4.5 Price Prospects and Benefit Estimate

4.5.1 Marketing and Price Prospects

1) Marketing prospects

In 1974, about 500,000 tons of rice including 6,000 tons of the imports was consumed in whole Nigeria which means that per-capita consumption of rice is equivalent to about 7.0 kg. In view of the current shifting of dietary preference from root crops to rice, potential demand for rice would be considerably higher than the present consumption.

Under this situation, the anticipated demand for rice is forecasted on the basis of the present consumption assuming that the consumption of rice will increase corresponding to per-capita income increase and anticipated population growth with the following conditions:

a) Population in the country was 75 million in 1976 and will increase by 2.5% per annum;

b) Present per-capita consumption of rice is 7.0 kg and will increase by the rate of (income elasticity of demand) x (growth rate of per-capita income);

c) Income elasticity for rice is 0.6; and

d) Growth rate of per-capita income is 4.0%.

Results of the estimate are presented in Table 13. In the estimate, total demand for rice is expected to attain 815,200 tons in 1985 and 1,320,000 tons in 1995. The estimated figures are slightly lower than the figures estimated by Federal Ministry of Agriculture and Natural Resources /1 , which indicates that our estimate is within a reasonable range.

In order to meet the estimated demand, rice production should increase by around 5% per annum. In the Third National Development Plan, domestic production of rice is expected to grow at an annual rate of 14%. However, the expected growth rate seems to be too much ambitious in due consideration of the past trend and even 5% of the increase per annum could not be attainable without intensive support of the Government for the implementation of rice development projects.

Incremental rice production generated by the Auchi Project is about 8,700 tons in 1989. Taking into consideration of the existing potential demand for rice and its future increase, the increased amount will be readily absorbed into the economy with no significant impact on domestic price.

/1 "Agricultural Development in Nigeria 1973-1985" Federal Ministry of Agriculture and Natural Resources, Joint Planning Committee, Lagos 1974.

2) Price prospects

Farm gate prices of the food crops are estimated both for economic analysis and financial analysis.

Economic farm gate prices are estimated basically on the basis of the international market price. The prices of the tradable goods such as rice and maize are evaluated by using the border price /1 taking into account the transportation cost and marketing costs. The economic prices for non-tradable goods such as yam, cassava and cocoyam are estimated based on the production cost plus assumed mark up rate.

Financial farm gate prices are estimated on the basis of the current local market prices by deducting market overhead cost and transportation cost. With respect to the price of rice, the domestic price has increased considerably since 1973. According to the collected information, present local market price of milled rice is around ₦700 - 1,000/t, which is considerably high compared with the current international market price of ₦170 - 220/t/2. However, in due consideration of the existing strong demand and expected future demand, the present market condition will not change substantially and the relatively high price will continue in the future. Domestic inflationary trend will also sustain the current high price.

Under this assumptions, mill gate price of rice is estimated conservatively at ₦ 560/t and ₦ 394/t in terms of the finantial and economic prices, respectively. Farm gate price of paddy is also estimated at ₦ 308/t as the financial price and ₦ 251/t as the economic price.

The estimated financial and economic prices of the food crops are presented in Table 14.

The prices of the farm inputs are also estimated both for economically and financially applying the same method used in the estimate of the food crops. Results of the estimate are shown in Table 15.

4.5.2 Estimate of Irrigation Benefit

Project benefit consists of direct benefit and indirect benefit. Direct benefit is the expected net incremental value of the agricultural products through the implementation of the irrigation project, while indirect benefit includes the employment opportunity to be increased, transfer of knowledge and contribution to even income distribution and regional economy as a whole. For the economic evaluation of the project, only the direct benefit is incorporated for the conservativeness of the analysis.

The irrigation benefit is estimated by calculating the net incremental value, which is the difference of the total returns

/1 IBRD forecast price around 1985.
/2 Price of rice FOB Bangkok around 1976.

to be produced inthe project area between under future without-project condition and future with-project condition.

