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Report Number 400/1/Pl

PLANNING DIVISION

AUGUST 1987

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CONTENTS

ΤA	ABLE O	DF CONTENTS	
		ANNEXURES	
LI	ST OF	APPENDICES	
1.	INT	RODUCTION	1
2.	ഭഭവ	GRAPHICAL DETAILS	
€. 0	GEU	GRAPHICAL DETAILS	3
	2.1	LOCATION	З
	2.2	TOPOGRAPHY	3
	2.3	CLIMATE	3
	2.4	VEGETATION	4
	2.5	GEOLOGY	5
	2.6	LAND USE	5
	2.7	IRRIGABLE SOILS	6
	2.8	WATER RESOURCES	8
З.	SOCI	IO-BCONOMIC FACTORS	8
		· .	
	3.1	HISTORICAL BACKGROUND	. 8
	3.2	POPULATION	9
	3.3	PRESENT IRRIGATION DEVELOPMENT	10
	3.4		12
	3.5	MARKETS FOR AGRICULTURAL PRODUCE	15
A	OPhin		
4.	gene	RAL ECONOMIC MODEL FOR IRRIGATION	16
	4.1	INTRODUCTION	16
	4.2	ASSUMPTIONS	20
	4.3	INPUTS	22
	4.4	COMPARISON AND OUTPUTS	31
			Ų⊥

٦ د PAGE

5.	. IRRIGATION POTENTIAL AT THREE AREAS	37
	5.1 GENERAL	37
	5.2 NOORDOEWER	38
	5.3 AUSSENKJER	40
	5.4 FISH RIVER MOUTH TO DABERAS	41
6.	ADDITIONAL ASPECTS	43
	6.1 ECONOMICS OF EXISTING DEVELOPMENT	43
	6.2 POTENTIAL FOR LARGE SCALE DEVELOPMENT	44
	6.3 DEVELOPMENT OF DABERAS	
		45
7.	CONCLUSIONS	46
8.	RECOMMENDATIONS	
		48
9.	APPROVAL	49

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5 2

LIST OF ANNEXURES

ANNEXURE 1 : LOCATION PLAN ANNEXURE 2 : SOIL POTENTIAL ANNEXURE 3 : GENERAL MODEL ANALYSIS PRINTOUT, ELECTRICITY 10 c/kWH ANNEXURE 4 : GENERAL MODEL ANALYSIS PRINTOUT, ELECTRICITY 13 c/kWH ANNEXURE 5 : GENERAL MODEL ANALYSIS PRINTOUT, ELECTRICITY 16 c/kWH ANNEXURE 6 : GENERAL MODEL ANALYSIS PRINTOUT, FLOOD IRRIGATION ANNEXURE 7 : GENERAL MODEL ANALYSIS PRINTOUT, FLOOD IRRIGATION ANNEXURE 8 : GENERAL MODEL ANALYSIS PRINTOUT, FLOOD IRRIGATION ANNEXURE 9 : GENERAL MODEL ANALYSIS PRINTOUT, FLOOD IRRIGATION ANNEXURE 10: NOORDOEWER IRRIGABLE SOILS ANNEXURE 11: NOORDOEWER ZONING ANNEXURE 12: MODEL ANALYSIS PRINTOUT, EXTENSION TO EXISTING DEVELOPMENT ANNEXURE 13: MODEL ANALYSIS PRINTOUT, DEVELOPMENT ZONES ANNEXURE 14: MODEL ANALYSIS PRINTOUT, BULK SUPPLY SUBSIDIZED ANNEXURE 15: MODEL ANALYSIS PRINTOUT, DEVELOPMENT ZONES 2 AND 3 ANNEXURE 16: AUSSENKJER IRRIGABLE SOILS ANNEXURE 17: AUSSENKJER ZONING ANNEXURE 18: MODEL ANALYSIS PRINTOUT ANNEXURE 19: IRRIGABLE SOILS, FISH RIVER MOUTH TO DABERAS ANNEXURE 20: IRRIGABLE SOILS DABERAS ANNEXURE 21: MODEL ANALYSIS PRINTOUT

LIST OF APPENDIXES

APPENDIX A : CROP WATER DEMAND AND IRRIGATION SYSTEM DESIGN APPENDIX B : MECHANISATION AND LABOUR REQUIREMENTS APPENDIX C : FLOOD IRRIGATION COSTS

APPENDIX D : BULKWATER SUPPLY SYSTEM FOR NOORDOEWER

1.

1. INTRODUCTION

The Orange River forms the southern border of South West Africa and is one of only five perennial rivers of the country. The land alongside the Orange River therefore has an important advantage because it has access to an assured source of water. This fact alone gives these lands an advantage and opportunities not enjoyed by many other places elsewhere in the country. In this respect it should be noted that large areas of land alongside the Orange River is cultivated and has been for many years.

The agricultural potential of these lands and unutilized lands could therefore be of great significance to the country in the struggle to reduce imports. Furthermore, the agricultural sector has great potential for employing large numbers of people. Therefore it is important that the development possibilities of the land along the Orange River be seriously examined and its potential determined.

It is within this context that the request from the Infrastructure Committee in 1981 should be seen. The committee had requested the Department of Water Affairs to investigate the practical and economic feasibility of irrigation development along the South West African side of the Lower Orange River. The items of reference were that the study should be confirmed to the three largest tracts of irrigable land. Further, the question of the legal position of the international border between South West Africa and the Republic of South Africa, the hydrology of the Orange River and the availability of water, need not be covered by the report.

The purpose of the investigation carried out, and detailed in this report are:

• to indicate the areas of potentially irrigable land and which of these could be considered for development; to determine whether irri= gation agriculture would be economically feasible at the three areas mentioned above;

- to determine what employ= ment opportunities could be created by the development;
- . to determine the effect on food production;
- to indicate the capital funding requirements of the development;
- to identify the critical parameters affecting the economic viability of any proposed development.

The results of this study are to be made available to the Agronomy Committee appointed by the National Assembly. It would thus become an input into determining the overall development priorities and possiblities of the country.

Due to the limitations of time and budget this report is basically a desk study. However a reconnaissance trip to the area was made as part of the work.

2. **GEOGRAPHICAL DETAILS**

2.1 LOCATION

The Lower Orange River, over its last 600 km, forms the southern border of South West Africa. Refer to ANNEXURE 1 for a location map. At 20° longitude the River becomes the southern border of South West Africa and before this point it flows through the Republic of South Africa.

2.2 TOPOGRAPHY

The lower part of the Orange River flows through a very dissected and mountainous area. Due to the incision of the Orange River in the landscape, agricultural soils are scarce and mostly limited to narrow strips alongside the river.

From South West African territory the Fish River contributes the only large tributary flow to the Orange River.

2.3 CLIMATE

The Lower Orange River region has an arid climate. East of the 18° longitude is a summer rainfall region whilst the area to the west receives rare, intensive rain showers throughout the year. The average annual rainfall decreases gradually from about a 100 mm in the east to less than 50 mm in the west. The annual average number of days with rain varies for the region between 10 and 20. A summary of the rainfall data for Noordoewer and Oranjemund is given in TABLE 1.

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		 RA 	INFALL (mm)	
GAUGING STATION	PERIOD OF RECORD	ANNUAL MEAN	ANNUAL MAXIMUM	ANNUAL MINIMUM
Noordoewer Oranjemund	1972/73 to 1984/85 1948/49 to 1984/85	74 50	180 122	4,2

TABLE 1: RAINFALL FIGURES FOR NOORDOEWER AND ORANJEMUND

Mean daily maximum temperatures for the hotest month is less than 31°C at Oranjemund. This increases gradually to more than 40°C at Noordoewer. Mean daily minimum temperatures for the coldest month is 7°C for Oranjemund and 3°C at Noordoewer.

The region along the Orange River from Noordoewer to Sendelingsdrif and Oranjemund receives only mild frost in winter and certain areas are virtually frost-free.

Mean annual gross "class A" pan evaporation along the Lower Orange River gradually increases from 2 540 mm at Oranjemund to 3 400 mm at the 20° longitude. For Noordoewer this mean is 2 918 mm and an estimate of the annual maximum is 3 400 mm.

2.4 VEGETATION

Two major vegetation types occur along the Lower Orange River. From the 20° longitude westwards to the Haib River, the vegetation type is classified as Dwarf Shrub Savanna and from here further westwards up to Oranjemund, it is classified as Desert and Succulent Steppe.

The Dwarf Shrub Savanna is dominated by Karoo shrubs and grasses. In some parts "Aloe dichotoma" is quite common and dominates the landscape.

4.

In the western parts of the Desert and Succulent Steppe area, near the coast, fairly large barren desert plains with sand dunes are encountered. Further inland the stony hills and mountains are fairly densely covered by succulents of different families. Further to the east, where some rain also falls during summer, the perennial vegetation becomes denser. Trees and shrubs are confined to river courses.

2.5 GEOLOGY

For the area along the Orange River from the 20° longitude up to Noordoewer and again from the Gamkab River up to the border of Diamond Area No 1 the geology consists of intrusive rocks of the Mokolian period and Orange River volcanic rocks of the Haib group.

Between Noordoewer and the Gamkab River, smaller areas of different rock types follows each other; sandstones and shales of the Karoo sequence, Nama sandstones and shales of the Damara sequence, post-Damara granites, Orange River volcanic rocks of the Haib group and sandstones and shales of the Karoo sequence.

Further westwards, into the Diamond Area No 1, various rocks of the Gariep complex are found and lastly this is followed by the sand sea of the Namib Desert.

2.6 LAND USE

From the country's eastern border at 20° longitude to the 18°4' longitude, the land adjacent to the river is divided into large farms which are owned by private farmers. The dominant land use here is irrigation on the riparian irrigable soils and sheep farming on the rest of the farmlands.

6.

At Noordoewer and Aussenkjer irrigation is practised.

All other riparian ground is State land, unused except for the Diamond Area No 1. This area is held by concession under control of the firm C D M (Pty) Ltd. The town Oranjemund has developed as a result of the diamond mining at the mouth of the Orange River.

Other mining activities near to the river are the Rosh Pinah mine where lead, zinc and silver are mined and two smaller mines on the farms Ysterputs 254 and Border 155 in the Karasburg district where blue agate and rose quartz are mined respectively.

2.7 IRRIGABLE SOILS

In 1979 a reconnaissance survey of irrigable soil along the Orange River between Augrabies and Alexander Bay was carried out by the Soil and Irrigation Research Institute of Pretoria (Ref. 1). The results of the reconnaissance survey are used in this irrigation feasibility study.

The reconnaissance survey was done on both sides of the river up to a height of 50 metres above the river's "flood line". At some places where irrigable soil extended further inland, these were also identified. The different soil types were identified and classified according to their suitability for irrigation.

Reduced copies of the maps showing the irrigable soil classes are given as ANNEXURE 2.

The total areas of each soil class in the region under discussion are given in TABLE 2 below.

TABLE 2: SUMMARY OF AREAS SUITABLE FOR IRRIGATION UP TO 50 m ABOVE THE FLOOD LINE OF THE RIVER

PHYSICAL IRRIGATION SUITABILITY CLASS		GROSS AREA (ha)		
	DESCRIPTION	R S A SIDE	S W A SIDE	
I II	Suitable for irrigation Conditionally Irrigable	11 430 13 470	7 820 15 810	
TOTAL		24 900	23 630	

The Class I soils are mainly restricted to thin corridors along the river, as can be seen from the maps in ANNEXURE 2. Most of the present irrigation is being practised on the Class I soils.

- Class II soils are classified as conditionally irrigable because one or more of the physical soil properties do not comply with the criteria used in evaluating the suitability of the soil for irrigation.

Currently however, irrigation is practised succesfully on certain types of the Class II soils namely the Dundee B and Dundee C soils. At Aussenkjer and Hakiesdoorn there are large areas of these soils under lucern. At Noordoewer and Komsberg various crops are grown on an experimental basis with good success on small areas of these soils.

Soil analyses have been done on the Class II soils at Aussenkjer by the Oenological and Viticulture Research Institute, Stellenbosch. These indicated that it is virtually impossible to degenerate the physical structure of these soils by tillage practises, or to inundate them by incorrect irrigation practises. The courser gravellike top layer of the soil serves to retard moisture evaporation from the soil. A disadvantage of the soil is however its low water retaining capability. Thus it is concluded that these soils are suitable for irrigation with proper irrigation and management. This feasibility study therefore assumes that Dundee B and Dundee C Class II soils can be cultivated successfully.

2.8 WATER RESOURCES

The Orange River is the major and most important water resource of the region under consideration. According to the Water Act the river falls under the jurisdiction of the Republic of South Africa although a dispute exists in this regard. However, certain water rights have been granted to farmers on the northern bank, in South West Africa, by the Republic. The whole matter of water rights and allocations is being discussed between the respective governments of South West Africa and South Africa and therefore it is not intended in this report to discuss the subject.

Neither is it intended to discuss the hydrology of the river. It is assumed that water for irrigation development discussed in this report can and will be made available as required.

3. SOCIO-ECONOMIC FACTORS

3.1 HISTORICAL BACKGROUND

During the precolonial stages most of what is now known as the Karasburg District was occupied by a Nama group, called the Bondelswarts. The German colonisation began at the end of the 19 th century and by 1903, some farmland along the River had been awarded to private farmers. South West Africa was entrusted to the Union of South Africa as a Class C Mandate in 1919. All land rights of private chartered companies were then cancelled and the settlement of White farmers was stimulated.

The Noordoewer settlement had its origin during the depression and drought years of the early 1930's.

(Å 19 The history of the diamond mining on the west coast of South West Africa dates back to April 1908 when the first diamond was found at Kolmanskop near Luderitz. In September 1908 the first Diamond Area was established by the German Government.

3.2 POPULATION

3.2.1 General

The population figures according to the 1981 Census for Oranjemund, Rosh Pinah, Noordoewer and the riparian farms on the South West African side of the Orange River are given in TABLE 3 below.

TABLE 3: POPULATION OF ORANJEMUND, ROSH PINAH, NOORDOEWER AND ORANGE RIVER

WARDS AND A CONTRACT OF A C	· ·	1981 CENSUS POPULATION					
NO	LOCATION	WAMBO & KAVANGO	 NAMA	COLOUREDS	 WHITES	 OTHER	TOTAL
1	Oranjemund	1 296	7	59	2 720		4 110
ź	Rosh Pinah	235	15	59	256	30 8	4 112 571
3	Noordoewer	57	82	188	111	49	487
4	S.W.A Orange River	1			1 114	45	407
	Riparian Farms	82	135	158	45	22	442

RIPARIAN FARMS

3.2.2 Manpower

Unskilled labour is available in large numbers in South West Africa and experience obtained to date has indicated that the ability of these labourers is excellent. Thus no problems are foreseen in recruiting unskilled or semi skilled workers.

10.

As far as farm management is concerned current practice is that the resident farmer does this himself. Only in a few instances in the area are farm managers or assistants employed. Obtaining suitably skilled persons to manage and work on any irrigation development may be a difficulty.

3.3 PRESENT IRRIGATION DEVELOPMENT

3.3.1 Irrigated areas and irrigation methods

The areas of Orange River riparian land under irrigation in South West Africa and the irrigation methods used are summarised in TABLE 4, based on figures supplied by the farmers themselves in 1985.

TABLE 4: APPROXIMATE AREAS PRESENTLY UNDER IRRIGATION ON THE SOUTH WEST AFRICAN SIDE OF THE ORANGE RIVER AND THE IRRIGATION METHODS BEING USED

	LOCATION	IRRIGATION METHOD	POWER SOURCE	AREA PRE= SENTLY UNDER IRRIGATTION (ha)
1.	PRIVATE FARMS			
1.1	Khomsberg (Eastern Section)	 Flood	 Diesel	25
1.2	Khomsberg (Western Section)	Flood and Sprinkler	Diesel	43
1.3	Stolzenfells (Eastern Section)		Diesel	5
1.4	Stolzenfells (Central Section)	Flood	Diesel	55
1.5	Stolzenfells (Western Section)	Flood	Diesel	30
1.6	Beenbreek (Eastern Section)	Flood	Diesel	15
1.7	Beenbreek (Central Section)	Flood	Diesel	30
1.8	Beenbreek (Western Section)	Flood	Diesel	15
1.9	Khaais	Flood	Gravity Flow	100
1			In Private Canal	1
1.10	Velloorsdrif	Flood	Diesel	18
1.11	Keimasmund	Flood	Diesel	10
1.12	Pella Drift	Flood and Sprinkler	SWAWEC Electricity	140
1.13	Houmsrivier	Flood	Diesel	22
1.14	Gaidip	Flood	Gravity Flow In	
			Private Canal	41
1.15	Ramansdrif (Central Section)	Flood	Diesel	5
1.16	Ramansdrif (Silverstroom)	Flood	Diesel	20
1.17	Hakiesdoom	Sprinkler and Centre Pivot	SWAWEC Electricity	315
1.18	Aussenkjer	Sprinkler	Diesel	400

	LOCATION	IRRIGATION METHOD	POWER SOURCE	AREA PRE= SENTLY UNDER IRRIGATTION (ha)
2.	NOORDOEWER (Part of the Vicolsdrif irrigation scheme)	Flood	Gravity Flow In Scheme Canal	 373*
3.	DIAMOND AREA: DABERAS	 Flood	 SWAWEC Electricity	 76
TOTAL				

* Of the 373 ha under irrigation at Noordoewer only 283 ha is officially scheduled, for 21 farmers.

3.3.2 Crop production

Up until 1965 lucern cultivation was practiced almost exclusively. Since then with the opening of the Cape Town Fresh Produce market farmers have diversified their production base. Now only 60% of irrigated land is under lucern. Other crops grown are cotton, tomatoes, musk-mellon, beans, peas, pumpkin and gem squashes. Some farmers also grow wheat and maize and a few have citrus orchards and vineyards. At places, dates, mango and paw-paw are grown, mainly on the lower potential soils.

Typical yields obtained for some of the crops grown reported by the farmers at Noordoewer and Aussenkjer are given in TABLE 5.

CROP	YIELD (ton/ha)	
Lucern	15 - 22 per year	
Cotton	3,5	
Tomatoes	50	
Musk-mellon	18	
Dry beans	1,4	
Dry peas	2,4	
Pumpkin	10	
Gem Squashes	20	
Wheat	3,5 - 4,5	
Maize	6,5	

TABLE 5: REPORTED AVERAGE CROP YIELDS

Lucern is sold either to the nearest agricultural co-operative or on contract to large consumers in the Cape Province and to a lesser extent directly to local sheep farmers. Lucern produced at Daberas is supplied to the dairy farm there.

Cotton, beans, peas and maize are sent to Upington whilst wheat is milled at Kakamas.

Fresh vegetables and fruit are mainly grown at Noordoewer and Aussenkjer. Most of the Noordoewer vegetables and fruits are sold on the Cape Town market. Those produced at Aussenkjer are also delivered on contract to fruit and vegetable outlets in South West Africa and to the military.

3.4 INFRASTRUCTURE

In general, land along side the Orange River is poorly provided for in terms of infrastructure, as will be discussed below. Whilst the area is not isolated from the rest of the country it is remote and partly served. The implication for development and especially irrigation is that this will increase operating and maintenance costs and pose significant marketting and manpower problems.

3.4.1 Railways

The nearest railway line to the Orange River is the Luderitz - Aus - Seeheim - Karasburg - Ariamsvlei-Upington line. From Seeheim the railway also branches off to Keetmanshoop and the rest of South West Africa.

3.4.2 Roads

There are only three road bridge crossings over the Orange River. They are at Oranjemund, Noordoewer and Onseepkans. A number of pontoon crossings also exists.

East of Noordoewer a network of proclaimed roads connect all riparian farms with towns in the interior. There is, however, no road stretching all the way along the river.

From Noordoewer westward, there is a dirt road on the South West African side along the river up to the pontoon bridge near Sendelingsdrif. From here the road continues to Alexander Bay on the South African side of the river.

3.4.3 Electricity

A 330 kV SWAWEC electrical power line from Karasburg to Aggeneys crosses the Orange River at the farm Gaidip. There are no offtakes for any consumers at the Orange River.

Places currently supplied with electricity are:

Oranjemund; Dabaras; Rosh Pinah; Hakiesdoorn; Pella Drift.

The electricity to these places is supplied from the Republic of South Africa. The cost of electricity supplied for irrigation in TABLE 6 below.

14.

TABLE 6: COST OF ELECTRICITY SUPPLIED FOR IRRIGATION

IRRIGATION FARM	AREA PROVIDED WITH ELECTRICAL DISTRI= BUTION LINES (ha)	COST OF ELECTRICITY (c/kWh)
Daberas	392	16
Hakiesdoorn	315	8,4
Pella Drift	250	10

Negotiations between ESCOM/SWAWEC and the Farmers Cooperative at Noordoewer to provide Noordoewer with electrical power are in progress. Vioolsdrif, just across the river, will shortly be supplied with ESCOM electrical power.

