala en Nahl and Jebel Mabrakat areas both form part of the clay plains of East Central Sudan. They are heavy cracking clays of reasonable fertility, but are difficult to cultivate by non-mechanical means. They are remarkably uniform throughout the area, which obviates the need for detailed soil surveys to allocate holdings. Although fairly productive, their relatively low nitrogen content means that continuous cultivation for more than 4-5 years exhausts the soil and a fallow period of several years is usually necessary if yields are to be maintained; this fallow break is also needed to control weed infestation by Striga and other species.

In most areas the clay plains are almost completely flat and as such are well suited to mechanisation. The land around Jebel Maharigat, within 5 km of the jebels themselves, is, however, somewhat undulating and is less suitable for tractor cultivation. None of this land is cropped at present, even though the area immediately to the east is heavily cultivated.

(c) Other factors

In both the Qala en Nahl and Jebel Maharigat areas there is abundant grazing for livestock during and directly after the rainy season, while as the dry season progresses the volume and quality of natural feed becomes seriously reduced. In the higher rainfall conditions of Qala en Nahl, biting flies cause severe discomfort to cattle and other stock in the wet season and are one of the reasons for the migration of the nomadic herds northwards out of the area during this season.

3. Crops and livestock

(a) Crops

Dura and sesame are the only major rainfed crops grown in the region. A little short-staple cotton is produced, but this has not proved to be a viable crop for most farmers. Dura is the staple foodgrain and is grown for both subsistence and sale, whereas sesame is almost entirely a cash crop.

Despite continued research at Abu Na'ama, Jebel Tozi and elsewhere in the Central Rainlands, no other crops suitable for commercial rainfed production in the region have yet been identified. Amongst the various possibilities, sunflower, safflower and cowpeas have some promise, but at the present state of knowledge none of these can yet be recommended for production on a farm scale.

(b) Livestock

Although small farmers in the region keep small stock and a few cattle, there is no sedentary livestock production of significance. Both the large mechanised farms and the small bildat or mechanised units are based on crop production rather than mixed farming.

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This is a reflection of the lack of grazing in the latter part of the dry season and the biting flies and other problems in the rains. Some farmers keep stock on a limited scale, their feed intake being obtained from grazing and dura residues, but there are no well-established mixed farming systems in the area.

There is little justification for adding to the difficulties of refugee settlement by attempting to introduce to them new and untried farming systems. At a later stage mixed farming might be developed, when its technical and economic feasibility has been adequately tested, but at this stage its introduction to the Qala en Nahl or Jebel Maharigat settlements would not be appropriate. Moreover, most of the farming refugees do not possess sufficient animals for them to start mixed farming. Purchase of stock for issue to them would be expensive and also probably politically unacceptable, since the Sudanese in the area do not receive such benefits from Government.

There are some 2,000 pastoralists amongst the Wad el Hileiwu refugees who will be resettled. Most of these were formerly nomadic or semi-nomadic in their areas of origin and as such can be expected to resume this way of life if at all possible. They are unlikely to develop sedentary livestock production at either Qala en Nahl or Jebel Maharigat, because of their background and the fact that the physical conditions favour nomadic rather than sedentary systems.

4. Farming systems

(a) Methods of cultivation

Under mechanised farming, cultivation is normally carried out by wide-level disc-drills pulled by 65-75 HP tractors. After the first rains have fallen and substantial weed germination has occurred, the land is cultivated by disc to prepare it for planting and destroy the weed growth. In the higher rainfall areas a second cultivation is often carried out, to provide further weed control, and at the same time the seed is drilled. Sesame is planted in late June or in the first half of July and dura in July and early August.

Although it is in the higher rainfall area, at Qala en Nahl only one rather than two cultivations is normally undertaken. It is

unlikely, however, that in many years a single operation would be sufficient to achieve the average yields projected for the scheme. In some years, when weed growth is not particularly strong, one cultivation would be adequate but in other wetter years two would be necessary. For planning purposes an average of 1.5 cultivations per crop (i.e. one discing-cum-planting operation in half the years and in the other a separate discing cultivation and then discing-cum-planting) has been assumed for Qala en Nahl.

In the lower rainfall zone, of which the Jebel Maharigat area is typical, weed growth is less and the crop can usually be established with a single cultivation. On the other hand, the later onset of rains means that planting dates are more critical, and sowing needs to be completed in as short a time as possible.

The crop is hand weeded once or twice, normally within the first 4 - 6 weeks after planting. On average this does not take more than 2 - 2½ mandays per weeding per feddan. No fertilizers or farm chemicals are applied. Both research and farmers' experience in the region have shown that their use is not economically justified. Sesame is harvested in October, before dura. Cutting and threshing, both of which are done by hand, have to be completed fairly rapidly, because of the danger of shattering and the consequent loss of yield. Dura does not suffer from this problem and its harvest and threshing can therefore be extended over the period from October to December/ January, as necessary.

Under the bildat (hand cultivated) system the sequence and type of operations are the same, the only major difference being that the land is prepared by hand instead of cultivated by tractor. Because of the heavy texture of the soil and its behaviour under differing moisture conditions, hand cultivation is an extremely arduous task and the total crop area on a bildat farm is typically only about five feddans. Apart from restricting the cropped area, the length of time required to prepare land for planting means that part of the crop is often sown late, with a resultant reduction in yield. Information collected from farmers in the Nuba Mountains Smallholders' Mechanisation Scheme, in Kordofan (Report on the Nuba Mountains

Smallholders' Mechanisation Scheme, UK Ministry of Overseas Development, June 1975), indicated that yields under mechanisation could be expected to be some 20 per cent higher than under the bildat system, because of earlier planting and more effective pre-planting weed control.

(b) Yields

Accurate yield data are not readily available, especially as regards the differences in crop productivity between mechanised and bildat farms and between large estate-type operations and family holdings. Table C.1 shows yield data from various relevant sources. These are all for mechanised farming.

Table C.1 Crop Yield Data

Source	Crop	Kg/feddan
1. IBRD Second Mechanised Farming Project Appraisal Report 1972 (Umm Seinat area). Average yields obtained in 1969/70 and 1970/71	Dura	440
	Sesame	165
2. National Council for Research, 1975. Average yield in the Gedaref region, 1954/55, 1974/75	Dura	398
3. Leeds University Central Rainlands Study, 1975.		
Agadi State Farm, 1971/72-1974/75	Dura	318
	Sesame	150
Large private farms, 1973/74-1974/75	Dura	336
	Sesame	71
4. Qala en Nahl Refugee Settlement estimates for 1971-1973.	Dura	600-800
	Sesame	158-237

Note: 100 kg of dura = 1 sack
45 kg of sesame = 1 kantar
79 kg of sesame = 1 sack

(b) Yields

Absolute yield data are not readily available, especially as regards the differences in crop productivity between mechanized and hilldat farms and between large estate-type operations and family holdings. Table 6.1 shows yield data from various relevant sources. These are all for mechanized farming.

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	Seeame	71
4. Data on Hail Refugee Settlement estimates for 1971-1975.	Dura	600-800
	Seeame	158-237

Note: 100 kg of dura = 1 sack
45 kg of seeame = 1 kantar
75 kg of seeame = 1 sack

The Umm Seinat area is almost adjacent to the Qala en Nahl settlement and conditions are very similar. The Leeds University survey covered the Damazin area, west of the Blue Nile, where annual rainfall is appreciably higher than at Qala en Nahl and averages some 800 mm. The estimates for sesame and dura yields at Qala en Nahl appear to be unrealistically high and may be those achieved in good years rather than a general average.

In view of the wide range of yields shown and the lack of accurate records for Qala en Nahl, only an approximate estimate can be made at this stage. On the basis of the figures given in Table A.1 and other information from the region, the levels of yield assumed for planning purposes are as follows:-

	Dura kg/feddan	Sesamo kg/feddan
Qala en Nahl	500	150
Jebel Maharigat	350	-

Yields would probably be somewhat higher under a system of individual land holdings (i.e. the present Qala en Nahl system) than on large centrally-managed units. On farms of, for instance, only 10 feddans there is usually more intensive day-to-day management than on a large unit of, say, 1,000 or 1,500 feddans. In the absence, however, of any clear indication of the degree of yield difference, no distinction has been made.

For bildat cultivation yields have been taken as 20 per cent below those from mechanised farming, because of the effects of later planting dates and less effective pre-planting weed control.

(o) Cropping patterns

Where dura monoculture is practised, long-term yields can be maintained only if the land is fallowed for at least 4 - 5 years out of 10. This means that the maximum cropping intensity is only 50 - 60 per cent. If sesame is rotated with dura, weed infestation is better controlled and a more favourable nutrient balance is maintained. As a result a smaller proportion of fallow is necessary.

Estimates of the exact proportion of dura, sesame and fallow

desirable for such a rotation vary. On the basis of the Leeds University survey results and crop area data for the Gedaref region, the overall ratio of sesame to dura is at present usually between 1 to 4 or 5; i.e. 4 - 5 feddans of dura to one of sesame. With its high price, sesame can give attractive returns, but for the large farm typical of this region its main disadvantage is its higher peak requirement of hired labour for harvesting and the risk of losses if sufficient labour is not available during the critical harvesting period, which is at most 2 - 4 weeks. At this time it is far more vulnerable to labour shortages than is the case with dura. A typical cropping pattern in the region might therefore contain only 15 per cent sesame, with 60 per cent under dura and the remaining 25 per cent fallow.

On the Qala en Nahl settlement the holdings average only 10 feddans and most farmers have more than sufficient family labour to meet the labour requirements of crop production. This may well be the reason for the apparently high proportion of sesame in the settlers' crop areas. In the three years of effective agricultural operation the cropping has been as follows:-

Year	Total crop area (feddans)	Dura (%)	Sesame (%)
1971	13 353	73	27
1972	28 723	46	54
1973	39 410	44	56

Crop rotations considered in the assessment of farm budgets are shown in Table C.2. They refer to both tractor and bildat cultivation.

Table C.2 Crop rotations considered for farm budgets (% of cultivable area)

Site	Dura	Sesame	Fallow
Qala en Nahl			
1. "Existing" pattern	40	40	20
2. "Regional" pattern	60	15	25
Jebel Maharigat	50	-	50

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Table 0.2. Crop rotations considered for farm budgets (% of cultivable area)

Site	Dura	Sesame	Fallow
Qala en Nahl			
1. "Mixed" pattern	40	40	20
2. "Regional" pattern	60	15	25
Jebel Mahareb	50	-	50

(d) Labour requirements

Whatever system of agricultural production and management is adopted in the settlement, it is reasonable to assume that the labour required would be provided by the refugees themselves. Calculation of crop labour costs is therefore unnecessary, since hiring of casual workers would not take place on a significant scale. On the other hand, the seasonality of requirements in relation to labour supply could be important in terms of the size of holding and the areas of crop that a farming family can work.

As regards bildat cultivation, the work input required to prepare the land for planting is normally so large that a typical family cannot cultivate more than about five feddans of crop. With mechanisation, the land preparation constraint is removed and a larger crop acreage can be grown. Where there is a substantial proportion of sesame the harvesting and threshing requirements of this crop probably sets the cropped area limit, while where only dura is produced weeding is likely to be the peak demand.

Approximate labour requirements assumed for dura and sesame production under tractor cultivation are shown below. Bildat would be the same except for its heavy input for land preparation.

Mandays/feddan	Dura	Sesame
1. Qala en Nahl		
2 weedings	4 - 5	4 - 5
Harvesting, threshing and sack handling	9	7
	13 - 14	11 - 12
2. Jebel Maharigat		
1 - 2 weedings	2½ - 5	-
Harvesting, threshing and sack handling	7	-
	9½ - 12	

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Approximate labour requirements assumed for dura and sesame production under tractor cultivation are shown below. Bildat would be the same except for its heavy input for land preparation.

Months/feddan	Dura	Sesame
1. Gala on Nafi		
2 weedings	4 - 5	4 - 5
Harvesting, threshing and sack handling	9	7
	13 - 14	11 - 12
2. Jebel Mobarkat		
1 - 2 weedings	2½ - 5	-
Harvesting, threshing and sack handling	7	-
	9½ - 12	

Small inputs of labour would be required outside the growing season, for such tasks as bush control, but these would be unimportant from the viewpoint of the seasonal labour balance. Apart from the driver and his assistant, the labour requirements per feddan for tractor operations would be negligible.

To give full benefit, weeding must be done within a month of planting, in which case the weeding requirements on a holding are likely to occur during a period of not much more than 1½ months. Allowing for a limited amount of time off, a farming family with one full-time adult worker, the farmer himself, could probably handle up to 8 - 10 feddans of crop, assuming an average of 4 - 5 mandays per feddan for weeding. Where only dura is grown, a holding with up to 8 - 10 feddans could therefore be worked by a refugee settler without hired labour.

If sesame as well as dura is being produced, the crop area that can be worked by a family unit would be slightly reduced, due to the peak input needed for sesame harvesting. Even with some staggering of planting dates, sesame cutting and threshing would probably have to be completed within a month. In this case a farmer could cope with at most four feddans. Under the present cropping pattern at Qala en Nahl, this would mean a total crop area of eight feddans (4 feddans of dura and 4 feddans of sesame).

Allowing for the fallow break, the holding sizes that a typicall farming family could manage without hired labour would be as follows for the cropping patterns shown in Table C.2. The figures have been rounded to some extent.

1. Qala en Nahl	Holding size (feddans)
"Existing" cropping pattern	10
"Regional" cropping pattern	12
2. Jebel Maharigat	15

(e) Crop prices

On the refugee settlements most of the dura produced would be consumed by the farmers and other local residents and only that

quantity surplus to subsistence requirements would be sold outside. Since most of the dura output would be consumed on the scheme, the dura should be valued in terms of what it would cost to buy if it were not produced on the scheme. Imputed prices would thus be higher than normal farm-gate prices, which are based on the produce being transported from the farm to an outside market and sold there, the costs of transport and marketing being deducted from the market price to arrive at the farm-gate value.

If the Qala en Nahl and Jebel Maharigat settlements did not produce their own grain it would be bought from local markets or mechanised farms in the vicinity and transported to the site. As a reasonable approximation, dura output on the schemes could thus be valued on the basis of prices received by producers at regional markets. These contain a similar element of transport and other marketing costs to get the produce from the farm to the market as in the case of grain bought in for the scheme and being moved from the supplying farm or local market to the scheme.

Sesame would be sold in local or regional markets and most would eventually be exported through Port Sudan. In contrast to dura, it should therefore be valued in terms of typical farm-gate prices in the area.

Price data have been obtained from Gedaref market, the main regional market. Table C.3 gives recorded prices at Gedaref since 1969.

Table C.3 Gedaref market prices since 1969 (LS/ton)

Year	Dura	Sesame
1969/70	15.9	47.3
1970/71	13.3	45.8
1971/72	9.7	48.7
1972/73	9.2	55.9
1973/74	24.2	78.3
1974/75	24.9	106.8
1975/76 (approximate)	36.0	100.0

Note: One ton = 22 kantars.

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Table 0.3 Gedaref market prices since 1969 (£S/ton)

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1970/71	13.3	45.8
1971/72	9.7	48.7
1972/73	9.2	55.9
1973/74	24.2	78.3
1974/75	24.9	106.8
1975/76 (approximate)	36.0	100.0

Note: One ton = 22 kantars.

In the past 2 - 3 years world commodity prices have been at unusually high levels. Since dura and sesame from Kassala Province are exported on a large scale, this sudden price rise shows up clearly in the data for 1973/74 to the present. Detailed projections made by the World Bank and other agencies indicate that in the future prices should fall somewhat towards their previous long-term trend. This is already happening with sugar, cotton, and various grains and oilseeds. Price projections cannot be made with any degree of certainty, but as an approximate estimate the future average prices at Gedaref market have been assumed to be significantly below recent levels, the values taken being LS 20 for dura and LS 70 for sesame. In terms of crop values at the refugee settlements, dura and sesame prices would then be as follows:-

	Assumed Prices at the Settlements
Dura	LS 20.00/ton
Sesame (Qala en Nahl)	LS 60.00/ton

(f) Tractor Cultivation Costs

Tractor cultivation would be the major crop production cost on the refugee settlements; it would not, of course, be incurred under the bildat system.

On properly cleared land, a 65 - 75 HP tractor with disc-drill can achieve a cultivation rate of five feddans per hour. As an overall average, however, it would be wise to assume a lower working rate of 3 - 4 feddans per hour. This allows for some land not being completely cleared of roots and other obstacles, tractors becoming bogged down on wet soils and other problems. Taking account of dead time (e.g. movement between work areas) and of transport of crop produce from the fields, an average output of $2\frac{1}{2}$ feddans of land per cultivation has been assumed.

Tractor utilisation in this type of farming is very low. Apart from the actual cultivation, tractors will be required for several haulage purposes, but the number of hours per tractor per year is unlikely to exceed 500 - 600. Basically, this is a rather uneconomic use of an expensive tractor, but is a reflection of the

highly seasonal nature of the production system.

Calculation of tractor cultivation costs on the refugee settlements has been based on the following assumptions:-

(i) Capital costs of the tractor unit delivered to site would be LS 6 000, of which LS 3 750 would be for the tractor (an MF-185, the most common type in the region) and LS 2 250 would be for the disc-drill (the estimate is based on the cost of an MF implement which is also in common use). These figures do not include Customs duties and taxes, because these are not levied on purchases made by the Office of the Commissioner for Refugees or UNHCR.

In addition to the tractor - disc drill units, one four-wheel trailer would be needed for every four tractors, for the transport of fuel, crop output, other supplies and labour. These would cost LS 750 each. A water tanker would also be required for every eight tractors, its capital cost being LS 850.

(ii) As is customary in the region, temporary drivers and assistants would be hired for most of the tractor units. As far as possible they would be recruited from suitable members of the refugee community, for an average period of three months at a total cost of LS 60 per month per driver and assistant. During the cultivation season two shifts are usually worked, which means that two driver-assistant teams would be required. For general duties in the dry season there would be one permanent driver and assistant for every fourth tractor, at LS 60 per month. The driver and assistant normally undertake routine field maintenance and repairs as well as cultivation operations.

Under these assumptions the annual direct labour costs for tractor operations would be as follows:

	LS/annum
3 tractor units: 2 driver/assistant teams per unit for 3 months, @ LS 60/month/team	1 080
1 tractor unit: 1 permanent driver/assistant team @ LS 50/month*	600
1 temporary team for 3 months @ LS 60/month	180
Total for 4 units	1 860
Cost per unit	465

* Drivers employed the whole year round rather than only for the cropping season usually receive a lower average wage per month for the year as a whole.

(iii) With an average of 500 hours worked per annum, the tractors and disc drills would have an average working life of 10 years (i.e. 5 000 hours). At the end of this period they would be sold for an average value of 10 per cent of the original purchase price, that is LS 600. The length of working life for trailers and water tankers would be five years, their residual value being 10 per cent of the purchase price.

Depreciation costs per tractor unit would be as follows:-

	LS/annum
Tractor - disc drill units (LS 6 000 - 600, ÷ 10 years)	540
One trailer per 4 units (LS 750 - 75, ÷ 5 years)	34
One tanker per 8 units (LS 850 - 85 ÷ 5 years)	20
Total	594

(iv) Repairs and maintenance: Annual expenditure on repairs and maintenance, including the purchase of spares, would be equivalent to 7.5 per cent of the capital cost of the tractors and associated equipment. Costs would thus be as follows:-

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One tanker per 8 units (£s 850 - 85 ÷ 5 years)	20
Total	594

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Repairs and maintenance	LS/annum
Tractor - disc drill units: 7.5% of LS 6 000	450
Trailers: 7.5% of LS 750 ÷ 4	14
Water tankers: 7.5% of LS 850 ÷ 8	8
Cost per tractor unit	472

(v) Fuel and lubricants: Average diesel fuel consumption is about two gallons per hour, which at a price of LS 0.35 per gallon gives an hourly cost of LS 0.70. A further 10 per cent, or LS 0.07, should be allowed for oil and lubricants. The diesel price assumes bulk buying. Under the system of buying in 4-gallon tins, which is used at Qala en Nahl, the cost can be as high as LS 0.55 per gallon.

On the basis of these assumptions, Table C.4 shows the estimated cost of cultivation per tractor unit on the refugee settlement. The primary objective is to indicate the actual costs incurred by the settlement organisation, and therefore the level of charges which would have to be made to recover these from the farmers. For this reason interest charges on the capital value of machinery and equipment have not been included, because their purchase would be financed by a grant or an interest-free loan from UNHCR or other agencies. On the other hand, depreciation is included, to enable provision to be made for replacement of equipment and thus permit the tractor operations to be financially self-supporting.

Table C.4 Estimated tractor cultivation costs (LS per unit)

Item	LS/annum	LS/hour
Fuel and lubricants	385	0.77
Repairs and maintenance	472	0.94
Drivers and assistants	465	0.93
Depreciation	594	1.19
Miscellaneous items (overheads, insurance, tools, etc.) and contingencies (10%)	195	0.39
	2 111	4.22
Cost per crop feddan per cultivation ($2\frac{1}{2}$ feddans/hour)		1.69

Repairs and maintenance

Tractor - disc drill units: 7.5% of LS 6 000 450

Trailers: 7.5% of LS 750 ÷ 4 14

Water tankers: 7.5% of LS 850 ÷ 8 8

Cost per tractor unit 472

(v) Fuel and lubricants: Average diesel fuel consumption is about two gallons per hour, which at a price of LS 0.35 per gallon gives an hourly cost of LS 0.70. A further 10 per cent, or LS 0.07, should be allowed for oil and lubricants. The diesel price assumes bulk buying. Under the system of buying in 4-gallon tins, which is used at Gala on Nauk, the cost can be as high as LS 0.55 per gallon.

On the basis of these assumptions, Table C.4 shows the estimated cost of cultivation per tractor unit on the refugee settlement. The primary objective is to indicate the actual costs incurred by the settlement organization, and therefore the level of charges which would have to be made to recover those from the farmers. For this reason interest charges on the capital value of machinery and equipment have not been included, because their purchase would be financed by a grant or an interest-free loan from UNHCR or other agencies. On the other hand, depreciation is included, to enable provision to be made for replacement of equipment and thus permit the tractor operations to be financially self-supporting.

Table C.4 Estimated tractor cultivation costs (LS per unit)

Item	LS/annum	LS/hour
Fuel and lubricants	765	0.77
Repairs and maintenance	472	0.94
Drivers and assistants	465	0.95
Depreciation	594	1.19
Miscellaneous items (overheads, insurance, tools, etc.) and contingencies (10%)	195	0.39
	2 111	4.22
Cost per crop feddan per cultivation ($2\frac{1}{2}$ feddans/hour)		1.69

Recurrent expenditure per tractor unit would be about LS 1 500 per annum and depreciation would be some LS 600. The hourly operating cost of LS 4.22 is significantly less than the average private hire charge in the region, which is LS 6 - 6.50 per hour for a tractor and disc-drill. This lower figure is, however, partly because no interest is charged on the capital value of the tractor and equipment, and depreciation is lower due to the absence of customs duties and taxes in the capital costs. Addition of these items would raise the cost to some LS 5.50.