For the estimate of the irrigation benefit, net income of each crop per ha is firstly calculated on the basis of the estimated economic price and volume for inputs and outputs both on future without-project condition and future with-project condition. It is assumed that present agricultural condition will not change considerably and remain at the present level without introducing substantial investment in the agricultural infrastructure and/or institutions. Results of the calculation are presented in Table 35.

Total returns of agricultural production are calculated by applying the net income per crop estimated above to the cultivated area in the project area. The irrigation benefit for the Auchi Project is thus estimated at ₦ 1.925 million as the difference of the two total returns which is presented in Table 36.

Build-up period of the irrigation project is assumed at 5 years for the estate farm and 7 years for the small holder area after completion of the irrigation facilities during which the benefit will increase linearly.

4.6 Project Evaluation

4.6.1 General

Project evaluation is made to ascertain the feasibility of the project in view of economic, financial and socio-economic aspects.

The economic feasibility of the Auchi Project is evaluated by the internal rate of return on the basis of the economic construction cost and benefit. Sensitivity analysis is also made with respect to change in the project costs, productivity of rice and price of rice.

Financial evaluation is conducted both from the view points of farmers to be involved in the porject and the estate farm. Typical farm budget is analyzed to assess whether the project will have sufficient incentive to the farmers with enough income increase and to assess the capacity to pay. For ascertaining the financial soundness of the project for the project executing organization, profitability of the estate farm is assessed on the basis of the estimated project revenues and the operation cost, together with the assessment of financial rate of return.

Socio-economic inpacts of the project are breifly assesed in due consideration of the effect of the project on the regional economy.

4.6.2 Economic Evaluation

1) Economic project costs and benefits

Economic project costs

For the economic evaluation, economic construction costs are estimated by applying the following adjustments to the project costs (or financial costs) estimated in the preceding section:

a) Cost for the construction machineries is valued by their depreciation cost instead of the procurement cost;

b) Compensation costs for land acquisition are excluded;

c) Price contingency for the construction cost is excluded;

d) Shadow exchange rate of N1.0 = US$1.27 is applied instead of the official rate for conversions from US$ to N;

e) Wage of the unskilled labor is shadowed at 60% of the current wage rate; and

f) Import taxe on the construction machinery is excluded.

Through these adjustments, the economic construction costs of the Auchi Project are estimated at ₦14.56 million consisting of ₦8.164 million of foreign currency portion and ₦6.396 million of local currency portion. The estimated costs are summarized into Table 37 and its annual disbursement schedule is shown in Table 38.

Annual operation, maintenance and replacement costs are estimated at ₦465,000 at its full development stage.

Economic benefit

As explained in the preceding section, only the irrigation benefit is incorporated in the calculation of economic internal rate of return. The estimated benefit is ₦1.925 million at the full development stage of the project. The benefit will increase linearly after completion of the irrigation facilities and will attain the target amount in 1989.

2) IRR of the project

On the basis of the economic construction costs and benefit, economic internal rate of return (IRR) of the project is calculated for the project life of 30 years after completion of the project construction works. The estimated IRR is 7.1% which indicates that the project possesses relatively low economic viability.

Sensitivity analysis is made with respect to the increase in the project cost and reduction of the productivity of rice and its price. The results are presented in Table 39, which shows that the economy of the project is quite sensitive to the change in the productivity of rice and the price but not so sensitive to increase in the project costs.

4.6.3 Financial Analysis

Farm budget analysis

At present, typical farmer in the project area holding 1.5 ha gains ₦1,021 annually as the gross farm incomes and the net income is ₦92 per year.

Upon completion of the irrigation project, 1.2 ha of the irrigated land will be allocated to each farm family. The gross income is expected to increase considerably up to ₦3,166 at the full development stage through the introduction of the intensive irrigation farming. Farming expenses will increase in proportion to the increase in farm inputs dosage. Living expenses will also increase for the improvement of their living standard. Total expenses will amount to ₦2,016 for the typical farmer.