In other words electricity supply in the region along the river currently is not controlled by the South West African authorities.

3.4.4 Communications

All the farms, settlements and towns along the Orange River enjoy a telephone service. Postal services are available at Oranjemund, Rosh Pinah, Noordoewer, Warmbad and Ariamsvlei.

3.4.5 Other Communal Services

There are primary schools at Oranjemund, Rosh Pinah, Noordoewer, Warmbad, Karasburg and Ariamsvlei. The secondary school nearest to the Orange River in South West Africa is at Karasburg.

There are hospital facilities at Oranjemund and Karasburg and there is a clinic at Noordoewer.

The regional police headquarters is in Karasburg whilst local police stations are at Oranjemund, Noordoewer, Warmbad and Ariamsvlei.

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3.4.6 Discussion

The infrastructure has a very important bearing upon the ability of the area to support development. If development takes place many services will be required, some of which are not currently catered for. Some will have a direct bearing upon development such as transport services; the need for good roads, repair services, spare parts, workshops etc. Others will have a social impact; the need for community services such as schools, clinics and the like. The financial burden of providing such services will have to be planned for and borne. With the present infrastructure this aspect will tend to restrict any development to those places currently catered for in terms of services.

The current infrastructure also has an influence upon what crops could or should be grown. For example fruit and vegetables can be sold on the Cape Market due to its relative proximity and large consumer market. Staple foods such as maize and wheat could be marketted in South West Africa.

3.5 MARKETS FOR ACRICULTURAL PRODUCE

Three potential markets have been identified for agricultural produce from the lower Orange River. These are;

Cape Metropolitan Market Area; South West Africa; International Export.

In terms of size and ability to absorb products, the Cape Market is the most important. It is expected that fruit and vegetables grown along the Orange River would compete favourably with produce from other regions. This would be the major market. The Western Cape also provides a ready market for lucern especially for dairy and horse breeding concerns.

The local South West Africa market is in comparison small and dispersed. Only Windhoek offers a market of any size for fruit and vegetables. On the other hand most agricultural produce is imported at present. Therefore the

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potential for staple products grown locally should not be ignored. Hence produce from the area could reduce imports especially if preferential treatment were to be given to local products.

Lastly there is the international market. The potential of this market for South West African produce is thought to be small. It may be that certain fruits could be exported as long as the quality, price and timing are correct.

4. GENERAL ECONOMIC MODEL FOR IRRIGATION

4.1 INTRODUCTION

The purpose of the general economic model is to enable the economic feasibility for an irrigation scheme to be evaluated. The model requires that certain assumptions be made concerning the characteristics of an irrigation scheme to be analysed. Inputs to the model are in the form of costs.

A diagramatic description of the model is given on page 18 and in the subsequent sections there are brief explanations of the inputs.

Various values that emerge from the flowchart can be used to calculate a variaty of economic and other parameters, all of which are results obtained when looking from different angles towards the feasibility of irrigation.

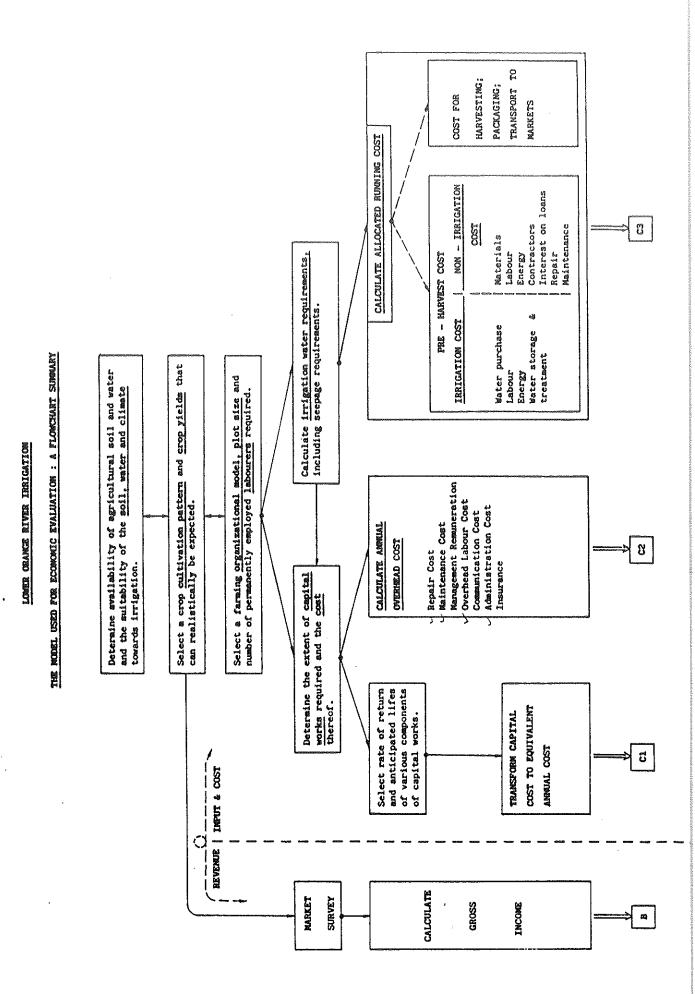
A number of such economic parameters are:

- * Total capital requirement for development
- * Gross margin on crop production = B -C3
- * Nett anual cash flow = B C3 C2
- * Benefits mius cost = B (C1 + C2 + C3)
- * Benifits over cost = B1/(C1 + C2 + C3)
- * Internal rate of return, which is that interest rate by which C1 (Capi= talized Annual Cost) becomes equal to B - C3 - C2 (Nett annual cash flow).

Some other usefull parameters are:

- * Labour opportunity creatment
- * Capital investment required per labour opportunity created
- * Food import replacement

The general economic model is computerized on the computer system of the Department of Water Affairs. The software is available in the Departments computer library under the following labels: Disc 1: ORANGE RIVER, GENERAL, NOOR 23, AUSSEN and Disc 2: ORANGE RIVER, NOOR 1, FLOODE, FLOODD, DABIM



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ASSUMPTIONS							
1. COMMERCIAL, OPERATION RUN BY A SINGLE FARMER PLUS FARM WORKERS. NO SUBSIDIES PROVIDED.							
2. FARM SIZE	200 ha						
3. CROPS	MAIZE, WHEAT AND COTTON						
4. IRRIGATION SYSTEM	HAND MOVED SPRINKLER						
5. WATER SUPPLY	: 7,8 m³/h/ha						
6. ENERGY SOURCE	ELECTRICITY, TO CENTRAL PO AND RETICULATION BY FARM						

	allannen an alter zu einen eine eine einen ein	0,000,000,000,000,000,000,000,000,000,	
IN	PUT		
EXPENDITURE CAPITAL IRRIGATION SYSTEM WATER SUPPLY	R4700/ha R 890/ha R1850/ha		R2800/ha
ELECTRICITY SUPPLY MECHANISATION FARM IMPROVEMENT	R 1650/ha R 330/ha R 630/ha R1000/ha	WHEAT MAIZE	R1655/ha R1679/ha
MAINTENANCE CAPITAL WORKS EQUIPMENT MECHANISATION	R 118/ha R 12/ha R 65/ha R 46/ha		
OPERATION MARKETING	VARIABLE		
WATER ELECTRICITY CONTRACT	R0,0012/m ³ VARIABLE VARIABLE		
RUNNING INTEREST	VARIABLE VARIABLE		
COMPARIS	ON		
INCOME vs.	EXPENDITURE		

OUTPUT BENEFIT / COST RATIO BENEFIT - COST = NETT BENEFIT TOTAL CAPITAL COST INTERNAL RATE OF RETURN NETT OPERATIONS CASH FLOW

20.

4.2 ASSUMPTIONS

4.2.1 Commercial Operation

In order to develop the general model certain assumptions were made concerning the type of development. It has been assumed that the irrigation development will take the form of a commercial operation involving a single farmer assisted by a number of permanent and temporary farm workers.

4.2.2 Size of Irrigation Units

The size of irrigation unit has been taken as 200 hectares. This size has been chosen for a number of reasons. It can be managed by one person, for the type of crops to be grown. Mechanisation costs per hectare are significantly reduced as are capital costs. In arriving at the 200 hectares other, smaller, areas were looked into. However it was found that in most cases these were uneconomic. Hence it was decided to use 200 hectare units in the analysis.

Some of the short comings with this approach are that the size is influenced by the crops that can be profitably grown. It also depends upon the cost of energy, the degree of management skills available and subsidies. There is no optimum unit size as such a size will depend upon not only the above factors but many others. This is an aspect which could be researched further.

4.2.3 Crops

Three crops have been chosen for use in the model; cotton, wheat and maize.

Other crops, such as vegetables, were considered but not included. The reasons for not including them were that this was to be a general model and the market would not be able to absorb the volume of produce if all the farm units were to produce vegetables. In other words only a small area could be given over to vegetable production. There was also the price variations throughout the year to consider which would complicate the calculations.

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For these reasons it was decided to concentrate upon three crops and accept that this would be the bottom line.

The cropping system adopted is the successive cultivation of the three crops on a two year cycle. The Diagram below demonstrates the concept.

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NOTE : >DENOTES PLANTING DATE

#### 4.2.4 Irrigation System

A semi permanent hand moved sprinkler system has been chosen as the most appropriate system.

The capacity of the system has been designed taking account of; the crop water demand, irrigation efficiency, peak requirements, the elevation of the irrigated lands and the pumping head required by the system.

22.

Refer to APPENDIX A for more details.

#### 4.2.5 Electricity Supply

It is assumed that an electricity supply is available at a central point. Distribution from this point to the consumer points on the irrigation units and provision of transformers is the responsibility of the farmer.

#### 4.2.6 Farm Improvement Costs

Farm improvement costs such as land clearing and levelling, fencing, roads, buildings and mechanisation are borne by the farmer.

#### 4.3 INPUTS

Inputs to the general model can be broken down into two broad catagories: expenditures and incomes. Expenditures can be further broken down into such items as capital, maintenance and operation costs. Income is derived from the sale of produce grown on the farm.

#### 4.3.1 Income

The income generated from the sale of cotton, wheat and maize depends upon the yields and the selling price. TABLE 7 gives the expected income.

CROP	YIELD	<b>PURCHASE</b> PRICE	INCOME
	tonne/ha	R/tonne	R/ha
Cotton	3,5	800,00	2 800
Wheat	5,0	331,14	1 655
Maize	6,0	279,89	1 679

#### TABLE 7 : EXPECTED INCOME FROM SALE OF PRODUCE

#### 4.3.2 Capital Expenditure

Capital expenditure is taken to include farm improvement costs, establishing the electrical distribution, purchase of irrigation equipment and the water supply system. The acquisition of plant such as tractors, planters, spreaders etc. is also included here.

#### 4.3.2.1 Farm Improvement Costs

TABLE 8 gives the breakdown of Farm Improvement costs.

DESCRIPTION	COST R	UNIT RATE R/ha
Building:		
3 N° Sheds @ R18 000 each	7500054 000	270
1 N° House/Office	150 100-50-000	250
Land Clearing & Levelling	65 000 -	325
Fencing: 7000 m @ R1,57/m	10 500	55
Roads	20 000	100
	320 000	
TOTAL	199 500 ?s	1 000

#### TABLE 8 : FARM IMPROVEMENT COSTS

#### 4.3.4.2 Water Supply System

The water supply system is taken to consist of a number of river intake pumps and distribution pipelines. The sprinkler equipment is connected into the pipe network as required . A description and typical layout of a water supply system is given in APPENDIX A.

#### 24.

# TABLE 9 : WATER SUPPLY SYSTEM COSTS

DESCRIPTION	COST R	UNIT RATE R/ha
Civíl Works M & E Installation	293 800 76 200	1 469   381
	370 000	1 850

#### 4.3.2.3 Irrigation Equipment

The equipment required for the irrigation system is detailed in Appendix A. It consists of a number of quick coupling pipes and risers. The capital cost is estimated to be R178 000 or R890/ha.

#### 4.3.2.4 Electricity Supply

It is assumed that on average a farmer will have to provide 4000 metres of electric cable. This is to get the power from a central power point to his own point of demand, i.e. his pumps. In addition step-down transformers will be required. The rating of the transformers will differ depending upon the power to be drawn. To pump water to higher ground, ie to an average height of 40 m above mean water level, will require more power.

Therefore two different cases have been considered. The one case where the average elevation of the irrigated area is 25 metres above mean water level. The other where the average elevation is 40 metres.

#### 25.

#### TABLE 10 : COSTS OF ELECTRICITY SUPPLY

DESCRIPTION	COST R	UNIT RATE R/ha
Powerlines: 4000 m @ R13/m Transformers	   52 000 	260
25 m elevation; 2 N° 300 K @ R6000 40 m elevation; 2 N° 400 K	12 000	60
40 m erevation: 2 Nº 400 K @ R8000	16 000	80

#### 4.3.2.5 Mechanisation

A summary of the mechanisation requirements and the costs thereof is given in APPENDIX B. The total cost of this equipment is R125 200, which gives a unit capital cost hectare of R630.

#### 4.3.2.6 Summary

A summary of the capital costs is given in TABLE 11 below.

#### TABLE 11 : SUMMARY OF CAPITAL COSTS

DESCRIPTION	COST	UNIT RATE
Farm Improvements	- 199 500	1 000
Water Supply System	370 000	1 850
Irrigation Equipment	178 000	890
Electricity supply	64 000 or 68 000	320 or 340
Mechanisation	125 200	630

#### 4.3.3 Maintenance Cost

Maintenance costs for irrigation units are calculated and given in TABLE 12.

#### TABLE 12 : MAINTENANCE COSTS

DESCRIPTION	RATE	CAPTIAL R	Maintenance R/a	UNIT RATE R/ha/a
Farm Improvements Water Supply System	0,5% of capital cost 0,5% of cost of civil	199 500	1 000	5
and a mapped along	works 4% of cost of M & E	293 800	1 469	7
į	works	76 200	3 000	15
Irrigation Equipment	5% of cost	178 000	8 800	44
Electricity Supply	2% of cost	64 000	1 200.	6
		68 000	1 400	7
Mechanisation	Item	125 000	9 200	46

The maintenance costs for the mechanised equipment, such as tractors, depends upon the number of hours worked. The hours worked depend in turn upon the crop being cultivated. A detailed breakdown of these maintenance costs is given in APPENDIX B and summerised below:

\ \	cotton	R 38/ha
	wheat	R 28/ha
	maize	R 26/ha.

In any one year one crop of each of the above is cultivated. But only 100 hectares of each is under cultivation. Therefore the total maintenance costs are: R38 x 100 ha + R28 000 x 100 ha + R26 x 100 ha giving R9 200. But since for that year a total of 200 hectares was cultivated the equivalent unit maintenance cost will be R9 200 - 200 Ha ie. R46/ha.

27.

#### 4.3.4 Operations Costs

Operating costs are going to be determined principally by what crops are grown. Cotton for example will require a greater labour input than wheat say. Therefore its labour operating costs are going to be higher than that of the other crops grown.

The other variable to be considered is that of electricity. Apart from the fact that the amount of electricity used will depend upon the crop, there are two other factors to consider. Firstly the power used will depend upon the pumping head required. This in turn depends upon the height of the irrigation land above mean water level. For the purpose of the general model only two heights have been considered, known as the lower ground and the higher ground. The lower ground refers to land with an average elevation of 25 metres above mean water level and a maximum height of 30 metres. The higher ground refers to land with an average elevation of 25 metres above mean water level and a maximum height of 50 metres.

Secondly, there is no established electricity supply grid along the river. Therefore there is no approved tariff structure for electricity. Thus the cost of electricity is an unknown factor.

Attempts were made to obtain from SWAWEC budget estimates of cost but they were unable to supply any details. Therefore three cost structures for electricity have been used in the evaluation, namely; 10c/kWh, 13 c/kWh and 16c/kWh. These are based upon tariffs which are currently being levied at Daberas (16c/kWh), Hakiesdoorn (8,4c/kWh), and Pella Drif (10c/kWh).

#### 4.3.4.1 Electricity Costs

The cost of electricity as a function of pumping height and crops grown is given in TABLE 13 below. Electricity is supplied at a central point and the cost is taken at that point.

#### 28.

UNIT COST OF	AVERAGE	OPERATING COST R/ha/a						
ELECTRICITY c/kWh	PUMPING HEAD m	COTTON	WHEAT	MAIZE	TOTAL			
10	53 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	215	95	171	481			
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	68	  275	155	220	617			
13	53	279	124	223	626			
	68	358	159	286	803			
1.6	53	343	152	274	769			
	68	441	195	352	988			

TABLE 13 : OPERATING COST OF ELECTRICITY

4.3.4.2 Transport Costs

This covers the cost of transporting goods and materials to the irrigation units. It is assumed that all incoming materials have to be transported 100 km. Produce is road transported to a railhead, which is also taken to be 100 km away. Wheat and maize are to be sent by rail to Mariental while cotton is sent by rail to Upington.

TABLE	14	:	TRANSPORT	COSTS

ITEM	UNIT_RATE R/ha			
	COTTON	WHEAT	MAIZE	TOTAL
Road Transport Rail Transport	42,0 42,5	56,0 49,5	68,0 62,5	166,5 154,5

4.3.4.3 Water

A "river tariff" of $0,12 \text{ c/m}^3$ is levied upon water abstracted from the Orange River. Since the farmers will be responsible for their own water supply, this is the only cost incurred.

4.3.4.4 Labour

The labour requirements and the associated costs are discussed in Appendix B. A summary of the cost of labour, derived from APPENDIX B is given in TABLE 15 below.

TABLE 15 : LABOUR COSTS

ITEM	UNIT RATE R/ha		
	COTTON	WHEAT	MAIZE
Labour	476	32	41

These costs are in terms of rand per hectare cultivated.

4.3.4.5 Material Costs

The cost of materials required for cultivation is summarised in TABLE 16 below. For more detail, the reader is referred to APPENDIX B.

TABLE 16 : MATERIAL COSTS

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UNIT RATE R/ha		
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COTTON	WHEAT	MAIZE
37 226 204	69 215 38	40 202 70
	COTTON 37 226	UNIT RATE R/ha COTTON WHEAT 37 69 226 215 204 38

4.3.4.6 Fuel Costs

Fuel costs for tractors are calculated in APPENDIX B, and are given below.

TABLE 17 : FUEL COSTS

ITEM	UNIT RATE R/ha		
	COTTON	WHEAT	MAIZE
Fuel Cost	. 46	35	33

4.3.4.7 Contract Services

Apart from transportation, it is assumed that a contracter is used to harvest wheat and maize. Cotton is harvested by hand. Aerial spraying is also carried out by a contractor. The rates quoted are for each hectare under cultivation.

31.

ITEM UNIT RATE R/ha WHEAT MAIZE Harvesting 100 120 Spraying 9 -

TABLE 18 : CONTRACT SERVICES

4.3.4.8 Interest on Production Capital

Loans of varying amounts are made at different stages through the growing season and are repaid shortly after harvesting. Interest is payable on such loans. For a typical irrigation unit in the Ramah area the Directorate of Agricultural Production Economics in the RSA calculated the fixed interest costs for various crops. These figures are adopted here, and are given below.

Cotton	R130/ha
Wheat	R 50/ha
Maize	R 45/ha.

4.3.4.9 Salaries

It is assumed that the farmer or farm manager draws a salary from the enterprise. An amount of R40 000 per year is assumed as the salary drawn.

4.4 COMPARISON AND OUTPUT

The income generated can be calculated as can the expenditures incurred in running an enterprise. This is for the general case outlined above. These can be compared to each other, in various ways, to determine the viability of

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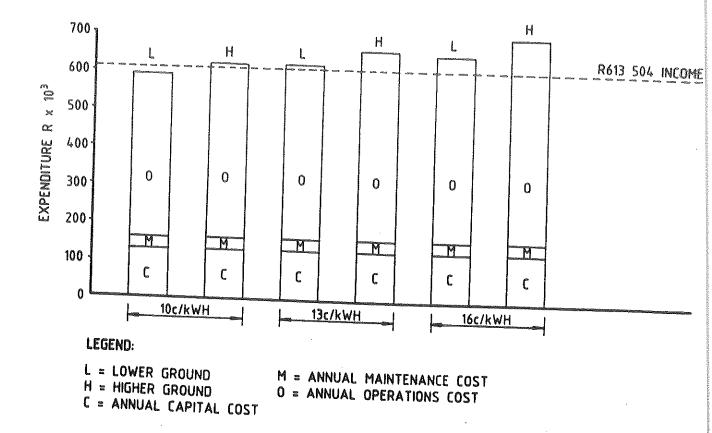
the development. The comparison of income and expenditure based upon the costs derived above is given in TABLE 19. Printouts of each case considered are given in ANNEXURES 3, 4 and 5.