(g) Crop Production Costs

Apart from tractor cultivation, the only other significant crop production costs for refugee farmers would be seed and sacks. Most of the dura would be locally consumed and sacks would normally be re-used. Since sesame would go for export it would be transported out of the area in sacks which would not be returned to the farmers.

Seed: Seed requirements per feddan would be low. Seed rates and costs are estimated to be as follows:-

	Seed rate (kg/feddan)	Cost/feddan
Dura	4	LS 0.08
Sesame	3	LS 0.17

Sacks: These are assumed to cost LS 0.30 each, the cost per feddan of sesame thus being about LS 0.60 (one sack holds 79 kg of sesame). On average, sacks for dura could be re-used 4 - 5 times, so the annual cost per 100 kg of dura produced (one sack holds 100 kg of dura) would be about LS 0.07. At Qala en Nahl and Jebel Maharigat the cost of sacks per feddan of dura would be LS 0.35 and LS 0.25 respectively.

Table C.5 presents estimated crop budgets for the Qala en Nahl and Jebel Maharigat areas for the two systems of production, tractor cultivation and bildat cultivation.

Table C.5 Crop Budgets for Qala en Nahl and Jebel Maharigat (LS/feddan)

	Mechanised			Bildat		
	Qala en Nahl		Jebel Maharigat	Qala en Nahl		Jebel Maharigat
	Sesame	Dura	Dura	Sesame	Dura	Dura
1. Gross output						
Yield (kg/feddan)	150	500	350	120	400	280
Gross output (LS)	9.00	10.00	7.00	7.20	8.00	5.60
2. Costs of production						
Seed	0.17	0.08	0.08	0.17	0.08	0.08
Sacks	0.60	0.35	0.25	0.48	0.28	0.20
Tractor cultivation:						
No. of cultivations	1½	1½	1	-	-	-
Cultivation cost	2.54	2.54	1.69	-	-	-
Total	3.31	2.97	2.02	0.65	0.36	0.28
3. Net returns:	5.69	7.03	4.98	6.55	7.64	5.32

Under tractor cultivation, net returns per feddan would be LS 5 for dura production at Jebel Maharigat, LS 7 for dura production at Qala en Nahl and about LS 5.70 for sesame at Qala en Nahl. The income per crop feddan under bildat cultivation would be between LS 0.34 and LS 0.86 higher, the smaller gross output being more than offset by the fact that no tractor costs are incurred.

These returns are based on the assumption that the refugee farmers and their families would provide all the labour required on the holding. Since the objective is to indicate farmers' incomes rather than the returns to the national economy, no account has been taken of the opportunity cost of labour in the region or the country as a whole.

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5. Returns from farming systems

Table C.6 shows the estimated incomes of refugee farmers from the various holding sizes and cropping patterns outlined in Section 4.

Table C.6 Estimated Refugee Incomes from Farming

		Qala en Nahl - "Existing" cropping pattern	Qala en Nahl - "Regional" cropping pattern	Jebel Maharigat
1. Mechanised				
Holding size (feddans)		10	12.0	16
Dura (feddans)		4	7.2	8
Sesame (feddans)		4	1.8	-
Fallow (feddans)		2	3.0	8
Net return/feddan	LS	5.1	5.0	2.5
Total net return	LS	50.6	60.6	39.7
2. Bildat cultivation				
Holding zize (feddans)		6.25	6.7	10
Dura (feddans)		2.5	4.0	5
Sesame (feddans)		2.5	1.0	-
Fallow (feddans)		1.0	1.7	5
Net return/feddan	LS	5.7	5.5	2.7
Total net return	LS	35.5	37.1	26.6

Total net income to a refugee from farming a family holding at Qala en Nahl would be about LS 50 - 60 with mechanisation and LS 35 - 37 under bildat cultivation. At Jebel Maharigat incomes would be lower, the comparable figures being LS 40 and LS 27. These figures assume that the full cost of tractor operations would be met by the farmers. In all cases the farmer would produce sufficient dura to meet his family's subsistence grain requirements. Otherwise, however, his farm income

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would be insufficient to provide him with what would be considered an acceptable standard of living in the region. Most refugee farmers would receive some supplementary income from their goats and sheep, vegetable growing in the rains and other small-scale activities, but this would be relatively small.

It is thus clear that most farmers would have to supplement their income by obtaining wage employment in the dry season. This is customary amongst Sudanese farmers in the region and reflects the fact that small-scale individual farming under local conditions no longer provides an acceptable standard of living.

Bildat cultivation would give a significantly lower income per family holding, in addition to requiring a very high labour input during the land preparation period. Nevertheless, in theory, it does have certain advantages over mechanised farming. The scheme management would not be required to run a tractor fleet, costs per crop feddan would be reduced and there would not be the problem of recovering cultivation costs from the farmers.

On balance, however, the provision of tractor services is considered to be necessary where the successful settlement of refugee farmers on family holdings is intended. Apart from the higher income that mechanised farming can produce (see Table C.6), the adoption of bildat cultivation is likely to be less acceptable to refugees because (a) they know that tractor services are supplied at Qala en Nahl, (b) they already have some knowledge of mechanised cultivation, as is shown by the fact that there is a number of tractors owned by refugees at Wad el Hileiwu and (c) the extremely hard work required for land preparation in June - July makes the system less attractive. Even though they could perhaps be forced to accept bildat cultivation, this would provoke serious discontent amongst the refugees and could thereby prejudice the success of the whole settlement.

It must be stressed that our preference for a mechanised farming system rather than bildat cultivation assumes that farmers would pay the full cost of tractor operations. A self-supporting tractor service would ease the budgetary burden on the Sudan Government and facilitate

more efficient management by avoiding the need for the scheme organisation to obtain funds from the Government to meet the recurrent costs of machinery operation. This has been a major reason for the poor tractor performance at Qala en Nahl since 1974. If refugee farmers are not prepared to pay a realistic level of cultivation charges, tractor services should be withdrawn. Farmers could then go over to bildat cultivation or could hire tractors at commercial rates from private sources in the area.

One point that does emerge from the evaluation of net returns shown above is that the income from farming would be little higher than the farmer would receive if during his growing season he were instead to rely wholely on wage employment outside the settlement. At Qala en Nahl a farmer could expect to receive LS 50 - 60 per annum from his holding plus, say, LS 10 from small stock and other minor agricultural activities. His total income of LS 60 - 70 is equivalent to the earnings from $2\frac{1}{2}$ - $2\frac{3}{4}$ months' work on large-scale mechanised rainfed farms. During the time spent on crop production on his own holding (July to October, and sometimes well into November) the farmer could have found at least two months' wage employment, if not more. In financial terms, therefore, the income from running his own farm would only slightly outweigh that from wage employment. On the other hand, there are clear social benefits from the former, such as a closer family life and a more settled existence.

In the case of mechanised farmers' holdings in the Jebel Maharigat area and bildat farmers in both locations, incomes would generally be higher from wage employment than from farming. Seasonal work is readily available on mechanised farms within a reasonable distance. If refugees who were previously farmers were settled at Jebel Maharigat, some would therefore be likely to prefer wage employment to full-time farming.

APPENDIX D

WAGE EMPLOYMENT FOR ERITREAN REFUGEES IN EAST CENTRAL SUDAN

APPENDIX 3

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IN EAST CENTRAL SUDAN

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WAGE EMPLOYMENT FOR ERITREAN REFUGEES IN EAST CENTRAL SUDAN

1. Introduction

In order to become self-supporting, most of the Wad el Hileiwu refugees will have to find wage employment. Even the farmers will probably seek wage employment in the dry season, to supplement their subsistence production.

As required by the Terms of Reference, a brief study has been made of wage employment opportunities for the refugees. The main objectives were, first to ascertain the likely availability of different types of work by area and by season, secondly to assess the possible level of earnings from such employment and, lastly to propose measures to enable the refugees to be kept informed of the opportunities and to promote their taking up available jobs. Since it is intended that the refugees should become self-supporting as soon as possible, the crucial factor is job availability within the next 5-6 years; attention has thus been concentrated on this period. The longer-term prospects are more difficult to assess, because at this stage it is not known which of the major developments envisaged will in fact be implemented.

Availability of employment for the refugees will depend on the overall labour supply and demand situation, the refugees' particular skills, the willingness of Sudanese employers to engage Eritreans and a variety of other factors. In view of the resultant difficulty of making precise forecasts, it is not realistic to quantify exactly the number of jobs that would be available to the refugees. Such projections would have little validity and would indicate a degree of certainty which could not in practice be relied upon. Therefore, our approach has been to indicate the probable main sources of employment but not to attempt to forecast the exact number of work opportunities there.

At most, the resettlement programme will be dealing with 5,500 refugee families. The proportion of economically active persons in this population is dependent to some extent on the degree of participation by women, a variable factor which cannot be forecast with accuracy. Since over 60 per

cent of the 1975 refugees are under 15 years of age, there are unlikely to be more than 1.5 economically active members per family. Even if every one of these people, including farmers and others with non-wage means of support, were to seek wage employment, there would be no more than just over 8,000 persons involved. Although there would be some local effects in the immediate vicinity of the major resettlement areas, this number is too small to have a significant impact on the Provincial labour supply - demand balance. In practice, moreover, considerably less than 8,000 refugees are likely to seek wage employment.

Thus a detailed assessment of the refugees' impact on the labour market in Kassala Province was not considered necessary and attention has been concentrated rather on the probable supply of jobs for them. This will depend partly on their aptitude and skills.

As discussed in Chapter 2, some 70 per cent of the Wad el Hileiwu refugees, the main group with which this study is concerned, are farmers, pastoralists or casual labourers. Few of these could be expected to obtain worthwhile jobs in towns, because of their lack of suitable skills and the relative competitiveness of the urban labour markets. Unemployment in towns in Kassala Province is not a major problem, but work is less readily available than in the rural areas. Furthermore, there are few towns of significant size in the Province. Another 23 per cent of the refugees class themselves as merchants and traders, government employees, teachers and others, most of whom, being refugees, would find it very difficult to resume their previous occupation in Sudanese towns. For instance, the Sudan Government could not be expected to take Eritrean civil servants and teachers into its service and the entry of Eritrean merchants into trade in competition with established Sudanese merchants would provoke strong opposition. Thus, few of these refugees are likely to find urban jobs.

From the viewpoint of job opportunities for refugees, the main concern is therefore with employment in the rural areas. The skilled and semi-skilled workers comprise only 7 per cent of the refugees and with their skills should have less difficulty in obtaining employment. Some would, anyway, be required for the construction and operation of the proposed new settlement(s) at Qala en Nahl and in the Jebel Maharigat/Showak area.

Sudan Government and UNHCR intend the refugees' permanent base to be the new settlement(s) which will be provided for them. For socio-political reasons the movement of refugees to take up permanent employment and residence elsewhere in the Province or other parts of Sudan is not considered desirable. In view of this policy, this review is concerned with seasonal wage employment and, to a lesser extent, with construction work within easy reach of the sites.

The main types of wage employment which might be open to the refugees will be the following:-

(a) Agricultural labouring, on irrigated and dryland farms.

(b) Major construction projects in the local area.

In comparison with agricultural labouring, the opportunities for Eritrean refugees to obtain construction work are very limited. The number of unskilled workers required will not be high and the competition for jobs can be expected to be stronger than in agriculture. Construction work on major projects is relatively attractive, because it is longer term and less seasonal in nature and provides a pleasanter environment than farm work and offers good rates of pay. With their lack of experience in this type of work, most refugees are unlikely to be able to compete successfully for such jobs.

The Gedaref - Khashm el Girba section of the Khartoum - Port Sudan Highway will pass very close to Showak and within 10 km of the Jebel Maharigat site. Construction is due to begin in 1977. The requirement of unskilled labour will, however, be only 600 workers for the two year construction period. Other road programmes include the Gedaref - Es Suki road, scheduled to start at the end of 1978, and a road from Gedaref to Sim-Sim. In both cases, the work areas will be a considerable distance from the Showak area where most of the refugees who are dependent on wage employment will be resettled. As in the case of the Khashm el Girba - Gedaref road, total requirements of unskilled workers will not be high.

Plans exist for the construction of a Setit - Atbara dam and the extension of irrigation from the river Atbara, but no final decision to implement these projects has yet been made. Apart from the road projects, the only other definite major construction work within a reasonable distance

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Plans exist for the construction of a Setit - Atbara canal and the extension of irrigation from the river Atbara, but no final decision to implement these projects has yet been made. Apart from the road projects, the only other definite major construction work within a reasonable distance

of Showak is the Rahad Irrigation Project, some 200km away. Construction work is, however, already in full swing and further increases in the labour force, which includes 8,000 - 10,000 labourers, are unlikely.

In view of these factors, most of the cash earnings of the refugees can be expected to come from seasonal employment in agriculture. The opportunities in rainfed and irrigated farming are discussed separately in Sections 2 and 3.

2. Rainfed agricultural employment in Kassala Province

2.1 Labour demand and supply

During the past 20 years there has been a rapid expansion in rainfed agriculture in Kassala Province through the development of large-scale mechanised dura (sorghum) and sesame cultivation. Seasonal employment in weeding and harvesting is readily available and labour shortages often occur. The mechanised farming sector can be expected to continue to be the main source of wage employment in rainfed agriculture in the future.

On the basis of data presented in the ILO (International Labour Office) Study of Growth, Employment and Equity in Sudan, published in 1975, the cropped areas under mechanised farming in the Province between 1969 and 1974 were as shown in Table D.1.

Table D.1 Cropped areas under mechanised rainfed farming in Kassala Province ('000 feddans)

	1969	1970	1971	1972	1973
Sorghum	1 244	1 692	1 468	1 083	1 391
Sesame	322	284	278	370	442
Cotton	64	20	5	16	21
Total	1 639	1 996	1 751	1 469	1 854

These figures indicate no clear trend in cropped acreages. Although every year new land is being cleared, this is probably balanced to some extent by the abandonment of existing cultivated areas due to soil exhaustion. There may well have been some expansion in cropped areas since 1973, but

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the evidence for such an increase is not available. Moreover, the Mechanised Farming Corporation (MFC), the body most closely concerned with mechanised farming, considers the present crop acreage to be approximately 1.8 million feddans, about the same as in 1973.

According to ILO, average labour requirements for the two main crops, dura and sesame, are about 11 mandays per feddan (this excludes time spent on tractor operations). The main input is for harvesting and threshing and, to a lesser extent, for weeding. Labour inputs vary considerably from season to season, due to variations in yields and weed growth. The main periods of labour activity are as shown in Table D.2.

Table D.2. Main periods of labour activity in mechanised rainfed farming

Crop	Activity	Period
Dura	Weeding	August
	Harvesting and threshing	October - January
Sesame	Weeding	July
	Harvesting and threshing	October - November

Work is thus available for most of the period between July and January, but the main peak is from October to January, for harvesting and threshing. According to ILO, the average period of work for a seasonal labourer in mechanised farming is about three months.

Accurate data on the number of seasonal workers employed are not available. On the basis of a cropped area of 1.8 million feddans, an average labour requirement of 11 mandays per crop feddan and an input per man of 75 working days, it is estimated that some 265,000 seasonal jobs are normally available. Of these, approximately two-thirds are usually filled from local sources and the remaining 90,000 are taken by migrant workers. In 1975, however, the migrant labour supply dropped by 30,000 and serious local labour shortages occurred. Although in general the work required is undertaken without severe crop losses due to lack of labour, periodic

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shortages do undoubtedly occur and additional labour could be absorbed without difficulty.

Current employment prospects for Eritrean refugees in mechanised rain-fed farming are thus reasonably favourable. Numerous Eritreans from the Qala en Nahl and Wad el Hileiwu settlements have already successfully found seasonal jobs in this sector and there seems little reason why many more could no do so. Since there are already over 260,000 seasonal workers in mechanised farming, the addition of at the very most 6 - 8,000 refugees to the labour force should not cause problems. Both the Qala en Nahl and Jebel Maharigat/Showak resettlement sites are conveniently situated close to major areas of mechanised farming. The former is near the Sim-Sim - Um Seinat area and, as regards the latter, there is the Gabub area to the south and the mechanised farms of the Presidential Decree Area.

The farmers do not consider the Eritreans to be as good workers as the Western Sudanese. They find them fairly satisfactory for harvesting and threshing and not so effective at weeding, but are quite prepared to employ them, particularly in view of the periodic labour shortages.

The future labour demand of this type of agriculture in Kassala Province will depend on the area cropped and the man-day requirements per crop feddan. As regards the former, studies are in progress for the selection of new areas for development and MFC consider that a further one million feddans could be opened up for cultivation. At the least the mechanised crop area could probably be expanded by a further half million feddans. Judging by the speed with which new land has been developed in the past, this increase could well take place during the next 5 - 6 years, in which case the cropped area could be expected to be at least 25 per cent above present levels by the 1980's.

There appears to be little likelihood of significant improvements in crop yields in the immediate future. Many farmers do not follow a proper rotation and yields decline due to the progressive exhaustion of the soils. Thus no increase in man-day requirements per crop feddan is likely.

If a significant degree of mechanisation of harvesting and weeding occurs, labour requirements per feddan will in fact fall. At present almost all harvesting and all weeding is done by hand. The MFC is examining the

economics of further mechanisation, but no definite policy has yet been determined. In view of the high cost of buying and maintaining imported machinery and the lower market prices of present combinable dura varieties, it appears likely that in most cases mechanisation of dura harvesting would not be economically justified at present levels of labour and machinery costs. Equipment suitable for mechanised sesame harvesting is not available. The design difficulties are considerable, because of the vulnerability of the mature plant to shattering (few indehiscent varieties have yet been developed). Mechanisation of harvesting, therefore, appears unlikely to make a major impact on labour demand in the next few years.

Weeding could be mechanised through the application of herbicides. Once again, however, the economics of mechanisation do not appear to be favourable in most cases. In 1974-75 typical costs of weeding in a comparable area of mechanised cropping in Blue Nile Province were found by the Leeds University 1975 Study of Agricultural Development in the Sudan Central Rainlands to be LS 0.40 - 0.50 per feddan for dura and LS 0.40 per feddan for sesame. Even allowing for inflation since 1974 and the possible need for two hand weedings, this would normally be below the cost of herbicide application by tractor spraying.

In contrast to the conclusions reached by ILO in their 1975 report, we consider it unlikely that further mechanisation of crop operations will take place on a scale sufficiently large to affect seriously the demand for seasonal labour up to 1980. In the long term, increasing mechanisation will no doubt occur, especially if wage rates continue to rise. From the viewpoint of the problem of finding work for the Eritrean refugees, however, it does not appear to be a vital factor.

If it is accepted that labour requirements per crop feddan will not be significantly reduced in the immediate future, the total demand for seasonal labour for mechanised rainfed farming in Kassala Province can be expected to rise in line with the expansion of crop areas. As the Provincial population increases, the supply of local labour will grow, but at a rate of not much more than 2 - 2½ per cent, the rate of population growth. The labour demand from mechanised farming should rise at least as rapidly. Some increased inmigration of labour from some other Provinces might occur, to help meet this demand, but nevertheless the future prospects for refugee employment in this sector are relatively favourable.

economics of further mechanization, but no definite policy has yet been determined. In view of the high cost of buying and maintaining imported machinery and the lower market prices of present combinable dura varieties, it appears likely that in most cases mechanization of dura harvesting would not be economically justified at present levels of labour and machinery costs. Equipment suitable for mechanized cassava harvesting is not available. The dealing difficulties are considerable, because of the vulnerability of the mature plant to shattering (few independent varieties have yet been developed). Mechanization of harvesting, therefore, appears unlikely to make a major impact on labour demand in the next few years.

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2.2 Wage rates and income levels

Payments to seasonal labourers are invariably made on a piece-rate basis. They also vary substantially from area to area and year to year and, in terms of earnings per day, according to the task being undertaken. In general, seasonal wage rates are considerably higher than on irrigation schemes, largely because of the greater scarcity of labour in the immediate vicinity of most mechanised farms, the harsh living conditions and the lack of amenities, and the distance from major population centres.

Wage rates generally vary between LS 0.30 and LS 1.00 per man-day, plus food and other perquisites, but on occasions they reach LS 2.00 or more. According to the ILO 1975 report and other sources, as a general average seasonal workers can expect to earn between LS 15 and LS 25 per month, plus perquisites, the most important of which is food. As an approximate estimate these perquisites are worth some LS 5.00 - 6.00 per month. Thus total monthly earnings in cash and kind would be some LS 20 - 30. For calculation purposes an average of LS 25 has been taken.

At present, seasonal labourers on mechanised farms work an average of three months. The main labour requirements occur during the period of 3 - 4 months between October and January, and in August. Although total labour use in August, when weeding is undertaken, is less than from October to January, the labour supply is also reduced by the fact that many of the seasonal labour force are cultivating their own crops at this time (the cropping season is from July to September, which is the rainy season in this part of Sudan). Wage rates in August often reach high levels because of the peak demand for weeding and the reduced labour supply.

An Eritrean refugee who does not have a holding of his own would probably find a month's wage employment during the rainy season, and some three months' work thereafter. In the calculation of potential incomes, it has therefore been assumed that refugees without holdings could work for four months per year in mechanised agriculture. Because of the need to harvest their own crops, those with holdings would not be available for outside employment until November and would be unlikely to find more than $2\frac{1}{2}$ months work in mechanised farming thereafter.

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Under these assumptions, the average earnings and working periods for refugees working as seasonal labourers on mechanised farms would be as follows:-

	Working period	Earnings in Cash and Kind
1. Refugees without holdings	August, then October-January	LS 100
2. Refugees with holdings	October-January	LS 62.5

Note: Workers on mechanised farms are normally not accompanied by their families, so there would be no additional earnings from family members.

3. Seasonal employment opportunities in irrigated agriculture

3.1 Employment opportunities

As regards seasonal employment in irrigated agriculture, the main areas of interest for the refugees with which this report is concerned are the Khashm el Girba, Gezira and Rahad schemes and the numerous pump schemes along the Blue Nile. Table D.3 gives the approximate areas of these projects, the location of which is shown in Figure 5.1. Rahad is not yet in operation but is due to start cropping in 1977. The White Nile pump schemes have not been considered because of their greater distance from the areas of refugee concentrations and the fact that they draw their casual labour mainly from the regions to the west of the river.

Table D.3 Irrigation scheme areas

Scheme	Area ('000 feddans)	Main Crops
Gezira	2 050	Long-staple cotton, groundnuts, dura, wheat
Khashm el Girba*	450	Medium-staple cotton, groundnuts, wheat
Blue Nile Pump Schemes (including Es Suki)	390	Cotton, groundnuts, dura
Rahad Phase I (to be in full operation in 1978)	300	Medium-staple cotton, groundnuts

* excluding the sugar cane plantation.

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There is a 60,000 feddan irrigated sugar scheme in operation at Khashm el Girba and a smaller sugar scheme at Guneid, on the east bank of the Blue Nile. In addition, major irrigated sugar projects under construction include Kenana (60,000 feddans), on the east bank of the White Nile near Kosti, Hagar Asalaya (35,000 feddans) and North West Sennar (32,000 feddans) on the west bank of the Blue Nile. These schemes have not been considered as likely sources of seasonal wage employment for Eritreans. Khashm el Girba, which is the nearest, has adopted a system whereby the scheme maintains a permanent labour force large enough to handle almost all the cane harvesting work, which is the peak labour requirement. Harvesting takes place from November to June, after which the workers are occupied in cane planting and other tasks. Under this system there is little hiring of seasonal labourers. Most of the permanent labour force at Khashm el Girba are Westerners (i.e. from Western Sudan), who are generally well adapted to the kind of heavy manual labour required.