Annual net reserve or capacity to pay which is defined as the difference between the gross income and the total expenses will increase to ₦1,150 in the project area. The increased net reserve indicates that the typical farmers will have sufficient

capacity to pay for charges on the irrigation water and machinery services.

Profitability of the estate farm

Profitability of the estate farm is assessed on the basis of the estimated revenue and the operation cost including the depreciation cost of the investment cost.

The revenue for the estate farm consists of income from selling rice which includes the products both in the estate farm and in the small holder area and charges on the irrigation water and farm machinery services to be collected from farmers. Assuming that selling price of milled rice is ₦560/t and the charges to be imposed on the farmers shall cover the operation and maintenance cost for the irrigation facilities, farm machineries and rice mill, the expected annual revenue of the estate farm are estimated at ₦4.95 million at the full development stage.

The operation cost for the estate farm includes the production cost of rice, depreciation cost for the equipment and building facilities and operation and maintenance cost for the irrigation facilities and the project office. Purchasing cost of paddy from farmers is also included in the operation cost, which is valued at ₦308/t. The estimated annual operation cost of the estate farm is ₦2.8 million at the full development stage of the project.

Net profit of the estate farm is, thus, calculated at ₦2.15 million per year, the profit ratio to the project costs or total investment cost is 9.4%. Due to the low returns during the buildup period and the length to be required for the full development, the financial rate of return for the estate farm is 7.8%.

4.6.4 Socio-Economic Impacts

Besides the irrigation benefit, indirect benefits such as creation of employment opportunity, transfer of knowledge and experience, and contribution to regional economy are expected to be derived from the implementation of the project.

Creation of employment opportunity will be one of the valuable indirect benefits of the project implementation from the stage of the construction to the operation. About 248 permanent staffs and laborers will be employed in the Auchi Project Office together with 35,000 mandays of seasonal laborers per year. Increase in employment opportunity is expected on farm by introducing the intensive farming, which will provide the benefit for solving the unemployment problem in the region.

Transfer of knowledge and demonstration effect are another impacts on the economy. During the construction stage, local staffs will gain the experience in various work-fields, while the project staffs, extension workers and farmers in the project area will be trained intensively for acquiring the technics of the irrigation farming together with operation and maintenance of the farm machinery and equipment. Since the project is the first intensive irrigation paddy cultivation project with mechanized farming in the state, considerable demonstration effects will be extended to the region.

Increased agricultural production will contribute to solve the food crops shortage in the country and also contribute to increase in farm income. As the farm income is relatively lower than that in urban area, the increased farm income will contribute not only to enhance the regional income but also to even income distribution in the country.

All these effects mentioned above will contribute to promote the national policy described in the third development plan which includes even distribution of income, reduction of unemployment and increase in the food supply. Socio-economic stability is also expected to be facilitated in the region through the effects.

5 . CONCLUSIONS AND RECOMMENDATIONS

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Concludions

The Owerri Project in Imo State and the Auchi Project in Bendel State will not only contribute to the national rice production policy, but also improve drastically the prevailing subsistence level of agriculture thereby enhancing the living conditions of the inhabitants. In addition, the projects will be quite effective in demonstrating the intensive irrigated farming of rice culture to the surrounding regions.

The Owerri Project is technically sound and economically feasible. Financial viability of the project is also confirmed from the view points of the farmers economy to be involved and the estate farm. It is, therefore, recommended that further steps including the financial arrangement be taken soonest possible for the early implementation of the project.

The Auchi Project is also technically sound and seems to be barely feasible economically taking into account the socio-economic impacts and indirect benefits to be generated by the project although the economic internal rate of return is relatively lower than that of the Owerri Project. The relatively low financial rate of return indicates that the project requires the finance with rather soft conditions far the implementation of the project.