TABLE 19 : COMPARISION OF INCOME AND EXPENITURE (Rand)

		FIXED COST		VARIABLE		COSTIS	
CASE	ITEM		9444-946-9444-944-944-944-944-944-944-94	LOWER GROUND		HIGHER	GRAND
		TOTAL	arevial.	TOTAL	ANNUAL.	TOTAL	ANNUAL
I (Electricity 10 c/kWH)	Income Expenditure Capital Maintenance Operations	555 190 555 190	613 504 443 926 84 772 20 140 339 014	373 000 373 000	148 929 47 971 4 432 96 526	306 600 386 600	178 563 49 880 4 840 123 843
II (Electricity 13 c/kWH)	Income Expenditure Capital Maintenance Operations	555 190 555 190	613 504 443 926 84 769 20 140 339 014	373 000 373 000	177 886 47 971 4 432 125 483	386 600 336 600	215 716 49 830 4 840 160 996
III (Electricity 16 c/kWH)	Income Expenditure Capital Maintenance Operations	555 190	613 504 443 926 84 769 20 140 339 014	373 000 373 000	206 343 47 971 4 432 154 440	386 600 386 600	252 868 49 880 4 840 198 148

These results are represented diagrammatically below. The effect of the elevation of the lands to be irrigated can be seen, with respect to the Operational costs. Also it can be seen that the cost of electricity has a marked influence upon profitability.

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There are various methods of analysing these figures to investigate the economic and financial feasibility of a project. Given below are the various methods that have been employed.

4.4.1 Benefit-Cost Ratio

The benefit-cost ratio is the annual income or benefit from the project divided by the annual amortized costs. If the ratio exceed unity then the scheme is potentially viable.

From TABLE 20 the various benefit-cost ratio's can be determined for each case, i.e. for a certain land elevation and cost of electricity. These ratio's vary between 0.88 for high lands and most expensive electricity, to 1.04 for the least expensive electricity on the low lands.

34.

TABLE 20 : BENEFIT-COST RATIO'S

COST OF ELECTRICITY	BENEFIT-COST RATIO				
c/kWH	LOW ELEVATION LAND	HIGH ELEVATION LAND			
10 13 16	1.04 0.99 0.94	0.99 0.93 0.88			

4.4.2 Nett Benefits

Nett benefit is defined as the sum of all benefits minus the sum of all costs. As it is assummed here that both benefits and costs are constant during the project, the annual nett benefit is calculated. The values calculated are given in TABLE 21.

TABLE 21 : NETT BENEFITS

COST OF ELECTRICITY	NETT ANNUAL BENEFIT (R)					
c/kWH	LOW ELEVATION LAND	HIGH ELEVATION LAND				
10 13 16	20 649 - 8 308 - 37 265	- 8 985 - 46 138 - 83 290				

4.4.3 Internal Rate of Return

The internal rate of return method entails the establishment of the discount rate which would result in the present value of nett income equalling that of the investment. This rate of interal return is the interest rate at which the Benefit-Cost ratio is unity.

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The internal rates of return for the various circumstances considered by the general model are given in TABLE 22 below.

TABLE 22 : INTERNAL RATES OF RETURN

COST OF ELECTRICITY	INTERNAL RATE OF RETURN				
c/kWH	LOW ELEVATION LAND	HIGH ELEVATION LAND			
10 13	14				
16	5				

4.4.4 Nett Operations Cashflow

The nett operations cashflow is the difference between the gross annual income of the project and the annual operating costs. It is a measure of the benefits produced by a scheme when the amortised capital costs are not included as a cost. In other words how profitable would a scheme be if the capital costs were to be subsidized. In TABLE 23, below, the nett operations cashflows derived from the general model are given.

TABLE 23 : NETT OPERATIONS CASHFLOW

COST OF ELECTRICITY	NETT ANNUAL OPERATIONS CASHFLOW			
c/kWH	LOWER GROUND	HIGHER GROUND		
10 '	R 153 392	R 125 667		
13	R 124 435	R 88 514		
16	R 95 478	R 51 362		

4.4.5 Flood Irrigation

The general model has been applied to the case of flood irrigation using the some electricity costs as before but only the lower ground is used. The Table below summarises the findings of the general model. For a more detailed discussion of the various parameters used refer to APPENDIX C.

ECONOMIC	COST OF ELECTRICITY (c/kWH)					
PARAMETER	10	13	16	DIESEL POWER		
Nett Operations Cashflow Nett Benefit Benefit/Cost Ratio Internal Rate of Return	R 172 457 R 15 749 1.03 13.4%	R 153 335 - R 3 373 0.99 11.1%	R 134 213 - R 22 495 0.97 8.5%	90223 - 91380 0.87 0		

TABLE 24 : GENERAL MODEL APPLIED TO FLOOD IRRIGATION

A full printout of all the cases considered is given in ANNEXURES 6, 7, 8 and 9.

4.4.6 Conclusions

Given the assumptions made in the general model the following conclusions can be drawn. Irrigation development is economically feasible only on the lower elevation land. This is providing the cost of electricity is 10 c/kWH or less, irrespective of whether flood or sprinkler irrigation is considered.

The model could be utilised to investigate the sensitivity of the results to the various assumptions. For example, the influence of reducing the size of the farm units to 100 ha was investigated. In doing so the capital, maintenance and operations costs were adjusted accordingly. This analysis indicated that under the given conditions assumed the smaller farm units were uneconomic, even with an electricity cost of 10 c/kWH.

5. IRRIGATION POTENTIAL THREE AREAS

5.1 GENERAL

In the previous chapter a general model was developed to evaluate the economic potential of irrigation along the Orange River. In that model certain general assumptions were made. The model will now be applied to analyse a number of specific cases. To do this three potential development areas have been selected for analysis. These areas have been selected on the basis that they constitute three of the larger areas where irrigable soils are available.

The areas chosen for further evaluation are:

Noordoewer Aussenkjer Fish River Mouth to Daberas.

For each case considered the assumptions in the general model have been modified, where necessary, to take account of local conditions.

Each of the specific areas are considered separately.

5.2 NOORDOEWER

5.2.1 Project Land

At Noordoewer, there is about 570 ha of Class 1 irrigation soil spread out as a long narrow strip along the river. Almost all present irrigation, namely flood irrigation, is being practised on this soil. Of this 570 hectares a total of 283 ha is scheduled for irrigation, but at stages up to 373 ha is irrigated. Further extension of irrigation land is limited by the water supply capacity of the present integrated canal system.

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Up to a height of 50 m above the high water level, there is an additional 1630 ha of Class II irrigable soil of the Dundee B type. These soils also extend above this contour line. However due to the cost of pumping water above these levels, this extension is not considered. The distribution of the irrigable soils is shown in ANNEXURE 10.

There are thus a total of 2200 hectares of soil suitable for irrigation at Noordoewer. This area is reduced to allow for infrastructure and also subdivision into zones as per TABLE 25 and ANNEXURE 11.

ZONE NO	EFFECTIVE AREA (ha)	COMMENT
1 2 3	630 800 200	Between river and road to Aussenkjer Between road to Aussenkjer and 200 m contour Between 200 m and 210 m contours
TOTAL	1630	74% of total available irrigable soil

TABLE 25: NOORDOEWER IRRIGATION ZONES: EFFECTIVE AREAS ASSUMED

5.2.2 Development Assumptions

The existing lands scheduled for irrigation are all in Zone 1 and average 13,5 hectare per farmer, for 21 farmers. Since these farming units are very small, it is assumed that all additional land in Zone 1 will be added to the existing farms. This will then increase the size of each farming unit to 30 hectares.

For Zone 2 and Zone 3, new 200 ha farming units are assumed. The farming units obtain irrigation water from a bulk water supply system. A costing for the bulk water supply system is given in APPENDIX D.

5.2.3 Cases Considered

Four specific cases have been considered for Noordoewer. The inputs into the general model have been adopted to each of the cases considered. These were;

- (i) extension to the existing development, but only in Zone1,
- (ii) development of Zone 2 only
- (iii) development of Zone 2, with the capital cost of bulkwater supply scheme being totally subsidized,
- (iv) development of Zones 2 and 3.

Details of the inputs are given on the printouts of each of the cases. The printouts which are given in ANNEXURES 12 to 15.

5.2.4 Summary of Results

As stated above the full results of the analysis are given in the ANNEXURES, only a summary of these results are given here.

TABLE 26 : SUMMARY OF RESULTS FOR NOORDOEWER

ECONOMIC PARAMETERS	CASE					
	(i)	(11)	 (iii) 	(iv)		
Nett Operations Cashflow Nett Benefit Benefit/Cost Ratio Internal Rate of Return	R 13 628 R 799 1.0 12.9%	R 81 417 - R 46 308 0.9 2.8%	R 126 730 - R 995 0.9 11.3%	R 49 589 - R 78 723 0.8 O		

5.3 AUSSENKJER

5.3.1 Project Land

Up to 50 m above the river high water level, as shown in Annexure 15, there is a total of about 470 ha of Class I soil. There is a further 2000 ha of Class II soil of the Dundee B and Dundee C type, with Dundee B being in the majority. Further inland and higher up from the river, there is an additional area of more than 3000 ha of this Class II soil. The Class I soil forms a narrow strip next to the river. Presently, there is about 400 ha of both soil classes under hand movable sprinkler irrigation.

The irrigable soil up to the 170 m contour line (50 m above river high water level) have been subdivided into three irrigation zones, as is shown on the 1:50 000 scale map in Annexure 17. Approximate geographical details of these zones are given in TABLE 27. Only Zones 1 and 2 are considered in the analysis.

ZONE	ASSUMED TOTAL IRRI= GABLE AREA	TAL IRRI= OF NEAREST PLOT		ELEVATION ABOVE RIVER WATER LEVEL (m)		
			AVERAGE	HIGHEST POINT		
1 2	800 600	50 870	 20 30	25 35		
3	500	1 700	45	55		
OTAL	2000					

TABLE 27: AUSSENKJER IRRIGATION ZONES, GEOGRAPHICAL INFORMATION

5.3.2 Results of Analysis

The assumptions made in the analysis are shown on the printout, which is given in ANNEXURE 18. The result of the analysis is shown in the TABLE 28 below.

TABLE 28 : SUMMARY OF RESULTS OF ANALYSIS

	NETT OPERATIONS CASHFLOW	NETT BENEFIT	BENEFIT/COST RATIO	INTERNAL RATE OF RETURN
Lower Ground Zone 1	R 98 531	- R 29 659	0.9	6.6%
Higher Ground Zone 2	R 58 289	- R 90 530	0.8	• 0

From this analysis irrigation development at Aussenkjer would not be economic.

It can be seen from the above TABLE that only an extension to the existing irrigation, on Zone 1, would be economically feasible. This remains so even if a capital subsidy were to be given for a bulk water supply scheme. In other words the total area under cultivation would amount to some 630 hectares.

5.4 FISH RIVER MOUTH TO DABERAS

5.4.1 Project Land

Downstream from the Fish River mouth up to Daberas in the Diamond Area no 1, there are a number of larger irrigable areas. For example; at the Dabimub and Boom Rivers, the Sebrasfontein River, Lorelei, Sendelingsdrift and Daberas. The Dabimub, Boom and Sebrasfontein River areas are jointly referred to as the Dabimub Area.

The relevant irrigable areas are shown in Annexures 19 and 20. The only present development in this region is the 392 ha at Daberas. This area has been supplied with electricity at a central supply point at a cost of 16 c/kWh.

Since most of the land forms a narrow strip along the river, only one strip of irrigation plots (one zone) directly adjacent to the river is considered for irrigation.

The areas of irrigation land and approximate geographical details are given in TABLE 29.

TABLE 29:	FISH RIVER	MOUTH TO	DABERAS	GEOGRAPHICAL	INFORMATION	OF IRRIGABLE
/ (////////////////////////////	AREAS					•
مان من المراجع						

		GROSS AREAS OF IRRIGABLE SOIL		ASSUMED NETT IRRIGABLE AREA	OF NEAREST PLOT BORDER FROM THE	GROUND ELEVATION ABOVE RIVER WATER LEVEL	
NO	REGION	CLASS I (ha)	CLASS II (ha)	 (ha)	RIVER (m)	 AVERACE (m)	HIGHEST POINT (m)
*****	annan da an	[/ 	(1847				
1	Dabimub	700	740	1200	50	35	50
2	Lorelei	250	630	600	50	35	50
3	Sendelingsdrift	670	1030	1400	50	35	50
4	Daberas	1660	900	1800	50	25	35
							1
TOT	AL.	3280	 3300 	5000			

5.4.2 Results of Analysis

The assumptions made in the analysis are shown on the printout, which is given in ANNEXURE 21. The result of the analysis is shown in TABLE 30 below.

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TABLE 30 : SUMMARY OF RESULTS OF ANALYSIS

NETT OPERATIONS	NETT BENEFIT	BENEFIT/COST	INTERNAL RATE
CASHFLOW		RATIO	OF RETURN
R 28 839	- R 124 032	0.8	0

From this analysis irrigation development between the Fish River mouth and Daberas would not be considered economic.

6. ADDITIONAL ASPECTS

6.1 ECONOMICS OF EXISTING DEVELOPMENT

Areas of existing development are briefly summarised in TABLE 31

TYPE OF DEVELOPMENT	AREA (ha)
. Gravity flow flood irrigation	430
2. Pumping using electrical power	531
3. Pumping using diesel energy	767
SUB TOTAL : LANDS PRESENTLY UNDER IRRIGATION	 1 728
4. Developed land with electricity supply,	
presently not utilized	422
TOTAL DEVELOPED LAND	2 150

TABLE 31 : EXISTING DEVELOPMENT

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In terms of the general evaluation model, the lands that are economically feasible for irrigation are as shown in TABLE 32.

	TYPE OF LANDS	AREA (ha)
		ĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸ
. Land under gr	ravity flow flood irrigation	430
2. Land under i	rrigation using electrical power	455
3. Land develop	ed but not presently utilized	110
TOTAL		995

TABLE 32 : ECONOMICALLY IRRIGABLE LANDS

Items (2) and (3) above consist of those lands on the farms Hakiesdoorn and Pelladrift and totals less than items (2) and (4) in TABLE 31 since the farm Daberas is excluded from the list of economically feasible land. Refer also to TABLES 4 and 6 for more detail as to locations of the lands discussed.

However, most of the capital works provided for in the general model have already been established and paid for at the existing developments. Also, by producing higher income cash crops the income-cost ratio will increase. This may result in a benefit-cost ratio in excess of one indicating that even diesel schemes can be economically viable.

6.2 POTENTIAL FOR LARGE SCALE DEVELOPMENT

The critical aspect with regard to economic viability is the cost of electricity. If electricity can be provided for a cost of 10 c/kWH or less then it will be economic to operate some irrigation schemes along the Orange River.

It would be possible to supply electricity at an acceptable tariff if economics of scale could be brought into play in providing the electrical infrastructure. In other words, providing an electrical reticulation network along both sides of the Orange River. Taking into consideration the location of the irrigable soils and the extent of the individual stretchs, only the region between the farms Houms Revier and Aussenkjer should be so supplied. Outside of this region extending such a large scale distribution network would not be practical.

The cost of providing such an electrical infrastructure has been estimated to be R12,3 million; R3 million for a substation at Gaidip, R7,8 million for the powerlines and R1,5 million for a further 5 substation. Given the expected level of energy requirements to be met the total energy cost would be in the order of 7,25 c/kWH.

Therefore on the basis of the calculation used in this report, irrigation development of the region between Houms Revier and Aussenkjer would be economically viable. This would be about 10 000 hectares.

The total initial capital investment required for such a development would be approximately R54 million, shared between the South African and South West African governments.

6.3 DEVELOPMENT OF DABERAS

Whilst it has been shown that the development of Daberas is not economically viable under the present model, it is felt that such a scheme could be viable under different parameters. The demand probably exists in that area for fresh vegetables and fruit. Such demand centres would be; Oranjemund, Luderitz, Aus, Alexander Bay and Port Nolloth.

The growing of higher income crops and the development of a smaller area of land could well change the economics of such a scheme. This has not specifically been looked into. To do so properly would require a market survey to be conducted in order to determine the type and volume of each crop that could be marketted.

46.

7. CONCLUSIONS

The economic feasibility of irrigation along the Orange River in general and for three specific areas has been investigated. It has emerged that the biggest single factor governing viability is that of the cost of electricity. Other factors such as the size of irrigation units and the type of crops that are grown also influence the study but to a lesser extent. In coming to these conclusions it must be stated that these are based upon certain assumptions. Briefly these assumptions are that the scheme must generate cash income, that it will enjoy a relatively high level of management and that a certain level of remuneration must be achieved. It certainly does not consider subsistance farming.

It is evident from this study that given the assumptions, the cost of electricity is critical. Irrigation of the proposed farming units is not economical when electricity costs in excess of 10 c/kWH. Increasing the area under cultivation is not considered practical as there is a limit to the area of land that one person can manage. Changing to higher income crops would improve the situation but this has other associated problems already discussed in the report.

Also as part of the economic feasibility of the development the cost of such development must also be considered. The input of capital required to develop further the available land for irrigation is R54 million, in present values. Whether such funds are available is a question which is beyond the scope of this report to consider. But it is one that has a direct bearing on practicality and economic viability.

In terms of practicality the governing physical and socio-economic factors need to be considered separately.

The available land does not always exist in convenient configurations. However sufficient suitable land is available. Water is also available for irrigation. Perhaps not sufficient for all the land but there again all the land would not be developed. The climate is suitable for the growing of

OND034

47.

certain crops. On the other hand the physical infrastructure is poorly developed. Whilst this in itself would not rule development out it will act as a constraint and attention will focus on the better provided for areas.

Considering the physical factors alone it is practical to develop irrigation along the Lower Orange River.

With respect to the socio-economic factors these pose the more important constraints on development. Development of any area in the region will require a substantial injection of funds - not just capital funds for the irrigation development itself. Such funds are scarce and there would be competing requirements for those same funds.

Manpower with the appropriate skills to make a success of such a project is seen as posing a problem. The provision of supporting services not only in the economic sphere but also in the social sphere will pose difficulties. This will also be with regard to manpower and infrastructure.

The type of crops to be grown, the volume and the marketting of them is an area which would need more attention and investigation.

Considering the socio economic factors, as outlined above, doubts must be expressed as to the general practicality of the proposed development of irrigation agriculture.

The number of new jobs that could be created by total regional development is approximately 1000 permanent job opportunities and 8000 temparary job opportunities. The cost of creating each new permanent job opportunity is an average R45 000, which is high in comparison with industrial job creation.

However these factors must not be judged in isolation, they must be compared with similar development projects. Only in such a manner can a proper perspective and an objective evaluation be made as to what development action would yield the best results.

8. RECOMMENDATIONS

It is recommended that;

- 8.1 the conclusions as arrived at in paragraph 7 of this report be accepted
- 8.2 this report be made available to the following institutions to take cognisance of

Directorate Agriculture and Forestry: Department of Agriculture and Nature Conservation

Department of Economic Affairs

Directorate Agriculture: Administration for Whites

Directorate Development Co-ordination: Department of Governmental Affairs

South West African Agronomic Board

THE LIBRARY SEC. OF WATER AFFAIRS PRIVATE BAG 13193 WINDHOEK 9000

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APPROVAL 9.

9.1 This Report has been read and approved for submission to the Director: Investigations

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9.2 I support the recommendations set out in this Report and submit it to the Secretary for Water Affairs for approval in principle.

66 Cing

DIRECTOR : INVESTIGATIONS 16-21.28 DATE:

9.3 The recommendations in this Report have been decided upon as follows:

Approved

151 auts

SECRETARY FOR WATER AFFAIRS DATE: 22.2.88

APPENDIX A

1. CROP WATER DEMAND AND PEAK IRRIGATION REQUIREMENTS

In a recent publication (Ref. 2), called the Green Book, the irrigation requirements for various crops at various weather guaging stations were computer simulated by using the "evaporation pan method". The guaging station under consideration here is Vioolsdrift.

In order to use the published data in this book, a decision must be made on the value of the total water input per irrigation cycle in millimetres, called the design application.

Two soil classes are being considered for irrigation, namely Class I and Class II. In the absence of measured soil water infiltration rates and storage capacities, the values of these parameters are assumed to be in accordance with generalised figures that have been given in literature (References 3 and 4) for various soil texture classes. This information is summarized in TABLE A.1

IRRIGABILITY CLASS	ASSUMED TEXTURE CLASS	ASSUMED INFILTRATION RATE (mm/h)	ASSUMED AVAILABLE MOISTURE (mm/m depth)
I	Medium textured Silt		
	Loam 	10	150
ΓI	Moderate course tex=	ł	
	tured Loamy Sand	20	85
		2.5	63

TABLE A.1: SOIL INFILTRATION RATES AND PLANT AVAILABLE MOISTURE

51.