The indications are that the Kenana and other sugar projects will also follow this system. Opportunities for seasonal employment of Eritrean refugees on irrigated sugar plantations are thus likely to be negligible. Moreover, they would have difficulty in competing for such jobs with the Westerners, who are more suited to the heavy work involved.

Attention has therefore been concentrated on the irrigated areas listed in Table D.3. Cropping in these schemes is based on long- or medium-staple cotton, groundnuts, dura and wheat. Seasonal labour is required mainly for cotton picking; there is also a limited requirement for groundnut harvesting. Employment prospects in the four areas are discussed briefly below.

(a) The Gezira Scheme

Including Managil, Guneid and other extensions, the Gezira Scheme covers over two million feddans. It employs about half a million casual labourers per year, of which some two-thirds come from other Provinces, mainly the Blue Nile and the Western Provinces. Only 5,000 - 9,000 come from Kassala Province. The main period of demand is from January to March, when the cotton is picked.

Despite the large numbers of casual labourers required, the Gezira has not suffered from serious labour shortages in recent years. It has been estimated that between 1967 and 1974 labour shortages did not exceed 4.3 per cent per annum of the calculated demand and were usually considerably

less. The fact that real wages of seasonal workers have probably declined slightly also indicates that there has been no significant overall shortage.

At present a plan to change the Gezira cropping pattern is under consideration. This would involve a reduction of one-third in the cotton area and a corresponding increase in the groundnuts and wheat acreage. With cotton picking being the major source of casual employment, a substantial decline in seasonal work opportunities can be expected. Since wheat production is fully mechanised and groundnuts are becoming increasingly so, the expansion in these crops will do little to offset the reduction in labour demand for cotton picking.

In view of these prospects and the fact that there is little tradition of employment of casual labourers from Kassala Province in the Gezira, it is not considered that the scheme is likely to offer as attractive work opportunities as the mechanised rainfed farms or other irrigation projects.

(b) Khashm el Girba

The crop rotation in Khashm el Girba is based on the following annual acreages of major crops:-

	Feddans
Medium-staple Acala cotton	110,000
Groundnuts	110,000
Wheat	110,000

Seasonal labour is required from November to March, the peak period being December to January, when cotton picking begins. Demand is less in November, when the groundnuts are harvested, and in February and March, when the second and third pickings of the cotton crops are completed.

According to the Agricultural Production Corporation (APC), which manages Khashm el Girba as well as the publicly-owned pump schemes on the Blue, White and main Niles, approximately 90,000 - 100,000 seasonal labourers are brought into the scheme each year. Some 30,000 come from the Gash Delta, the flood irrigation area north of Kassala town. These labourers work at Khashm el Girba from January to March, when they return to the Gash to harvest their castor crop. Most of the remaining 60,000 - 70,000 seasonal workers come from Gedaref and other parts of Kassala Province. A considerable

(c) Blue Nile pump schemes

The Blue Nile pump schemes comprise a large number of individual schemes located along the river between 40 km north and 120 km south of Sennar. With the exception of the recently-completed Es Suki project (gross area 90,000 feddans), virtually all were formerly in private hands and were nationalised eight years ago.

Cropping at Es Suki is based on medium-staple Acala cotton, groundnuts and some wheat. On the other schemes the cotton grown is long-staple and dura is a major crop. The pattern of demand for seasonal labour is similar to the Gezira, the main peak being from January to March for cotton picking. Picking begins somewhat earlier at Es Suki, because Acala matures before the long-staple varieties.

According to the AFC, severe shortages of seasonal labour occur on some of these schemes and refugees could find seasonal work without difficulty. Most of the schemes are within 175-200 km of the Gala en Nahl settlement by road, although the distance to the new settlement in the Showak area is some 100 km greater. Due to the presence of both medium and long-staple cotton, the picking season would be somewhat longer than in the Gezira and Managil el Girba. An average period of 3½ months from December to March has therefore been assumed.

Detailed data on wage rates are not available, but wages are likely to be slightly above those in the Gezira, because of the greater scarcity of labour. ILO considered that in the Gezira in 1975 daily earnings averaged between IS 0.35 and IS 0.50, of which one-third was cash and two-thirds in kind. Another survey did, however, indicate somewhat higher figures (M. S. Mann, 'Labour employment and productivity of tenant farmers in Gezira mechanised farming area', University of Khartoum, 1975). For the Blue Nile schemes an average of IS 0.50 per day has been taken, with 25 days worked per month and 3½ months of possible seasonal employment for refugees per

annum. Potential annual income per head from this source would then be LS 49 (LS 14 x 3.5 months), say LS 50. This is higher than from Khashm el el Girba, but well below the income that can be earned from working on mechanised farms.

(d) The Rahad Project

The first half of the Rahad Phase I area of 300,000 feddans is due to be brought under irrigation in 1977 and the other 150,000 feddans in 1978. Cropping will be based on 50 per cent medium-staple Acala cotton, 33 per cent groundnuts and 17 per cent fodder and other crops.

With this relatively intensive rotation and the high proportion of cotton, labour requirements per feddan will be greater than on the other irrigation schemes. The tenancies will be 24 feddans. In view of this comparatively large holding size and the sparse population in the areas adjacent to the project, requirements of migrant labour for harvesting work will be high. For the 300,000 feddans of the first phase (no decision has been taken on the implementation of Phase 2, which would cover about 500,000 feddans), 100,000 - 150,000 such workers would probably be needed.

To a considerable extent the impact of the project on the seasonal labour market in the Gezira and other nearby regions will depend on the degree of competition that arises between the Gezira and Rahad. Peak labour demand in the former is from January to March, for cotton picking. The Rahad Corporation intend to plant their cotton sufficiently early for most of the picking to take place in November and December and to be completed in January. If this objective is achieved the seasonal labour demand on the two schemes would be complementary rather than competitive, apart from a short period in January when picking would be in progress in both the Gezira and Rahad. Thus the casual labour which comes to the Gezira in January could come to the region two months earlier, in November, and work for two months in the Rahad before moving across the Blue Nile to start the Gezira cotton picking in January.

At this stage it is not possible to forecast events with any accuracy. Clearly, commissioning of the Rahad Project will result in some increase in the overall demand for seasonal labour, however successful is the attempt to tie in the cotton growing calendars of the two schemes. Rahad must therefore

be considered as a possible source of wage employment for Eritrean refugees. In view, however, of the promising prospects on the Khashm el Girba and Blue Nile pump schemes, both of which are in operation rather than under construction, further consideration has not been given to Rahad at this stage. It is abundantly clear that more than sufficient seasonal work is anyway available to keep all the Eritrean refugees in employment for much of the dry season.

4. Overall employment prospects and potential wage earnings

Table D.4 summarises the main seasonal employment opportunities for Eritrean refugees in the near future. In all cases, there is considered to be sufficient work to employ all refugees who might take up such employment.

Table D.4 Seasonal employment opportunities for Eritrean refugees

	Area	Potential Annual Earnings* LS	Period							Total** worked (months)
			Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	
1.	Mechanised rainfed farming in Kassala Province	100	—	—	—	—	—	—			4
2.	Khashm el Girba	38					—	—	—		3
3.	Blue Nile pump schemes	50					—	—	—	—	3½

* Annual earnings include wages in both cash and kind.

** This is the total time that on average each refugee would be able to find work in this field, and allows for movement between work areas and other types of lost time.

As indicated in the discussion above, employment in mechanised farming would be readily available to refugees at both the Qala en Nahl and Showak/Jebel Maharigat settlements. As regards irrigated farming, on the basis of distance one would expect those from Qala en Nahl to favour the Blue Nile pump schemes whereas those in the Showak area would tend to prefer working at Khashm el Girba. If, however, transport to and from the irrigation scheme

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2. Khasm el Girba	30	———	3
3. Blue Nile pump schemes	50	———	3½

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were provided, as is normally the case at Khashm el Girba, the factor of distance might be of little significance.

From the viewpoint of a refugee dependent entirely on wage employment (i.e. with no farm of his own), his best strategy would be to work from August to January on mechanised rainfed farms in the Gedaref, Showak, Sim-Sim - Um Seinat, Gabub and other areas of Kassala Province. Since wages on mechanised farms are far higher than on the irrigation schemes, he would continue working there until the work ran out, probably in the second half of January. By this time he should have earned some LS 100. He would then move to the Blue Nile pump schemes or Khashm el Girba, for the second half of the cotton picking season. Earnings would be higher on the pump schemes, because of the longer picking period and the slightly better wages. If he reached there by the end of January or beginning of February, he could probably expect to obtain at least 1½ months' work, from which he would earn about LS 21. If, on the other hand, he went to Khashm el Girba, his picking season would finish earlier, because medium-staple rather than long-staple cotton is grown there. Assuming he found a total of one month's work, his earnings would be some LS 13.

A refugee farmer with a holding of his own at Qala en Nahl or Jebel Maharigat would earn less in seasonal wage employment, because he would be engaged in his own crop production work until October. Allowing for the time needed for dura harvesting, he would be unlikely to be available for outside employment until November. Between November and January he might obtain 2½ months' work on mechanised farms, earning him about LS 62. Thereafter he could move to the Blue Nile or Khashm el Girba schemes and earn another LS 13 - 21.

On the basis of these assumptions, Table D.5 shows the potential annual income of the refugees from seasonal wage employment, for farmers and non-farmers.

Table D.5 Refugees' potential annual income from wage employment (LS)

Source of Employment	Non-farmers	Farmers
Mechanised rainfed farming	100	62
Irrigation schemes	13 - 21	13 - 21
Total	113 - 121	75 - 83

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These figures represent the maximum that refugees are likely to earn if they are willing to take full advantage of the seasonal employment opportunities available. Assuming that the charges made for water and other services in the refugee settlements are not excessive, this should be sufficient to support a typical family, though not at a very high standard of living. Many families will, of course, have more than one member capable of undertaking seasonal wage employment. In these cases annual incomes from outside employment should be sufficient to provide a more adequate standard of living. This question, and also farmers' likely earnings from their cropping activities, is discussed in the Main Report.

APPENDIX E

HEALTH AND NUTRITIONAL SERVICES

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1. Those at greatest risk

Following any major disruption of normal life such as has occurred amongst the refugees, those primarily at risk are the children of pre-schooling age, the old and the infirm. Inevitably, changes in dietary habits are forced upon those unfortunate enough to have to depend upon relief supplies, because the foodstuffs provided frequently differ from the traditional diet. This change of diet is rarely accompanied by an educational input, as the urgency of the situation seldom allows this to be done. As a result the mothers frequently do not know how best to prepare these new foodstuffs for their children. The effect can often lead to a falling off of the nutritional plane of the children which can result in mild or even severe malnutrition as well as a lowered resistance to communicable diseases.

Any new settlement, no matter how well planned, often causes, at least in the initial stages, unnatural crowding of housing and service facilities resulting in an ideal environment for the spreading of disease, especially amongst a population with lowered resistance.

Where the refugees originate from a hilly well-drained region and are forced to move to the wetter plains they find themselves in contact with a new range of diseases and parasites to which they have little or no immunity. Malaria is a good example of this.

A good curative and preventive health service is therefore essential.

2. Those with special needs

A close look at the refugee population census taken at Wad el Hileiwu shows that 62 per cent of the total are aged 15 years or under. It can be assumed that of this number those falling in the greatest risk age groups (i.e. below seven years old) make up no less than 40 per cent of the total refugee population. Any plans which are aimed at creating a stable environment for the refugees must therefore take full account of

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these highly vulnerable members, who are totally dependent on their parents or guardians for their wellbeing. Special attention must be paid to those families who, through the absence or death of the head of the household, have lost much of their financial or social security, since it is amongst these families that the risks will be greatest. Even those families with a member in employment often need guidance on the feeding of the younger children, on family budgetting, etc., as many will, probably for the first time, be forced entirely into a cash economy.

3. Relief food supplies

The continuing handing out of relief food supplies over a long period can create undesirable changes in the recipients that undermines their self-respect, takes away initiative and, on occasions, fosters a begging mentality. It is desirable, therefore, from all angles that relief supplies continue only as long as is absolutely essential. However, the decision to reduce or cut off relief supplies can be carried out responsibly only when adequate safeguards have been made for the feeding of the children. To achieve the required level of self-sufficiency some form of self or paid employment is obviously necessary. Within any community, and especially one with a large number of family units deprived of their head, there will always be those who will find it necessary to receive assistance. In the absence of an organised Social Service the normal way to cope with these special families is through the Health Service.

4. The major health hazards

Aside from normal wounds and burns, investigations into the incidence of disease amongst the refugees at Wad el Hileiwu and Qala en Nahl indicates that the major health problems are malaria, upper respiratory infections, intestinal infection and parasites, and T.B. Although not specifically recorded, periodic outbreaks of measles and other diseases are known to occur amongst the children. These diseases are compounded by the low plane of nutrition of many of the children and the mortality rate is unacceptably high.

The treatment of patients is complicated at Wad el Hileiwu by the presence of two separate and loosely co-ordinated bodies providing the health services - the Ministry of Health, and Asme-Humanitas (a German relief organisation). Owing to the current

unco-ordinated approach, double or even treble treatment of the same patient is not unknown. Cases of premature curtailment of treatment of T.B. cases is fairly common, due partially to the high degree of mobility of some refugees and partially through the patient's ignorance of the need for prolonged treatment.

It is vital that any future provision of health services for the proposed settlement at Jebel Maharigat as well as any improvements made at Qala en Nahl incorporate a strong preventive health component. This is sadly lacking at present. Only in this way can any long-term health service hope to bring about a reduction in the high infant mortality rates and a reduction in the suffering caused by diseases which are easily preventable through a higher level of understanding amongst the population.

5. The Health Services at Qala en Nahl

As a result of the widely dispersed pattern of settlement at Qala en Nahl, the provision of a comprehensive yet economic health service is extremely difficult.

The settlement is currently served by a Health Centre and four Dressing Stations, which are now being upgraded to dispensary standard. With these facilities it is probably the best served area in Kassala Province. Provincial statistics* show that on average each Health Centre serves a population of approximately 80,000 people and each Dispensary an average of 20,000 people. The settlement at Qala en Nahl, with a population of not more than 20,000 people, can therefore boast a health service of luxurious proportions.

(a) The Health Centre

At present the major health facility within the settlement is situated at the village of Um Saqata, the main administrative centre for the settlement. The Health Centre is run by a Medical Assistant with the help of two Sudanese male nurses, a cook and two orderlies. It contains two six-bedded wards for male and female patients in addition to a dispensary unit and permanent staff housing. The service provided is almost exclusively of a curative nature, with no planned attempt to provide any special

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* Sudan Almanac, 1970, 1971.

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services for those primarily at risk - the mothers and pre-school children. The Centre is administered by the Assistant Commissioner for Health based at Gedaref H ospital, which also acts as the referral unit. Supplies of drugs and equipment are drawn from Gedaref and are on occasion supplemented by supplies from the Commissioner for Refugees, through his assistant in Gedaref.

The In-patient records of the Health Centre show only 63 patients as being admitted in 1975, with a total of 252 for the three-year period ending January 1976. This compares to a theoretical capacity of more than 1,000 per annum. Out-patient returns are shown in Table E.1.

Table E.1 Out-patient returns - Um Saqata Health Centre

	1974		1975	
	Male	Female	Male	Female
Diagnosis				
Intestinal	3 380	3 263	2 869	2 953
Respiratory	2 466	2 325	2 193	1 986
Urinary System	252	260	176	242
Blood circulation	456	512	176	242
Eye infection	680	789	652	702
Ear infection	360	285	278	230
Wounds	2 235	786	1 171	630
Malaria	1 661	1 406	1 677	1 518
T.B.	9	3	39	39
Other	1 355	1 670	1 726	1 774
Total cases	12 854	11 299	10 957	10 316
Grand total	24 153		21 272	

Source: Records at Um Saqata Health Centre.

Table E.1 Out-patient returns - Um Sagata Health Centre

Diagnosis	1974		1975	
	Male	Female	Male	Female
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Eye infection	680	789	682	702
Ear infection	360	265	278	230
Wounds	2 259	766	1 171	690
Malaria	1 661	1 406	1 677	1 518
T.B.	9	5	39	39
Other	1 355	1 670	1 726	1 714
Total cases	12 854	11 299	10 957	10 316
Grand total	24 153		21 272	

Source: Records at Um Sagata Health Centre.

Assuming a 300 day working year, the number of patients treated on average per day is 80 in 1974 and 71 in 1975. However, this patient load does not correspond with the visual impression gained by periodic visits to the Centre, which would indicate a lower true figure. It is possible that the figures relate to the total number of visits for treatment. If this is the case then the figures are more realistic. The greater incidence of malaria in 1975 compared to 1974 causes concern, especially when one remembers that the population of the settlement fell drastically following the breakdown of agricultural services after the 1973 harvest. The consistently high incidence of intestinal complaints and upper respiratory infections throughout both years are also an indication of a declining health situation, possibly brought about by falling standards in water and sanitation facilities coupled with an inadequate plane of nutrition.

Somewhat surprisingly, the Health Centre is not connected to the extensive piped water supply network throughout the settlement and water has to be carted in drums from the waterpoint approximately ¼ km away.

(b) The village Dressing Stations

In addition to the Health Centre at Um Sayata four of the other five villages in the settlement are served by a simple Dressing Station. The stations at Salmin, Um Burush and Zarzur are each run by a single Sudanese male nurse whilst that at Deheima is staffed by two female nurses from the refugee community. Until recently these dressing stations consisted of a single grass hut, but following an offer of financial assistance from the Sudanese Red Crescent these are being replaced by permanent stone-built structures. In theory, the Dressing Stations are supervised by the Health Assistant based at Um Saqata, but in practice this is done only on an irregular basis due partially to inertia complicated by poor road communications between the villages especially during the rains. Drug supplies are drawn from Um Saqata but shortages frequently occur. No provision is made for regular meetings between the respective health staff so each tends to work in

isolation. Case referral to Um Saqata tends to break down in practice, due partially to poor transport facilities within the settlement. Many patients by-pass Um Saqata and report direct to Gedaref Hospital, thus putting additional strain on the facilities there. Treatment records at the Dressing Stations are not sufficiently well maintained to be of use in this study and pin-point again the necessity of adequate supervision.

(c) Conclusions

In spite of a health service which by normal Sudanese standards could be described as more than adequate, the quality of the treatment leaves much room for improvement. If the settlement at Qala en Nahl is to regain the confidence of the refugees the provision of an adequate and imaginative health service will play a large part in overcoming the present difficulties. Frequent illness or death within a settler family not only causes much mental anguish and hardship but erodes more quickly than anything the determination to stay.

The main conclusions from this brief review of the Qala en Nahl health services are as follows:-

(i) With the completion of the permanent buildings to house the Dispensaries, there is little need for further capital investment, except perhaps to ensure that the housing facilities for the staff are adequate. The Health Centre at Um Saqata should be connected to the water supply as soon as possible; the cost involved is very small in proportion to the benefits this will bring to staff morale.

(ii) The major input needed is the introduction of a simple yet comprehensive preventive health element which incorporates a strong health education input coupled with a basic vaccination service. The capital and recurrent costs of this innovation are minimal and could, over a period of a few years, actually cut the cost of providing a health service to the settlement, as greater understanding of basic health practices brings about a drop in the incidence of disease.

The main input apart from supplies is made up of the in-service training of the existing personnel. Hopefully, this can be carried out within the Sudan but because of the necessity of maintaining on-going services staff release will have to be phased over two or more years.

It is essential that adequate supervision of all levels of service is ensured and supplies of drugs, vaccines and equipment are always available. This will in turn depend upon a clear understanding of the objectives throughout the service, with prompt and timely commissioning of supplies by those implementing the scheme.

(iii) The in-patient facility at Um Saqata Health Centre is currently under-utilised and it is recommended that part of the facility should be converted to a small maternity ward. A nurse with midwifery training will be required to run this unit and to oversee an ante-natal and post-natal service that should be introduced.

(iv) At a later stage in the development of the comprehensive health service the possibility of using the Health Centre and the Dispensaries as centres spreading practical knowledge of nutrition might be considered. Initially, some facility should be included to provide subsidised or free protein foodstuffs to mothers with severely malnourished children. Later a small demonstration garden could be attached to the centre to demonstrate simple vegetable/fruit growing if a solution can be found to the conservation of water. The stocking of seeds and insecticides for public sale might have to be considered.

(d) Capital costs

The capital costs of the recommended improvements are estimated to be as follows:-

Item	LS
Water supply connection to Um Saqata health centre	600
Conversion to maternity ward at Um Saqata	1 300
Vaccination equipment (cool boxes, refrigerators, Salter hanging scales) for 4 dispensaries	1 400
Visual aid equipment, @ LS 100 for each unit	500
	3 800

(e) Recurrent costs

The main additional recurrent cost would be the salary of the extra nurse, @ LS 800 per annum.

6. Health Services for Jebel Maharigat

6.1 General

As this settlement is still at the planning stage it is timely to consider the type of health service that is both desirable and practical. Experience can be gained from the existing facilities at Wad el Hileiwu and Qala en Nahl and an attempt made to provide a workable solution.

Agricultural production will not be sufficient to provide the settlers with an adequate standard of living and most families will also depend upon money sent back from family members employed elsewhere. The settlement can therefore be best described as a semi-urban environment.

From the beginning the intention should be to create a balanced health service covering the curative and preventive aspects with a strong educational element. Because of the artificially created semi-urban situation in which the refugees will find themselves it is to be expected that those families with minimal means of support will require special attention. The service should therefore include a social worker who would be responsible for following up special cases of need brought to light by the health service. This worker will require access to externally provided sources of foodstuffs, clothing, etc., with which to provide some meaningful form of assistance.

As the settlement is planned it is possible to incorporate a health service based on a single centre within easy reach of the whole population. This obviates the need to provide small Dressing Stations and thereby reduces staffing and capital costs. As the settlement is serving a refugee population which could leave en masse at the cessation of hostilities it is obviously necessary to minimise capital expenditure wherever possible. At the same time inadequate facilities will cause frustration and friction, so a compromise has to be reached which is felt to be reasonable. Care must also be taken to ensure that health facilities in Showak and Gedaref are improved where necessary to cope with the anticipated extra load.

To minimise capital expenditure it is envisaged that any unskilled health staff (e.g. orderlies) will be recruited from the refugee population together with any trained nurses within the community. This will reduce the staff housing necessary (housing at Jebel Maharigat will be provided only for Sudanese staff).

6.2 The dispensary

It has been assumed that a single large dispensary would be provided at Jebel Maharigat. This would comprise the following:-

- An open covered waiting area for up to 50 people at one time (40 m^2 total area)
- Two examination/consulting rooms leading off the waiting area (each of 20 m^2)
- A room for preparation and giving of injections (16 m^2)
- A room for dealing with septic cases/boils, etc. (16 m^2)
- A drug store/dispensary where drugs/medicaments are handed out (25 m^2)
- A room for conducting a pre-school clinic with examination couch for ante- and post-natal clinic work (20 m^2)
- A small store for foodstuffs (12 m^2)
- A small office opening onto the waiting area for patients' records, etc. (20 m^2)
- Verandahs, etc: say, 20 m^2

For Master Plan B, involving 24,000 rather than 17,000 settlers, an additional examination room would be required.