5.2 Recommendations

For successful implementation of the projects, it is recommended that the following steps are taken promptly:

(1) Maintenance and continuous observation of the water level guages at the proposed intake sites on the Oramirukuwa river and the Ojo river;

(2) Execution of farm survey in the project areas including population survey for the sake of land acquisition for the projects;

(3) Establishment of the proposed Project Coordination Commitee which shall make the necessary arrangement including the preparation of the finance of the projects;

(4) Preparation of detailed topographic maps for the project areas with a scale of 1:5,000 and a contour interval of at least 1m;

(5) Execution of the detailed design of the project works; and

(6) Recruitment of well-experienced foreign experts for design, construction supervision and operation of the projects.

TABLE

Table 1 Meteorological Data, Owerri Area

Item	Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total or Mean
Monthly Mean Rainfall /1	mm	23	47	121	198	268	302	360	301	419	281	75	23	2.418
Design Drought Monthly Rainfall	"	20	41	105	172	233	262	313	261	364	244	65	20	2.100
Numbers of Rainy Days /2	days	2	4	7	12	16	17	19	19	19	17	3	2	137
Monthly Mean Temperature (Maximum) /3	^{o}C	32	33	33	32	31	30	29	29	29	30	31	32	31
Monthly Mean Temperature (Mean) /3	"	26	28	27	27	27	26	25	25	26	26	27	26	26
Monthly Mean Temperature (Minimum) /3	"	20	22	22	22	22	22	22	22	22	22	22	20	22
Monthly Mean Relative Humidity /3	%	71	77	77	81	82	84	86	86	84	82	81	71	80
Monthly Mean Sunshine Hours /3	hours	5.9	5.6	5.1	5.8	5.5	4.6	2.9	2.5	2.7	3.8	5.4	5.9	4.6
Monthly Mean Wind Speed /3	km/day	91	114	117	108	100	113	113	132	127	111	87	92	109
Monthly Mean Piche Evaporation /3	mm	4	3	4	3	2	2	2	2	2	2	3	4	3
Monthly Mean Class A Pan Evaporation /4	mm	3.3	3.2	3.9	3.3	2.8	1.9	1.5	2.0	2.7	3.1	2.3	2.9	2.7

Note: /1 1907-1962, 1973-1976 Station : Owerri
/2 1973-1976 Station : Owerri
/3 1972-1976 Station : Umudike
/4 1976 Station : Umudike

Table 2 Discharge of the Oramirukwa River

Monthly Mean Discharge

(Unit : m^3/sec)

Year	J	F	M	A	M	J	J	A	S	O	N	D
1973	4.14	3.79	3.61	8.00	7.52	9.83	9.43	13.84	13.88	13.59	4.72	4.03
1974	3.50	3.26	3.12	6.83	7.54	8.72	8.92	8.46	9.28	9.47	4.24	3.95
1975	3.75	3.81	3.83	7.64	9.22	9.14	7.96	10.08	9.70	11.15	3.94	2.99
1976	2.65	2.82	3.03	5.52	6.70	9.85	8.06	6.51	8.46	13.02	4.58	2.90
Mean	3.51	3.42	3.40	7.00	7.75	9.39	8.59	9.72	8.22	11.80	4.37	3.47

Discharge under 20% Drought Condition

(Unit : m^3/sec)

Month	J	F	M	A	M	J	J	A	S	O	N	D
Discharge	2.90	2.75	2.65	6.37	5.91	7.93	7.44	11.01	11.31	10.80	3.65	3.15

Table 3 Required Farm Machinery for Owerri Project

Description		Required Numbers
1) Tractor and combine		
- Wheel type tractors	60PS class	30
- Wheel type tractors	40PS class	40
- Crawler type tractors	60PS class	5
- Crawler type tractors	40PS class	5
- Self-propelled type combines	100PS class	20
2) Other equipment and attachment		
- Disc plows	26" x 3	5
- Disc harrows	20" x 24	4
- Rotavators	1.8 - 2.0 m	28
- Broad casters	350 ℓ	9
- Swath sprayers	400 ℓ	16
- Dusters	35 kg	6
- Puddling rakes	3.0 m	9
- Rear-mounted mowers	1.8 - 2.0 m	8
- Dump trailers	2-ton	25
- Trucks	6-ton	5
- Tool bars	3.0 m	10
- Float wheels		20 (set)
3) Spare parts		L.S.
4) Service tools and equipments		L.S.