It is further assumed that a maximum of 50% of the plant available moisture in the Class I soils and 70% of those in the Class II soils can be consumed before a reduction in plant growth and crop yield will take place. By using this information the required irrigation application needed to restore the soil water content from this level of depletion back to field capacity, called the maximum design application, can be calculated. The results are given in TABLE A.2 below. Any water provided over and above this will leach out of the plant root zone and is unavailable for the plant.

CROP	DEPTH OF PLANT ROOT ZONE (mm)	MAXIMUM DESIGN APPLICATION (mm)		
		Clas≤I Soil	Class II Soil	
Cotton	1 000	75	60	
Wheat	900	68	54	
Maize	900	68	54	

TABLE A.2 IRRIGATION: DESIGN APPLICATION

An irrigation system with a design application of 50 mm and an application rate of less than 10 mm/h will therefore be suitable for use on both soil classes.

According to the Green Book, the total evapotranspiration for cotton being grown from 15 September to 12 April, is 1 276 mm. For a 50 mm design application, the effective rainfall is 24 mm, so that the nett average irrigation requirement is 1 252 mm per growing season. The distribution of this water requirement is given in Figure A.1, together with that of maize, which is partly grown over the same period.

Since the seasonal requirements of wheat and maize have not been simulated in the Green Book, an approximate hand calculation is done below. The calcula= tion is based on crop factors being given in the Green Book

To determine the average monthly A-pan evaporation for Vioolsdrif, which is not directly given in the Green Book, the monthly evapotranspiration for lucern has been divided by its crop factors, as in TABLE A.3.

MONTH	MONTHLY EVAPO= TRANSPIRATION OF LECURN: E	MONTHLY CROP FACTORS OF LUCERN	CALCULATED "A-PAN" EVAPORATION: E	
and amount and a downard particular and an and an and	(mm)		(mm/month)	(mm/day)
July	60	0,5	120	3,87
August	1 79	0,5	158	5,10
September	134	0,6	223	7,43
October	198	0,7	283	9,13
November	267	0,8	334	11,13
December	295	0,8	369	11,90
January	290	0,8	363	11,71
February	239	0,8	299	10,68
March	221	0,8	276	8,90
April	155	0,7	221	7,37
May	95	0,6	158	5,10
June	57	0,5	114	3,80
	TOTAL		2 918	

TABLE A.3 DERIVATION OF MONTHLY A-PAN EVAPORATION AT VIOOLSDRIF

NOTE: The original calculation of the evaportranspiration was, apart from the crop factors, based on an adjusted 15 year Symons evaporation pan record (1961-1975).

Using the crop factors of wheat and maize given in the Green Book, the water requirements are derived in TABLE A.4.

₩CLINTENNING ₩₩₩₩WORKER/TOTELET/NT/PHOTELET/NT/PHOTELET/NT/PHOTELET/NT/PHOTELE/	Transition			**********	
PERIOD	NUMBER OF DAYS	CROP FACTOR	E (REFER TO TABLE 7.1) (mm/day)	E =F.E (mm/day)	E OVER
A WHEAT	1	a fa fa ga na mana na m			
15/05-31/05	17	0,3	5,10	1,53	26
01/06-23/06	23	0,3	3,80	1,14	26
24/06-30/06	7	0,5	3,80	1,14	13
01/07-03/07	3	0,5	3,87	1,94	6
04/07-13/07	10	0,7	3,87	2,71	27
14/07-28/07	15	0,9	3,87	3,48	52
29/07-31/07	3	1 1.0	3,87	3,87	12
01/08-31/08	31	1,0	5,10	5,10	158
01/09-16/09	16	ι,ο	7,43	7,43	119
17/09-30/09	14	0,7	7,43	5,20	1 73
01/10	1	0,7	9,13	6,39	6
02/10-11/10	1 10	0,4	9,13	3,65	37
TOTAL FOR WHEAT	150				555
B MAIZE		<u></u>	An	and an	L
15/12-31/12	17	0,4	11,90	4,76	81
01/01-17/01	17	0,7	11,50	8,20	1 139
18/01-31/01	14	1,0	11,71	11,71	159
01/02-03/02	3	1.0	10,68	10,68	
04/02-28/02	25	1,1	10,68		· 294
01/03-10/03	10	1,1	8,90	9,79	98
11/03-27/03	17	0,9	8,90	8,01	136
28/03-31/03	4	0,5	8,90	4,45	1 18
01/04-13/04	13	0,5	7,37	3,69	48
TOTAL FOR MAIZE	120				

TABLE A.4: ESTIMATED EVAPOTRANSPIRATION OF WHEAT AND MAIZE AT VIOOLSDRIF

Assume the effective rainfall for wheat as nil and that for maize as 10 mm, which reduces the nett irrigation requirement to 555 mm and 1 000 mm per season respectively. (The effective rainfall for lucern over the period from

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December to March was calculated in the Green Book as 11 mm and that for January to April as 15 mm. The 10 mm assumed for maize is therefore on the conservative side).

In the general model, it was assumed that for any given summer season, 50% of the soil will be under cotton and the other 50% under maize. The area under cotton will be followed by wheat in the next winter and then maize in the following summer and the area under maize will be followed by cotton in the next spring. This system means that the total nett annual crop water demand is (555 + 1.252 + 1.000)/2 = 1403,5 mm or 14.035 m³/ha.

The peak irrigation requirement is, however, not the average of the individual summer crop peaks since these peaks do not coincide. The water demand distribution with time for cotton and maize as shown in Figure A.1, illustrates this aspect. By calculating a weighted average of the water requirements for each day a nett peak water demand of 9,54 mm/day is derived. This peak is, however, a result of daily evaporation averaged over a whole month and the short term peak will be somewhat higher. Such short term peaks have been calculated in the Green Book for individual crop systems and this data will be used to estimate a peak factor for the composite crop system under consideration.

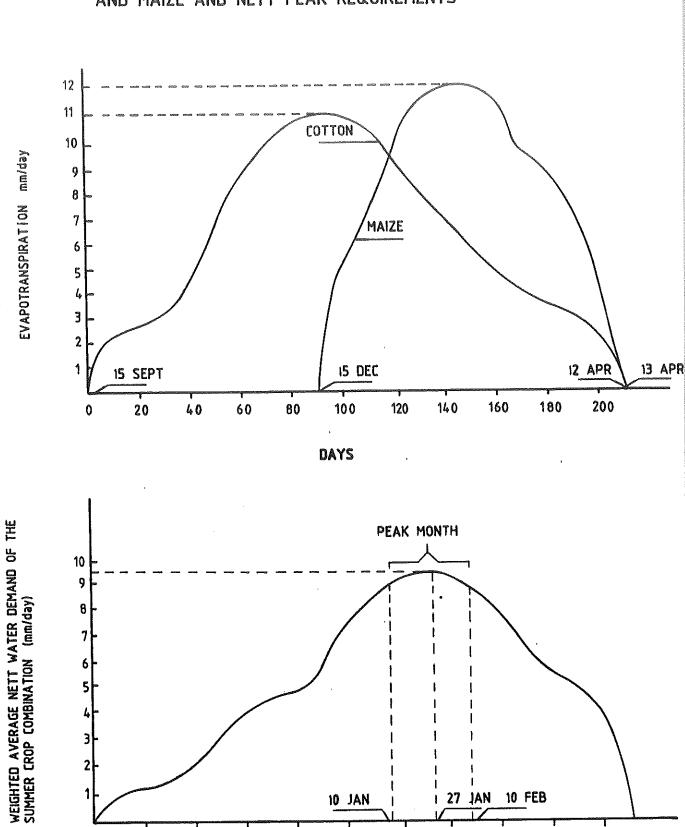
As can be derived from Figure A.1, the peak water requirement occurs during the end of January. A crop of which the peak also occurs during this period is cotton being planted on 15 November. The long term peak for this crop, as calculated by dividing the total evapotranspiration during the peak period by the number of days in the period, is 9,57 mm/day. The short term peak for this crop is 11,1 mm/day, yielding a long term/short term peak factor of 1,16. However, 90% of the time, the peak will be below 9,8 mm/day, yielding a long term/short term peak factor of 1,024. This latter factor is used, yielding a peak irrigation requirement in our case of 9,54 x 1,024 = 9,77 = 9.8 mm/dav. The reason for the latter peak factor being used is that the irrigation system is not designed to operate 24 hours per peak day, thus leaving a couple of hours for extended irrigation when needed. Also during

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this period, a higher soil moisture tension for cotton can be allowed so that better use is made of the soil water reservoir, which effectively decreases the critical peak factor.

To summarise, the nett peak irrigation requirement is taken as 9,8 mm/day.

The peak month; as derived from Figure A.1 occurs from 10 January to 10 February as can be seen from Figure 7.1, and the water requirement during this period is calculated as 279 mm/month. Allowing for 4 mm of effective rain during this period, the nett peak month irrigation requirement is 275 mm.



NETT WATER DEMAND DISTRIBUTION CURVES FOR COTTON AND MAIZE AND NETT PEAK REQUIREMENTS

DAYS

10 JAN

10 FEB

JAN

(1)

2. SPRINKLER SYSTEM LAYOUT, DESIGN AND COSTING

Two basic irrigation land units have been selected to structure and cost the irrigation system, namely 100 ha and 30 ha. Each basic unit has its own main water supply system which subtracts water directly from the river. Refer to Figures A.2 and A.3 for layout sketches. The 20 ha basic unit were selected to represent a typical system layout on soils that form a narrow strip along the river. The 100 ha basic unit is to represent layout systems on wider soil strips so that the soils further away from the river also share in one common water supply system.

The required gross rate for the irrigation systems is determined by the formulae:

$$Q = \underline{i A}$$
360 z u

where

Q = gross flow rate in m¹/s

i = nett peak irrigation demand in mm/day

A = area under irrigation in ha

z = efficiency of the irrigation system

u = number of irrigation hours per day.

The unit area under consideration is 1 ha and from paragraph 6.3.2, i = 9,8 mm/day.

CND034

58.

With z = 0,7 and u = 18, the resulting flow rate Q is 7,778 m³/ha/h, or approximately 7,78 m³/ha/h. From the previous section, the nett average annual irrigation volume is 14 03S m³/ha and the corresponding gross value is thus 14 035/0,7 = 20 050 m³/ha/a. The resulting average annual number of pumping hours is 20 050/7,778 = 2 578.

The energy requirements for irrigation is calculated from the formulae:

$$P = \frac{\partial gh}{rs}$$
(2)

where

Р	-	power requirement in kW
Q		gross flow rate in m ³ /s
g		gravitational acceleration in $\ensuremath{m}/\ensuremath{s}^2$
h	з	average pumping head in metres
r		effeciency factor of the pumps

s = effeciency factor of the motors

For electrical pumpsets the values of r and s are taken as 0,75 and 0,8 respectively and with $g = 9.8 \text{ m/s}^2$, formulae (2) reduces to:

$$P = 16,3 \text{ Qh}$$
 (3)

The maximum and average energy demands for lower ground in the general model are 2,043 kW/ha and 1,866 kW/ha respectively. The average annual energy consumption is therefore 1,866 mulitplied by the number of pumping hours per year, which amounts to 4811 kWh/ha/a. The corresponding figures for higher ground 2 are 2,747 kW/ha, 2,395 kW/ha and 6174 kWh/ha/a.

In TABLE A.5, a schedule of costs and quantities is given for the water supply system of a 100 ha basic unit on lower ground. The sprinkler system is

CND034

59.

designed so that five 1,58 ha areas can be irrigated simultaneously, and three such set-ups per day of 6 hours each will suffice in the peak irrigation periods. The peak irrigation cycle for a 50 mm application and 9,8 mm/day application rate is 5 days. The gross precipitation rate of the system is 10 mm/h.

The layout in FIGURE A.2 will be satisfactory as long as the land is fairly flat, but as soon as steeper slopes are encountered, it would be better if one pump supplies the upper horizontal pipeline only and the other pump the lower horizontal line. This implies a double pipeline of smaller diameter over the first 250 m. The extra cost of this is however mostly offset by a cost reduction due to one pumpset now being smaller. This alternative is therefore not considered in the economic analysis.

Costs and quantities for the 20 ha unit on the lower ground are given in TABLE A.2.

The values in TABLE A.5 and TABLE A.5 reduce to R455/ha/a and R453/ha/a respectively when converted to equivalent annual costs with maintenance costs included. This means that the two systems are equivalent as far as annualised cost is concerned. The cost of the system in FIGURE A.2 is therefore taken as being representative for most of the land forms that will be encountered. In the report, for simplicity, all hand movable sprinkler system layouts refer to the one given in FIGURE A.2, unless otherwise specified.

TABLE A.5: COSTS AND QUATITIES FOR THE 100 ha BASIC UNIT SPRINKLER SYSTEM

ITEM	DESCRIPTION	UNIT	QUANTITY	RATE (R)	ROUND OFF AMOUN
	SECTION 1: MECHANICAL AND ELECTRICAL				Carl Carl Carl Carl Carl Carl Carl Carl
	INSTALLION	1			rroos et school even we
1 2 3	Two stage centifugal pumps 132 kW Electric motors Electrical connections	No No Sum	2	10 300 6 500	20 13
	TOTAL FOR PUMPSETS			 •	34
απαγίατας τη προβού γεταικός που πο	SECTION 2: CIVIL WORKS				
1 2 3 4	450 mm CID FC underground pipe class 12 350 mm CID FC pipe class 18 250 mm NB uPVC underground pipe, class 4 Pumpstation and connections, valves,	m m m	 250 400 2 520	98 64 23	24 25 58
5 6	metres On land underground pipe connections Permanent hydrants 	Sum Sum No	 32 	 650	13 4 20
	TOTAL FOR CIVIL WORKS		 		146
********	SECTION 3: SPRINKLER SYSTEM			(500)-0000-00-00-0000	
1 2 3	1 108 NB Aluminium quick coupling pipes 89 NB Aluminium quick coupling pipes Sprinklers, 2,5 m risers, saddles and	 m 	360 6 720	16,33 10,17	 5 68
4	base plates End caps, T-pieces and bends 	No Sum 	595 	19,42	11 3
	TOTAL FOR SPRINKLER SYSTEM				88
	GRAND TOTAL	<u></u>		<u> </u>	 R269
					. <u>.</u>

FOR THE LOWER GROUND

TABLE A.6: COSTS AND QUANTITIES FOR THE 20 ha BASIC UNIT SPRINKLER SYSTEM

ITEM	DESCRIPTION	UNIT	QUANTITY	RATE	 AMOUNT
	SECTION 1: MECHANICAL AND ELECTRICAL	4072550000775000000000000000000000000000			
1 2 3	Two stage centifugal pumps 45 kW Electric motors Electrical Connections	No No Sum		7 800 2 700 300	7 80 2 70 30
	TOTAL FOR PUMPSETS				 10 8(
	SECTION 2: CIVIL WORKS				
1 2 3	250 mm NB uPVC underground pipe, class 6 Pumpstation, connection, valves, etc. Permanent hydrants	m Sum No 	420 . 7	30 650	12 6(4 7 4 5(
	TOTAL FOR CIVIL WORKS	 			21.8
841 1117777777778994949999999999999999999999	SECTION 3: SPRINKLER SYSTEM				
1 2 3	 108 NB Aluminium quick coupling pipes 89 NB Aluminium quick coupling pipes Sprinklers, risers, saddles and base	 [m m	402 930	16,33 10,17 	65 94
4	plates End caps, T-pieces, bends 	No Sum 	105	19,42 	20 5
	TOTAL FOR SPRINKLER SYSTEM	 			18 5
	GRAND TOTAL				51 2

FOR THE LOWER GROUND

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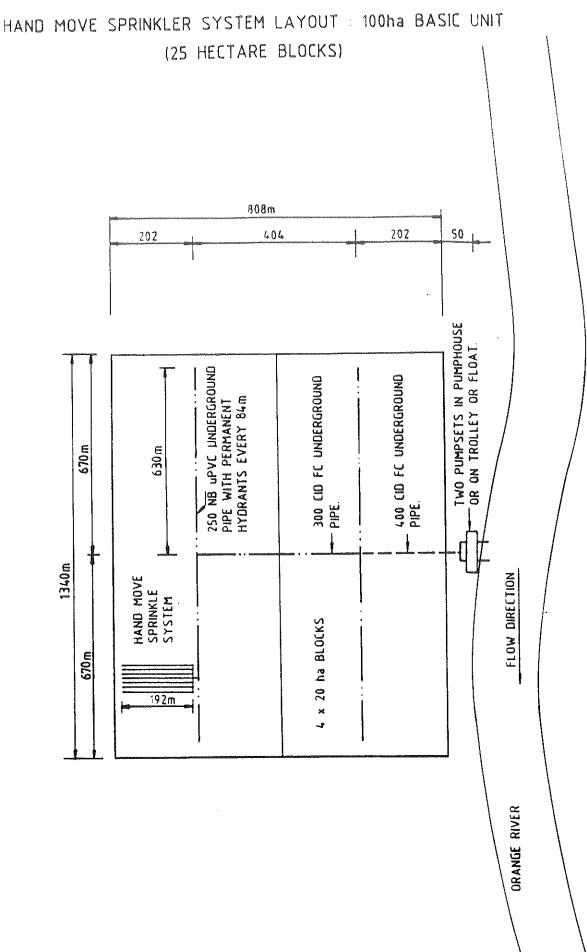
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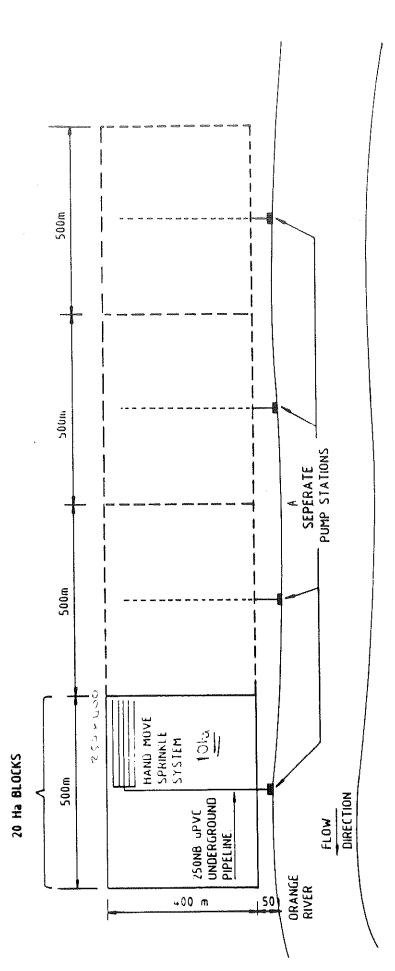
For the layout in FIGURE A.2 as applied to the higher ground the two 132 kW motors are replaced by two 185 kW motors and the first 25 m of pipline are taken as class 18 instead of class 12. The costs for the pumpsets and civil works now become R38 100 and R147 200 respectively, while that of the irrigation system remains unchanged.

A summary of the capital costs, expressed as rand per hectare and as used in the general model, are given in TABLE A.7 below.

NO	DESCRIPTION	UNIT CAPITAL COST (R/ha)		
		GROUP 1	ELEVATION	
1 2 3	Pumpsets Civil works Sprinkler System	341 1464 888	GROUP 2 381 1472 888	
	TOTAL	2693	2741	

TABLE A.7 WATER SUPPLY AND IRRIGATION SYSTEM COST AS FOR THE GENERAL EVALUATION MODEL





SPRINKLER SYSTEM LAYOUT : 20ha BASIC UNIT.

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APPENDIX B

1. CROP GROWING METHODS AND MECHANISATION

The crops considered in this model for cultivation are cotton, wheat and maize. In all cases, the soil preparation before planting is started by chisel ploughing the land. If the previous harvest was cotton, however, the ploughing is preceded by cutting the stems with a rotary disc cutter. Thereafter the land is disced with an offset disc, but in the case of wheat this operation is preceded by the spreading of fertilizer. The seeds are planted and in the case of cotton and maize, starter fertilizer is planted simultaneously. Maize and cotton are thereafter mechanically cultivated. All other weed and pest control is done chemically. For maize and cotton, one nitrogen top application is also done.

Harvesting of maize and wheat is done mechanically by contractors and cotton harvesting is done by hand. All produce is baled and road transported by contractors to the nearest railway station from where the cotton is sent to Upington and the wheat and maize sent via Mariental to Windhoek.

The actual on-land periods for the crop system under consideration was given in paragraph 4.3.3 of this report.