6.3 Staffing

It is envisaged that the staff would consist of:-

	17,000 settlers	24,000 settlers
Medical Assistant	1	1
Nurses	3	4
Social Worker	1	1
Orderlies	3	4
General helper	1	1

6.4 Housing and other facilities

Housing would be required for the Sudanese staff, namely the Medical Assistant, the nurses and the social worker. Other staff would be recruited from the refugee population.

Water should be piped to all rooms in the Dispensary with the exception of the food store and administrative office. Staff houses should receive a separate metered supply. A drinking fountain should be provided in the waiting area and a standpipe placed close to the latrines.

The compound should be laid out with a service road and buildings should be sited to allow room for future expansion. Care should be taken to ensure correct orientation of the buildings in regard to the sun and religious taboos.

A double latrine facility (1 male and 2 female) of the deep pit type will be required.

A normal level of locally available furnishings are provided for throughout, with the addition of a 6 cu.ft. kerosene/electric refrigerator for vaccines. Periodic use of a 4-wheel drive vehicle would be necessary, for drawing supplies from Showak or Gedaref as well as providing an ambulance service in cases of emergency.

For Master Plan B, involving 24,000 rather than 17,000 settlers, an additional examination room would be required.

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A normal level of locally available furnishings are provided for throughout, with the addition of a 6 cu.ft. kerosene/electric refrigerator for vaccines. Periodic use of a 4-wheel drive vehicle would be necessary, for towing supplies from Showak or Gedaref as well as providing an ambulance service in cases of emergency.

6.5 Supplies

A normal allocation of drugs, medicines and supplies for a dispensary serving a population of 17,000 - 24,000 people will be required. In addition, it will require vaccines, dilutants and disposable syringes to enable a preventive health programme to be carried out. Provision is also made for the purchasing, if necessary, of health education posters, flip charts, flannel graph materials, slides, etc., as well as a supply of locally printed Road-to-Health charts designed along the lines of the Morley charts now widely used.

6.6 Capital costs

The estimated capital costs of setting up the proposed large dispensary at Jebel Maharigat are shown in Table E.2. Costs of a vehicle have not been included, it being assumed that the health service would have access to the scheme management's vehicles.

Table E.2 Capital costs of health services at Jebel Maharigat (LS)

	Item	17,000 population	24,000 population
1.	Dispensary	LS	LS
	Buildings: 209 m^2 @ LS 100	20 900	-
	229 m^2 @ LS 100	-	22 900
	Furnishings and equipment	2 000	2 200
2.	Housing		
	2 T1 houses	24 000	24 000
	1 T2 house (for the Social Worker)	10 500	10 500
	Small hostel for nurses	12 000	12 000
3.	Total	58 900	61 100

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1 T2 house (for the Social Worker)	10 500	10 500
Small hostel for nurses	12 000	12 000
3. Total	58 900	61 100

6.7 Recurrent costs

Table E.2 gives the estimated recurrent costs of the health service at Jebel Maharigat, excluding drugs, vaccines and other materials. Building maintenance has not been included here, being covered under the maintenance programme for the whole settlement.

Table E.2 Estimated recurrent costs* of Jebel Maharigat health services (LS per annum)

Item	17,000 population	24,000 population
1. Staff costs		
Medical Assistant	1 500	1 500
Nurses, @ LS 800	2 400	3 200
Social Worker	1 000	1 000
Orderlies	1 500	2 000
General helper	300	300
Total	6 700	8 000
2. Equipment maintenance		
10% of capital cost	200	220
3. Annual total	6 900	8 220

* Excluding vaccines, drugs and other materials.

7. Health services at Showak

Some upgrading of the health services at Showak would be required to cater for the increased demand resulting from the Jebel Maharigat settlement. The alternatives are:-

(a) Provide sufficient additional capacity at the proposed Rural Hospital.

(b) Upgrade the existing dispensary to a Health Centre.

6.7 Recurrent costs

Table B.2 gives the estimated recurrent costs of the health service at Yebel Mubarkat, excluding drugs, vaccines and other materials. Building maintenance has not been included here, being covered under the maintenance programme for the whole settlement.

Table B.2: Estimated recurrent costs* of Yebel Mubarkat health services (LS per annum)

Item	17,000 population	24,000 population
1. Staff costs		
Medical Assistant	1 500	1 500
Nurses, @ LS 800	2 400	3 200
Social Worker	1 000	1 000
Orderlies	1 500	2 000
General helper	300	300
Total	6 700	8 000
2. Equipment maintenance		
10% of capital cost	200	220
3. Annual total	6 900	8 220

* Excluding vaccines, drugs and other materials.

7. Health services at Shoyek

Some upgrading of the health services at Shoyek would be required to cater for the increased demand resulting from the Yebel Mubarkat settlement. The alternatives are:-

(a) Provide sufficient additional capacity at the proposed Rural Hospital.

(b) Upgrade the existing dispensary to a Health Centre.

Although approved in principle, few details are available about the proposed 30 bed Rural Hospital at Showak. It is intended that this should be built on a self-help basis, by the local community.

At this stage it is not possible to prepare detailed cost estimates for a possible extension to the proposed hospital. To give some indication of the possible cost of such an extension, we have assumed that an extra small ward for 10 or 12 persons, plus the necessary furnishings and equipment, would be provided. With a ward of 5 m x 10 m and another 20 m^2 for other additional space, the total building cost has been taken as 70 m^2 x LS 100, or LS 7,000. Allowing for beds, other furniture and equipment, the total cost might be LS 9,000.

Total capital costs of providing additional capacity at the proposed Showak Rural Hospital are thus estimated to be as follows:-

Item	LS
Hospital building and equipment	9 000
Housing: Extra hostel capacity for two nurses: say,	6 000
	15 000

Apart from medicines and supplies, which have not been estimated, the additional recurrent costs due to the project would be mainly for the extra staff required. Assuming that two extra nurses and two extra orderlies would be needed, the additional costs would be as follows:-

	LS per annum
1. Staff costs	
2 nurses	1 600
2 orderlies	1 000
2. Maintenance of equipment	
10% of capital cost	200
3. Total	2 800

If no Rural Hospital is built at Showak, the present dispensary might need to be upgraded to a Health Centre. This is assumed to involve the addition of the following buildings to those already in existence:-

- One 10 - 12 bed ward (50 m^2) plus other space (20 m^2)
- One consulting room (20 m^2)
- One other room (20 m^2)

Staffing would need to be increased by two nurses and two orderlies. The additional capital and recurrent costs are estimated to be approximately as follows:-

1. Capital costs

		LS
Buildings:	110 m^2 @ LS 100	11 000
Equipment:	say,	3 000
Housing:	One small hostel for nurses, say	6 000
	Total	20 000

2. Additional recurrent costs

Staff costs: As for Rural Hospital, given above	2 600
Equipment maintenance	300
Total	2 900

8. Gedaref hospital

The present availability of beds at Gedaref Hospital is as follows:-

	Beds
General	215
Maternity	9
T.B.	32
Children's	12

If the health facilities at Jebel Maharigat and Qala en Nahl are to be a success it is essential that they receive administrative support from Gedaref and access to the hospital as the major referral unit. At present the hospital's facilities are over-extended and will need to be strengthened if it is to give the support necessary. It is hoped that

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1. Capital costs

		LS
Buildings:	110 m^2 @ LS 100	11 000
Equipment:	say.	3 000
Housing:	One small house for nurses, say	6 000
	Total	20 000

2. Additional recurrent costs

Staff costs: As for Rural Hospital, given above	2 600
Equipment maintenance	300
Total	2 900

3. Gedaref Hospital

The present availability of beds at Gedaref Hospital is as follows:-

	Beds
General	215
Maternity	9
T.B.	32
Children's	12

If the health facilities at Jebel Marakht and Qala en Nail are to be a success it is essential that they receive administrative support from Gedaref and access to the hospital as the major referral unit. At present the hospital's facilities are over-extended and will need to be strengthened if it is to give the support necessary. It is hoped that

a well-run facility at Jebel Maharigat and Qala en Nahl will cope with the major proportion of the health needs of the refugees, but inevitably some cases will need to be referred.

The general level of equipment and drug supplies within the Hospital leaves much to be desired and causes intense frustration amongst the staff. It is strongly recommended that an additional children's ward of 12 beds be added thereby doubling the capacity of the paediatric unit. In addition, it is recommended that a staff house be built for the paediatrician as the lack of accommodation for this post has in the past been the major cause of staff discontent, resulting in excessive staff turnover.

On the basis of information obtained from the Provincial offices in Gedaref, the size of an extra paediatric ward would be 50 m^2. Allowing another 20 m^2 for other purposes, the capital cost is estimated to be approximately as follows:-

	LS
Building: 70 m^2 @ LS 100	7 000
Furnishings and equipment: say,	2 000
T1 type house for paediatrician	12 000
Additional hostel capacity for two nurses:	6 000
	27 000

As regards recurrent costs the paediatrician's salary is covered under the present hospital budget. Staff costs for the extra two nurses and two orderlies required would be LS 2,600 (see above) and maintenance of equipment LS 200.

APPENDIX F

PERMANENT WATER SUPPLY FOR JEBEL MAHARIGAT

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1. Alternative sources of supply

A major requirement is an immediately available reliable water source. Three possible sources have been considered:-

(a) Groundwater
(b) Run-off storage
(c) Atbara reservoir

(a) Groundwater

A study of groundwater resources within the Presidential Decree Area was made by the Rural Water Corporation (RWC) in 1974. Groundwater is not available at the site because of the existence of a considerable depth of basalt rock. The Nubian Sandstone is available within the PDA, but is of limited quality due to its poor transmissibility. Four tubewells were constructed in or close to the PDA, but none of these are associated with a suitable site for a large settlement. One of the tubewells (Maharigat) has been used to provide water for a refugee settlement, but has proved to be capable of a very limited water supply.

Groundwater as a source of supply for the Jebel Maharigat settlement cannot be considered because:-

(i) The source is not of proven reliability.
(ii) It is too far distant from the settlement, involving very high transmission costs.

A more detailed discussion of the groundwater source is contained in the pre-feasibility report prepared by the Consultants in January 1976.

(b) Run-off storage

It is common practice in the Sudan, especially in the clay plains, to provide a source of water by intercepting and storing

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(i) The source is not of proven reliability.
(ii) It is too far distant from the settlement, involving very high transmission costs.

A more detailed discussion of the groundwater source is contained in the pre-feasibility report prepared by the Consultants in January 1976.

(b) Run-off storage

It is common practice in the Sudan, especially in the clay plains, to provide a source of water by intercepting and storing

run-off during the rainy season. This is done by excavating large pits (hafirs) in the clay in an area where run-off channels naturally; in some cases channels are dug to increase the interception of run-off.

At the Maharigat site it would be possible to construct a hafir in a natural drainage line about two kilometres north of Jebel 1. However, the catchment area which feeds the natural drainage is quite inadequate to supply enough water for a settlement as large as that proposed for Jebel Maharigat. Further, the provision of water from a hafir source creates pollution hazards, especially when serving a population with a very high incidence of waterborne diseases. Since the obvious area for hafir construction is only some two kilometres from the settlement, the risk of serious pollution would be very high. It is considered that hafir storage is not a feasible source of supply for the settlement at Jebel Maharigat.

(c) Atbara reservoir

The proposed settlement site at Jebel Maharigat lies some 15 km due west of the Atbara reservoir, i.e. that section of the R. Atbara upstream of the dam at Khashm el Girba. The reservoir provides a perennial water source, although by the end of the dry season it recedes into a series of pools. Considerable siltation has occurred since the construction of the dam, causing partial sealing of the bed and a consequent reduction of sub-surface flow between the pools. This means that heavy abstraction from one pool cannot be equalised by sufficiently rapid flow from neighbouring pools. Nevertheless, the reservoir does provide an exploitable and reliable water source, and alternative methods and costs of exploiting this supply are considered in the following sections.

2. Showak Waterworks

Completed in 1970, this waterworks supplies treated water to Showak and Gedaref, with a maximum design capacity of 9,090 m^3 per day. However, the design capacity cannot be met at present because of problems relating to water intake: as explained above, abstraction from a single pool is not equalised by sub-surface flow from adjoining pools. Consequently, at the end of the dry season temporary pumps have to be used to transfer water

from neighbouring pools to the intake pool to maintain supply. In spite of this, there is no evidence that required demand cannot be met, or that a small increase in total requirements cannot be supplied.

At present the demand from the waterworks is 6,600 m^3/day for Gedaref, and 350 m^3/day for Showak, a total of 6,950 m^3/day. Thus the present demand is considerable less than the design capacity of 9,090 m^3/day. As noted above, this design capacity is unlikely to be met because of the intake restrictions, but the present demand could be exceeded even with the existing restrictions.

Water to Gedaref is pumped from the waterworks by two (duty and standby) 633 HP centrifugal pumps against a total head of 210 m as measured at the outlet. The pumps are rated at a total head of 240 m. The pumping main is 500 mm diameter, continuously welded, bitumen lined steel pipe delivering water to a 9,090 m^3 service reservoir at Gedaref at a pumping rate of approximately 420 m^3/hour, requiring 15 to 16 hours pumping per day to maintain the level in the service reservoir.

3. Water requirement at Jebel Maharigat

In Chapter 5, the maximum population to be settled at Jebel Maharigat has been assessed as 24,000. For reasons explained in Chapter 5, the actual population settled is likely to be considerably less, and may not exceed 17,000. For the purposes of calculating water supply requirements, the higher figure has, however, been chosen. In the likely event that less than 24,000 people are settled, the extra capacity will allow for the settlement of new refugees who may arrive in the Sudan in the future.

In assessing the supply requirement of the new settlement, the following assumptions have been made:-

(a) Consumption will be at the rate of 20 litres/head/day for those served by waterpoints and 50 litres/head/day for those on service connections.

(b) Water will be supplied for small animals, e.g. sheep, goats and donkeys but not for cattle, which can be watered at the water-yards within the PDA; an arbitrary number of small stock has been allowed for at one animal per person.

(c) Wastage and leakage would be 10 per cent of supply.

The daily requirements of the human population for the maximum population of 24,000 are:-

22,750 at 20 litres/head/day	455 m^3
1,250 at 50 litres/head/day	62.5 m^3
	517.5 m^3

For the animal population an allowance of 2 litres/head/day has been made, requiring a total of about 50 m^3 per day.

Therefore, total water requirement is 567.5 m^3 per day; allowing for wastage and leakage at 10 per cent, the settlement would have a daily requirement of 625 m^3. For a population of 17,000, the requirement for humans and animals would be 450 m^3 per day.

These requirements could be raised to 700 m^3/day if provision is made for extra capacity in the settlement to cope with an extra influx of up to 4,000 refugees. With a spare design capacity of 3,000 m^3/day, the Showak system could easily cope with this demand, even allowing for the present intake problems.

4. Alternative supply systems

From the previous sections it can be seen that the water supply to Jebel Maharigat requires that up to 700 m^3/day be supplied from the Atbara reservoir. Three alternative methods of effecting this supply have been examined:-

(a) Direct extraction from the Atbara reservoir.
(b) Pumping treated water from the Showak waterworks.
(c) Pressure tapping of the Gedaref pumping main.

(a) Direct extraction from the Atbara would require the building of a pumping station at the reservoir with treatment works. Since an adequate supply of treated water can be obtained from Showak waterworks at the same distance from the site, this alternative can be dismissed.

(b) Pumping from Showak waterworks would require the installation of two pumps (duty and standby) and 13 kilometres of 250 mm steel trunk main.

The daily requirements of the human population for the maximum population of 24,000 are:-

22,750 at 20 litres/head/day	455 m^3
1,250 at 50 litres/head/day	62.5 m^3
	517.5 m^3

For the animal population an allowance of 2 litres/head/day has been made, requiring a total of about 50 m^3 per day.

Therefore, total water requirement is 567.5 m^3 per day; allowing for wastage and leakage at 10 per cent, the settlement would have a daily requirement of 625 m^3. For a population of 17,000, the requirement for humans and animals would be 450 m^3 per day.

These requirements could be raised to 700 m^3/day if provision is made for extra capacity in the settlement to cope with an extra influx of up to 4,000 refugees. With a spare design capacity of 3,000 m^3/day, the Showak system could easily cope with this demand, even allowing for the present intake problems.

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(b) Pumping from Showak waterworks would require the installation of two pumps (duty and standby) and 13 kilometres of 250 mm steel trunk main.

(c) Pressure tapping of the Gedaref mains would obviate the need for pumps and reduce the trunk main to 7 kilometres of 200 mm steel pipe. Possible pipeline routes for these two alternatives are shown in Figure 6.3.2.

Since water supply is equally feasible from either the waterworks or the Gedaref main, alternative (c) provides by far the cheaper system; therefore only this alternative has been costed in detail.

5. Recommended water supply system

A detailed survey will be necessary to establish the exact point on the Gedaref main where a pressure connection can be made; for calculation purposes a point 10 km along the main from the waterworks has been assumed. This is identified as point B on Figure 6.3.2.

To ensure delivery of the required 625 m^3/day to the settlement, 200 mm diameter trunk main will be required from point B to point C, a maximum distance of 7 km. At C, the trunk main will bifurcate to the high level storage tanks at D and E; the mains C - D and C - E will be of 150 mm diameter. The total length of these secondary mains will be just under 4 kilometres. Thus a total trunk main length of 11 kilometres has been allowed; this figure is probably over-generous, but allowance must be made for variation of the pressure connection point.

Since the Gedaref trunk main lies immediately to the south of the railway line, a thrust boring will be required under the line to allow the 200 mm trunk main to be installed. The cost of this has been included in the cost for the trunk main.

It is recommended that steel pipes should be used in the supply system. Other materials, while cheaper, are subject to damage by impact loads and especially by pressures resulting from the swelling and shrinking of expanding lattice clays, in which virtually the whole system will have to be laid.

A gravity distribution system from high level storage tanks is suggested. Storage capacity should be sufficient to allow for one full day's supply; thus storage capacity of 625 m^3 will be required.

The distribution system will consist of 100 mm diameter mains with 75 mm spurs, leading from each of the two storage tanks. A connection between the two storage tanks has been allowed for to maintain a hydraulic balance in the system and provide a standby temporary supply at each of the main settlement areas should its own supply break down. The details of the suggested distribution system are shown in Figure 6.2.

The distribution system will deliver water to a number of watering points. These will consist of a small area enclosed by a fence and containing a tapstand with six taps and an animal watering trough. In addition, service connections would be provided for administrative staff housing, dispensary and other central services. To aid leak detection, all branches would incorporate valves.

The number of watering points is dependent on the settled population and the distance over which water is fetched. No household should be further than 0.5 kilometres from a watering point, to minimise contamination of the water. To achieve this it will require 11 watering points to serve a population of 17,000 and 15 for a maximum population of 24,000. These will require some 8.5 kilometres of distribution pipeline to serve 11 watering points and 11 kilometres for the 15 watering points. The proposed layout is shown in Figure 6.1.

This layout does not allow the design of a gridiron system, and necessitates a number of "dead-ends" in the distribution system; these would, however, be fitted with washout valves to permit flushing of the mains to be carried out as necessary.

Maintenance of the installed system would best be carried out by the Public Electricity and Water Corporation (PEWC), who are the obvious agency to instal the system. Costs of maintenance would thus be the responsibility of the Corporation, in return for which normal charges would be levied on the consumer. In Kassala Province, water is normally charged per unit of four gallons, since water is normally collected in four-gallon tins. The normal charge is 0.5 piastres per tin; for service connections the charge is 10 piastres/m^3, usually recorded by meter measurement. However, there is a lack of both meters and spares, and a fixed charge would be preferable to metering. This could be on the basis of 50 litres/head/day, say 5 piastres/day/household for those with a service connection.

6. Costs of water supply

Costs have been worked out for a supply system to serve both a 17,000 and 24,000 population. The trunk main costs are those for the larger population, since subsequent expansion of the trunk main to meet an increased demand would be very costly. Variation in costs between the two systems are thus dependent on differences in the storage and distribution requirements.

(a) Costs for a 17,000 population

Table F.1 shows the estimated capital costs of water supply for a settlement of 17,000 people.

Table F.1 Estimated capital costs of water supply for 17,000 people

	Item	LS
1.	Trunk main	
	7,000 m of 200 mm steel main	88 960
	4,000 m of 150 mm steel main	38 440
	Pressure connection	1 000
	Thrust bore	500
	Valves and tools	2 100
	Trunk main sub-total	131 000
2.	Distribution	
	6 100 m of 100 mm distribution main	39 650
	2 400 m of 75 mm distribution spur	10 800
	Valves	2 300
	Sub-total	52 750
	2 x 230 m^3 high level storage tanks	21 000
	Pipes and valves	560
	Tank erection	3 800
	Sub-total	25 360
	11 tapstands for watering points	8 800
	Spares	1 500
	Distribution sub-total	88 410
3.	Contingencies (10%)	21 940
4.	Total	241 350

6. Costs of water supply

Costs have been worked out for a supply system to serve both a 17,000 and 34,000 population. The trunk main costs are those for the larger population, since subsequent expansion of the trunk main to meet an increased demand would be very costly. Variation in costs between the two systems are thus dependent on differences in the storage and distribution requirements.

(a) Costs for a 17000 population

Table P.1 shows the estimated capital costs of water supply for a settlement of 17,000 people.

Table P.1 Estimated capital costs of water supply for 17,000 people

Item	R$
1. Trunk main	
7,000 m of 200 mm steel main	88 960
4,000 m of 150 mm steel main	32 440
Pressure reducer	1 000
Burst bore	500
Valves and tools	2 100
Trunk main sub-total	131 000
2. Distribution	
6 100 m of 100 mm distribution main	39 650
2 400 m of 75 mm distribution spur	10 800
Valves	2 300
Sub-total	52 750
2 x 250 m³ high level storage tanks	21 000
Pipes and valves	560
Tank erection	3 800
Sub-total	25 360
11 tapstands for watering points	8 800
Spares	1 500
Distribution sub-total	82 410
3. Contingencies (10%)	24 940
4. Total	241 350

(b) Costs for a 24,000 population

In this case the cost of the trunk mains remains the same; the distribution costs are increased by additional storage and watering points. Thus the cost would be as shown in Table F.2.

Table F.2 Estimated capital costs of water supply for 24,000 people

	Item	LS
1.	Trunk main	131 000
2.	Distribution	
	7 400 m of 100 mm distribution main	48 100
	3 500 m of 75 mm distribution spur	15 750
	Valves	3 000
	Sub-total	66 850
	2 x 315 m^3 high level storage tanks	25 000
	Pipes and valves	560
	Tank erection	3 800
	Sub-total	29 360
	15 tapstands for watering points	12 000
	Spares	2 000
	Distribution Sub-total	110 210
3.	Contingencies (10%)	24 120
4.	Total	265 330

To allow for capacity to absorb more than 24,000 refugees, Jebel 3 (see Figure 6.2) could be used to settle a further 4,000 people. It is calculated that provision of water supply to this jebel would add a further LS 55,000 to the cost of the supply. The costs of these various alternatives are summarised as follows:-

(i) Water supply for 17,000 people LS 241,350
(ii) Water supply for 24,000 people LS 265,330
(iii) Water supply for 28,000 people LS 320,330

(b) Costs for a 7½,000 population

In both cases the cost of the trunk mains remains the same; the distribution costs are increased by additional storage and watering points. Thus the cost would be as shown in Table P.2.