Table 4 Main Features of Rice Mill and Storage Facilities for Owerri Project

Main Features	Unit Capacity	Nos.	Total Capacity
1) Receiving equipment Paddy cleaners, receiving bins, etc.	3.5 t/hr	3	10.5 t/hr
2) Drying equipment Paddy dryers, tempering bins, etc.	10 t/hr	3	30 t/hr
3) Parboiling equipment Receiving hopper, soaking and steaming tanks, dryers, etc.	1 t/hr	3	3 t/hr
4) Milling equipment Rice milling unit, packing unit, etc.	1.5 t/hr	3	4.5 t/hr
5) Storage equipment Storage silos, aeration system, etc.	1,000 t	5	5,000 t
6) Power supplying plant Control panel, wiring materials, diesel generators.	200 KVA	3	600 KVA

Table 5 Features of Major Project Works, Owerri Project

Major Project Works	Unit	Quantity
1. Civil Works		
Headworks		
Concrete weir, length	m	42
-"- , height	"	5.5
-"- , volume	m3	3,500
Embankment	"	32,000
Max. intake discharge	m3/sec	3.0
Irrigation canals		
Head race	km	16.4
Secondary canal	"	11.4
Tertiary canal	"	50.6
Supply canal	"	219
Drainage canals		
Colllector drain	km	26
Field drain	"	110
Farm road		
Main farm road	km	20
Branch farm road	"	150
Paddy field construction	ha	2,100
2. Processing and Storage Facilities		
Rice mill buildings	m2	6,000
Rice mill (1.5 t/hr, 200 KVA)	Nos.	3
3. Office and Related Facilities		
Project office, garage and training center	m2	2,525
Housings for staff	m2	1,600
Warehouse, generator house and workshop	m2	2,550
Motor pool	m2	2,400

Table 6 Diversion Water Requirement of Owerri Project

(unit : m^3/sec)

Month	J	F	M	A	M	J	J	A	S	O	N	D
Requirement	1.6	2.5	1.4	0.5	0.1	0.2	0.4	0.2	0.4	-	1.5	1.5

Table 7 Project Cost for Owerri Project

(Unit: N1,000)

Item	Foreign currency	Local currency	Total	(N/ha)
1. Civil works	5,680	6,970	12,650	(6,024)
2. Processing, storage and office facilities	2,980	3,240	6,220	(2,962)
3. Initial farm investment	2,390	1,380	3,770	(1,795)
Total	11,050	11,590	22,640	(10,781)

Table 8 Annual Disbursement Schedule of Project Cost, Owerri Project

(Unit : ₦1,000)

Item	Total Cost			1977			1978			1979			1980			1981			1982			1983		
	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total
1. Civil works	5,680	6,970	12,650	231	27	258	2,828	382	3,210	812	1,828	2,640	855	2,148	3,003	465	1,237	1,702	489	1,348	1,837	-	-	-
2. Processing, storage, office facilities	2,980	3,240	6,220	-	291	291	-	874	874	-	160	160	960	1,885	2,845	-	-	-	1,093	-	1,093	957	-	957
3. Initial farm investment	2,390	1,380	3,770	-	-	-	-	-	-	-	-	-	723	332	1,055	852	494	1,346	815	554	1,369	-	-	-
Total	11,050	11,590	22,640	231	318	549	2,828	1,256	4,084	812	1,988	2,800	2,538	4,365	6,903	1,317	1,731	3,048	2,397	1,902	4,299	957	-	957

F.C. : Foreign currency in naira equipment

C.C. : Local currency

Table 9 Construction Cost of Civil Works for Owerri Project

(Unit: ₦1,000)