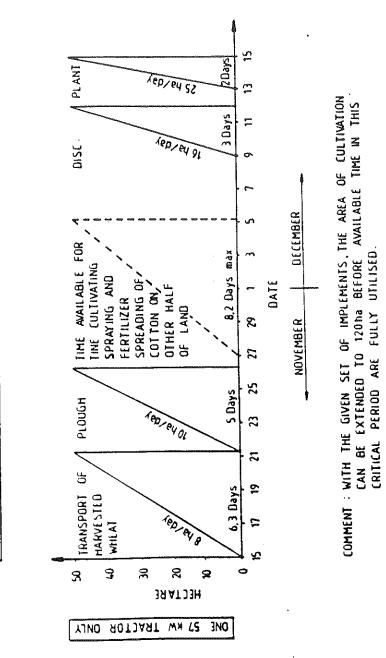
A minimum, but sufficient set of impliments, tractors and vehicles required for the assumed cultivation pattern are listed in TABLE B.1.

IMPLEMENT	AMOUNT	SIZE	1985 PU COS R	
Light duty vehichle	1	1 ton	13	300
Tractor with altitude compensation	Ι ι	57 kW	34	860
Four wheeled dropside trailer	2	5 ton	11	600
Rotary type mower (shlasher)	1	1,85 m	3	500
Mounted offset disc harrow	1	1,9 m	2	500
Mounted chisel plough	1	7 tyne; 2,1 m	3	550
Mounted pneumatic planter	1	4 row x 0,09 m	8	150
Trailed disc wheat planter	1.	14 row x 0,15 m	. 8	190
Mounted fertilizer speader	1	3 m; 350 kg	1	710
Boom type sprayer		600 €; 10 m boom	, ,	680
TOTAL CAPITAL COST			R90	040

TABLE B.1 BASIC REQUIREMENT OF VEHICLES: TRACTORS AND IMPLIMENTS

Note that in TABLE B.1 no provision is made for lorries and harvesters, since these services are obtained from contractors.

The critical period in the whole mechanised cultivation process have been identified as the switching from wheat to maize on half of the irrigation land, while cotton on the other half of the land may require spraying, time cultivation and fertilizer spreading. A mechanised working program for this period is given in FIGURE B.1 for a 100 ha irrigation unit. It have been calculated that the maximum area that can be served by the basic mechanisation set is 120 ha. This can be deduced from FIGURE B.1. WORKING PROGRAM FOR CRITICAL STAGE ON 100 ha UNITS : SWITCHING FROM WHEAT TO MAIZE ON HALF OF THE LAND.





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By just adding one 29 kw turbo tractor and two more 5 ton trailors to the list, a total area of up to 200 ha can be cultivated, as is shown in FIGURE B.2 The total mechanisation cost is now R125 185. Further extensions to mechanisation have not been considered since 200 hectares is already a large irrigation unit.

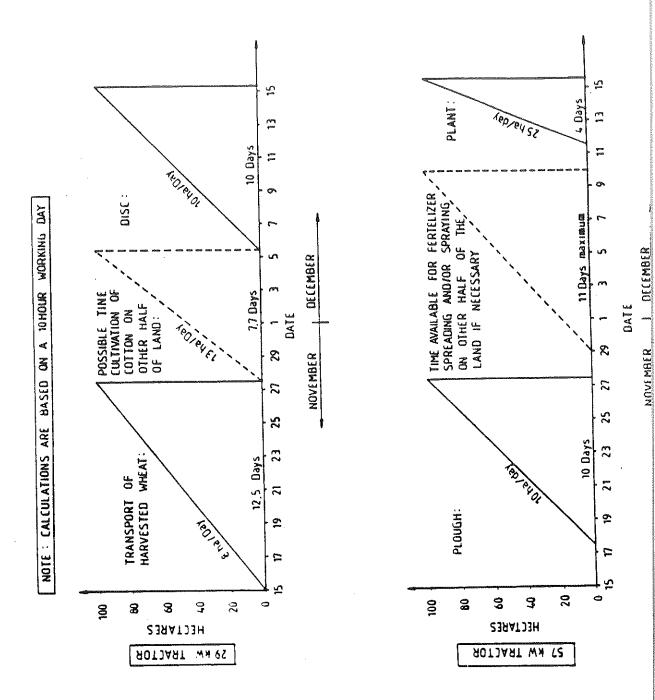
In FIGURE B.3 a graph is presented which gives the capital cost for mechanisation per hectare, as calculated for various sizes of independent irrigation units.

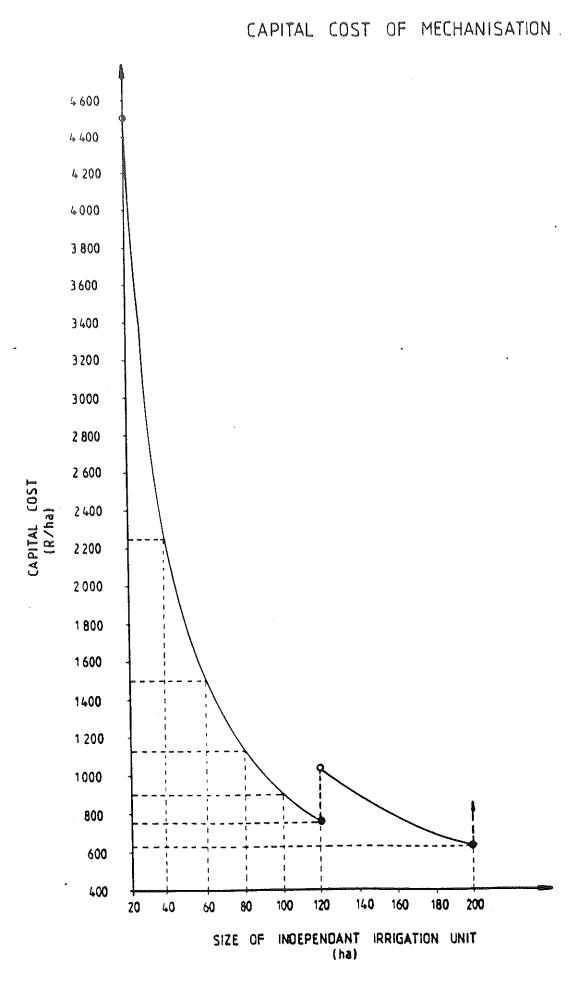
From the graph it is clear that when the size of the independant irrigation unit decreases from 200 ha, the cost per hectare of mechanisation gradually increases until a unit of about 80 ha is reached, from there on this unit cost increases at a much faster rate.

In this study, two basic independant units, namely a 100 ha unit and a 200 ha unit are considered, unless it is specifically otherwise stated.

FIGURE B.

WORKING PROGRAM FOR CRITICAL STAGE ON 200ha UNITS SWITCHING FROM WHEAT TO MAIZE ON HALF OF THE LAND.





71.

2. LABOUR REQUIREMENTS AND OPERATING COSTS

Permanent labour is required to operate the irrigation system and mechanised equipment, to do maintenance on all capital works and to act as co-workers and supervisors to seasonal workers on all other aspects requiring labour. Seasonal workers are required for hand intensive operations like de-weeding, harvesting of cotton, packaging and loading, etc.

It is estimated by the Division of Agricultural Engineering in Pretoria that, when working in a team, one labourer must be provided for every 10 ha to 15 ha to operate a hand movable sprinkler irrigation system. For a 200 ha unit, therefore 20 labourers are require to operate irrigation. It is further calculated that 8 labourers for mechanised operations and two more for general maintenance and assistence are required per 200 ha unit. However, since only half of the land is irrigated simultaneously with the peak mechanised input, the persons needed for all operations need not be all different labourers, but they can work interchangebly between operation types. An average figure of 20 permanent workers per 200 ha irrigation unit is therefore used in this model. This reduce to one worker per 10 ha. This unit figure also holds for 100 ha irrigation units, but not necessarily for units significantly smaller.

The peak number of temporary or seasonal workers are required during cotton picking. It is estimated that between 1,5 and 1,8 labourers are required per hectare under cotton, for the harvesting. Therefore, additional to the 20 permanent workers on a 200 ha land, another 180 temporary workers are needed for cotton picking. The total labour requirement therefore reduce to one per hectare during the peak period.

Figures provided by the Noordoewer farmer's association regarding their peak labour requirements under the present cropping system also reduce to about one labourer per hectare. This figure is therefore assumed as a norm in this report. As far as allocated operating costs are concerned, transport costs and electricity costs for irrigation are dealt with elsewhere. Here, a breakdown of material costs, labour costs and costs for fuel, maintenance and repair on tractors and implements are given. The material cost is given in TABLE B.2.

TABLE	B.2:	MATERIAL	COSTS

ITEM			COTTON		WHEAT		MAIZE	
			QUAN= TITY	COST (R/ha)	QUAN= TITY	COST (R/ha)	QUAN= TITY	CO (R
Seed		 						abeter an
	(a) 2.3.4 (30)	kg/ha	30	37	115	69	20	
1.21.01117612		kg/ha	170 -	- 84	208	103	189	1
	(b) Uream (46) HB	kg/ha	178	96	205	112	196	1(
a) ()	(c) Potash Nitrate	kg/ha	51	46				-
Chemicals	(a) Weed Control	Sum		53		23		
(b) Pest Control	Sum		151		15			
TOTA	L COST		999-974/2019-97409-944(2004)-2019-944(2004)-2019-944(2004)-2019-944(2004)-2019-944(2004)-2019-944(2004)-2019-9	467)	322	adahan yang wanta ana ang gaping manana	3

In TABLE B.2 the mechanised tillage actions and its requirements are given, while the cost for labour, fuel, maintenance and repair is given in the sub= sequent tables, namely TABLE B.4, B.5 and B.6.

1 30 hg	ha + R2/kg.	60	
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TABLE		MECHANISED				

		TIMES	INPUT (h	ours/ha)		NIMBER	POWER	a
	ACTIVITY	OVER	INPLEMENT	TRACTOR	LABOUR	OF LABOURERS	DEMAND (1611)	TAL (:
-1750000200	SECTION 1: COTTON				Í			-
1.	Plough	11	1.	1,10	1,21	1	48	
2.	Disc	1 1	0,63	0,69	0,76		- 33	
3.	Plant with starter fertilizer	11	0,40	0,44	1,45		26	101/04405
4.	Tine cultivation	1 1	0,50	0,55	0,61		32	
5.	Fertilizer spreading	1	0,71	0,78	1,72		15	
6.	Spray for weeds	11	0,28	0,31	1,02		25	
7.	Spray for pests	6	1,68	1,85	6,10		25	
8.	Stem cutting	1	0,56	0,62	0,68		20	1
9.	On-farm transport		0,14	0,15	0,33	2 '		
+6.000	TOTAL FOR COTTON	 	5,90	6,49	13,88			
	SECTION 2: WHEAT						 	
1.	Plough	1	1	1,10	1,21		48	1
2.	Spread fertilizer	1	0,71	0,78	1,72		15	
З.	Disc	1	0,63	0,69	0,76		33	
4.	Plant	1	1	1,10	3,63		39	
5.	Spray weed killer	[1	0,28	0,31	1,02	3	25	1
6.	On-farm transport	- 	0,79 	0,87	1,18		[1
	TOTAL FOR WHEAT	 	4,41	4,85	9,52		- 	1
	SECTION 3: MAIZE							
1.	Plough	1		1,10	1,21	1	48	
2.	Disc	1	0,63	0,69	0,76		33	1
з.	Plant with starter fertilizer	1	0,40	0,44	1,45		26	
4.	Tine cultivation	1	0,50	0,55	0,61	1	32	1
5.	Fertilizer spreading		0,71	0,78	1,72		15	1
6.	Spraying	2	0,56	0,62	2,03	3	25	1
7.	On farm transport	-	0,50	0,55	0,77			
	TOTAL FOR MAIZE		4,30	4,73	8,55			

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TABLE B.4: LABOUR COSTS

	LABOUR UNIT COST	COTTON		weat		MAIZE	
ACTION	(R/h)	QUANTITY (h/ha)	005T (R/ha)	QUAWITTY (h/ha)	005T (R/ha)	QUANTITY (h/ha)	0 ()
Operating of tractor	0,7	7,14	5,00	5,34	3,75	5,20	
Operating of impliments	0,5	6,74	3,40	4,19	2,10	3,35	1
Irrigation	0,5	30	15,00		15,00		1
Loading input materials	0,5	0,7	0,35		0,35		į
Loading produce	0,35	3,5	1,25	5	1,75	6	1
Thinning by hand	0,35	25	8,75		1 -	-	1
Cultivate by hand	0,35	50	17,50	_	-		Ì
Picking up of maize	0,35	N27		605		20	
Cotton picking	12c/kg	3500 kg	420,00		***	-	1
Bale, weigh and stitch	0,35	12	4,20 	25	8,75	30	1
TOTAL COST (ROUNDED TO NEXT RAND)(R/ha)	eneretario da la administrazione della construcción del la construcción del del construcción del del construcción		476		32	19-70-700-700-700-700-700-700-700-700-700	; 1 1

TABLE B.5: FUEL COSTS

NO	DESCRIPTION	COTTON	WHEAT	MAIZE
1.	Power consumption: (kWh/ha	•	138	132
2.	On farm transport: (ton-km) 0,45	5,55	6,45
3.	Fuel consumption	70	53	51
4.	Fuel cost: (R/ha)	46 	35 	33

NOTE: Fuel consumption has been taken as 0,38 ℓ/kWh or 0,1 $\ell/ton-km$ and the fuel price as 65,04 c/ℓ

75.

IMPLIMENT/TRACTOR	MAINT & CO REPAIR		TTON		HEAT	MAIZE	
	UNIT COSTS (R/ha)	 (h/ha)	 (R/ha)	 (h/ha)	 (R/ha)	(h/ha)	(R/ha)
57 kW Tractor Trailors Rotary Mower Disc Harrow Chissel Plough Pneumatic Planter Wheat Planter Fertilizer Spreader Spray Equipment	4,18 0,29 2,80 1,20 1,06 4,35 4,37 1,71 1,71	6,49 0,14 0,56 0,63 1,50 0,45 - 0,71 1,96	27,13 0,04 1,57 0,76 1,59 1,96 	4,85 0,79 0,63 1,00 1,00 1,00 0,71 0,28	20,27 0,23 	4,73 0,50 0,63 1,50 0,40 0,71	19,77 0,15
TOTAL COST (R/ha)			38		28	0,56	<u>1,00</u> 26

TABLE B.5: MAINTENANCE AND REPAIR COST

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APPENDIX C

COSTS RELATED TO FLOOD IRRIGATION

The following costs apply when having flood irrigation with electrical power instead of the sprinkler irrigation system evaluated earlier. Only the changes to the sprinkler system costs for the low Elevation Ground of the general evaluation model are given here.

Land preparation cost is increased by R100/ha to make provision for land levelling. Implement costs have been increased by R1 050 to provide for ridging equipment.

The layout of the grounds and water supply system chosen is sketched in FIGURE A.2 of APPENDIX A.

Costs of the water supply system changes to those tabled below.

TABLE C.1: COSTS AND QUANTITIES OF A FLOOD IRRIGATION WATER SUPPLY SYSTEM

		and the second state of th	-		6 6
item	DESCRIPTION	UNIT	QUANTITY	UNIT COST (R)	AMOUNT (R)
~~22535559999999999999999999999999999999	SECTION 1: MECHANICAL AND ELECTRICAL				
1	i Pumps	I No	1	7 500	 750(
2	45 kW Electric motors	No	1	2 800	2 80(
3	Electrical Connections	Ì		Sum 	25
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	TOTAL FOR PUMPSETS	999-999 99 00 0000 1997 1997 1997 1997 1997		   	10 55
- <u></u>	SECTION 2: CIVIL WORKS				
1 2	   315 mm NB uPVC pipe, class 4   Pipe specials, valves, metres, pump	m	450 	38	17 10
	house			Sum	4 73
3	Hydrants and outlet structures	No	4	800	3 20
	TOTAL FOR CIVIL WORKS				2 <b>5</b> 03
	SECTION 3: IRRIGATION SYSTEM				
1	Irrigation Furrows	ha	20	1 500	30 00
			, 	۲ ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰	T

(20 ha Units)

Other capital cost changes are an increase in the electrical distribution cost of R160/ha due to more transformers needed. As far as allocated operations costs are concerned, the pumping cost for water decreases by R163/ha/a, R213/ha/a and R260/ha/a respectively for the 10c/kWh, 13c/kWh and 16c/kWh cases respectively, but higher labour and mechanisation costs cause an increase of R55/ha/a on the total allocated operating costs. The labour input have been taken as 100 man-hours per hectare per year.

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Maintenance cost on capital works and thus operating overhead costs increases by R38/ha/a.

When irrigation with diesel power instead of electricity is considered, all the costs for electrical distribution and electrical connections fall away, but the capital layout on the diesel motors increases by R22 500 to that of the electrical motors. This reduces to an increased annualised capital cost of R165/ha/a and maintenance cost of R45/ha/a.

The diesel motor's fuel consumption is given by a supplier of the equipment as 0,25  $\ell/kWh$ . With a diesel cost of 65,04 c/ $\ell$  and an energy consumption 4235 kWh/ha/a, the operating energy cost is R689 per hectare per year.

A motor efficiency of 60% has been assumed.

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# APPENDIX D

# COSTING FOR NOORDOEWER BULK WATER SUPPLY SYSTEM

A cost breakdown of the assumed bulk water supply system at Noordoewer for Zones 2 and 3 is given in TABLE D.1.

ITEM	DESCRIPTION		QUANTITY	RATE (R)	AMOUNT (R)
1 2 3 4	SECTION 1: MECHANICAL INSTALLATIONS Type 16 "Mono Floodlifter" pumps 300 kW Electric motors 5% Allowance for transport and installment Overhead crane installed in pumphouse	   No   No 	     8   	43 000 14 300 Sum Sum	344 00 114 40 22 60 59 00
	SUBIOTAL				540 0
1	SECTION 2: ELECTRICAL INSTALLATION All cables, transformers, switchboards, control devices, etc.			Sum	140 0
1 2	SECTION 3: PUMP HOUSE Foundation blocks and stilling basin Pumphouse building			   Sum   Sum	43 0
	SUBIOTAL				73 0
1 2 3	SECTION 4: WATER SUPPLY CIVIL WORKS Canal 1 m NB Pipeline Pipe specials for connections at pump house	n 	400	   Sum   361   Sum	1 000 0 144 4 138 0
	SUBTOTAL			l	1 282 4
- miraiz	TOTAL	. <u>.</u>	0		2 035 4

# TABLE D.1: COSTS AND QUANTITUES FOR THE ASSUMED BULK WATER SUPPLY SYSTEM FOR NOOPDOEMER ZONE 2 AND ZONE

Due to the 100% stand-by facility, the redemption period for mechanical equipment is taken as 25 years and the annual maintenance cost as 2,5% of the capital cost. All other cost items are annualised as before.

The total annualised capital and maintenance cost as well as that assumed for salaries and the resulting water unit cost is given in TABLE D.2. The average water production is 20 050 m $^{3}/a$ .