Table P.2. Estimated capital costs of water supply for 84,000 people

Item		
1. Trunk main		151 000
2. Distribution		
7 400 m of 100 mm distribution main		48 100
3 500 m of 75 mm distribution pipe		15 750
Valves		3 000
	Sub-total	66 850
2 x 315 m^3 high level storage tanks		25 000
Pipes and valves		560
Tank erection		3 900
	Sub-total	29 360
15 tapstands for watering points		12 000
Spares		2 000
	Distribution Sub-total	110 210
3. Contingencies (10%)		24 120
4. Total		265 330

To allow for capacity to absorb more than 84,000 refugees, Label 3 (see Figure 6.4) could be used to settle a further 4,000 people. It is calculated that provision of water supply to this label would add a further £5 55,000 to the cost of the supply. The costs of these various alternatives are summarised as follows:-

(i) Water supply for 11 000 people £5 241,330;

(ii) Water supply for 24,000 people £5 265,330;

(iii) Water supply for 28,000 people £5 320,330

(o) Recurrent costs

Running costs have been based on the maintenance of the distribution system and the cost of the additional pumping hours needed at Showak waterworks to supply the water required at Jebel Maharigat. The pumps are rated at 420 m^3/hour, but it is not known if this is their present performance; to provide a measure of safety, an extra two hours has been assumed as necessary to provide the settlement's supply.

The annual running costs are summarised below:-

	LS
Maintenance of distribution system	5 000
Extra pumping requirement	5 500
Pump maintenance	250
Total	10 750

(c) Recurrent costs

Running costs have been based on the maintenance of the distribution system and the cost of the additional pumping hours needed at Thowek waterworks to supply the water required at Jobel Makartiyat. The pumps are rated at 450 m^3/hour, but it is not known if this is their present performance; to provide a measure of safety, an extra two hours has been assumed as necessary to provide the settlement's supply.

The annual running costs are summarised below:-

	LE
Maintenance of distribution system	5 000
Extra pumping requirement	5 500
Pump maintenance	250
Total	10 750

APPENDIX G

SANITATION

APPENDIX C

SANITATION

APPENDIX G

SANITATION

1. General

The first step in waste collection and disposal is the provision of some kind of latrine system. In any designs there are two important factors which must be taken into account. These are:-

(a) Whether to install communal facilities or facilities for every family.

(b) Local customs and the type of apparatus best suited to them.

The choice to be made in (a) above is generally governed by the factors of cheapness and degree of urgency. It has been found that where both needs are acute, the provision of communal latrines, at least for the majority, is preferable. Communal latrines are, however, liable to neglect and/or abuse, and regular inspection needs to be carried out by the health administration.

Where the degree of urgency and the need to cut costs are not acute, individual latrines, one per family or pair of families, are preferable. It is hoped that in this kind of situation the sharing of facilities will promote individual responsibility towards the cleanliness of the latrine. However, in some communities it may still be necessary to carry out regular inspections and even allow for teaching of rudimentary personal hygiene.

2. Existing situation

In the brief survey made of the existing habits of existing refugee communities, it was found that the people generally disliked communal latrines and preferred to use the open country adjacent to their settlement. The grounds for the dislike of public latrines were twofold:-

(i) distance to latrines;

(ii) cleanliness of latrine.

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(i) distance to latrines,

(ii) cleanliness of latrine.

It was found that some latrines were placed at distances as far as 5 km from the settlement. This was presumably done as a health precaution, but has tended to act as a disincentive to use. Latrine blocks were found to be dirty and the majority appeared not to have been cleaned for some time. Besides being a health hazard, this is a further disincentive to use.

The practice of using the open country together with the lack of cleanliness in the existing toilets, puts the people at a considerable health risk. Health records confirmed this, a high proportion of illnesses recorded being of enteric origin.

In the Consultants' survey an effort was made to ascertain the type of apparatus that was best suited to the people. Given a choice of latrine system, the following was found to be the order of preference:

(a) Waterborne systems;
(b) Pit privy systems;
(c) 'Night soil' bucket closets.

Although the sample size of this survey was very small, it gave an indication of the feelings on this matter. It was quite clear that method (c) was not liked because the buckets were never or very rarely emptied.

The results of the Consultants' survey were discussed with local and Ministry of Health officials, who generally concurred with the findings and gave valuable assistance in the formulation of the proposals.

3. Proposals

The latrine system proposed for the refugee settlement site at Jebel Maharigat is of the pit privy type. Pit privies generally consist of a manually dug hole round or circular in cross section and not less than 3 m deep (the Ministry of Health recommend that a depth of 6 m be used in this type of development). The volume of the pit is related to its useful life and on whether the water table is penetrated.

The Ministry of Health normally recommend that the pits should be at least 2m x 2m x 6m deep, giving a useful volume of 24 m^3 (846 ft^3). Based on WHO (World Health Organisation) design criteria for sanitary

pit privies, it is estimated that a pit this size would have a useful life of about 80 years with five people (i.e. a typical family) using it. Taking a design life of 20 years for a pit latrine on this project and assuming five persons per pit latrine, a volume of 6 m^3 per family would be required.

APPENDIX H

ELECTRICITY SUPPLY FOR JEBEL MAHARIGAT

APPENDIX B

ELECTRICITY SUPPLY FOR JUNIOR MARARIDOAT

APPENDIX H

ELECTRICITY SUPPLY FOR JEBEL MAHARIGAT

1. Introduction

At this level of study it is difficult to assess the exact electrical power requirements for a development of this type. Once a need for electrical power is established the question of whether to provide power to the whole settlement must be considered. There is also the question of whether to establish local generating capacity or to rely on transmission from an offtake from the Showak sub-station on the main Khashm el Girba - Gedaref power line. A brief study concerning the relative merits of possible power sources has been made based on discussions with PEWC (Public Electricity and Water Corporation).

2. Project Power Demand

To enable an outline scheme to be designed and costed, it has been assumed that power will be required in main buildings, the dispensary, schools, workshops and other central facilities, management housing and for street lights. It would not be supplied to refugees' houses.

Based on these assumptions and on the project design population, it is estimated that the total power demand will be of the order of 260 kw. Taking account of the diversity which will occur in a large number of small buildings, an assumed continuous load of 200 KVA has been taken as an appropriate estimate at the present time.

3. Alternative sources of supply

There are two alternative methods of providing an electrical supply to the project site, as follows:-

(a) Connection to the existing PEWC grid system, some 15 km distant.

(b) Provision of a small generator station at the site, with standby facilities.

(a) Connection to the main grid

There is an existing 66 KV/11 KV, 2.5 MVA transformer/switching station at Showak, with spare capacity (four spare feeders). It would appear to be possible to take an 11 KV supply from one of these spare feeders and supply the proposed site at Jebel Maharigat, using an overhead 11 KV line. This line would terminate at the settlement, with a 11 KV/415 V (300 KVA) transformer substation. From this low voltage substation, a 415 volt 3 phase supply would be distributed on possibly a 'ring' and 'spur' distribution system to the consumers.

(b) Local generation

This scheme would be an on site generating system. It would involve the construction of a small generator station at Jebel Maharigat, consisting of two 200 KVA diesel generators complete with all necessary ancillary equipment.

The proposed generator station would be equipped with automatic standby facilities, and at this stage it is envisaged that continuous manning would not be necessary. Routine maintenance and supervision could be undertaken by the maintenance engineer stationed at Showak, assisted by an operator/mechanic.

4. Choice of Power System

In order to select the more economic power supply, the capital and running costs for both schemes were compared over a period of 10 years, assuming a continuous load of 200 KVA. The majority of unit rates used in the comparison were obtained from PEWC Khartoum. It was not possible to obtain a reliable rate for bulk purchase of diesel fuel/gas oil (e.g. say 30 - 35 Redwood secs). The price range quoted was LS 11 to LS 20 per barrel (LS 0.275 to LS 0.50 per gallon).

Excluding items that are common to both, such as the local distribution system, the capital costs of the two alternatives would be as follows (these costs exclude import duties and taxes):-

A. On-site generation:	LS
Two diesel generators	35 000
Generator housing, switching gear, etc.	7 000
	42 000

B. Mains supply:	
15 km of 11 KV transmission line	90 000
11 KV/415 volt transformer at Jebel Maharigat	14 600
	104 600

The estimated capital and running costs of the two alternatives have been compared in terms of their present value at an interest rate of 10 per cent. Account has been taken of the following assumptions:-

(i) the average load would be 200 KVA for 12 hours per day;

(ii) the diesel generators would last for 15 years and the transmission line for 50 years;

(iii) annual cost of maintenance and spares of the generators would be equivalent to 10 per cent of the capital cost: i.e. LS 3,500 per annum.

(iv) fuel consumption would be 140 Imperial gallons per day or 51,100 gallons per annum. Costs have been estimated on the basis of two diesel fuel prices, LS 0.30 and LS 0.40. Annual fuel costs would then be LS 15,330 and LS 20,440 respectively.

(v) Prices charged for power from the grid would be based on PEWC's Tariff T4.3.1. Unit prices fall with increased load and range from LS 0.0183 per KWH to LS 0.0138 per KWH for electricity from the existing sub-station at Showak. Total annual cost would be LS 11,000.

The comparison indicated that over a 10 year period the costs of local generation would be slightly higher if the diesel price of LS 0.30 were applied. If the refugees moved out after 10 years and electricity consumption in the vicinity of Jebel Maharigat fell to negligible

proportions, as would probably occur, the costs of the transmission line and associated facilities would have to be written off over 10 years instead of 50. In this case power generated at the site would be cheaper at a diesel price of up to LS 0.36 - 0.37 per gallon.

Local generation has the added advantage of increased flexibility. Capacity can be raised relatively easily in the event of demand being above projected levels and at the other extreme the equipment can be removed and installed at another site when it is no longer required at Jebel Maharigat. In view of this added flexibility and the broadly similar costs, diesel generation on site is recommended.

It should also be noted that although the systems costed are for a maximum load of 300 KVA, the diesel system envisaged could if required supply 400 KVA.

APPENDIX C

ALTERNATIVE FORMS OF AGRICULTURAL PRODUCTION

APPENDIX J

EXISTING AGENCIES AND INSTITUTIONS

APPENDIX J

EXISTING AGENCIES AND INSTITUTIONS

1. Province Administration

Kassala Province, as an administrative unit, is composed of a single provincial executive council (headed by the Commissioner) which controls the work of three district councils, headed by Assistant Commissioners (Northern DC based at Kassala, Central DC at New Halfa and Southern DC at Gedaref). Under the District Councils is a further tier of rural or town councils. Rural councils are normally under the supervision of one (or possibly two) local government executive officers, with town councils having a substantially larger administrative staff. Southern (or Gedaref) DC has one town council - at Gedaref - and nine rural councils. These are:

Gedaref Rural
Wad el Hileiwu
Es Showak
Butana
Qala en Nahl
Dokha
Mafaza
Hawata
Kassab

Below the rural councils there is a further tier of village councils (in all, 154 in Gedaref District), largely created as a focus for any local self-improvement efforts and lacking any sustained or effective link to the local government administration at the rural council level. They have no paid staff and take little practical part in local administration.

This structure of province - district - rural/urban administration is not confined to the local government service only. Similarly, other ministries (notably Health, Education, and Agriculture) are organised in the field along the same hierarchy of responsibility.

Under the new provincial system, however, ministries (apart from Local Government) have been formally abolished as independent agencies within each province. In staff terms, this means that all government officials working in the province are seconded to the provincial administration whatever their parent ministry. In budgetary terms, it means that the province receives a comprehensive budget covering all government expenditure (excepting transport, judiciary, and defence).*

The system is, however, less integrated, less rigid and less powerful than it appears. Staff remain tied to their own ministry establishments, budgets are submitted on a ministry (and even departmental) basis, and at all levels of administration, individual ministries and departments enjoy considerable autonomy from their 'parallel' local government officer (and rather less autonomy from their 'vertical' ministry superior at district and province level).

There is a further important point on the 'developmental' aspect of the new system. Provincial spending is almost entirely based on recurrent expenditure (especially salaries); the development budget is allocated to central ministries and the rapidly expanding parastatal sector. The latter, of course, also has a large recurrent expenditure outside the provincial budget and increasingly in the Sudan it is the management of, for example, the Sudan Sugar Corporation, the Mechanised Farming Corporation, and the Rahad Corporation which determine development priorities in provinces such as Kassala.

2. <u>The Provincial Commissioner</u>

Under the new system, the office of the Provincial Commissioner is a source of both strength and weakness, especially in relation to the issues of programme management discussed in this report. On the one hand, the Commissioner is particularly well-placed to respond to emergencies and unforeseen contingencies. His small and easily convened Security Committee can rapidly deploy, for example, the material and human resources necessary for a sudden refugee influx and effectively administer settlement programmes for 4/5 months. On the other hand, the Commissioner has little control over longer-term issues of development planning (such as settlement policy and social service allocation), partly because

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* In 1975-76, Education, with LS 4,183,146, had by far the biggest vote. Provincial Administration (which included Police and Prisons along with Local Government itself) had LS 2,216,207 and Health LS 1,610,975. Agricultural Services (i.e. excluding Natural Resources, RWDC and Animal Resources) was only LS 89,530.

decisions may be extra-provincial and partly because the Commissioner needs to accommodate the often competing intra-provincial interests (field departments, local citizens, commercial groups, etc.). Furthermore, the very authority of the Commissioner (and also of the 'departmental' Assistant Commissioners at province headquarters*) inhibits the autonomy of the district and rural council officer, especially on contingency expenditure, for example.

3. Local Councils

The 'local council' is not as cohesive an institution as it may appear. True, the council meeting involves all the important field officers as well as elected councillors and there is constant informal contact between departments. However, if, for example, it was decided that the Ministry of Education was henceforth to be outside the local council and provincial administration system, it is unlikely that there would be any noticeable change (as the switching of the RWDC from a ministry department to a public corporation indicates). In this way, one can regard ministries 'in the field' as agencies attached to the local council. Thus it would be feasible either to transfer responsibility for an entire scheme to a council (such as Gedaref District Council) or to transfer a particular responsibility to a particular 'agency' working under the aegis of the local council.

Gedaref District Council illustrates the point. Although there is a senior local government executive as Assistant Commissioner based in Gedaref itself, supported by a few junior officers, in both size and seniority this is a much weaker establishment than that attached to Health, for example, and probably no greater than that of Public Works or Agriculture.

4. Qala en Nahl Rural Council

The rural councils under Gedaref District Council are poorly staffed and seriously lacking in revenue. Qala en Nahl is no exception. There is an executive officer (DS Grade) at Qala en Nahl and a junior executive officer (B Grade) has been assigned to Um Saqata. There is also an education officer at Qala en Nahl responsible for the nine boys' elementary

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* Thus the previous Provincial Agricultural Officer is now labelled Assistant Commissioner for Agriculture.

schools in the council (6 boys' and 3 girls'). However, the nearest public health officer is in Hawata RC (there are four dispensaries in Qala en Nahl RC); there is only a building supervisor* in the 'PWD' (still called this, although technically it is now the Ministry of Construction and Public Works). There is no Police Officer in the Council, and sergeants are in charge of the four police posts; Agriculture is represented by a forest ranger (i.e. Natural Resources Department) preoccupied largely with charcoal-burning, and an agricultural supervisor at the scheme itself. During the period when the Qala en Nahl settlement scheme came under the Commissioner for Refugees, there was an Agricultural Officer at Qala en Nahl (as well as a Community Development Officer as Scheme Manager).

5. Office of the Commission for Refugees

As an agency for the implementation of resettlement, the Commission has a central strategic role, yet its powers are constrained by financial limitations as well as staff shortages.

Following any emergency influx, which is dealt with by the provincial authorities, it is the responsibility of the Commission to administer the resettlement camps and plan any welfare or development programmes. The Commission cannot do this alone (it was only recently that the Commissioner has been able to acquire a post of Co-ordinator to be based at Gedaref), so it either recruits staff from other ministries, which form teams for particular projects, or it recruits agencies to undertake particular tasks (the RWC for water supply at Qala en Nahl, for example). Much of the cost of this ad hoc arrangement is borne by UNHCR although, as a matter of policy, it withdraws from funding as soon as it feels that the host government is in a position to take over. Thus the tendency is for the Commission itself to withdraw, leaving administration to the local authorities concerned.

The senior staff that the Commission recruits are often from Local Government. This has the advantage of ensuring close informal links with the provincial and local administration and facilitates the eventual transfer of responsibilities to local authorities. This policy may appear to over-emphasise the regulatory rather than developmental aspects of

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* The nearest officer is in Gedaref and he, of course, is responsible for any building programmes; thus the supervisor simply handles maintenance.

refugee administration, but it must be remembered that transfers to the Commission are unlike secondments to the public corporations. There are additional allowances, but problems of housing, transport (and - for many - the unwelcome nature of the job itself) mean that there is little competition to become involved in the Commission's work.

6. UNHCR

Under its charter, the UNHCR is prevented from assuming a direct operational role in refugee administration. There are very rare exceptions (such as the Southern Sudan 'Special Operation'), but there is no reason to believe that UNHCR policy will be changed for Kassala. However, UNHCR in the Sudan, as a major funding source, is bound to work very closely with its operating partner in the Government of Sudan and obviously the UNHCR's confidence in the administrative capacity of its partner is an important factor in its annual request for fund-allocation in Geneva. Although UNHCR fund staff costs (often, for example, funding Government of Sudan posts for two years), there is no question of the UNHCR themselves appointing staff either from within or outside the UN system. Nor is there any question of UNHCR imposing an administrative structure for any part of refugee administration on Government of Sudan.

7. Other Agencies

Support for refugees comes from several sources. Some, such as World Food programme, have no direct involvement. Other agencies have direct contact but do not play any role in matters of policy and administration. They should not be ignored, however, as they contribute to the reduction in costs in refugee administration to the UNHCR and Government of Sudan.

The operational arm of the Sudan Council of Churches is at present the Swedish Evangelical Mission, which has two doctors, a few nurses, and a community development officer concerned with promoting, for example, child care, house improvement and vegetable gardening. ASME Humanitas has only a doctor, but like the Mission it provides material relief (medicines, blankets, milk powder, etc.). Other organisations such as the Eritrean Red Cross and Red Crescent Society and the possibly defunct Eritrean Relief Association are primarily concerned with relief inside Eritrea itself, although it appears that, as in the PLF and ELF relief operations,

some material reaches the camps inside the Sudan.

Staffing, rather than finance, appears to be the main problem of these agencies. However, there is likely to be a continuing influx of relief aid while the camps remain dependent and impoverished. Therefore one has to accept that there will continue to be a sizeable group of refugees who will assess, quite rationally, that it is in their interests to remain dependent on relief rather than seek employment or produce surplus crops.

(b) Khashm el Girba

The crop rotation in Khashm el Girba is based on the following annual acreages of major crops:-

	Feddans
Medium-staple Nile cotton	110,000
Groundnuts	110,000
Wheat	110,000

Seasonal labour is required from November to March, the peak period being December to January, when cotton picking begins. Demand is less in November, when the groundnuts are harvested, and in February and March, when the second and third pickings of the cotton crops are completed.

According to the Agricultural Production Corporation (APC), which manages Khashm el Girba as well as the publicly-owned pump schemes on the Blue, White and main Nile, approximately 90,000 - 100,000 seasonal labourers are brought into the scheme each year. Some 30,000 come from the Dash Delta, the flood irrigation area north of Kassala town. These labourers work at Khashm el Girba from January to March, when they return to the Dash to harvest their cash crop. Most of the remaining 60,000 - 70,000 seasonal workers come from Gedaref and other parts of Kassala Province. A considerable

number of Eritrean refugees from Wad el Hileiwu and elsewhere have been employed on the scheme. APC consider them to be reasonably competent at cotton picking, though not quite up to the standard of the other members of the casual labour force, mainly due to lack of experience.

Shortages of seasonal labour are a frequent problem on the scheme. To attract labour, the APC provide transport to bring workers from their home areas and to return them there at the end of the working season. Cash wages are higher than in the Gezira, averaging LS 0.40 - 0.50 per day, but food is not normally provided. Unlike the Gezira, pickers do not usually bring their families.

In view of the general labour supply - demand situation at Khashm el Girba and the fact that Eritrean refugees have already been employed there on a substantial scale, the scheme should provide attractive opportunities for seasonal wage employment. This is particularly true for the refugees who will be resettled in the Showak area, because this is only some 100 km away. Those at Qala en Nahl, which is over 250 km distant, may well prefer to work on the Blue Nile schemes and on nearby mechanised rainfed farms.

Requirements of casual labour for groundnut harvesting are much lower than for cotton picking. Furthermore, the introduction of mechanised groundnut harvesting has already begun, in which case labour demand for this operation will be reduced. Thus seasonal wage employment for refugees would be confined largely to cotton picking. Labour requirements per feddan are lower towards the end of the season, because the yield from the third and, to a lesser extent, the second picks is much less than from the first.

Allowing for this factor, it is assumed that refugees would be able to obtain seasonal employment at Khashm el Girba for three months, between December and March. Cotton pickers in the Gezira and Khashm el Girba customarily work continuously during the picking season. A somewhat higher monthly input than the 25 days taken for work on mechanised farms could therefore be expected. For calculation purposes an average of 28 days worked per month (i.e. 84 days per year) has been assumed.

Earnings would depend to some extent on the picking skill of the refugees. Since they have apparently shown themselves to be reasonably competent at this work, the potential income to refugees from cotton picking

in Khashm el Girba has been calculated on the basis of the average present earnings on the scheme, namely LS 0.45 per day. Monthly earnings would then be LS 12.60 and total income over the three months worked between December and March would be about LS 38. This is well below the potential earnings in mechanised agriculture.

(c) Blue Nile pump schemes

The Blue Nile pump schemes comprise a large number of individual schemes located along the river between 40 km north and 120 km south of Sennar. With the exception of the recently-completed Es Suki project (gross area 90,000 feddans), virtually all were formerly in private hands and were nationalised eight years ago.

Cropping at Es Suki is based on medium-staple Acala cotton, groundnuts and some wheat. On the other schemes the cotton grown is long-staple and dura is a major crop. The pattern of demand for seasonal labour is similar to the Gezira, the main peak being from January to March for cotton picking. Picking begins somewhat earlier at Es Suki, because Acala matures before the long-staple varieties.

According to the APC, severe shortages of seasonal labour occur on some of these schemes and refugees could find seasonal work without difficulty. Most of the schemes are within 175-200 km of the Qala en Nahl settlement by road, although the distance to the new settlement in the Showak area is some 100 km greater. Due to the presence of both medium and long-staple cotton, the picking season would be somewhat longer than in the Gezira and Khashm el Girba. An average period of 3½ months from December to March has therefore been assumed.