Work Item	Foreign currency	Local currency	Total
1. Preparatory works	-	26	26
2. Head works	63	91	154
3. Head race	125	372	497
4. Irrigation canals	133	1,261	1,394
5. Drainage canals	103	944	1,047
6. Roads	575	549	1,124
7. Reclamation	600	547	1,147
8. Construction machinery	2,290	-	2,290
Sub-total	3,889	3,790	7,679
9. Engineering services	770	570	1,340
10. Contingencies	1,021	2,610	3,631
Grand Total	5,680	6,970	12,650

Table 10 Construction Cost of Processing, Storage and Office Facilities, Owerri Project

Description	Unit	Quantity	Unit Cost (₦)	Amount (₦)
1. Project office	m^2	1,500	144	216,000
2. Garage	"	800	45	36,000
3. Training center	"	200	144	29,000
4. Weather station	"	25	45	1,000
5. Houses for senior staff	"	600	190	114,000
6. Dormitory	"	1,000	190	190,000
7. Warehouse	"	1,800	71	128,000
8. Generator house	"	450	339	153,000
9. Workshop	"	300	190	57,000
10. Motor pool	"	2,400	45	109,000
11. Rice mill buildings	"	6,000		1,174,000
i) Receiving, clearing & drying house	"	1,800	263	(473,000)
ii) Parboiling house	"	1,800	280	(504,000)
iii) Milling house	"	200	207	(41,000)
iv) Storage house	"	2,200	71	(156,000)
12. Rice mill	LS			2,102,000
13. Contingencies	"			1,911,000
Total				6,220,000

Table 11 Initial Farm Investment, Owerri Project

(Unit: N1,000)

Item		Amount
1)	Farm inputs	
	Seed	43
	Fertilizer	
	- Compund	88
	- Urea	62
	Agro-chemicals	
	- Fungicide	265
	- Insecticide	35
	- Herbicide	335
	Sub-total	828
2)	Farm machinery	1,733
3)	Contingencies	1,209
	Total	3,770

Table 12 Annual Operation and Maintenance Cost for Owerri Project

(Unit: ₦1,000)

Item	Amount
1. Irrigation & drainage facilities including road	206
2. Project office & related facilities	10
3. Personnel expenses	
i) Nigerian staff	81
ii) Foreign experts/1	200
Total	497

/1 Operation guidance by foreign experts will cover the first three years of operation.

Table 13 Demand Forecast of Rice

Year	Per-Capita Consumption (kg)	Population (10^3)	Total-Demand (t)	Year	Per-Capita Consumption (kg)	Population (10^3)	Total-Demand (t)
1976	7.0	75,000	525,000	91	10.0	108,600	1,086,000
77	7.2	76,900	553,700	92	10.2	111,300	1,135,300
78	7.3	78,800	575,200	93	10.5	114,100	1,198,100
79	7.5	80,800	606,000	94	10.7	117,000	1,251,900
80	7.7	82,800	637,600	95	11.0	120,000	1,320,000
81	7.9	84,900	670,700	96	11.2	122,900	1,376,500
82	8.1	87,000	704,700	97	11.5	126,000	1,449,000
83	8.3	89,000	738,700	98	11.8	129,100	1,523,400
84	8.5	91,000	773,500	99	12.1	132,300	1,600,800
85	8.7	93,700	815,200	2000	12.4	135,700	1,682,700
86	8.9	96,000	854,400	01	12.7	139,000	1,765,300
87	9.1	98,400	895,400	02	13.0	142,500	1,852,500
88	9.3	100,900	938,400	03	13.3	146,100	1,943,100
89	9.5	103,400	982,300	04	13.6	149,700	2,035,900
90	9.8	106,000	1,038,800	05	13.9	153,500	2,133,700

Table 14 Economic and Financial Farm Gate Price of Food Crops

(N/t)

	Financial Price/1	Economic Price /2
Yam	232	175
Cassava	63	50
Maize	184	164
Cocoyam	136	102
Rice (Paddy)/3	560(308)	394(251)

/1 Financial farm gate price is estimated on the basis of the recent domestic retail price collected in the project areas taking into account the market overhead cost, transportation and assembly cost.