DESCRIPTION	Wenny the angle and your provide any second start of the provide and the provi	And a second a second a second a second a second
DEDCATATION	AMOUNT	COST PER CUBIC METRE WATER
	(R/a)	PUMP (c/m ³ )
Annualised capital cost Annual maintenance cost Salaries Electricity @ 11c/kWh	264 300 24 000 30 000 316 630	1,318 0,120 0,150 1,579
TOTAL ANNUAL COST	634 930	3,167

TABLE D.2: WATER UNIT COST OF THE INTEGRATED AND	
J.Z. WATER UNIT COST OF THE INTEGRATED WATER SUPPLY S	SVCmma
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ANNEXURE 4

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ANNEXURE 5

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	MAIN	142834	8 a*3		1812 9/813			171 48										
	发展的时候							4764										
ABOUR	COTTON		8 Ma		478 B/RE			12										
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	SUNTOTAL				467 1744			447										
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	SUBTOTAL							12										
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T V B Y C A S E : FLOOD IRRIGATION HODEL WITH UNIT CLECTRICITY COST AT 18 C/14A secondsegases

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	yen			LA010	54000	12	45	5520
- <b>1</b>	HOUSE	1	No	58988	50000	12	45	6037
	LAND CLEAD	300		425	85110	12	15	11263
	FINCING	7000		1.57	18998	12	45	1327
	90485		TEN	26660	20000	12	45	2415
	SUBTOTAL	•			219998			26062
vater sup		· •	11124	250310	251311	12	38	31874
VALUE SUP	HIE KORKS		ITEN	105360	115580	12	15	15491
	SUBTOTAL				355841			46564
16910 CYC1	FURIOUS ETC	1	ITEN	388888	310010	12	18	51196
	POSED LINE	4608		13	52808	:2	28	5962
LLLL INT	TRANSFORMED		He	4418	8844	12	20	117
	SUBTOTAL	,			11801			9141
Kenwise	EQUIPHENT	1	ITEN	126258	126238	1	10	2234
SUB TOTAL	مت سعي بليد زوي مير م			4-2-2-00 to # 4-2 16 5 00	1162840			15670

LTEN	NESCRIP '#	QUANTITY	INT	PATE	CAPITAL MOUNT	LAUSAL AAUDAA
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	ALL	t of Cap		. 15	38888	15040
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		2084700			1/XW	]8	28432
	WEAT	725000		.1	1/11刷	30	:2604
	NATE			.1	1/11例	30	22716
	SUITOTAL						6374
IOAS TRANS	001100	108	Ko	94	0 /Ha		944(
	weat	1 69	Ha	113	9 /H.s		1130
	PAIZE.	188	Ha	136	8/Ha		1346
	SUNTOTAL						1230
RAIL TRAM	COTTON	198	Ha		Q /Ha		654
	une at	100	H4		8 /Ha		978
	MAILE	100	Ko	125	8/Ha		1230
	SUPTOTAL						3148
watte	COTTON	2184711	A*]	. 9615			250
	WEAT	92500		1912	1/n*3		111
	MAITE	16464481	A*3	. 9612	8/n*3		211
	SUBTITAL.						561
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	weat		) Ha		2 R / Ha		
	HAIZE	101	i Ha	313	2 1/14		3120 1141
	SUBTOTAL						444
FUEL	COTTON		i Ka		s B/Ha		35
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	MAITE		i Ka	1	3 8/H4		10- 114
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	MATZ		ê Ha	12	\$ \$/Hs		229
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соттон	100	3.5	308	200000	
WHFAT	100	5	371.14	165570	
HAIZE	100	54	279.19	167234	

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S T U D Y C A S F : FIGOD IRRIGATION MODEL WITH UNIT FIELTRICITY COST AT 13 c/UNA resserves and the second seco

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rien tip				13100		12		6521
	HOUSE	1	Ne			12		
	LANS CLEAS	288	Ha			12		11263
	FENCING	7800	A	1.57	11998			1327
	ROADS	1	<b>LTEN</b>		21101	12		2415
	SLOTAL				219998		-	26262
hater sup	CIVIL WKS	1	TEM	250300	251310	12	20	
	A+E KOAKS		ITEN	105518	145580	12		
	SUBTOTAL				333801			16564
INTIC SYST	FURIOUS ETT	1	ITTN	3#8880 13	398088	12	18	53896
elect sipp	PORETLINE	4868	A	13	52888	12	20	6962
	TRANSFORMET		No	4488	8810	12	21	1179
	SUBTOTAL				10884			0141
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	weat	925110	в*3	. 13	8/Xua	14	16383
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	SUBTOTAL						82866
ioas trais	000000	190	Ka	84	8/Ha		3400
	uéai	108	Ka		e/Ha		11300
	兩國	100	Ha	136	t/Ha		13500
	MIDTOR						13340
IAN TRANS		110			1/Ha		8500
	HEAT	110			€ /Ha		9900
	MIC	100	Ha	152	R/Ha		12510
	SUBTOTAL.						31900
ia ter	COTTON	2986798		. 0812			2515
	weat	925111			1 / n*3		2100
	MIT	1866601	B.1	. 8012	1/a*1		5615
	SUBTOTAL						49898
AND	COTTON	18	-		1 1/Ha		4291
	<b>BEAT</b>	180	i kas I Has		2 8/Ha 1 8/Ha		5940
	HATE .	191	ns	11	1/11.5		59988
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within s	COTTOM	100 100	-		2 R /Na		12210
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V845	WEAT		i Ka		5 \$/Na		3581
	MAIZE		l Ha	-	1 1/4		2280
	SUBTOTAL						11489
HARWER P	WEAT	18	) Ha	18	1 1/Ha		1 66 6 4
LEAN ACT 1	MATZE		l Ha	• •	8 R /No		12084
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	WEAT	• •	1 N.s	5	1 1 /14		5866
	MALZE		l Ha	4	S 8/Ha		4514
	SUBTOTAL						2251
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	(ha)	(t/ha)	(R/+)	(8)		
COTTON	100	3,5		280000		
HEAT	109	۳,	331.14	165570		
MAIZE	100	6	279.89	t 67934		
SUR TOTAL			R	613504		

CPERATINES

ANNEXURE 7

			即另邻特拉锡特拉特的名称特式	操行委任保险	N N N N N N N N N N N N N N N N N N N		
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with Sup					219998			26562
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INEIG STST	TURNOUS ETC	1	ITEN	30000	348848			46564
TICL 2014	POSER LINE	4000	<b>A</b>	13	2010	12	1\$	23096
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	SUBTOTAL	•		4488	8810	12	28	1179
Climita	EQUIPRINT	•	11TA		50810			8141
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US TOTAL					1162840			156708

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en ce	CONTON	2066700				78 78	29165
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	SUBTOTAL			24			658
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ua tea	COTTON	2166711			2 8/n*3		11
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	SUSTOTICE						1981
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	WEAT	10	0 Ha		2 8 Ma		59
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	SUBTOTAL.						467
MATERIALS	COTTON	••	e Ha		7 1/Ha		122
	u seat	11	Q Ka		2 8 /14		312
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	SUBICTAL						46
RØ.	COTTON	11	l Ha		16 9/Ha		2.
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	SUBTOTAL						\$
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ITEN	AREA	YTELD	PRICE	INCOME
	(ha)	(t/ha)	(R/t)	(8)
*** <b>*</b> *************				
COTTON	100	<b>7.5</b>	000	280000
WHEAT	100	5	331,14	165570
MAIZE	100	6	279.89	167934
SUB TOTAL			R	613504
		****	패턴 프 런 및 된 코 코 코 공 과	위 은 왕 및 관 은 고 가 관

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## ANNEXURE 8

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	furious etc.	t	1154	300000	388689	12	28	1
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ITEN	n, Aircsta	RANTITY	wit	PATE	MØUNT (Bang)	THTEREST RATE (%)	(Years)	anguna Angunt
MA 110			¥4		54060	12	43	6528
R0171 1707		1	Ha .	34990	50000	12	45.	¥37
	HOUSS	210	- +	425	15110	12	45	11263
		7100		1.57	11998	12	43	1327
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	SUBTOTAL		11CM	234348	251301	12	20	31174
later sup	CIAIT ARE			334510	334244	12	15	41521
	H+E KONIS		ITEM	334344	581660			79618
	SUNTOTAL.			306646	300000	12	10	53196
	FURIOUS ET		1124	190996	30000	12	20	
elott spp	POWER LIN		A			12	21	1
	TRANSPORTE	Dî (	i No	4488		16		i
	SUBTOTAL				1	12	19	2734
RECHANIS	EWIPPON		i ttea	126254	126250	-		
sug total	a a a a a a a a a a a a a a a a a a a			SANGALING GALANCE GALANCE	1227840			10168

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elec	CONTON	2186700	A'J		1/X (M	191977 	
	HEAT	725000	10*3		2/2104	38	2732
	國位	1666608			R/TIM	30	4923
	surita,			1020	N 7 P 244	34	13819
POAG TRANS	COTTON	100	Ka	94	f /Ha		848
	4eat	184	Ka	113	-		
	HATTE Suntotal	100	Ka	136	R/Ha		1130 1340 1340
ATL TRAM	CONTON	108	H.		¥7H8		
	Heat	100	Ko	<b>\$</b> \$	Ø MA		998
	MAITE	100	Na	123	R/Ha		1231
	SUDTOTAL						12.141 UPA
uater	COTTON	2186788	Б°я	. 1112	8/a^3		.1474 256
	ureat	923100	R*1	.1012			296
	Halle	1666688	a^3	. 1012	1/a*3		2000
	Suito Ma						561
	COTTON	tte	Ha	498	8/Ka		1981
	u cat	108	Я۵		8 /Hs		426
	haite	190	Ha	59	9/Ha		591
	SUBTOTAL						5790
MITTIN.8	COTTON	108	Ka	467	1/Ka		46711
	HEAT	180	Ha	322			1224
	HA LIE	100	Ha	312	8/Na		31210
	SUNTOTAL						11110
101	COTTON	180	Ha	46	₽/Ha		4611
	HEAT	100	Ha	33	2/14		336
	MITE	têû	Ha	13	1/Ha		331
	SUBTOTIM						1141
MAVERT	ure at	188	Ha	180	₽/Ha		10000
	Haize	160	Ka	120	R /Na		12000
	SUPTOTAL						22810
PPAY	VACAT	100	Ha	9	R /%a		901
INTEREST	COTTON	100	Ha	130	t/Ha		3466
	ləçat	188	Ka		R /Na		5000
	HAIZE	100	Ka	45	1/Ha		4598
	SUITOTAL				-		22300
ANNERT	RENARCHIC		t TEH	40668 (	2		44410
	TRAWSPORT	38888		.14			4211
	DIVERSE	1	l TEM	4808-1	t		4408
	SUBTOTAL						48210

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ELIC SUP	N.L.	I I	f Cas			. 32	1	57
	CONTON			15	Haji I	38		42
fermalise.						28		35
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-					31672			1283
40461X	SURTOTAL Equipment	1	ITEN	32485	32485	12	4 	575 
elett supp	POLER LINE TRANSFORMER	-	n Kaj	6144	1	15	50	
innic Equip	PIPES ETC		I TEN M	13	4	12	24	(
	SUBTOTAL			15259	15854	12	10	290
	A+E VORTS	1	I TEN	. 344	23688			3101
	CIVIL HKS		ITEH	15101	7508	12	15	1102
	SUNTOTAL				9737 161 <b>18</b>	12	38	1000
	ROADE	1	LTEM	1768	1719	12	1.1	1179
	FDCING	1.648	A	1.57	2316		45	246

1101	ÆSCAIP'N Q	UANTITY	UNIT	PATE	NOUBIT (Bass)	INTEREST RATE (1)	PERIOD (Years)	AMOUNT AMOUNT
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inic ew Elect sy	SUBTOTAL P PIPES ETC P POWER LINE TRANSFORME	8	1   TEH 1 m 0 Ha	15359 13 6409	15858 4	12 12 12	10 20 20	2986 6 1
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XESCRIP'N CU	ANTITY UNIT	RATE INIT	ףין)אף (146 אני אם אני א	анара Мана Тирок
		ى كەممىرە، قەمىمە، كەممەرەمەرەمەر مەمەرىياسەرى – ئ		3301
	152931 A*3	.13 \$7164	34	1552
UTION I	67397 A*3	.13 1/134	] <b>\$</b>	2796
weat	121423 A'J	13 1/144	7	784
MATTE SUNDIAL	161963 11 3			1315
	15 Ha	37 R/Ha		1740
COTTON		116 R/Ha		2003
acai	15 Ha 15 Ha	139 BAHA		5130
MAITE	(1) 114			
Land Contract	15 Na	85 8/Ma		1485
COTTON SEAT	IS Ha	99 R/Ha		1875
	15 Ha	125 11/10		4633
KA LE	13 1.0			2167
SUNTUI M.	1788600 A*3	.1012 R/A*3		952
PU\$\$E\$1007 PAN:	772988 A*3	.9612 R/A*3		1715
RZE	1428588 A*3	. 1012 8/n*3		1178
FICH CAMAL	13 80	98 R AL		5984
SUBTOTIAL				7140
COTTON	15 Ha	476 R /Ha		489
LUI I COM	15 14	32 I.Ma		613
BALTE	15 Ha	41 9/Ha		9235
SUBTOTAL				7513

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OPERATION

weat MAITE SUNDIAL ROAD TRAMS COTTON acaî MAITE AMOTA

RATE TRANS COTTON øéat KA I TE SUDTOT M. 

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TEM

COTTON

WHEAT

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3 U М 14 A R Ŷ 使精神的感觉的现在分词 TTEM AHOUNT (Rand) i ł 1 INTITAL ANNUAL Э INCOME 22627 -----EXPENDITURE 1 CAPTTAL Т 01672 12835 HAINTENANCE 1 3131 OPERATIONS 1 77268 SUBTOTAL 1 91672 91234 ***

> ECONONIC PARAMETERS Т VALUE NETT OPERATIONS CASH FLOW (R) ( 17628 × NETT BENCELT (R) I 773 BENEFITZCOST RATTO 1 1,007 INTERNAL RATE OF RETURN (*) : 12.732

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			1103	1.0444	1.40444		1.	11284
FOMER LINE		2540	A	13	12500	12	28	1352
	8	2	No	6840	12448	12		1681
SUBTOTAL								5959
EQUIPMENT		1	(TEN	125210	125200	12	18	2215
29 2 60/12 8% Hz	A WORKER OF LEASE			dan sana mananan da sana sa s	892290	****		127725
٤					l traine py es p	n n n H étő († 1) († 423 f.	ED EZ D.C. (1839)	, i kazi n tiri
XISCRIP'N	QUANTI	۲ĭ	ហ៖ព	PATE	CAPITAL			jatia.
					ANOLINI			ANOUNT
AL	X al Ca	)		.115	199999			100
CIVIL WAS	X (f G)	3		.005	27280			1464
H+E 188	Z of Ca	)		. 14	51910			2072
MLL.	I of Ca	>		.05	178868			874
ALL.	I of Car	)		.02				891
001100		111	Ra					3810
<b>INEAT</b>		108	Ha	29				2946
HATZE		111	Ha					2501
								73526
	THANSFORMET SUBTOTAL EQUIPMENT EQUIPMENT E DESCRIPIN ALL CIVILIAS N+E WES ALL CUTTON	TRANSFORMER SUBTOTAL EQUIPMENT EQUIPMENT E DESCRIP'N QUANTI ALL I of Ca CIVIL MS I of Ca ALL I OF CA	POWER LINE         2540           THANKSORNER         2           SUBTOTAL         2           EQUIPHENT         1             EXECTIVAL         2           MAL         0           MAL         1           COVID_UKS         1           ALL         2           CIVIL         KS           Z         2           ALL         2           CIVIL         KS           Z         1           CUVIL         KS           Z         1           CUVIL         KS           Z         1           K         1           K         1           K         1           K         1           K         1	PORER LINE         2518 A           TRANSFORMER         2 Ho           SUBTOTAL         2 Ho           EQUITMENT         1 ITEM	POMER LINE         2510 A         13           TRANSFORMER         2 Ho         5840           SUBTOTAL         2 Ho         5840           EQUITMENT         1 ITEM         125200	TRANSFORMET         2         He         6444         12446           SUBTOTAL         44580         44580         44580           EQUIPMENT         1         ITEM         175280         123288           892290         892290         892290         892290           EQUIPMENT         1         ITEM         175280         123288           DESCRIP'N         0         MANTITY         UNIT         8ATE         CAPTTAL           ALL         X         af         Cap         .045         292888           He MS         X         af         Cap         .045         292888           He MS         X         af         Cap         .045         292888           He MS         X         af         Cap         .045         292888           ALL         X         af         Cap         .045         199990           CTVTL         MS         X         af         Cap         .045         199990           CTVTL         MS         X         af         Cap         .045         199990           CTVTL         MS         X         af         Cap         .045         19840	POWER LINE         2500 A         13         12500 12           TRANSFORMER         2 Ho         6840 12600 12         17           SUBTOTAL         44500         12         17           SUBTOTAL         1 ITEN         125200 12         12           8972200         8972200         12         12           BESCRIP'N         0 MANTITY         UNIT         RATE         CAPITAL           ALL         2 of Cap         .005         272800         199990           CTUTL MAS Z of Cap         .045         199990         .045         272800           ALL         Z of Cap         .045         199090         .045         19800           ALL         Z of Cap         .045         19800         .044         51800           ALL         Z of Cap         .02         14500         .02         14500           CUTTOR         105         17800         .02         14500         .02         14500           CUTTOR         105         .02         14500         .02         14500         .02           WEAT         105         .02         .02         14500         .02         .02	PTGREER LINE         2548 A         13         12586         12         28           TRAMSFORMER         2 Ho         6440         12480         12         28           SUBTOTAL         44580         12688         12         28           SUBTOTAL         44580         126288         12         18           SUBTOTAL         44580         125288         12         18           SUBTOTAL         44580         125288         12         18           B972290         897290         897290         12         18           BESCRIP'IN         GMANTITY         UNIT         RATE         CAPITAL           ALL         X of Cap         .005         272800           H+E MIS X of Cap         .04         51810           ALL         X of Cap         .05         178000           ALL         X of Cap         .02         14500           CUTTOR         100 Ha         .30         .30           MEEAT         100 Ha         .30         .30

FEW	SE Di Cleva Cive	201	Ne Ne Ne	18000 Stoce	54440 58480	12	15	6528
L AM Fey Rom	D CLEMA CINC	281		50000	56466			
FEW	C [ )82		M.			17	45	1037
ROA			n 🛛	325	65110	12	45	7848
		7898	Ą	1.57	10790	12	K.	1327
	11	1	! TEN	28888	20009	12	45	2415
508	TOTAL				179998			241 47
NATION SUP CIV	1. W# \$	1	TTEM	292868	292810	12	38	36320
H+E	lion 19	t	1121	51898	31800	12	15	7686
SUB	IOT NL				344688		-	43956
19216 EQUI PTP	es etc	1	1106	178000	178888	12	10	31584
elect supp fom	BR LINE	2540	A	13	12500	12	28	4352
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SUB	IOTAL				44588			5959
KECHAANISE EQU	TP HE IT	1	(TEN	125210	125200	12	18	22159

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ANDUNT INTEREST

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VESCRIP'N QUANTITY UNIT

C T IL D Y C A S F : VOORDOEVER : DEVELOPMENT OF ZONE 2 ONLY (ONLYTING ZONE 3)

OPERATIONS

ITEN	)EXXIP'N	QUANTITY	UNIT	RATE	UNIT	»()(¢		ALIBAG
nœ	CONTON	( NA()		و ویسین بورستان ویورد های هفت. ا	*	ICAD		and the
	WEAT	1788440			] [] ///開		15	1584
	MATZE	79 <b>2900</b> 142 <b>6300</b>			3 2/244		15	702
	SUITOTAL	1769966	14° J	.1	3 1/RW		15	1265
POAD TEN	CONTON	100	Ha	0	7 8/Ha			1351
	WEAT	100			/ ¥/ns 6 7/Hs			971
	MAITE	100			8 1/29 8 (Ha			1188
<i></i>	SUTTOTAL			13.	ય ચ/મહ			1900
ALL THE	Control	i e e	Ha		i i /Ha		~	34291
	sé at	100	Ha		9 97 Ha			5544
	MAINE	100	Ka		1/Ha			9906
110 8253	SU/DIDTAL							12500
inter	COTTON	1788440		. 8344	8/a^3			31909
	iqueat Hatte	792900		. 6344	1/n*3			61528
	HAITE Subtotal	1420300	a*3	. 1344	R/n*3			27276
LANDER	COTTON							49141 137943
	le stat	180 I			8Ma			47588
	MAIZE	100   100			R/Ha			3218
	SUSTOTAL	1441	મ્લો	41	8/Ha			4140
MATERIAL S	COTTON	1 <b>10</b> H	ls		<b>A A</b> ·			54988
	VIEAT	140 }			\$/Na			16798
	NAIZE	148 *	-	-	₹/%a			32210
	SUBTOTAL		~	312	e/Ha			31200
FUEL	COTTON	189 H	A	16	9/Ka			110100
	<b>LANGAT</b>	188 8			#/Ha 17/Ha			4588
	쎼]洭	140 H	8		1/Ka			3508
	SUNDTAL				1 1 1 1 2			131
HASVEST	weat	100 H	a	100	₽./H.s			11468
	MAITC	110 K	a	128				1 100
	SUBTOTAL							12044
SPPAY Wither off	u cat	180 N	<b>4</b>	ę	₽ /Ha			22448
TERRET	COTTOM	100 H.		130	-			700
	iðéat Halte	100 H.	-	34	8744			13888
	HALTE	100 Ha	•	45	£/H≱			5010
AMAGENETIT	SUBTOTAL REPUNERATE							4510 22 500
ett on the Land State of Land State	TRANSPORT	111		40000	8			44000 22300
	DIVENSE	30180 h		. 14 1				4268
	SUDTOTAL	t (1	UN	4000 1	1			4668
	JUBIQING,							48211
UD TOTAL		ann an tha ann an tha an tha an tha				جمی ویند و ورزیک ولی		
and a subsection of the subsec	i Extension and Excitation in	angena ing na tagai	2 Barris & Barris		resona tad	i di la se i se i su tat tat		19541
*****							••••••	
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		******				AGAGAG	*****	
TEM		AREA		YTELD				
			•			PRICE	INCOME	
		(hai)		(t/ha)		(R/t)	(R)	
JTTON				3.5		 800	284000	
DTTON HEAT		 100		3.5		800	280000	

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1.15 M	ARCA	YTELD	PRICE	INCOME
	(ha)	(t/ha)	(R/t)	(R)
COTTON	100	3.5	800	280000
WHEAT	100		331.14	165370
HAIZE	100	4	279.09	167734
************				
SUR TOTAL			R	613504
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ANNEXURE 13