Detailed data on wage rates are not available, but wages are likely to be slightly above those in the Gezira, because of the greater scarcity of labour. ILO considered that in the Gezira in 1975 daily earnings averaged between LS 0.35 and LS 0.50, of which one-third was cash and two-thirds in kind. Another survey did, however, indicate somewhat higher figures (W. S. Mann, 'Labour employment and productivity of tenant farmers in Gezira mechanised farming area', University of Khartoum, 1975). For the Blue Nile schemes an average of LS 0.50 per day has been taken, with 28 days worked per month and 3½ months of possible seasonal employment for refugees per

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annum. Potential annual income per head from this source would then be LS 49 (LS 14 x 3.5 months), say LS 50. This is higher than from Khashm el el Girba, but well below the income that can be earned from working on mechanised farms.

(d) The Rahad Project

The first half of the Rahad Phase I area of 300,000 feddans is due to be brought under irrigation in 1977 and the other 150,000 feddans in 1978. Cropping will be based on 50 per cent medium-staple Acala cotton, 33 per cent groundnuts and 17 per cent fodder and other crops.

With this relatively intensive rotation and the high proportion of cotton, labour requirements per feddan will be greater than on the other irrigation schemes. The tenancies will be 24 feddans. In view of this comparatively large holding size and the sparse population in the areas adjacent to the project, requirements of migrant labour for harvesting work will be high. For the 300,000 feddans of the first phase (no decision has been taken on the implementation of Phase 2, which would cover about 500,000 feddans), 100,000 - 150,000 such workers would probably be needed.

To a considerable extent the impact of the project on the seasonal labour market in the Gezira and other nearby regions will depend on the degree of competition that arises between the Gezira and Rahad. Peak labour demand in the former is from January to March, for cotton picking. The Rahad Corporation intend to plant their cotton sufficiently early for most of the picking to take place in November and December and to be completed in January. If this objective is achieved the seasonal labour demand on the two schemes would be complementary rather than competitive, apart from a short period in January when picking would be in progress in both the Gezira and Rahad. Thus the casual labour which comes to the Gezira in January could come to the region two months earlier, in November, and work for two months in the Rahad before moving across the Blue Nile to start the Gezira cotton picking in January.

At this stage it is not possible to forecast events with any accuracy. Clearly, commissioning of the Rahad Project will result in some increase in the overall demand for seasonal labour, however successful is the attempt to tie in the cotton growing calendars of the two schemes. Rahad must therefore

be considered as a possible source of wage employment for Eritrean refugees. In view, however, of the promising prospects on the Khashm el Girba and Blue Nile pump schemes, both of which are in operation rather than under construction, further consideration has not been given to Rahad at this stage. It is abundantly clear that more than sufficient seasonal work is anyway available to keep all the Eritrean refugees in employment for much of the dry season.

4. Overall employment prospects and potential wage earnings

Table D.4 summarises the main seasonal employment opportunities for Eritrean refugees in the near future. In all cases, there is considered to be sufficient work to employ all refugees who might take up such employment.

Table D.4 Seasonal employment opportunities for Eritrean refugees

Area	Potential Annual Earnings* LS	Period							Total** worked (months)
		Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	
1. Mechanised rainfed farming in Kassala Province	100	—	———							4
2. Khashm el Girba	38				———					3
3. Blue Nile pump schemes	50				———					3½

* Annual earnings include wages in both cash and kind.

** This is the total time that on average each refugee would be able to find work in this field, and allows for movement between work areas and other types of lost time.

As indicated in the discussion above, employment in mechanised farming would be readily available to refugees at both the Qala en Nahl and Showak/Jebel Maharigat settlements. As regards irrigated farming, on the basis of distance one would expect those from Qala en Nahl to favour the Blue Nile pump schemes whereas those in the Showak area would tend to prefer working at Khashm el Girba. If, however, transport to and from the irrigation scheme

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2. Khasm el Girba	30	———	3
3. Blue Nile pump schemes	50	———	3½

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As indicated in the discussion above, employment in mechanised farming would be readily available to refugees at both the Gala en Nahl and Showak/Tobol Settlements. As regards irrigated farming, on the basis of distance one would expect those from Gala en Nahl to favour the Blue Nile pump schemes whereas those in the Showak area would tend to prefer working at Khasm el Girba. It, however, transport to and from the irrigation scheme be considered as a possible source of wage employment for Eritrean refugees. In view, however, of the promising prospects on the Khasm el Girba and Blue Nile pump schemes, both of which are in operation rather than under construction, further consideration has not been given to Rahad at this stage. It is abundantly clear that more than sufficient seasonal work is anyway available to keep all the Eritrean refugees in employment for much of the dry season.

were provided, as is normally the case at Khashm el Girba, the factor of distance might be of little significance.

From the viewpoint of a refugee dependent entirely on wage employment (i.e. with no farm of his own), his best strategy would be to work from August to January on mechanised rainfed farms in the Gedaref, Showak, Sim-Sim - Um Seinat, Gabub and other areas of Kassala Province. Since wages on mechanised farms are far higher than on the irrigation schemes, he would continue working there until the work ran out, probably in the second half of January. By this time he should have earned some LS 100. He would then move to the Blue Nile pump schemes or Khashm el Girba, for the second half of the cotton picking season. Earnings would be higher on the pump schemes, because of the longer picking period and the slightly better wages. If he reached there by the end of January or beginning of February, he could probably expect to obtain at least 1½ months' work, from which he would earn about LS 21. If, on the other hand, he went to Khashm el Girba, his picking season would finish earlier, because medium-staple rather than long-staple cotton is grown there. Assuming he found a total of one month's work, his earnings would be some LS 13.

A refugee farmer with a holding of his own at Qala en Nahl or Jebel Maharigat would earn less in seasonal wage employment, because he would be engaged in his own crop production work until October. Allowing for the time needed for dura harvesting, he would be unlikely to be available for outside employment until November. Between November and January he might obtain 2½ months' work on mechanised farms, earning him about LS 62. Thereafter he could move to the Blue Nile or Khashm el Girba schemes and earn another LS 13 - 21.

On the basis of these assumptions, Table D.5 shows the potential annual income of the refugees from seasonal wage employment, for farmers and non-farmers.

Table D.5 Refugees' potential annual income from wage employment (LS)

Source of Employment	Non-farmers	Farmers
Mechanised rainfed farming	100	62
Irrigation schemes	13 - 21	13 - 21
Total	113 - 121	75 - 83

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Source of Employment	Non-Farmers	Farmers
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Total	113 - 121	75 - 83

These figures represent the maximum that refugees are likely to earn if they are willing to take full advantage of the seasonal employment opportunities available. Assuming that the charges made for water and other services in the refugee settlements are not excessive, this should be sufficient to support a typical family, though not at a very high standard of living. Many families will, of course, have more than one member capable of undertaking seasonal wage employment. In these cases annual incomes from outside employment should be sufficient to provide a more adequate standard of living. This question, and also farmers' likely earnings from their cropping activities, is discussed in the Main Report.

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APPENDIX E

HEALTH AND NUTRITIONAL SERVICES

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1. Those at greatest risk

Following any major disruption of normal life such as has occurred amongst the refugees, those primarily at risk are the children of pre-schooling age, the old and the infirm. Inevitably, changes in dietary habits are forced upon those unfortunate enough to have to depend upon relief supplies, because the foodstuffs provided frequently differ from the traditional diet. This change of diet is rarely accompanied by an educational input, as the urgency of the situation seldom allows this to be done. As a result the mothers frequently do not know how best to prepare these new foodstuffs for their children. The effect can often lead to a falling off of the nutritional plane of the children which can result in mild or even severe malnutrition as well as a lowered resistance to communicable diseases.

Any new settlement, no matter how well planned, often causes, at least in the initial stages, unnatural crowding of housing and service facilities resulting in an ideal environment for the spreading of disease, especially amongst a population with lowered resistance.

Where the refugees originate from a hilly well-drained region and are forced to move to the wetter plains they find themselves in contact with a new range of diseases and parasites to which they have little or no immunity. Malaria is a good example of this.

A good curative and preventive health service is therefore essential.

2. Those with special needs

A close look at the refugee population census taken at Wad el Hileiwu shows that 62 per cent of the total are aged 15 years or under. It can be assumed that of this number those falling in the greatest risk age groups (i.e. below seven years old) make up no less than 40 per cent of the total refugee population. Any plans which are aimed at creating a stable environment for the refugees must therefore take full account of

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these highly vulnerable members, who are totally dependent on their parents or guardians for their wellbeing. Special attention must be paid to those families who, through the absence or death of the head of the household, have lost much of their financial or social security, since it is amongst these families that the risks will be greatest. Even those families with a member in employment often need guidance on the feeding of the younger children, on family budgetting, etc., as many will, probably for the first time, be forced entirely into a cash economy.

3. Relief food supplies

The continuing handing out of relief food supplies over a long period can create undesirable changes in the recipients that undermines their self-respect, takes away initiative and, on occasions, fosters a begging mentality. It is desirable, therefore, from all angles that relief supplies continue only as long as is absolutely essential. However, the decision to reduce or cut off relief supplies can be carried out responsibly only when adequate safeguards have been made for the feeding of the children. To achieve the required level of self-sufficiency some form of self or paid employment is obviously necessary. Within any community, and especially one with a large number of family units deprived of their head, there will always be those who will find it necessary to receive assistance. In the absence of an organised Social Service the normal way to cope with these special families is through the Health Service.

4. The major health hazards

Aside from normal wounds and burns, investigations into the incidence of disease amongst the refugees at Wad el Hileiwu and Qala en Nahl indicates that the major health problems are malaria, upper respiratory infections, intestinal infection and parasites, and T.B. Although not specifically recorded, periodic outbreaks of measles and other diseases are known to occur amongst the children. These diseases are compounded by the low plane of nutrition of many of the children and the mortality rate is unacceptably high.

The treatment of patients is complicated at Wad el Hileiwu by the presence of two separate and loosely co-ordinated bodies providing the health services - the Ministry of Health, and Asmo-Humanitas (a German relief organisation). Owing to the current

unco-ordinated approach, double or even treble treatment of the same patient is not unknown. Cases of premature curtailment of treatment of T.B. cases is fairly common, due partially to the high degree of mobility of some refugees and partially through the patient's ignorance of the need for prolonged treatment.

It is vital that any future provision of health services for the proposed settlement at Jebel Maharigat as well as any improvements made at Qala en Nahl incorporate a strong preventive health component. This is sadly lacking at present. Only in this way can any long-term health service hope to bring about a reduction in the high infant mortality rates and a reduction in the suffering caused by diseases which are easily preventable through a higher level of understanding amongst the population.

5. The Health Services at Qala en Nahl

As a result of the widely dispersed pattern of settlement at Qala en Nahl, the provision of a comprehensive yet economic health service is extremely difficult.

The settlement is currently served by a Health Centre and four Dressing Stations, which are now being upgraded to dispensary standard. With these facilities it is probably the best served area in Kassala Province. Provincial statistics* show that on average each Health Centre serves a population of approximately 80,000 people and each Dispensary an average of 20,000 people. The settlement at Qala en Nahl, with a population of not more than 20,000 people, can therefore boast a health service of luxurious proportions.

(a) The Health Centre

At present the major health facility within the settlement is situated at the village of Um Saqata, the main administrative centre for the settlement. The Health Centre is run by a Medical Assistant with the help of two Sudanese male nurses, a cook and two orderlies. It contains two six-bedded wards for male and female patients in addition to a dispensary unit and permanent staff housing. The service provided is almost exclusively of a curative nature, with no planned attempt to provide any special

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* Sudan Almanac, 1970, 1971.

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services for those primarily at risk - the mothers and pre-school children. The Centre is administered by the Assistant Commissioner for Health based at Gedaref H ospital, which also acts as the referral unit. Supplies of drugs and equipment are drawn from Gedaref and are on occasion supplemented by supplies from the Commissioner for Refugees, through his assistant in Gedaref.

The In-patient records of the Health Centre show only 63 patients as being admitted in 1975, with a total of 252 for the three-year period ending January 1976. This compares to a theoretical capacity of more than 1,000 per annum. Out-patient returns are shown in Table E.1.

Table E.1 Out-patient returns - Um Saqata Health Centre

	1974		1975	
	Male	Female	Male	Female
Diagnosis				
Intestinal	3 380	3 263	2 869	2 953
Respiratory	2 466	2 325	2 193	1 986
Urinary System	252	260	176	242
Blood circulation	456	512	176	242
Eye infection	680	789	652	702
Ear infection	360	285	278	230
Wounds	2 235	786	1 171	630
Malaria	1 661	1 406	1 677	1 518
T.B.	9	3	39	39
Other	1 355	1 670	1 726	1 774
Total cases	12 854	11 299	10 957	10 316
Grand total	24 153		21 272	

Source: Records at Um Saqata Health Centre.

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Table B.1 Out-patient returns - Um Sagata Health Centre

	1975		1975	
	Male	Female	Male	Female
Diarrhoeal				
Intestinal	3 380	3 263	2 869	2 955
Respiratory	2 466	2 325	2 193	1 998
Urinary System	252	260	176	242
Blood circulation	456	512	176	242
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T.B.	9	5	39	39
Other	1 355	1 670	1 726	1 774
Total cases	12 854	11 299	10 597	10 376
Grand total	24 153		21 272	

Source: Records at Um Sagata Health Centre.

Assuming a 300 day working year, the number of patients treated on average per day is 80 in 1974 and 71 in 1975. However, this patient load does not correspond with the visual impression gained by periodic visits to the Centre, which would indicate a lower true figure. It is possible that the figures relate to the total number of visits for treatment. If this is the case then the figures are more realistic. The greater incidence of malaria in 1975 compared to 1974 causes concern, especially when one remembers that the population of the settlement fell drastically following the breakdown of agricultural services after the 1973 harvest. The consistently high incidence of intestinal complaints and upper respiratory infections throughout both years are also an indication of a declining health situation, possibly brought about by falling standards in water and sanitation facilities coupled with an inadequate plane of nutrition.

Somewhat surprisingly, the Health Centre is not connected to the extensive piped water supply network throughout the settlement and water has to be carted in drums from the waterpoint approximately $\frac{1}{4}$ km away.

(b) <u>The village Dressing Stations</u>

In addition to the Health Centre at Um Sawata four of the other five villages in the settlement are served by a simple Dressing Station. The stations at Salmin, Um Burush and Zarzur are each run by a single Sudanese male nurse whilst that at Deheima is staffed by two female nurses from the refugee community. Until recently these dressing stations consisted of a single grass hut, but following an offer of financial assistance from the Sudanese Red Crescent these are being replaced by permanent stone-built structures. In theory, the Dressing Stations are supervised by the Health Assistant based at Um Saqata, but in practice this is done only on an irregular basis due partially to inertia complicated by poor road communications between the villages especially during the rains. Drug supplies are drawn from Um Saqata but shortages frequently occur. No provision is made for regular meetings between the respective health staff so each tends to work in

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Somewhat surprisingly, the Health Centre is not connected to the extensive piped water supply network throughout the settlement and water has to be carted in drums from the waterpoint approximately ½ km away.

(b) The village Dressing Stations

In addition to the Health Centre at Um Sagata four of the other five villages in the settlement are served by a simple Dressing Station. The stations at Salmin, Um Durwah and Zamzur are each run by a single Sudanese male nurse whilst that at Dehaima is staffed by two female nurses from the refugee community. Until recently these dressing stations consisted of a single grass hut, but following an offer of financial assistance from the Sudanese Red Crescent these are being replaced by permanent stone-built structures. In theory, the Dressing Stations are supervised by the Health Assistant based at Um Sagata, but in practice this is done only on an irregular basis due partially to inertia complicated by poor road communications between the villages especially during the rains. Drug supplies are drawn from Um Sagata but shortages frequently occur. No provision is made for regular meetings between the respective Health staff so each tends to work in

isolation. Case referral to Um Saqata tends to break down in practice, due partially to poor transport facilities within the settlement. Many patients by-pass Um Saqata and report direct to Gedaref Hospital, thus putting additional strain on the facilities there. Treatment records at the Dressing Stations are not sufficiently well maintained to be of use in this study and pin-point again the necessity of adequate supervision.

(c) Conclusions

In spite of a health service which by normal Sudanese standards could be described as more than adequate, the quality of the treatment leaves much room for improvement. If the settlement at Qala en Nahl is to regain the confidence of the refugees the provision of an adequate and imaginative health service will play a large part in overcoming the present difficulties. Frequent illness or death within a settler family not only causes much mental anguish and hardship but erodes more quickly than anything the determination to stay.

The main conclusions from this brief review of the Qala en Nahl health services are as follows:-

(i) With the completion of the permanent buildings to house the Dispensaries, there is little need for further capital investment, except perhaps to ensure that the housing facilities for the staff are adequate. The Health Centre at Um Saqata should be connected to the water supply as soon as possible; the cost involved is very small in proportion to the benefits this will bring to staff morale.

(ii) The major input needed is the introduction of a simple yet comprehensive preventive health element which incorporates a strong health education input coupled with a basic vaccination service. The capital and recurrent costs of this innovation are minimal and could, over a period of a few years, actually cut the cost of providing a health service to the settlement, as greater understanding of basic health practices brings about a drop in the incidence of disease.

The main input apart from supplies is made up of the in-service training of the existing personnel. Hopefully, this can be carried out within the Sudan but because of the necessity of maintaining on-going services staff release will have to be phased over two or more years.

It is essential that adequate supervision of all levels of service is ensured and supplies of drugs, vaccines and equipment are always available. This will in turn depend upon a clear understanding of the objectives throughout the service, with prompt and timely commissioning of supplies by those implementing the scheme.

(iii) The in-patient facility at Um Saqata Health Centre is currently under-utilised and it is recommended that part of the facility should be converted to a small maternity ward. A nurse with midwifery training will be required to run this unit and to oversee an ante-natal and post-natal service that should be introduced.

(iv) At a later stage in the development of the comprehensive health service the possibility of using the Health Centre and the Dispensaries as centres spreading practical knowledge of nutrition might be considered. Initially, some facility should be included to provide subsidised or free protein foodstuffs to mothers with severely malnourished children. Later a small demonstration garden could be attached to the centre to demonstrate simple vegetable/fruit growing if a solution can be found to the conservation of water. The stocking of seeds and insecticides for public sale might have to be considered.

(d) Capital costs

The capital costs of the recommended improvements are estimated to be as follows:-

The main input apart from supplies is made up of the in-service training of the existing personnel. Hopefully, this can be carried out within the Sudan but because of the necessity of maintaining on-going services early release will have to be phased over two or more years.

It is essential that adequate supervision of all levels of service is ensured and supplies of drugs, vaccines and equipment are always available. This will in turn depend upon a clear understanding of the objectives throughout the service, with prompt and timely communication of supplies by those implementing the scheme.

(iii) The in-patient facility at Um Sagata Health Centre is currently under-utilised and it is recommended that part of the facility should be converted to a small maternity ward. A nurse with midwifery training will be required to run this unit and to oversee an ante-natal and post-natal service that should be introduced.

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(d) Capital costs

The capital costs of the recommended improvements are estimated to be as follows:-

Item	LS
Water supply connection to Um Saqata health centre	600
Conversion to maternity ward at Um Saqata	1 300
Vaccination equipment (cool boxes, refrigerators, Salter hanging scales) for 4 dispensaries	1 400
Visual aid equipment, @ LS 100 for each unit	500
	3 800

(e) Recurrent costs

The main additional recurrent cost would be the salary of the extra nurse, @ LS 800 per annum.

6. Health Services for Jebel Maharigat

6.1 General

As this settlement is still at the planning stage it is timely to consider the type of health service that is both desirable and practical. Experience can be gained from the existing facilities at Wad el Hileiwu and Qala en Nahl and an attempt made to provide a workable solution.

Agricultural production will not be sufficient to provide the settlers with an adequate standard of living and most families will also depend upon money sent back from family members employed elsewhere. The settlement can therefore be best described as a semi-urban environment.

From the beginning the intention should be to create a balanced health service covering the curative and preventive aspects with a strong educational element. Because of the artificially created semi-urban situation in which the refugees will find themselves it is to be expected that those families with minimal means of support will require special attention. The service should therefore include a social worker who would be responsible for following up special cases of need brought to light by the health service. This worker will require access to externally provided sources of foodstuffs, clothing, etc., with which to provide some meaningful form of assistance.

Item	£S
Water supply connection to Um Sagata health centre	600
Conversion to maternity ward at Um Sagata	1 300
Vaccination equipment (cool boxes, refrigerators, Salter banding scales) for 4 dispensaries	1 400
Visual aid equipment, @ £S 100 for each unit	500
	3 800

(e) Recurrent costs

The main additional recurrent cost would be the salary of the extra nurse, @ £S 800 per annum.

6. Health Services for Jebel Mabrakat

6.1 General

As this settlement is still at the planning stage it is timely to consider the type of health service that is both desirable and practical. Experience can be gained from the existing facilities at Wad el Hilaiwa and Qala en Nahl and an attempt made to provide a workable solution.

Agricultural production will not be sufficient to provide the settlers with an adequate standard of living and most families will also depend upon money sent back from family members employed elsewhere. The settlement can therefore be best described as a semi-urban environment.

From the beginning the intention should be to create a balanced health service covering the curative and preventive aspects with a strong educational element. Because of the artificially created semi-urban situation in which the refugees will find themselves it is to be expected that those families with minimal means of support will require special attention. The service should therefore include a social worker who would be responsible for following up special cases of need brought to light by the health service. This worker will require access to externally provided sources of foodstuffs, clothing, etc., with which to provide some meaningful form of assistance.

As the settlement is planned it is possible to incorporate a health service based on a single centre within easy reach of the whole population. This obviates the need to provide small Dressing Stations and thereby reduces staffing and capital costs. As the settlement is serving a refugee population which could leave en masse at the cessation of hostilities it is obviously necessary to minimise capital expenditure wherever possible. At the same time inadequate facilities will cause frustration and friction, so a compromise has to be reached which is felt to be reasonable. Care must also be taken to ensure that health facilities in Showak and Gedaref are improved where necessary to cope with the anticipated extra load.

To minimise capital expenditure it is envisaged that any unskilled health staff (e.g. orderlies) will be recruited from the refugee population together with any trained nurses within the community. This will reduce the staff housing necessary (housing at Jebel Maharigat will be provided only for Sudanese staff).

6.2 The dispensary

It has been assumed that a single large dispensary would be provided at Jebel Maharigat. This would comprise the following:-

- An open covered waiting area for up to 50 people at one time (40 m^2 total area)
- Two examination/consulting rooms leading off the waiting area (each of 20 m^2)
- A room for preparation and giving of injections (16 m^2)
- A room for dealing with septic cases/boils, etc. (16 m^2)
- A drug store/dispensary where drugs/medicaments are handed out (25 m^2)
- A room for conducting a pre-school clinic with examination couch for ante- and post-natal clinic work (20 m^2)
- A small store for foodstuffs (12 m^2)
- A small office opening onto the waiting area for patients' records, etc. (20 m^2)
- Verandahs, etc: say, 20 m^2

For Master Plan B, involving 24,000 rather than 17,000 settlers, an additional examination room would be required.

6.3 Staffing

It is envisaged that the staff would consist of:-

	17,000 settlers	24,000 settlers
Medical Assistant	1	1
Nurses	3	4
Social Worker	1	1
Orderlies	3	4
General helper	1	1

6.4 Housing and other facilities

Housing would be required for the Sudanese staff, namely the Medical Assistant, the nurses and the social worker. Other staff would be recruited from the refugee population.