/2 Economic farm gate price for internationally traded crops is estimated on the basis of the forecasted international price prepared by IBRD taking into account the transportation and marketing costs. The price for non-traded crops such as yam, cassava and cocoyam is estimated by assumed crop profit calculations.

/3 Price of rice is mill gate price while price of paddy is farm gate price.

Table 15 Economic and Financial Price of Farm Inputs

(N/t)

	Economic/1	Financial/2
Seed		
Paddy	251	308
Yam	175	290
Cassava	-	-
Maize	164	230
Cocoyam	102	170
Fertilizer		
Urea	230	230
Compound	166	210
Chemicals		
Fungicide	3.5N/kg	4.2N/kg
Insecticide	4.5N/kg	5.6N/l
Herbicide	1.9N/kg(4.0N/l)	2.4N/kg(5.0N/l)
Farm Labor	1.2N/manday	2.0N/manday

/1 Estimated basically on the basis of the international market price forecasted by IBRD.

/2 Estimated on the basis of the current market price.

Table 16 Net Income per Ha in the Owerri Project Area

(N/ha)

Kind of Crops	Future Without-Project			Future With-Project		
	Gross Returns /1	Production Costs /2	Net Income	Gross Returns /1	Production Costs /3	Net Income
Rice /4						
Direct sowing	-	-	-	1,241.1	494.2	746.9
Transplanting	-	-	-	1,379	575.0	804
Yam	1,225	673	552			
Cassava	375	144	231	-	-	-
Maize	98	26	72	-	-	-
Cocoyam	316	142	174	-	-	-

/1 Economic price of the crop (N/t) multiplied by crop production per ha (t/ha).

/2 Including the cost mainly for seed and labor.

/3 Including the cost for farm inputs and operation and maintenance costs for farm machineries, rice mill and storage facilities.

/4 The net income for rice is calculated using mill gate price of rice.

Table 17 Estimate of Irrigation Benefit, Owerri Project

Kind of Crops	With-Project			Without-Project			(3)-(6) Net Incremental Income
	(1) Cult. Area (ha)	(2) Net Income (₦/ha)	(3) Total Return (₦)	(4) Cult. Area (ha)	(5) Net Income (₦/ha)	(6) Total Return (₦)	(₦)
Paddy							
Direct sowing	2,030	746.9	1,516,210	-	-	-	1,516,210
Transplanting	2,170	804	1,744,680	-	-	-	1,744,680
Yam	-	-	-	240	552	132.480	-132,480
Cassava	-	-	-	720	231	166,320	-166,320
Maize	-	-	-	320	72	23,040	- 23,040
Cocoyam	-	-	-	70	174	12.180	- 12,180
Total	4,200		3,260,890	1,350		334,020	2,926,870 (≒2,927,000)

Table 18 Economic Construction Cost of the Owerri Project

(Unit: N1,000)

Cost Item	Foreign Currency	Local Currency	Total
Civil Works	3,560	3,790	7,350
Rice Mill, Storage Facilities and Office Facilities	2,746	2,024	4,770
Initial Farm Investment	2,250	-	2,250
Total	8,556	5,814	14,370

Table 19 Annual Disbursement of Economic Construction Cost, Owerri Project

(Unit: ₦1,000)