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19		OPERATIONS	I			50856
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14		SUBTOTAL	١	392:	270	65981
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ADITERAC	-	<del></del>				Alba
TEN	DESCRIP 'N	QUANTITY	UNIT	PATE	ANOURI	ANOUN
 Famili 1177	 ALL	X of Cap			179998	104
VATER SUP	CIVIL WES			115	29284	146
4631 E M - 344	HE INT	Z of Cap		.14	51800	287
INRIG EGP	ALL	X of Cap		.15	178860	87
ELEE SUP	ALL	1 of Cap		.12	44518	89
RECHANISE	COTTON		6 Ha	30		38
THE LANSAU & GAL	WEAT		1 Ha	28		28
	HATZE		l Ka	26		26

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ITEN	NESCRIPTIN OU	WIITY	UNIT	TATE	ANOLINI (Band)	INTEREST RATE (Z)	PERTOD (Tears)	annaual Mnount
FADR 110	516205	 J	. <u></u>	19998	54888	12	45 45	6528 6837
•	HOUSE	1	H.	58649	58488	12	-	
	LAND CLEM	288	Xa	325	62000	12	15	7848
	FENCING	7116	A	1.57	11991	12	45	1327
	ROADS		1 TEM	24440	28888	12	45	2415
	SUBTOTAL				199 <del>99</del> 90			241.47
VATE SUP		1	ITEN	292810	29281	12	26	36331
8441CB 3434	H+E WORKS		ITEN	51880	51388	12	15	7686
	SUBTOTAL			•	344688			43956
			ITEN	178449	178888	12	11	31504
	PIPES ETC	251		13	32510	12	20	4352
FUEL I AND	P POLER LINE		2 Ha	6110	12000	12	21	1697
	TIMFORT				14588			5959
rechanise	SUBTOTAL Equipment		1 1124	125281	125210	12	18	22155
SUB TOTAL	يست بارويين سروي وروي				892298			12772

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					******	*****				166916899968188891666199
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CAPITAL

" T IJ B Y C A S E : HORRIDGEVER ; ZOMC 2 WITH THE CAPITAL COST OF THE BULK WATER SUPPLY SCHERE SUBSTRISED

ELEC COTTON 17000.00 n*3	ITEN	XSCRIP 'N	QUANTITY	UNET	241E	UN IT	PURP IRC VEAD (A)	AUNA AUNA
BUREAT         7722988 n*3         13 87484         15           NATEE         1428508 n*3         13 87484         15           SUBTOTAL         160 Ha         67 978a         15           RATE         180 Ha         114 274a         15           HATX         180 Ha         113 87484         15           SUBTOTAL         180 Ha         137 874a         13           RATE         180 Ha         137 874a         13           SUBTOTAL         180 Ha         137 874a         13           SUBTOTAL         180 Ha         137 874a         13           RATE         180 Ha         137 874a         13           SUBTOTAL         180 Ha         137 874a         13           MATEE         100 Ha         125 874a         12           SUBTOTAL         72986 a*3         123 874a         12           MATEE         1428500 a*3         623 874a         12           SUBTOTAL         128 874a         13         13           MATEE         1428508 a*3         623 874a         12           SUBTOTAL         128 874a         12         12           SUBTOTAL         148 Ha         132 874a         14	FLEC		1700400	а*Ĵ	1	₹./YLM	, بر وسن ومدن و بسرج مع مرد مرد م	
Initial         1428588 A*3         .13 #/NM         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13         13 <th13< th="">         13         <th13< th="">         13<td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1584)</td></th13<></th13<>								1584)
BOAD TRAD         SUBJORAL         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10			1428588	A*3				7\$23
MEAT         100 Ha         07 0/Mai         11           MAIZE         100 Ha         137 0/Ha         11           SUBTOTAL         100 Ha         53 0/Ha         13           RATL TRADE         COTTOD         100 Ha         53 0/Ha         13           RATL TRADE         COTTOD         100 Ha         53 0/Ha         13           MATZE         17004680 or 3         0231 8/A*3         0231 8/A*3         13           MATEE         17004680 or 3         0231 8/A*3         123         14           MATEE         17004680 or 3         0231 8/A*3         123         14           MATEE         17004680 or 3         0231 8/A*3         123         123           MATEE         17004680 or 3         0231 8/A*3         123         123           MATEE         17004680 or 3         0231 8/A*3         123         123           MATEE         17004680 or 3         0231 8/A*3         123         124           MATEE         100 Ha         476 8/Ma         124         124           MATEE         100 Ha         32 8/Ha         132         124           MATEE         100 Ha         32 8/Ha         132         132           M		SUTTOTAL				A / K 1924	15	12652
WREAT         116 Ha         114 2744         11           HATZE         180 Ha         139 87Ha         11           SUBTITIAL         180 Ha         65 8746         14           WARAT         108 Ha         65 8746         14           WARAT         108 Ha         97 874a         16           WARAT         108 Ha         97 874a         16           WARAT         108 Ha         125 87Ha         12           WARAT         1788486 a*3         1231 87743         12           WARAT         1788486 a*3         1231 87743         12           WAREAT         772988 a*3         1231 87743         13           WAREAT         1788486 a*3         1231 87743         13           WAREAT         1788486 a*3         1231 87743         13           WAREAT         1788486 a*3         1231 87744         13           LABOUR         COTTON         180 Ha         476 878a         72           MATEE         100 Ha         476 878a         12         72           MAREAT         160 Ha         132 874a         14           MATEE         100 Ha         122 874a         12           SUBTOTAL         10			169	Ka	67	i Aza		J35t6
IMALA         180 Ha         139 P/Ha         13           RATL TRAMS         COTITON         100 Ha         95 P/Ha         34           MARAT         100 Ha         95 P/Ha         34           MARAT         100 Ha         97 P/Ha         97           MATEN         100 Ha         97 P/Ha         97           MATEN         100 Ha         123 P/Ha         123           MATEN         1700446 P/Ha         123 P/Ha         123           MATEN         1200 P/Ha         123 P/Ha         123           MATEN         1200 P/Ha         123 P/Ha         123           SUBTOTAL         100 Ha         474         123           MATEN         100 Ha         122 P/Ha         127           MATEN         100 Ha         122 P/Ha         127           MATEN         100 Ha         132 P/Ha         131           UEL         COTTON         100 Ha         133 P/Ha         131           MATEN         100 Ha </td <td></td> <td></td> <td>10</td> <td>На</td> <td></td> <td></td> <td></td> <td>9798</td>			10	На				9798
SUBTOTAL     100 Ha     95 8/Ha     34       HATE THANS     COTTON     100 Ha     95 8/Ha     34       HATEE     100 Ha     97 9/Ma     9     9       SUBTOTAL     1700440 0*3     123 8/Ma     123     123       UATEN     COTTON     1700440 0*3     123 8/Ma     32       WATEN     792980 0*3     1231 8/A*3     32       WATEN     792980 0*3     1231 8/A*3     32       SUBTOTAL     1420500 0*3     1231 8/A*3     32       LABOUR     COTTON     180 Ha     476 8/Ha     47       SUBTOTAL     100 Ha     41 8/A*3     32       LABOUR     COTTON     180 Ha     476 8/Ha     47       MATENIAL     100 Ha     41 8/Ha     32     47       MATENIAL     100 Ha     41 8/Ha     32     32       SUBTOTAL     100 Ha     32 8/Ha     32     32       FUEL     COTTON     180 Ha     32 8/Ha     32       SUBTOTAL     100 Ha     46 8/Ha     32     32       FUEL     COTTON     180 Ha     33 8/Ha     33       SUBTOTAL     100 Ha     12 8/Ha     33     32       FUEL     COTTON     180 Ha     138 8/Ha     33			180	Ka		•		11600
INDEAT         INDEAT <thindeat< th=""> <thindeat< th=""> <thindeat< td="" th<=""><td></td><td></td><td></td><td></td><td></td><td>e / 116</td><td></td><td>t <b>3986</b></td></thindeat<></thindeat<></thindeat<>						e / 116		t <b>3986</b>
HATZE 100 Ha 123 8/Ha 122 1428308 a*3 .0231 8/a*3 .0331 8/a*3 .033	RULIARS		100	kta 🛛	វង	9 /Ma		34200
MATZE         198 Ha         123 B/Ma         0           SUBTOTAL         SUBTOTAL         38         32         33           MATEN         CUTTEN         1788446 n*3         .0231 R/n*3         33           MATEN         CUTTEN         1788446 n*3         .0231 R/n*3         33           MATEN         CUTTEN         1788446 n*3         .0231 R/n*3         33           MATEN         1428300 n*3         .0231 R/n*3         32         32           SUBTOTAL         1428300 n*3         .0231 R/n*3         32         32           LABOUR         COTTEN         180 Ha         476 R/85         476           SUBTOTAL         100 Ha         41 R/Na         32         32           KATENIAL         COTTEN         180 Ha         467 R/85         476           SUBTOTAL         100 Ha         32 R/Na         32         32           KATENIAL         COTTEN         180 Ha         312 R/Na         32           SUBTOTAL         100 Ha         32 R/Na         32         32           VIEL         COTTEN         180 Ha         312 R/Na         32         32           SUBTOTAL         100 Ha         32 R/Na         32         <								9540
SUBTOTAL         1786488 n*3			190	Ha				9966
Control         Treeses and s         -0231 R/n*3	A 12'0							15210
BREAT         772980 A*3         1231 R/A*3         18           MAIZE         1428500 A*3         4231 R/A*3         18           SUBTUTAL         32         8231 R/A*3         18           LABOUR         COTTON         180 Ha         476 R/Ra         76           WAIZE         100 Ha         476 R/Ra         76         77           WAEAT         160 Ha         41 R/Ha         32         77         77           SUBTOTAL         100 Ha         322 R/Ha         447         447           MATER 100 Ha         322 R/Ha         327         743         327           FUEL         COTTON         180 Ha         312 R/Ha         312         312           FUEL         COTTON         180 Ha         33 R/Ha         337         312           SUBTOTAL         180 Ha         33 R/Ha         331         337           ABUEST         180 Ha         130 R/Ha         331         331 <t< td=""><td>29 I K.B</td><td></td><td></td><td></td><td>. 0231</td><td>8/a*3</td><td></td><td>J8988</td></t<>	29 I K.B				. 0231	8/a*3		J8988
Initial         1428308 a*3         .8231 R/a*3         182           SUBTOTAL         1428308 a*3         .8231 R/a*3         .321           LABQUR         COTTOR         188 Ha         476 R/8a         774           MATEE         100 Ha         41 R/ha         32 R/ha         476           MATEE         100 Ha         41 R/ha         32 R/ha         476           SUBTOTAL         100 Ha         41 R/ha         32         749           MATERIALS         COTTOR         180 Ha         32 R/ha         447           MATERIALS         COTTOR         180 Ha         31 R/ha         32           SUBTOTAL         180 Ha         31 R/ha         32         31           TUEL         COTTOR         180 Ha         33 R/ha         35           SUBTOTAL         198 Ha         33 R/ha         35         31           ARVEST         MACAT         188 Ha         130 R/ha         32			792980	6*J				41317
SUBTOTAL         321           LABOUR         COTTOD         100 Ha         476 876a         726           MATE         100 Ha         32 874a         474           MATE         100 Ha         41 874a         32           SUBTOTAL         100 Ha         41 874a         32           HATERIALS         COTTODS         100 Ha         41 874a         32           SUBTOTAL         100 Ha         32 874a         447           HATERIALS         COTTODS         100 Ha         42 874a         547           HATERIALS         COTTODS         100 Ha         322 874a         447           HATERIALS         COTTODS         100 Ha         322 874a         322           SUBTOTAL         110 Ha         322 874a         322         324           TUEL         COTTON         100 Ha         312 874a         312           SUBTOTAL         100 Ha         31 874a         312         314           HAUZE         100 Ha         120 974a         320         324           SUBTOTAL         100 Ha         120 974a         320         324           SUBTOTAL         100 Ha         9 274a         320         324			1428500 /	13				18314
Control         The Ma         476         876a         776           MERAT         160 Ha         32 874a         476         476           SUBTOTAL         100 Ha         32 874a         32           SUBTOTAL         100 Ha         41 874a         41           HATERIALS         COTTON         100 Ha         467 874a         447           HATERIALS         COTTON         100 Ha         322 874a         447           HATERIALS         COTTON         100 Ha         322 874a         447           HATERIALS         COTTON         100 Ha         322 874a         447           SUBTOTAL         100 Ha         312 874a         312         312           FUEL         COTTON         100 Ha         312 874a         312           SUBTOTAL         100 Ha         31 874a         312           SUBTOTAL         100 Ha         31 874a         31           SUBTOTAL         100 Ha         128 974a         32           SUBT	A 50474 69-							32***
MATER         140 Ha         32 R/Ha         476           MATER TAL         100 Ha         41 R/Ha         32           SUBTOTAL         100 Ha         41 R/Ha         32           MATERTAL S         COTTOR         100 Ha         41 R/Ha         32           MATERTAL S         COTTOR         100 Ha         467 R/Ha         54           MATERTAL S         COTTOR         100 Ha         322 R/Ha         457           MATER TAL S         COTTOR         100 Ha         322 R/Ha         322           SUBTOTAL         100 Ha         312 R/Ha         322         312           UEL         COTTOR         100 Ha         33 R/Ha         331           SUBTOTAL         100 Ha         33 R/Ha         333           SUBTOTAL         100 Ha         120 R/Ha         331           SUBTOTAL         100 Ha         120 R/Ha         114           MATER         100 Ha         120 R/Ha         120           SUBTOTAL         100 Ha         120 R/Ha         120           MATER         100 Ha         120 R/Ha         120           SUBTOTAL         100 Ha         120 R/Ha         120           SUBTOTAL         100 Ha	和政府		100 H	la	496	ARA		12632
INVELE         100 Ha         41 MAA         32           SUBTOTAL         SUBTOTAL         41           MATERIALS         COTTOS         100 Ha         457 8/4a V         41           MATERIALS         COTTOS         100 Ha         322 8/4a V         447           MATERIALS         COTTOS         100 Ha         322 8/4a V         447           MATER         100 Ha         312 8/4a V         312         312           SUBTOTAL         100 Ha         312 8/4a V         312         312           FUEL         COTTON         100 Ha         313 8/4a V         313           SUBTOTAL         100 Ha         120 9/4a VIA         314           MATER         100 Ha         120 9/4a VIA         314           SUBTOTAL         100 Ha         120 9/4a VIA         100           SUBTOTAL         100 Ha         9 2/Ma         1200           SUBTOTAL         100 Ha         9 2/Ma         1200           MATEREST         COTTON         100 Ha         9 2/Ma         1200           MATEREST         COTTON         100 Ha         9 2/Ma         1200           MATEREST         COTTON         100 Ha         9 2/Ma         1200 <td></td> <td></td> <td>188 -</td> <td>la</td> <td></td> <td></td> <td></td> <td>47688</td>			188 -	la				47688
SUBIDITAL         41           HATERIAL S         COTTON         180 Ha         457 8/Ha L         547           HATERIAL S         COTTON         180 Ha         322 8/Ha         447           HATERIAL S         COTTON         180 Ha         322 8/Ha         447           HATER         180 Ha         312 8/Ha         312         7/Ha         312           SUBTOTAL         180 Ha         46 8/Ha         312         111         312           TUEL         COTTON         180 Ha         46 8/Ha         313         7/Ha         312           ARVEST         188 Ha         33 8/Ha         33         7/Ha         314           SUBTOTAL         186 Ha         180 8/Ha         33         7/Ha         314           ARVEST         HAAT         186 Ha         180 8/Ha         314         314           SUBTOTAL         186 Ha         180 8/Ha         120         71         314           MATER TAL         188 Ha         138 8/Ha         71         320         71           HATER TAL         188 Ha         138 8/Ha         130         71         348         34           HATER TAL         188 Ha         58 8/Ha			100 H	\$				3211
HARAT         100 Ha         447 8/46 Å         447           HARAT         100 Ha         322 8/46 Å         447           SUBTOTAL         100 Ha         322 8/46 Å         322           SUBTOTAL         100 Ha         312 8/46 Å         312           FUEL         COTTON         100 Ha         46 8/46 Å         311           AKEAT         100 Ha         46 8/46 Å         311         111           JAKEAT         100 Ha         33 8/4a         35         314           SUBTOTAL         100 Ha         100 8/4a         33         314           SUBTOTAL         100 Ha         120 8/4a         314           SUBTOTAL         100 Ha         120 8/4a         324           SUBTOTAL         100 Ha         120 8/4a         324           SUBTOTAL         100 Ha         9 2/4a         324           MAEEAT         100 Ha         9 2/4a         324           MAEEAT         100 Ha         9 2/4a         324								4180
HILH         100 Ha         322 P/10         447           HATZE         100 Ha         312 P/10         322           SUBTOTAL         100 Ha         312 P/10         322           UEL         COTTON         180 Ha         312 P/10         312           JUEL         COTTON         180 Ha         46 P/10         111           JHEAT         100 Ha         33 P/10         46           HATZE         100 Ha         33 P/10         33           SUBTOTAL         100 Ha         33 P/10         33           ABUEST         HEAT         194 Ha         131 P/10           HATZE         100 Ha         120 P/14         140           SUBTOTAL         100 Ha         9 P/14         120           MALEE         100 Ha         9 P/14         1201           MALEE         100 Ha         9 P/14         1201           MALEE         100 Ha         9 P/14         1201           MALEE         100 Ha         9 P/14 <td>IICUTUC R</td> <td></td> <td>190 K</td> <td>4</td> <td>467 8</td> <td>Alta 3</td> <td></td> <td>54760</td>	IICUTUC R		190 K	4	467 8	Alta 3		54760
INVEC         100 Ha         312 R/Ha         322           SUBTOTAL         SUBTOTAL         312           FUEL         COTION         180 Ha         46 R/Ha         111           IMEAT         188 Ha         35 R/Ha         46           HALZE         190 Ha         31 R/Ha         35           SUBTOTAL         190 Ha         31 R/Ha         35           ABVEST         IMEAT         190 Ha         31 R/Ha         35           SUBTOTAL         100 Ha         120 R/Ha         314           SUBTOTAL         100 Ha         120 R/Ha         114           SUBTOTAL         100 Ha         120 R/Ha         120           PPAY         IMEAT         100 Ha         9 R/Ha         120           SUBTOTAL         100 Ha         9 R/Ha         120         120           MAEEAT         100 Ha         9 R/Ha         120         120           MAEEAT         100 Ha         9 R/Ha         120         120           MAEEAT         100 Ha         120 R/Ha         120         120           MAEEAT         100 Ha         130 R/Ha         130         30           SUBTOTAL         100 Ha         40 R			100 H	8				46788
TUEL         COTTON         180 Ha         46 0 Aa         1101           HALZE         100 Ha         33 0 Aa         33 0 Aa         33 0 Aa           SUBTOTAL         100 Ha         130 0 Aa         33 0 Aa         33 0 Aa           SUBTOTAL         100 Ha         100 0 Aa         120 0 Aa         33 0 Aa           SUBTOTAL         100 Ha         120 0 Aa         120 0 Aa         33 0 Aa           SUBTOTAL         100 Ha         120 0 Aa         120 0 Aa         120 0 Aa           SUBTOTAL         100 Ha         120 0 Aa         120 0 Aa         120 0 Aa         120 0 Aa           PBAY         ISEEAT         100 Ha         120 0 Aa         120 0 Aa<			100 H.	<b>a</b> ·				2210
GUTTON         TER Ma         46 874a         111           WEAT         188 Ha         33 874a         35           SUBTOTAL         38 Ha         33 874a         35           SUBTOTAL         38 Ha         33 874a         35           ABVEST         MARAT         186 Ha         33 874a         35           SUBTOTAL         186 Ha         180 874a         31           MAUEST         MARAT         186 Ha         180 874a         31           SUBTOTAL         108 Ha         129 874a         120         100           SUBTOTAL         108 Ha         120 874a         120         70           MAREEST         COTTON         180 Ha         130 874a         70           MAREEST         COTTON         180 Ha         130 874a         70           MAREEST         COTTON         180 Ha         130 874a         70           MAREENT         180 Ha         130 874a         50         70           SUBTOTAL         180 Ha         430 80 8         2250         71           MAREENT         180 Ha         14 874a         458         74           MAREENT         11TEN         440 80 8         428         4	~	-			316 4	1.1.4		31280
WREAT         188 Ha         33 R/Ha         440           HALZE         188 Ha         33 R/Ha         33           SUBTOTAL         33         33         33           ARVEST         MREAT         186 Ha         33         8/Ha         33           SUBTOTAL         184 Ha         33         8/Ha         33         33           ARVEST         MREAT         186 Ha         180         8/Ha         114           NATZE         108 Ha         120         8/Ha         120         114           SUBTOTAL         188 Ha         136 8/Ha         120         2200         120         120           PRAY         MAEEAT         100 Ha         9         7/Ha         120         2200           MATEREST         COTTON         180 Ha         130         8/Ha         130         200         200           MAEEE         100 Ha         9         7/Ha         130         200         200         200           SUBTOTAL         180 Ha         130         8/Ha         130         200         200         200           MAEEE         100 Ha         45         8/Ha         130         450         200	ы,		100 H	•	46.0	Ma.:		110100
HATLE         100 Ha         33 0/Ha         35           SUBTOTAL         330 0/Ha         331         331           ABVEST         MATER         100 Ha         120 0/Ha         114           SUBTOTAL         100 Ha         121 0/Ha         114           SUBTOTAL         100 Ha         121 0/Ha         114           SUBTOTAL         100 Ha         121 0/Ha         1200           PRAY         MAREAT         100 Ha         0 2/Ha         1200           MATEREST         COTTON         180 Ha         130 0/Ha         0 2/Ha         1300           HATEREST         COTTON         180 Ha         130 0/Ha         0 2/Ha         1300           HATEREST         COTTON         180 Ha         130 0/Ha         0 1300         1300           HATEREST         100 Ha         4 0 2/Ha         500         500         500           HATEREST         100 Ha         4 5 0/Ha         1300         4 500         2250           SUBTOTAL         100 Ha         4 5 0/Ha         4500         2250         4400           MAREENETT         100 Ha         11 E/H         4 6000 R         420         4400           DIVERSE         1 11E/H		-	100 H.	5	-			4610
SUBTOTAL         31           ABVEST         MACAT         186 H.a         186 B./H.a         114           HATZE         108 H.a         128 B./H.a         186           SUBTOTAL         108 H.a         128 B./H.a         120           PRAY         MAEEAT         100 H.a         9 7./H.a         1200           MTEREST         COTTON         180 H.a         130 B./H.a         1200           MAEEAT         180 H.a         130 B./H.a         70         130           MAEEAT         188 H.a         50 R./H.a         70           MAEEAT         188 H.a         50 R./H.a         500           SUBTOTAL         100 H.a         45 R./H.a         500           SUBTOTAL         100 H.a         45 R./H.a         45 R./H.a           SUBTOTAL         11TEN         44000 R         2250           IMAGENEET         1 ITEN         44000 R         420           DIVERSE         1 ITEN         4600 R         440           SUBTOTAL         1 ITEN         4600 R         440			111 Ha	)		•		3544
HATZE         100 Ha         100 P/A         100 P/A         100 P/A           SUBTOTAL         100 Ha         120 P/A         120 P/A         120 P/A           PRAY         ISEAT         100 Ha         9 7/Ha         120 P/A         120 P/A           INTEREST         COTTOBAL         180 Ha         130 P/Ha         130 P/A         130 P/A         130 P/A           INTEREST         COTTOBAL         180 Ha         130 P/A         140					~~ •	( ng		7388
INTEL         100 Ha         120 9/Ha         120 1           SUBTOTAL         100 Ha         9 2/Ha         1201           PBAY         ISECAT         100 Ha         9 2/Ha         1201           MEERST         COTTON         180 Ha         130 8/Ha         1200           MAEERST         COTTON         180 Ha         130 8/Ha         1300           HAEERST         L00 Ha         9 2/Ha         1300           HAEERST         L00 Ha         9 2/Ha         1300           HAEERST         L00 Ha         50 7/Ha         1300           HAEERST         L00 Ha         45 8/Ha         500           SUBTOTAL         100 Ha         45 8/Ha         4500           IMAGENERT         RENUMERATE         1 ITEN         44000 R         420           DIVERSE         1 ITEN         4600 R         4400         4400	WIST		196 Ha		188.8	<i>.</i>		11.468
SUBJOYAL         128           PRAY         ISEAT         108 Ha         9 274a         2200           MTEREST         COTION         188 Ha         138 874a         71           MEREST         COTION         188 Ha         138 874a         71           MALE         188 Ha         58 87/Ha         1308           NALZE         188 Ha         58 87/Ha         580           SUBTOTAL         48 87/Ha         458         458           NMAGENEINT         20008 ba         .14 87ba         4888           DIVERSE         1 1TEN         4888 8         488           DIVERSE         1 1TEN         4888 8         488           ALL         4888 8         488         488			100 Ha					5198.0
GTEREST         GTEREST         GTEREST         100 Ha         9 2/Ha         71           IABEAT         180 Ha         130 8/Ha         71         71           IABEAT         180 Ha         130 8/Ha         71           IABEAT         180 Ha         50 8/Ha         50           SUBTOTAL         100 Ha         45 8/Ha         50           MAGENENT         REALER         1         11EN         4500 8           TRANSPORT         J8088 ba         .14 8/ba         400           DIVETSE         1         1TEN         4600 8         400           SUBTOTAL         1         1TEN         4800 8         400		SUBTOTAL				r na		12000
ALEREST         COTTON         180 Ma         130 A/Ma         74           INMEAT         186 Ma         130 A/Ma         130 A/Ma         130 A/Ma           INMEAT         186 Ma         50 R/Ma         500 R/Ma         500 R/Ma           SUBTOTAL         100 Ha         45 R/Ma         450 R/Ma         450 R/Ma           SUBTOTAL         1 ITEN         44000 R         2250 R/Ma         4400 R           TRANSPORY         30000 ka         .14 R/ka         450 R         4400 R           DIVERSE         1 ITEN         4600 R         4100 R         4100 R		iê yê û	100 Ha		6.0	<b>6</b> 1.		22000
Image A         146 Ha         1340           Haize         180 Ha         45 R/Ha         560           SUBTOTAL         45 R/Ha         450           Image Haize         1 ITEN         44080 R         2250           TRANSPORY         30000 km         14 R/Ha         4400           DIVERSE         1 ITEN         4600 R         4400           SUBTOTAL         1 ITEN         4600 R         4400								711
TRAILE 100 Ha 45 0/Ha 50 SUBTOTAL 450 AMAGENERIT RENUMERATE 1 ITEN 41000 R 2250 TRANSPORT J0000 km			LIE Ha					13960
SUBTOTAL 450 MAGEHENT REFUNERATE 1 ITEN 44000 R 2250 TRANSPORT J8000 km 14 p/km 420 DIVERSE 1 ITEN 4600 R 400 Subtotal 400		rai <i>t</i> e	188 Ha					5411
TRANSPORT J8868 ba		SUBTOTIN			4J W/	154		4500
TRANSPORT JOOR ka			1 111	71				22588
DIVERSE 1 LTEM 4600 R 410			JUIL IA			h		46888
SUBTOTAL 4826			1 111	74		18		4248
1924	1	SUBTOTAL			1884 X			4140
	*****		•					49288
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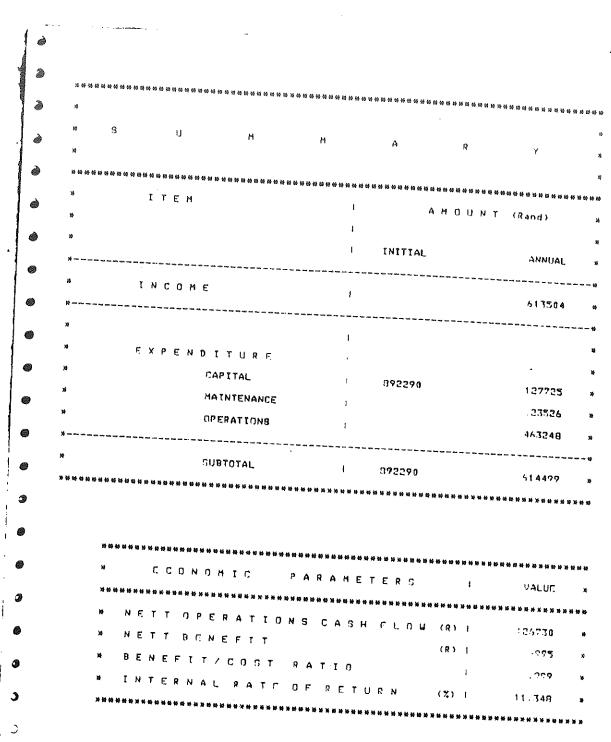
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SUR TOTAL