Water should be piped to all rooms in the Dispensary with the exception of the food store and administrative office. Staff houses should receive a separate metered supply. A drinking fountain should be provided in the waiting area and a standpipe placed close to the latrines.

The compound should be laid out with a service road and buildings should be sited to allow room for future expansion. Care should be taken to ensure correct orientation of the buildings in regard to the sun and religious taboos.

A double latrine facility (1 male and 2 female) of the deep pit type will be required.

A normal level of locally available furnishings are provided for throughout, with the addition of a 6 cu.ft. kerosene/electric refrigerator for vaccines. Periodic use of a 4-wheel drive vehicle would be necessary, for drawing supplies from Showak or Gedaref as well as providing an ambulance service in cases of emergency.

For Master Plan B, involving 24,000 rather than 17,000 settlers, an additional examination room would be required.

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6.5 Supplies

A normal allocation of drugs, medicines and supplies for a dispensary serving a population of 17,000 - 24,000 people will be required. In addition, it will require vaccines, dilutants and disposable syringes to enable a preventive health programme to be carried out. Provision is also made for the purchasing, if necessary, of health education posters, flip charts, flannel graph materials, slides, etc., as well as a supply of locally printed Road-to-Health charts designed along the lines of the Morley charts now widely used.

6.6 Capital costs

The estimated capital costs of setting up the proposed large dispensary at Jebel Maharigat are shown in Table E.2. Costs of a vehicle have not been included, it being assumed that the health service would have access to the scheme management's vehicles.

Table E.2 Capital costs of health services at Jebel Maharigat (LS)

	Item	17,000 population	24,000 population
1.	Dispensary	LS	LS
	Buildings: 209 m^2 @ LS 100	20 900	-
	229 m^2 @ LS 100	-	22 900
	Furnishings and equipment	2 000	2 200
2.	Housing		
	2 T1 houses	24 000	24 000
	1 T2 house (for the Social Worker)	10 500	10 500
	Small hostel for nurses	12 000	12 000
3.	Total	58 900	61 100

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A normal allocation of drugs, medicines and supplies for a dispensary serving a population of 17 000 - 24,000 people will be required. In addition, it will require vaccines, dilutants and disposable syringes to enable a preventive health programme to be carried out. Provision is also made for the purchasing, if necessary, of health education posters, flip charts, flannel graph materials, slides, etc., as well as a supply of locally printed Road-to-Health charts designed along the lines of the Morley charts now widely used.

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2. Housing		
2 T1 houses	24 000	24 000
1 T2 house (for the Social Worker)	10 500	10 500
Small hostel for nurses	12 000	12 000
3. Total	58 900	61 100

6.7 Recurrent costs

Table E.2 gives the estimated recurrent costs of the health service at Jebel Maharigat, excluding drugs, vaccines and other materials. Building maintenance has not been included here, being covered under the maintenance programme for the whole settlement.

Table E.2 Estimated recurrent costs* of Jebel Maharigat health services (LS per annum)

Item	17,000 population	24,000 population
1. Staff costs		
Medical Assistant	1 500	1 500
Nurses, @ LS 800	2 400	3 200
Social Worker	1 000	1 000
Orderlies	1 500	2 000
General helper	300	300
Total	6 700	8 000
2. Equipment maintenance		
10% of capital cost	200	220
3. Annual total	6 900	8 220

* Excluding vaccines, drugs and other materials.

7. Health services at Showak

Some upgrading of the health services at Showak would be required to cater for the increased demand resulting from the Jebel Maharigat settlement. The alternatives are:-

(a) Provide sufficient additional capacity at the proposed Rural Hospital.

(b) Upgrade the existing dispensary to a Health Centre.

6.7 Recurrent costs

Table E.2 gives the estimated recurrent costs of the health service at Tebel Mahareket, excluding drugs, vaccines and other materials. Building maintenance has not been included here, being covered under the maintenance programme for the whole settlement.

Table E.2 Estimated recurrent costs* of Tebel Mahareket health services

(LS per annum)

Item	17,000 population	24,000 population
1. Staff costs		
Medical Assistant	1 500	1 500
Nurses, @ LS 800	2 400	3 200
Social Worker	1 000	1 000
Orderlies	1 500	2 000
General helper	300	300
Total	6 700	8 000
2. Equipment maintenance		
10% of capital cost	200	220
3. Annual total	6 900	8 220

* Excluding vaccines, drugs and other materials.

7. Health services at Sbowek

Some upgrading of the health services at Sbowek would be required to cater for the increased demand resulting from the Tebel Mahareket settlement. The alternatives are:-

(a) Provide sufficient additional capacity at the proposed Rural Hospital.

(b) Upgrade the existing dispensary to a Health Centre.

Although approved in principle, few details are available about the proposed 30 bed Rural Hospital at Showak. It is intended that this should be built on a self-help basis, by the local community.

At this stage it is not possible to prepare detailed cost estimates for a possible extension to the proposed hospital. To give some indication of the possible cost of such an extension, we have assumed that an extra small ward for 10 or 12 persons, plus the necessary furnishings and equipment, would be provided. With a ward of 5 m x 10 m and another 20 m^2 for other additional space, the total building cost has been taken as 70 m^2 x LS 100, or LS 7,000. Allowing for beds, other furniture and equipment, the total cost might be LS 9,000.

Total capital costs of providing additional capacity at the proposed Showak Rural Hospital are thus estimated to be as follows:-

Item	LS
Hospital building and equipment	9 000
Housing: Extra hostel capacity for two nurses: say,	6 000
	15 000

Apart from medicines and supplies, which have not been estimated, the additional recurrent costs due to the project would be mainly for the extra staff required. Assuming that two extra nurses and two extra orderlies would be needed, the additional costs would be as follows:-

	LS per annum
1. Staff costs	
2 nurses	1 600
2 orderlies	1 000
2. Maintenance of equipment	
10% of capital cost	200
3. Total	2 800

Although approved in principle, few details are available about the proposed 30 bed Rural Hospital at Sbowak. It is intended that this should be built on a self-help basis, by the local community.

At this stage it is not possible to prepare detailed cost estimates for a possible extension to the proposed hospital. To give some indication of the possible cost of such an extension, we have assumed that an extra small ward for 10 or 12 persons, plus the necessary furnishings and equipment, would be provided. With a ward of 5 m x 10 m and another 20 m^2 for other additional space, the total building cost has been taken as 70 m^2 x I£ 100, or I£ 7,000. Allowing for beds, other furniture and equipment, the total cost might be I£ 9,000.

Total capital costs of providing additional capacity at the proposed Sbowak Rural Hospital are thus estimated to be as follows:-

Item	I£
Hospital building and equipment	9 000
Housing: Extra hostel capacity for two nurses: say,	6 000
	15 000

Apart from medicines and supplies, which have not been estimated, the additional recurrent costs due to the project would be mainly for the extra staff required. Assuming that two extra nurses and two extra orderlies would be needed, the additional costs would be as follows:-

	I£ per annum
1. Staff costs	
2 nurses	1 600
2 orderlies	1 000
2. Maintenance of equipment	
10% of capital cost	200
3. Total	2 800

If no Rural Hospital is built at Showak, the present dispensary might need to be upgraded to a Health Centre. This is assumed to involve the addition of the following buildings to those already in existence:-

- One 10 - 12 bed ward (50 m^2) plus other space (20 m^2)
- One consulting room (20 m^2)
- One other room (20 m^2)

Staffing would need to be increased by two nurses and two orderlies. The additional capital and recurrent costs are estimated to be approximately as follows:-

1. Capital costs		LS
Buildings:	110 m^2 @ LS 100	11 000
Equipment:	say,	3 000
Housing:	One small hostel for nurses, say	6 000
	Total	20 000

2. Additional recurrent costs		
Staff costs:	As for Rural Hospital, given above	2 600
Equipment maintenance		300
	Total	2 900

8. Gedaref hospital

The present availability of beds at Gedaref Hospital is as follows:-

	Beds
General	215
Maternity	9
T.B.	32
Children's	12

If the health facilities at Jebel Maharigat and Qala en Nahl are to be a success it is essential that they receive administrative support from Gedaref and access to the hospital as the major referral unit. At present the hospital's facilities are over-extended and will need to be strengthened if it is to give the support necessary. It is hoped that

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1. Capital costs

		£s
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Equipment:	say.	3 000
Housing:	One small hostel for nurses, say	6 000
	Total	20 000

2. Additional recurrent costs

Staff costs: As for Rural Hospital, given above	2 600
Equipment maintenance	300
Total	£ 900

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	Beds
General	215
Maternity	9
T.B.	32
Children's	12

If the health facilities at Tebel Markaret and Qala en Nail are to be a success it is essential that they receive administrative support from Gedaref and access to the hospital as the major referral unit. At present the hospital's facilities are over-extended and will need to be strengthened if it is to give the support necessary. It is hoped that

a well-run facility at Jebel Maharigat and Qala en Nahl will cope with the major proportion of the health needs of the refugees, but inevitably some cases will need to be referred.

The general level of equipment and drug supplies within the Hospital leaves much to be desired and causes intense frustration amongst the staff. It is strongly recommended that an additional children's ward of 12 beds be added thereby doubling the capacity of the paediatric unit. In addition, it is recommended that a staff house be built for the paediatrician as the lack of accommodation for this post has in the past been the major cause of staff discontent, resulting in excessive staff turnover.

On the basis of information obtained from the Provincial offices in Gedaref, the size of an extra paediatric ward would be 50 m^2. Allowing another 20 m^2 for other purposes, the capital cost is estimated to be approximately as follows:-

	LS
Building: 70 m^2 @ LS 100	7 000
Furnishings and equipment: say,	2 000
T1 type house for paediatrician	12 000
Additional hostel capacity for two nurses:	6 000
	27 000

As regards recurrent costs the paediatrician's salary is covered under the present hospital budget. Staff costs for the extra two nurses and two orderlies required would be LS 2,600 (see above) and maintenance of equipment LS 200.

a well-run facility at Jebel Mubarkat and Qala en Nahl will cope with the major proportion of the health needs of the refugees, but inevitably some cases will need to be referred.

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APPENDIX F

PERMANENT WATER SUPPLY FOR JEBEL MAHARIGAT

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PERMANENT WATER SUPPLY FOR JEBEL MAHARIGAT

1. Alternative sources of supply

A major requirement is an immediately available reliable water source. Three possible sources have been considered:-

(a) Groundwater
(b) Run-off storage
(c) Atbara reservoir

(a) Groundwater

A study of groundwater resources within the Presidential Decree Area was made by the Rural Water Corporation (RWC) in 1974. Groundwater is not available at the site because of the existence of a considerable depth of basalt rock. The Nubian Sandstone is available within the PDA, but is of limited quality due to its poor transmissibility. Four tubewells were constructed in or close to the PDA, but none of these are associated with a suitable site for a large settlement. One of the tubewells (Maharigat) has been used to provide water for a refugee settlement, but has proved to be capable of a very limited water supply.

Groundwater as a source of supply for the Jebel Maharigat settlement cannot be considered because:-

(i) The source is not of proven reliability.
(ii) It is too far distant from the settlement, involving very high transmission costs.

A more detailed discussion of the groundwater source is contained in the pre-feasibility report prepared by the Consultants in January 1976.

(b) Run-off storage

It is common practice in the Sudan, especially in the clay plains, to provide a source of water by intercepting and storing

APPENDIX P

PERMANENT WATER SUPPLY FOR JEBEL MABARIGAT

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(a) Groundwater
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(c) Atbara reservoir

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Groundwater as a source of supply for the Jebel Mabarigat settlement cannot be considered because:-

(i) The source is not of proven reliability.
(ii) It is too far distant from the settlement, involving very high transmission costs.

A more detailed discussion of the groundwater source is obtained in the pre-feasibility report prepared by the Consultants in January 1976.

(b) Run-off storage

It is common practice in the Sudan, especially in the clay plains, to provide a source of water by intercepting and storing

run-off during the rainy season. This is done by excavating large pits (hafirs) in the clay in an area where run-off channels naturally; in some cases channels are dug to increase the interception of run-off.

At the Maharigat site it would be possible to construct a hafir in a natural drainage line about two kilometres north of Jebel 1. However, the catchment area which feeds the natural drainage is quite inadequate to supply enough water for a settlement as large as that proposed for Jebel Maharigat. Further, the provision of water from a hafir source creates pollution hazards, especially when serving a population with a very high incidence of waterborne diseases. Since the obvious area for hafir construction is only some two kilometres from the settlement, the risk of serious pollution would be very high. It is considered that hafir storage is not a feasible source of supply for the settlement at Jebel Maharigat.

(c) Atbara reservoir

The proposed settlement site at Jebel Maharigat lies some 15 km due west of the Atbara reservoir, i.e. that section of the R. Atbara upstream of the dam at Khashm el Girba. The reservoir provides a perennial water source, although by the end of the dry season it recedes into a series of pools. Considerable siltation has occurred since the construction of the dam, causing partial sealing of the bed and a consequent reduction of sub-surface flow between the pools. This means that heavy abstraction from one pool cannot be equalised by sufficiently rapid flow from neighbouring pools. Nevertheless, the reservoir does provide an exploitable and reliable water source, and alternative methods and costs of exploiting this supply are considered in the following sections.

2. Showak Waterworks

Completed in 1970, this waterworks supplies treated water to Showak and Gedaref, with a maximum design capacity of 9,090 m^3 per day. However, the design capacity cannot be met at present because of problems relating to water intake: as explained above, abstraction from a single pool is not equalised by sub-surface flow from adjoining pools. Consequently, at the end of the dry season temporary pumps have to be used to transfer water

run-off during the rainy season. This is done by excavating large pits (*hafirs*) in the clay in an area where run-off channels naturally; in some cases channels are dug to increase the interception of run-off.

At the Mabarigat site it would be possible to construct a *hafir* in a natural drainage line about two kilometres north of Jebel 1. However, the catchment area which feeds the natural drainage is quite inadequate to supply enough water for a settlement as large as that proposed for Jebel Mabarigat. Further, the provision of water from a *hafir* source creates pollution hazards, especially when serving a population with a very high incidence of waterborne diseases. Since the obvious area for *hafir* construction is only some two kilometres from the settlement, the risk of serious pollution would be very high. It is considered that *hafir* storage is not a feasible source of supply for the settlement at Jebel Mabarigat.

(c) Abbara reservoir

The proposed settlement site at Jebel Mabarigat lies some 15 km due west of the Abbara reservoir, i.e. that section of the R. Abbara upstream of the dam at Khasm el Girba. The reservoir provides a perennial water source, although by the end of the dry season it recedes into a series of pools. Considerable siltation has occurred since the construction of the dam, causing partial sealing of the bed and a consequent reduction of sub-surface flow between the pools. This means that heavy abstraction from one pool cannot be equalised by sufficiently rapid flow from neighbouring pools. Nevertheless, the reservoir does provide an exploitable and reliable water source, and alternative methods and costs of exploiting this supply are considered in the following sections.

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Completed in 1970, this waterworks supplies treated water to Showak and Gedaref, with a maximum design capacity of 9,090 m^3 per day. However, the design capacity cannot be met at present because of problems relating to water intake: as explained above, abstraction from a single pool is not equalised by sub-surface flow from adjoining pools. Consequently, at the end of the dry season temporary pumps have to be used to transfer water

from neighbouring pools to the intake pool to maintain supply. In spite of this, there is no evidence that required demand cannot be met, or that a small increase in total requirements cannot be supplied.

At present the demand from the waterworks is 6,600 m^3/day for Gedaref, and 350 m^3/day for Showak, a total of 6,950 m^3/day. Thus the present demand is considerable less than the design capacity of 9,090 m^3/day. As noted above, this design capacity is unlikely to be met because of the intake restrictions, but the present demand could be exceeded even with the existing restrictions.

Water to Gedaref is pumped from the waterworks by two (duty and standby) 633 HP centrifugal pumps against a total head of 210 m as measured at the outlet. The pumps are rated at a total head of 240 m. The pumping main is 500 mm diameter, continuously welded, bitumen lined steel pipe delivering water to a 9,090 m^3 service reservoir at Gedaref at a pumping rate of approximately 420 m^3/hour, requiring 15 to 16 hours pumping per day to maintain the level in the service reservoir.

3. Water requirement at Jebel Maharigat

In Chapter 5, the maximum population to be settled at Jebel Maharigat has been assessed as 24,000. For reasons explained in Chapter 5, the actual population settled is likely to be considerably less, and may not exceed 17,000. For the purposes of calculating water supply requirements, the higher figure has, however, been chosen. In the likely event that less than 24,000 people are settled, the extra capacity will allow for the settlement of new refugees who may arrive in the Sudan in the future.

In assessing the supply requirement of the new settlement, the following assumptions have been made:-

(a) Consumption will be at the rate of 20 litres/head/day for those served by waterpoints and 50 litres/head/day for those on service connections.

(b) Water will be supplied for small animals, e.g. sheep, goats and donkeys but not for cattle, which can be watered at the water-yards within the PDA; an arbitrary number of small stock has been allowed for at one animal per person.

(c) Wastage and leakage would be 10 per cent of supply.

The daily requirements of the human population for the maximum population of 24,000 are:-

22,750 at 20 litres/head/day	455 m^3
1,250 at 50 litres/head/day	62.5 m^3
	517.5 m^3

For the animal population an allowance of 2 litres/head/day has been made, requiring a total of about 50 m^3 per day.

Therefore, total water requirement is 567.5 m^3 per day; allowing for wastage and leakage at 10 per cent, the settlement would have a daily requirement of 625 m^3. For a population of 17,000, the requirement for humans and animals would be 450 m^3 per day.

These requirements could be raised to 700 m^3/day if provision is made for extra capacity in the settlement to cope with an extra influx of up to 4,000 refugees. With a spare design capacity of 3,000 m^3/day, the Showak system could easily cope with this demand, even allowing for the present intake problems.

4. Alternative supply systems

From the previous sections it can be seen that the water supply to Jebel Maharigat requires that up to 700 m^3/day be supplied from the Atbara reservoir. Three alternative methods of effecting this supply have been examined:-

(a) Direct extraction from the Atbara reservoir.
(b) Pumping treated water from the Showak waterworks.
(c) Pressure tapping of the Gedaref pumping main.

(a) Direct extraction from the Atbara would require the building of a pumping station at the reservoir with treatment works. Since an adequate supply of treated water can be obtained from Showak waterworks at the same distance from the site, this alternative can be dismissed.

(b) Pumping from Showak waterworks would require the installation of two pumps (duty and standby) and 13 kilometres of 250 mm steel trunk main.

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(b) Pumping from Showak waterworks would require the installation of two pumps (duty and standby) and 13 kilometres of 250 mm steel trunk main.

(c) Pressure tapping of the Gedaref mains would obviate the need for pumps and reduce the trunk main to 7 kilometres of 200 mm steel pipe. Possible pipeline routes for these two alternatives are shown in Figure 6.3.2.

Since water supply is equally feasible from either the waterworks or the Gedaref main, alternative (c) provides by far the cheaper system; therefore only this alternative has been costed in detail.

5. Recommended water supply system

A detailed survey will be necessary to establish the exact point on the Gedaref main where a pressure connection can be made; for calculation purposes a point 10 km along the main from the waterworks has been assumed. This is identified as point B on Figure 6.3.2.

To ensure delivery of the required 625 m^3/day to the settlement, 200 mm diameter trunk main will be required from point B to point C, a maximum distance of 7 km. At C, the trunk main will bifurcate to the high level storage tanks at D and E; the mains C - D and C - E will be of 150 mm diameter. The total length of these secondary mains will be just under 4 kilometres. Thus a total trunk main length of 11 kilometres has been allowed; this figure is probably over-generous, but allowance must be made for variation of the pressure connection point.

Since the Gedaref trunk main lies immediately to the south of the railway line, a thrust boring will be required under the line to allow the 200 mm trunk main to be installed. The cost of this has been included in the cost for the trunk main.

It is recommended that steel pipes should be used in the supply system. Other materials, while cheaper, are subject to damage by impact loads and especially by pressures resulting from the swelling and shrinking of expanding lattice clays, in which virtually the whole system will have to be laid.

A gravity distribution system from high level storage tanks is suggested. Storage capacity should be sufficient to allow for one full day's supply; thus storage capacity of 625 m^3 will be required.

The distribution system will consist of 100 mm diameter mains with 75 mm spurs, leading from each of the two storage tanks. A connection between the two storage tanks has been allowed for to maintain a hydraulic balance in the system and provide a standby temporary supply at each of the main settlement areas should its own supply break down. The details of the suggested distribution system are shown in Figure 6.2.

The distribution system will deliver water to a number of watering points. These will consist of a small area enclosed by a fence and containing a tapstand with six taps and an animal watering trough. In addition, service connections would be provided for administrative staff housing, dispensary and other central services. To aid leak detection, all branches would incorporate valves.

The number of watering points is dependent on the settled population and the distance over which water is fetched. No household should be further than 0.5 kilometres from a watering point, to minimise contamination of the water. To achieve this it will require 11 watering points to serve a population of 17,000 and 15 for a maximum population of 24,000. These will require some 8.5 kilometres of distribution pipeline to serve 11 watering points and 11 kilometres for the 15 watering points. The proposed layout is shown in Figure 6.1.

This layout does not allow the design of a gridiron system, and necessitates a number of "dead-ends" in the distribution system; these would, however, be fitted with washout valves to permit flushing of the mains to be carried out as necessary.

Maintenance of the installed system would best be carried out by the Public Electricity and Water Corporation (PEWC), who are the obvious agency to instal the system. Costs of maintenance would thus be the responsibility of the Corporation, in return for which normal charges would be levied on the consumer. In Kassala Province, water is normally charged per unit of four gallons, since water is normally collected in four-gallon tins. The normal charge is 0.5 piastres per tin; for service connections the charge is 10 piastres/m^3, usually recorded by meter measurement. However, there is a lack of both meters and spares, and a fixed charge would be preferable to metering. This could be on the basis of 50 litres/head/day, say 5 piastres/day/household for those with a service connection.

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The distribution system will deliver water to a number of watering points. These will consist of a small area enclosed by a fence and containing a tapstand with six taps and an animal watering trough. In addition, service connections would be provided for administrative staff housing, dispensary and other central services. To aid leak detection, all branches would incorporate valves.

The number of watering points is dependent on the settled population and the distance over which water is fetched. No household should be further than 0.5 kilometres from a watering point, to minimise contamination of the water. To achieve this it will require 11 watering points to serve a population of 17,000 and 15 for a maximum population of 24,000. These will require some 8.5 kilometres of distribution pipeline to serve 11 watering points and 11 kilometres for the 15 watering points. The proposed layout is shown in Figure 6.1.

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6. Costs of water supply

Costs have been worked out for a supply system to serve both a 17,000 and 24,000 population. The trunk main costs are those for the larger population, since subsequent expansion of the trunk main to meet an increased demand would be very costly. Variation in costs between the two systems are thus dependent on differences in the storage and distribution requirements.

(a) Costs for a 17,000 population

Table F.1 shows the estimated capital costs of water supply for a settlement of 17,000 people.

Table F.1 Estimated capital costs of water supply for 17,000 people

	Item	LS
1.	Trunk main	
	7,000 m of 200 mm steel main	88 960
	4,000 m of 150 mm steel main	38 440
	Pressure connection	1 000
	Thrust bore	500
	Valves and tools	2 100
	Trunk main sub-total	131 000
2.	Distribution	
	6 100 m of 100 mm distribution main	39 650
	2 400 m of 75 mm distribution spur	10 800
	Valves	2 300
	Sub-total	52 750
	2 x 230 m^3 high level storage tanks	21 000
	Pipes and valves	560
	Tank erection	3 800
	Sub-total	25 360
	11 tapstands for watering points	8 800
	Spares	1 500
	Distribution sub-total	88 410
3.	Contingencies (10%)	21 940
4.	Total	241 350

6. Costs of water supply

Costs have been worked out for a supply system to serve both a 17,000 and 24,000 population. The trunk main costs are those for the larger population, since subsequent expansion of the trunk main to meet an increased demand would be very costly. Variation in costs between the two systems are thus dependent on differences in the storage and distribution requirements.

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Pressure connection	1 000
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Valves and tools	2 100
Trunk main sub-total	131 000
2. Distribution	
6 100 m of 100 mm distribution main	39 650
2 400 m of 75 mm distribution spur	10 800
Valves	2 300
Sub-total	52 750
2 x 250 m³ high level storage tanks	21 000
Pipes and valves	560
Tank erection	3 800
Sub-total	25 360
11 tapstands for watering points	8 800
Spares	1 500
Distribution sub-total	86 410
3. Contingencies (10%)	24 940
4. Total	241 350

(b) Costs for a 24,000 population

In this case the cost of the trunk mains remains the same; the distribution costs are increased by additional storage and watering points. Thus the cost would be as shown in Table F.2.

Table F.2 Estimated capital costs of water supply for 24,000 people

	Item	LS
1.	Trunk main	131 000
2.	Distribution	
	7 400 m of 100 mm distribution main	48 100
	3 500 m of 75 mm distribution spur	15 750
	Valves	3 000
	Sub-total	66 850
	2 x 315 m^3 high level storage tanks	25 000
	Pipes and valves	560
	Tank erection	3 800
	Sub-total	29 360
	15 tapstands for watering points	12 000
	Spares	2 000
	Distribution Sub-total	110 210
3.	Contingencies (10%)	24 120
4.	Total	265 330

To allow for capacity to absorb more than 24,000 refugees, Jebel 3 (see Figure 6.2) could be used to settle a further 4,000 people. It is calculated that provision of water supply to this jebel would add a further LS 55,000 to the cost of the supply. The costs of these various alternatives are summarised as follows:-

(i) Water supply for 17,000 people LS 241,350
(ii) Water supply for 24,000 people LS 265,330
(iii) Water supply for 28,000 people LS 320,330

(b) Costs for a 24,000 population

In this case the cost of the trunk mains remains the same; the distribution costs are increased by additional storage and watering points. Thus the cost would be as shown in Table F.2.

Table F.2 : Estimated capital costs of water supply for 24,000 people

Item	
1. Trunk main	131 000
2. Distribution	
7 400 m of 100 mm distribution main	48 100
3 500 m of 75 mm distribution spur	15 750
Valves	3 000
Sub-total	66 850
2 x 315 m^3 high level storage tanks	25 000
Pipes and valves	560
Tank erection	3 800
Sub-total	29 360
15 tapstands for watering points	12 000
Spares	2 000
Distribution Sub-total	110 210
3. Contingencies (10%)	24 120
4. Total	265 330

To allow for capacity to absorb more than 24,000 refugees, label 3 (see Figure 6.4) could be used to settle a further 4,000 people. It is calculated that provision of water supply to this label would add a further R$ 55,000 to the cost of the supply. The costs of these various alternatives are summarised as follows:-

(i) Water supply for 17 000 people R$ 241,330

(ii) Water supply for 24,000 people R$ 265,330

(iii) Water supply for 28,000 people R$ 320,330

(c) Recurrent costs

Running costs have been based on the maintenance of the distribution system and the cost of the additional pumping hours needed at Showak waterworks to supply the water required at Jebel Maharigat. The pumps are rated at 420 m^3/hour, but it is not known if this is their present performance; to provide a measure of safety, an extra two hours has been assumed as necessary to provide the settlement's supply.

The annual running costs are summarised below:-

	LS
Maintenance of distribution system	5 000
Extra pumping requirement	5 500
Pump maintenance	250
Total	10 750

(c) Recurrent costs

Running costs have been based on the maintenance of the distribution system and the cost of the additional pumping hours needed at Showak waterworks to supply the water required at Jobal Mabarkiyat. The pumps are rated at 420 m^3/hour, but it is not known if this is their present performance; to provide a measure of safety, an extra two hours has been assumed as necessary to provide the settlement's supply.

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	£
Maintenance of distribution system	5 000
Extra pumping requirement	5 500
Pump maintenance	250
Total	10 750

APPENDIX G

SANITATION

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1. General

The first step in waste collection and disposal is the provision of some kind of latrine system. In any designs there are two important factors which must be taken into account. These are:-

(a) Whether to install communal facilities or facilities for every family.

(b) Local customs and the type of apparatus best suited to them.

The choice to be made in (a) above is generally governed by the factors of cheapness and degree of urgency. It has been found that where both needs are acute, the provision of communal latrines, at least for the majority, is preferable. Communal latrines are, however, liable to neglect and/or abuse, and regular inspection needs to be carried out by the health administration.

Where the degree of urgency and the need to cut costs are not acute, individual latrines, one per family or pair of families, are preferable. It is hoped that in this kind of situation the sharing of facilities will promote individual responsibility towards the cleanliness of the latrine. However, in some communities it may still be necessary to carry out regular inspections and even allow for teaching of rudimentary personal hygiene.

2. Existing situation

In the brief survey made of the existing habits of existing refugee communities, it was found that the people generally disliked communal latrines and preferred to use the open country adjacent to their settlement. The grounds for the dislike of public latrines were twofold:-

(i) distance to latrines;

(ii) cleanliness of latrine.

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(i) distance to latrines;

(ii) cleanliness of latrine.

It was found that some latrines were placed at distances as far as 5 km from the settlement. This was presumably done as a health precaution, but has tended to act as a disincentive to use. Latrine blocks were found to be dirty and the majority appeared not to have been cleaned for some time. Besides being a health hazard, this is a further disincentive to use.

The practice of using the open country together with the lack of cleanliness in the existing toilets, puts the people at a considerable health risk. Health records confirmed this, a high proportion of illnesses recorded being of enteric origin.

In the Consultants' survey an effort was made to ascertain the type of apparatus that was best suited to the people. Given a choice of latrine system, the following was found to be the order of preference:

(a) Waterborne systems;
(b) Pit privy systems;
(c) 'Night soil' bucket closets.

Although the sample size of this survey was very small, it gave an indication of the feelings on this matter. It was quite clear that method (c) was not liked because the buckets were never or very rarely emptied.

The results of the Consultants' survey were discussed with local and Ministry of Health officials, who generally concurred with the findings and gave valuable assistance in the formulation of the proposals.

3. Proposals

The latrine system proposed for the refugee settlement site at Jebel Maharigat is of the pit privy type. Pit privies generally consist of a manually dug hole round or circular in cross section and not less than 3 m deep (the Ministry of Health recommend that a depth of 6 m be used in this type of development). The volume of the pit is related to its useful life and on whether the water table is penetrated.

The Ministry of Health normally recommend that the pits should be at least 2m x 2m x 6m deep, giving a useful volume of 24 m^3 (846 ft^3). Based on WHO (World Health Organisation) design criteria for sanitary

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pit privies, it is estimated that a pit this size would have a useful life of about 80 years with five people (i.e. a typical family) using it. Taking a design life of 20 years for a pit latrine on this project and assuming five persons per pit latrine, a volume of 6 m^3 per family would be required.

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APPENDIX H

ELECTRICITY SUPPLY FOR JEBEL MAHARIGAT

APPENDIX H

ELECTRICITY SUPPLY FOR DIESEL MAHARIGAT

APPENDIX H

ELECTRICITY SUPPLY FOR JEBEL MAHARIGAT

1. Introduction

At this level of study it is difficult to assess the exact electrical power requirements for a development of this type. Once a need for electrical power is established the question of whether to provide power to the whole settlement must be considered. There is also the question of whether to establish local generating capacity or to rely on transmission from an offtake from the Showak sub-station on the main Khashm el Girba - Gedaref power line. A brief study concerning the relative merits of possible power sources has been made based on discussions with PEWC (Public Electricity and Water Corporation).

2. Project Power Demand

To enable an outline scheme to be designed and costed, it has been assumed that power will be required in main buildings, the dispensary, schools, workshops and other central facilities, management housing and for street lights. It would not be supplied to refugees' houses.

Based on these assumptions and on the project design population, it is estimated that the total power demand will be of the order of 260 kw. Taking account of the diversity which will occur in a large number of small buildings, an assumed continuous load of 200 KVA has been taken as an appropriate estimate at the present time.

3. Alternative sources of supply

There are two alternative methods of providing an electrical supply to the project site, as follows:-

(a) Connection to the existing PEWC grid system, some 15 km distant.

(b) Provision of a small generator station at the site, with standby facilities.

APPENDIX B

ELECTRICITY SUPPLY FOR JEBEL MAHARIQAT

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3. Alternative sources of supply

There are two alternative methods of providing an electrical supply to the project site, as follows:-

(a) Connection to the existing PEWC grid system, some 15 km distant.
(b) Provision of a small generator station at the site, with standby facilities.

(a) Connection to the main grid

There is an existing 66 KV/11 KV, 2.5 MVA transformer/switching station at Showak, with spare capacity (four spare feeders). It would appear to be possible to take an 11 KV supply from one of these spare feeders and supply the proposed site at Jebel Maharigat, using an overhead 11 KV line. This line would terminate at the settlement, with a 11 KV/415 V (300 KVA) transformer substation. From this low voltage substation, a 415 volt 3 phase supply would be distributed on possibly a 'ring' and 'spur' distribution system to the consumers.

(b) Local generation

This scheme would be an on site generating system. It would involve the construction of a small generator station at Jebel Maharigat, consisting of two 200 KVA diesel generators complete with all necessary ancillary equipment.

The proposed generator station would be equipped with automatic standby facilities, and at this stage it is envisaged that continuous manning would not be necessary. Routine maintenance and supervision could be undertaken by the maintenance engineer stationed at Showak, assisted by an operator/mechanic.

4. Choice of Power System

In order to select the more economic power supply, the capital and running costs for both schemes were compared over a period of 10 years, assuming a continuous load of 200 KVA. The majority of unit rates used in the comparison were obtained from PEWC Khartoum. It was not possible to obtain a reliable rate for bulk purchase of diesel fuel/gas oil (e.g. say 30 - 35 Redwood secs). The price range quoted was LS 11 to LS 20 per barrel (LS 0.275 to LS 0.50 per gallon).

Excluding items that are common to both, such as the local distribution system, the capital costs of the two alternatives would be as follows (these costs exclude import duties and taxes):-

(a) Connection to the main grid

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Excluding items that are common to both, such as the local distribution system, the capital costs of the two alternatives would be as follows (these costs exclude import duties and taxes):

		LS
A.	<u>On-site generation</u>:	
	Two diesel generators	35 000
	Generator housing, switching gear, etc.	7 000
		42 000
B.	<u>Mains supply</u>:	
	15 km of 11 KV transmission line	90 000
	11 KV/415 volt transformer at Jebel Maharigat	14 600
		104 600

The estimated capital and running costs of the two alternatives have been compared in terms of their present value at an interest rate of 10 per cent. Account has been taken of the following assumptions:-

(i) the average load would be 200 KVA for 12 hours per day;

(ii) the diesel generators would last for 15 years and the transmission line for 50 years;

(iii) annual cost of maintenance and spares of the generators would be equivalent to 10 per cent of the capital cost: i.e. LS 3,500 per annum.

(iv) fuel consumption would be 140 Imperial gallons per day or 51,100 gallons per annum. Costs have been estimated on the basis of two diesel fuel prices, LS 0.30 and LS 0.40. Annual fuel costs would then be LS 15,330 and LS 20,440 respectively.

(v) Prices charged for power from the grid would be based on PEWC's Tariff T4.3.1. Unit prices fall with increased load and range from LS 0.0183 per KWH to LS 0.0138 per KWH for electricity from the existing sub-station at Showak. Total annual cost would be LS 11,000.

The comparison indicated that over a 10 year period the costs of local generation would be slightly higher if the diesel price of LS 0.30 were applied. If the refugees moved out after 10 years and electricity consumption in the vicinity of Jebel Maharigat fell to negligible

A. On-site generation:

	£s
Two diesel generators	75 000
Generator housing, switching gear, etc.	7 000
	42 000

B. Mains supply:

15 km of 11 KV transmission line	90 000
11 KV/415 volt transformer at Jebel Makarikgat	14 600
	104 600

The estimated capital and running costs of the two alternatives have been compared in terms of their present value at an interest rate of 10 per cent. Account has been taken of the following assumptions:-

(i) the average load would be 200 KVA for 12 hours per day

(ii) the diesel generators would last for 15 years and the transmission line for 50 years;

(iii) annual cost of maintenance and wages of the generators would be equivalent to 10 per cent of the capital cost; i.e. £s 3,500 per annum.

(iv) fuel consumption would be 140 Imperial gallons per day or 51,100 gallons per annum. Costs have been estimated on the basis of two diesel fuel prices, £s 0.30 and £s 0.40. Annual fuel costs would then be £s 15,330 and £s 20,440 respectively.

(v) Prices charged for power from the grid would be based on PEWC's Tariff T4.3.1. Unit prices fall with increased load and range from £s 0.0183 per KWH to £s 0.0138 per KWH for electricity from the existing sub-station at Shoonuk. Total annual cost would be £s 11,000.

The comparison indicated that over a 10 year period the costs of local generation would be slightly higher if the assumed price of £s 0.30 were applied. If the refugees moved out after 10 years and electricity consumption in the vicinity of Jebel Makarikgat fell to negligible

proportions, as would probably occur, the costs of the transmission line and associated facilities would have to be written off over 10 years instead of 50. In this case power generated at the site would be cheaper at a diesel price of up to LS 0.36 - 0.37 per gallon.

Local generation has the added advantage of increased flexibility. Capacity can be raised relatively easily in the event of demand being above projected levels and at the other extreme the equipment can be removed and installed at another site when it is no longer required at Jebel Maharigat. In view of this added flexibility and the broadly similar costs, diesel generation on site is recommended.

It should also be noted that although the systems costed are for a maximum load of 300 KVA, the diesel system envisaged could if required supply 400 KVA.

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APPENDIX C

ALTERNATIVE FORMS OF AGRICULTURAL PRODUCTION

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APPENDIX J

EXISTING AGENCIES AND INSTITUTIONS

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1. Province Administration

Kassala Province, as an administrative unit, is composed of a single provincial executive council (headed by the Commissioner) which controls the work of three district councils, headed by Assistant Commissioners (Northern DC based at Kassala, Central DC at New Halfa and Southern DC at Gedaref). Under the District Councils is a further tier of rural or town councils. Rural councils are normally under the supervision of one (or possibly two) local government executive officers, with town councils having a substantially larger administrative staff. Southern (or Gedaref) DC has one town council - at Gedaref - and nine rural councils. These are:

Gedaref Rural
Wad el Hileiwu
Es Showak
Butana
Qala en Nahl
Dokha
Mafaza
Hawata
Kassab

Below the rural councils there is a further tier of village councils (in all, 154 in Gedaref District), largely created as a focus for any local self-improvement efforts and lacking any sustained or effective link to the local government administration at the rural council level. They have no paid staff and take little practical part in local administration.

This structure of province - district - rural/urban administration is not confined to the local government service only. Similarly, other ministries (notably Health, Education, and Agriculture) are organised in the field along the same hierarchy of responsibility.

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This structure of province - district - rural/urban administration is not confined to the local government service only. Similarly other ministries (notably Health, Education, and Agriculture) are organised in the field along the same hierarchy of responsibility.

Under the new provincial system, however, ministries (apart from Local Government) have been formally abolished as independent agencies within each province. In staff terms, this means that all government officials working in the province are seconded to the provincial administration whatever their parent ministry. In budgetary terms, it means that the province receives a comprehensive budget covering all government expenditure (excepting transport, judiciary, and defence).*

The system is, however, less integrated, less rigid and less powerful than it appears. Staff remain tied to their own ministry establishments, budgets are submitted on a ministry (and even departmental) basis, and at all levels of administration, individual ministries and departments enjoy considerable autonomy from their 'parallel' local government officer (and rather less autonomy from their 'vertical' ministry superior at district and province level).

There is a further important point on the 'developmental' aspect of the new system. Provincial spending is almost entirely based on recurrent expenditure (especially salaries); the development budget is allocated to central ministries and the rapidly expanding parastatal sector. The latter, of course, also has a large recurrent expenditure outside the provincial budget and increasingly in the Sudan it is the management of, for example, the Sudan Sugar Corporation, the Mechanised Farming Corporation, and the Rahad Corporation which determine development priorities in provinces such as Kassala.

2. <u>The Provincial Commissioner</u>

Under the new system, the office of the Provincial Commissioner is a source of both strength and weakness, especially in relation to the issues of programme management discussed in this report. On the one hand, the Commissioner is particularly well-placed to respond to emergencies and unforeseen contingencies. His small and easily convened Security Committee can rapidly deploy, for example, the material and human resources necessary for a sudden refugee influx and effectively administer settlement programmes for 4/5 months. On the other hand, the Commissioner has little control over longer-term issues of development planning (such as settlement policy and social service allocation), partly because

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* In 1975-76, Education, with LS 4,183,146, had by far the biggest vote. Provincial Administration (which included Police and Prisons along with Local Government itself) had LS 2,216,207 and Health LS 1,610,975. Agricultural Services (i.e. excluding Natural Resources, RWDC and Animal Resources) was only LS 89,530.

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decisions may be extra-provincial and partly because the Commissioner needs to accommodate the often competing intra-provincial interests (field departments, local citizens, commercial groups, etc.). Furthermore, the very authority of the Commissioner (and also of the 'departmental' Assistant Commissioners at province headquarters*) inhibits the autonomy of the district and rural council officer, especially on contingency expenditure, for example.

3. Local Councils

The 'local council' is not as cohesive an institution as it may appear. True, the council meeting involves all the important field officers as well as elected councillors and there is constant informal contact between departments. However, if, for example, it was decided that the Ministry of Education was henceforth to be outside the local council and provincial administration system, it is unlikely that there would be any noticeable change (as the switching of the RWDC from a ministry department to a public corporation indicates). In this way, one can regard ministries 'in the field' as agencies attached to the local council. Thus it would be feasible either to transfer responsibility for an entire scheme to a council (such as Gedaref District Council) or to transfer a particular responsibility to a particular 'agency' working under the aegis of the local council.

Gedaref District Council illustrates the point. Although there is a senior local government executive as Assistant Commissioner based in Gedaref itself, supported by a few junior officers, in both size and seniority this is a much weaker establishment than that attached to Health, for example, and probably no greater than that of Public Works or Agriculture.

4. Qala en Nahl Rural Council

The rural councils under Gedaref District Council are poorly staffed and seriously lacking in revenue. Qala en Nahl is no exception. There is an executive officer (DS Grade) at Qala en Nahl and a junior executive officer (B Grade) has been assigned to Um Saqata. There is also an education officer at Qala en Nahl responsible for the nine boys' elementary

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schools in the council (6 boys' and 3 girls'). However, the nearest public health officer is in Hawata RC (there are four dispensaries in Qala en Nahl RC); there is only a building supervisor* in the 'PWD' (still called this, although technically it is now the Ministry of Construction and Public Works). There is no Police Officer in the Council, and sergeants are in charge of the four police posts; Agriculture is represented by a forest ranger (i.e. Natural Resources Department) preoccupied largely with charcoal-burning, and an agricultural supervisor at the scheme itself. During the period when the Qala en Nahl settlement scheme came under the Commissioner for Refugees, there was an Agricultural Officer at Qala en Nahl (as well as a Community Development Officer as Scheme Manager).

5. Office of the Commission for Refugees

As an agency for the implementation of resettlement, the Commission has a central strategic role, yet its powers are constrained by financial limitations as well as staff shortages.

Following any emergency influx, which is dealt with by the provincial authorities, it is the responsibility of the Commission to administer the resettlement camps and plan any welfare or development programmes. The Commission cannot do this alone (it was only recently that the Commissioner has been able to acquire a post of Co-ordinator to be based at Gedaref), so it either recruits staff from other ministries, which form teams for particular projects, or it recruits agencies to undertake particular tasks (the RWC for water supply at Qala en Nahl, for example). Much of the cost of this ad hoc arrangement is borne by UNHCR although, as a matter of policy, it withdraws from funding as soon as it feels that the host government is in a position to take over. Thus the tendency is for the Commission itself to withdraw, leaving administration to the local authorities concerned.

The senior staff that the Commission recruits are often from Local Government. This has the advantage of ensuring close informal links with the provincial and local administration and facilitates the eventual transfer of responsibilities to local authorities. This policy may appear to over-emphasise the regulatory rather than developmental aspects of

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refugee administration, but it must be remembered that transfers to the Commission are unlike secondments to the public corporations. There are additional allowances, but problems of housing, transport (and - for many - the unwelcome nature of the job itself) mean that there is little competition to become involved in the Commission's work.

6. UNHCR

Under its charter, the UNHCR is prevented from assuming a direct operational role in refugee administration. There are very rare exceptions (such as the Southern Sudan 'Special Operation'), but there is no reason to believe that UNHCR policy will be changed for Kassala. However, UNHCR in the Sudan, as a major funding source, is bound to work very closely with its operating partner in the Government of Sudan and obviously the UNHCR's confidence in the administrative capacity of its partner is an important factor in its annual request for fund-allocation in Geneva. Although UNHCR fund staff costs (often, for example, funding Government of Sudan posts for two years), there is no question of the UNHCR themselves appointing staff either from within or outside the UN system. Nor is there any question of UNHCR imposing an administrative structure for any part of refugee administration on Government of Sudan.

7. Other Agencies

Support for refugees comes from several sources. Some, such as World Food programme, have no direct involvement. Other agencies have direct contact but do not play any role in matters of policy and administration. They should not be ignored, however, as they contribute to the reduction in costs in refugee administration to the UNHCR and Government of Sudan.

The operational arm of the Sudan Council of Churches is at present the Swedish Evangelical Mission, which has two doctors, a few nurses, and a community development officer concerned with promoting, for example, child care, house improvement and vegetable gardening. ASME Humanitas has only a doctor, but like the Mission it provides material relief (medicines, blankets, milk powder, etc.). Other organisations such as the Eritrean Red Cross and Red Crescent Society and the possibly defunct Eritrean Relief Association are primarily concerned with relief inside Eritrea itself, although it appears that, as in the PLF and ELF relief operations,

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some material reaches the camps inside the Sudan.

Staffing, rather than finance, appears to be the main problem of these agencies. However, there is likely to be a continuing influx of relief aid while the camps remain dependent and impoverished. Therefore one has to accept that there will continue to be a sizeable group of refugees who will assess, quite rationally, that it is in their interests to remain dependent on relief rather than seek employment or produce surplus crops.

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