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ANNEXURE



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...... CONTRACTOR CONTRA I TEM FIND COSTS ESCIP'I EMITTY UNIT LONGT CROKERS RATE MØM INTEREST PER 109 .... HIGHT COURS 111111111 「峻剛」開発 MN 3 🗛 NOT INCOME 10900 NAR UND CLEA FDETHE INNE SITTLE 54 M 12 1521 1437 08 1 288 H4 19 19 19 19 19 58889 51110 12 12 123 12469 7849 1327 7868 m 1.57 11990 12 12 1 170 29111 21819 879999 2415 24147 WATCH SLP CIVE MES E LITEN 292891 CIVIL MIS Ref Wisizs 292988 292898 51899 1 1101 12 34 14338 t ITTH 292380 12 MAL HORSE Subtotal 51040 34 14330 12 1 ITON 55840 15 7688 INIS IN PIPO ETC 22819 12 1 1101 3444.68 15 1193 173988 178098 437934 3484.64 **MR 1310** PREDILINE 12 11 31584 2388 a 2 Re 2 Re 44543 13 22510 12 nastring Nastring 20 1332 .... 12000 12 20 6000 1847 SETTA 12589 12110 TOMITE DUPER 12 4352 20 1 1108 |26時 1447 123264 125288 147 12111 12 10 2199 1687 509 TOTAL 535490 12162 356400 15563 TABABA 44158 MOTIMET *auuu* FIND COSTS TTER 131111111111111448488888888888 NCR21P'1 QUESTITY UNITY LOVET CHINA EATE *********** (加林)町 -----AN MOUNT CAR AN'NT PATE """" AN ANYAMI CAP MI'NT PATE 54時 1月 <u>ац</u> T of Cap AN AND BY . ##9 199999 WATER SUP CTVIL HEB I H Cap Ref HEB I H Cap ALL I H Cap ......... 日間 16 1 272848 115 . 84 , 85 1464 292918 1 8994 .HS 1464 51368 1789 M .14 2172 ELET SUP 53.000 .14 I of Cap I of Cap 2222 .12 12568 658 I of Cap 1211 .12 248 **ECHAN S** CETTER . 1 📢 🛤 Ð **BEAT** (2086 .12 394 0 188 84 248 28 24 MIZ 2090 2690 180 No 107A 19758 3776 **JV 34** 

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STUDY CASE: MARKENER: 108 2 MM 108 3

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n.c	<b>ST 109</b>	te	) Ka				******	AN LOODIN	NICHT ,	s quaay	121	MITS	10000000000000000000000000000000000000	1111111	(1)	11 C/E B	(2016D	nem.
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	相加度	100			16 3/20			11664										7
6 4 53 5 5 S	<b>LOTTO</b>		•	12	19 8/140			13790										
earl main		169	Ka		· · · ·			14210										
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1	làs at	III Ka			\$/Na			111100										
1	HATTE	118 84			t Ala			4490										
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y yay	HEAT							12848										
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OTTON						
	100	3.5	300	280000		
HEAT	100	5	331.14			
AIZE	100	-	231.14	165570		
		4	277 87	167934		
BUB TOTAL		*********		****		
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Internation         19750         3776         23526           #         OPERATIONS         462090         75516         497614           #         OPERATIONS         462090         75516         497614           #         SUBTOTAL         \$335690         564010         356600         04055         360/00         128217		18				ផ្ទុំផ្លេសូសួនស្ត្រ ផ្ទេ		**********	២៥ ឆ្ ផ ផ ផ្ ផ្ ឆ ផ ផ ផ ផ	经保 销 题 算 神 化 物 的 略 静 臣	******	1 K H G B G B G G G G G G G G G G G G G G G
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SURTOTAL         5486           ALL TABLE         COTTOB         180 No         95 8/A6         558           ARL TABLE         COTTOB         180 No         97 9/A6         9980           ARIZ TABLE         180 No         121 1/A6         1218         9980           SURTOTAL         121 8/A0         141 2 1/A5         1218           ATES         COTTOB         1708468 a*3         141 2 1/A5         1218           ATES         COTTOB         1708468 a*3         141 2 1/A5         1218           ATES         COTTOB         1708468 a*3         141 2 1/A5         1218           MARZE         142888 a*3         141 2 1/A5         1715         1116           SUBTOTAL         4010         411 1/A6         4116           NORE         VERT         118 No         11 1/A6         1116           SUBTOTAL         5090         1118         111         1111           MERT         118 No         11 1/A6         1111           SUBTOTAL         1110         1110         1111           MERT         118 No         112 1/A5         1111           SUBTOTAL         1111         111 1/A5         11111           SUBTOT			100	14.9		217 1	1/18.0			21711	)									
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ATZE         148 Ma         123 4/4a         1398           SUFTOTAL         3998         3998           ATZE         17984/0 a*3         1412 4/x*3         2187           MATZE         17998 a*3         1412 4/x*3         2187           MATZE         1428 4/x*3         1715           MATZE         1482 8/x*3         1715           SUBTOTAL         4014         4/14           MATZE         148 Ma         12 6/14           MATZE         148 Ma         13 2 6/14           MATZE         148 Ma         13 8 6/14           MATZE         14																				
SUFTOTAL         34788           VATUE         17984.0 ar-3         .1412 4/ar-3         2177           VATUE         17984.0 ar-3         .4412 4/ar-3         752           NATUE         14225 8/ar-3         .4412 4/ar-3         752           NATUE         14225 8/ar-3         .4412 4/ar-3         752           NATUE         1425 4/ar-3         .411         752           NATUE         142 4/ar-3         .711         .4414           ABUER         142 4/ar-3         .411         .411           NATUE         148 4/a         .4210         .4210           <																				
MTSE UTTER 1798449 e^3 4412 4/e^3 2147 MATSE 179295 e^3 1412 4/e^3 952 MATSE 17285 e^3 1412 4/e^3 952 MATSE 17285 e^3 1412 4/e^3 952 MATSE 1748 e/4 6/4 6/4 414 ABUR COTTER 16 Ha 77 6 6/4 6 474 MATSE 18 Ha 12 8/6 326 MATSE 18 Ha 12 8/6 326 MATSE 18 Ha 14 1/4 118 MATSE 18 Ha 12 8/6 326 MATSE 18 Ha 14 1/4 118 MATSE 18 Ha 14 1/4 118 MATSE 18 Ha 12 8/6 326 MATSE 18 Ha 14 16 174 118 MATSE 18 Ha 12 8/6 326 MATSE 18 Ha 14 16 174 118 MATSE 18 Ha 12 8/6 326 MATSE 18 Ha 14 174 118 MATSE 18 Ha 12 8/74 118 MATSE 18 Ha 172 7/6 128 MATSE 18 Ha 128 7/6 128 MATSE 18 Ha 18 1/6 128 7/6 128 MATSE 18 Ha 128 MATSE 18 HA 128 MATSE 18 HA 128 MATSE 18 HA 128 MATSE 19 HA 128 MATSE 19 HA 148 148 7/6 148 MATSE 19 HA 148 7/6 148 MATSE 19 HA																				
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HATES     148 Ha     41 8/Ha     4180       SATURAL     54949       ATERIAL     54949       ATERIAL     100       MATERIAL     122 7/Ha       MATERIAL     122 7/Ha       MATERIAL     112 8/Ha       SUBTOR     148 Ha       WEAR     118 Ha       SUBTOR     148 Ha       WEAR     118 Ha       SUBTOR     114 Ha       WEAR     118 Ha       SUBTOR     114 Ha       MATERIAL     114 Ha       WEAR     118 Ha       SUBTOR     114 Ha       MATERIAL     114 Ha       SUBTOR     114 Ha       MATERIAL     114 Ha       SUBTOR     118 Ha       SUBTOR     118 Ha       SUBTOR     118 Ha       SUB										121	ė									
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Ref2E         168 Ha         312 8/Ha         11286           SUBTRIAL         111181           UEL         COTTOR         169 Ha         46 8/Ha         160           WELAT         188 Ha         33 8/Ha         160           WELAT         188 Ha         33 8/Ha         358           SUBTRIAL         1148         1148         1148           WELAT         188 Ha         33 8/Ha         338           SUBTRIAL         11484         1148         11484           WELAT         168 Ha         128 8/Ha         11484           WELAT         168 Ha         128 8/Ha         1288           SUBTRIAL         11484         128 8/Ha         128 8/Ha           SUBTRIAL         128 8/Ha         128 8/Ha         1288           SUBTRIAL         22468         1188         1188           SUBTRIAL         22488         138 8/Ha         138 8/Ha           SUBTRIAL         188 Ha         138 8/Ha         138 8/Ha           SUBTRIAL         138 8/Ha         138 8/Ha         138 8/Ha           SUBTRIAL         138 8/Ha         138 8/Ha         138 8/Ha           SUBTRIAL         148 8/Ha         148 8/Ha																				
SUBTRYAL         110100           UEL         CUTTOR         100 Ma         44 0/44         4440           WEAT         100 Ma         33 0/45         3569           RATEE         100 Ma         33 0/45         3780           SUBTRYAL         11466         11466           WARET         100 Ma         128 0/42         11466           SUBTRYAL         11466         11466           SUBTRYAL         11486         11466           SUBTRYAL         11486         11466           SUBTRYAL         11486         11486           SUBTRYAL         11486         11486           SUBTRYAL         1188         11486           SUBTRYAL         1188         11484           SUBTRYAL         1188         1148           SUBTRYAL         11484         11486           SUBTRYAL         11484         1148           SUBTRYAL         11																				
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HATZE     188 Ha     33 1 // 4a     138 8       SURTOTHL     II 480       UARWEYT     UARAN     II 480       UARWEYT     UARAN     II 480       UARWEYT     UARAN     II 480       UARWEYT     UARAN     II 480       SURTOTHL     II 480       UARAN     II 180																				
SURTOTAL     11484       MARKET     188 MA     188 MA       MARKET     188 MA     188 MA       MARKET     188 MA     128 MA       SURTOTAL     22408       STAT     108 MA     138 MA       MARKET     138 MA     138 MA       MARKET     138 MA     138 MA       MARKET     168 MA     438 MA       MARKET     11704     4484 8       TANSPORT     1386 MA     4166       TANSPORT     1386 MA     4166       SURTOTAL     4288																				
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NATZE     140 H.S     120 P.Ala     1200       SUBTOTAL     Z2000     Z2000       SPRAY     USE NA     9 P.Ala     Z2000       INTERFEST     100 H.S     9 P.Ala     130 P.Ala       INTERFEST     100 H.S     50 P.Ala     130 P.Ala       INTERFEST     100 H.S     50 P.Ala     50 P.Ala       INTERFEST     100 H.S     50 P.Ala     50 P.Ala       SUBTOTAL     Z230 P.Ala     Z230 P.Ala       INTERFEST     1 TEPH     100 P.Alaa     410 P.Alaa       INTERFEST     1 TEPH     100 P.Alaa     420 P.Alaa	1995 (1)		11	) Ha		188	1/Na													
SUBTOTAL         22000           SPRAY         VOEAT         100 Ra         9 87As         900           LITEREST         USERT         100 Ra         130 87As         130 87As           LITEREST         USERT         100 Ra         130 87As         130 87As           LITEREST         USERT         100 Ra         130 87As         130 87As           NATZE         100 Na         45 87As         140 8         -           NATZE         100 Na         45 87As         2250 8         -           NATZE         100 Na         45 87As         2250 8         -           NATZE         117DH         4404 8         458 87As         2250 8           NAMAGENETY         1200 Kase R         4400 8         4400 8           TAMBORETY         1200 Kase R         4400 8         4400 8           DINEVER         1170H         4860 R         4400 8           SUBTOTAL         42200         42200         42200						128	P/Na													
SPRAY         WEAT         108 Na         9 0 /As         940           WHEAT         108 Na         138 0 /Aa         138 0 /Aa         138 0 /Aa           WHEAT         160 Na         138 0 /Aa         138 0 /Aa         138 0 /Aa           WHATZE         160 Na         54 0 /Aa         54 0 /Aa         54 0 /Aa           WHATZE         180 Na         54 0 /Aa         54 0 /Aa         54 0 /Aa           WHATZE         180 Na         55 0 /Aa         530 0         -           SUBTOTAL         22300         2230 0         -         -           VARDACTNETY         1100 /A 400 0 R         420 0         -         -           DINETER         1 170 /         400 0 R         4400         -         -           DINETER         1 170 /         400 0 R         4400         -         -         -																				
INTEREST CETTOR 148 Na 138 8/Ha 1388/Ha 1388 HATAY 148 Ha 54 8/Ha 54 8	TPAT		181	l Ka		9	₹/Hs													
Ideat     160 Ha     54 0 //16     54 0 //16       NATEE     180 Ha     45 0 //16     4700       SUBTOTAL     22500     22500       SUBTOTAL     1100 Ha     41400       TRANSPORT     14860 k     41400       DINEYSE     1 [TEXH     1800 k       SUBTOTAL     41400     4240																				
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