Item	Total Cost	1977	1978	1979	1980	1981	1982	1983
Civil works								
1) Construction works	5,169	7	259	1,568	1,756	789	790	-
2) Engineering services, & administration	1,525	299	306	317	250	180	173	-
3) Physical contingency	656	-	34	200	224	99	99	-
Sub-Total	7,350	306	599	2,085	2,230	1,068	1,062	-
Processing, storage, officee facilities								
1) Processing facilities	3,554	-	-	-	1,866	-	927	761
2) Workshop & storage facilities	147	-	147	-	-	-	-	-
3) Office and related facilities	678	203	386	89	-	-	-	-
4) Physical contingency	391	30	80	13	184	-	46	38
Sub-Total	4,770	233	613	102	2,050	-	973	799
Initial farm investment								
1) Agricultural machinery	2,142	-	-	-	691	764	687	-
2) Farm inputs	-	-	-	-	-	-	-	-
3) Physical contingency	107	-	-	-	36	38	34	-
Sub-Total	2,250	-	-	-	727	802	721	-
Grand Total	14,370	539	1,212	2,187	5,007	1,870	2,756	799

Table 20 Sensitivity Analysis of the Owerri Project

Case	Project Cost	Productivity of Rice	Price of Rice	IRR (%)
1)	0	0	0	12.0
2)	+5%	0	0	11.3
3)	+10%	0	0	10.7
4)	0	-10%	0	9.4
5)	0	-20%	0	6.0
6)	0	0	-10%	9.4
7)	0	0	-20%	6.0
8)	+5%	-10%	-10%	7.2

Note: Project Cost :
0 = Original estimate of N14,37 million
+5% = N15.09 million
+10% = N15.81 million

Productivity of Rice:
0 = Original estimate of 5.0 t/ha for transplanting and 4.5 t/ha for direct sowing
-10% = 4.5 t/ha for transplanting and 4.0 t/ha for direct sowing
-20% = 4.0 t/ha for transplanting and 3.6 t/ha for direct sowing

Price of Rice :
0 = Original estimate of N394/t for milled rice
-10% = N355/t for milled rice
-20% = N315/t for milled rice

Table 21 Typical Farm Budget in the Owerri Project Area (Future With-Project)

	Cult. Area (ha)	Unit Yield (t/ha)	Total Yield (t)	Unit Price (₦/t)	Total Value (₦)
Average Farm Size		(1.2 ha)			
I. Gross Income					
1. Food crops					
Wet season paddy	1.2	5.0	6.0	308	1,848
Dry season paddy	1.2	5.0	6.0	308	1,848
(Sub-total)					(3,696)
2. Tree crops and others					46
Total Gross Income					3,742

	Area (ha)	Unit Amount (kg/ha)	Total Amount (kg)	Unit Price (₦/kg)	Total Cost (₦)
II. Gross Outgo					
1. Farming expenses					
Seed	2.4	35	84	0.31	26.0
Fertilizer					
Urea	2.4	129	309.6	0.23	71.2
Compound	2.4	200	480	0.21	100.8
Chemicals					
Insecticide	2.4	3 ℓ/ha	7.2 ℓ	5.6 ₦/ℓ	40.3
Fungicide	2.4	30	72	4.2	302.4
Herbicide	2.4	70	168	2.4	403.2
(Sub-total)					(943.9)
2. Living expenses					
Food consumption/1					781
Other living expenses					360
(Sub-total)					(1,141)
Total Gross Outgo					2,084.9
III. Net Reserve					1,657.1

/1 Includes the value of food crops which are produced by farmers themselves.

Table 22 Project Revenue and Cost, Owerri Project

Item	Amount (₦1,000)
I) Project Revenue	
1) Sales of rice 13,670 t/1 x ₦560/t	7,655
2) Machinery & water charge 2,170 ha x ₦210/ha/2	456
Total	8,111
II) Operation Cost	
1) Production cost	
- Farm inputs 2,030 ha x ₦395.3/ha	802
- Farm machinery cost	523
- Rice mill & storage	205
- Depreciation cost /3	375
Sub-total	1,905
2) O & M cost /4 4,200 ha x ₦70.8	297
3) Purchasing cost of paddy from farmer (10,850 - 460)t x ₦308/t	3,200
Total	5,402
III) Net Profit	2,709

/1 Rice production (13,990 t) - Self consumption of farmers (320 t) = 13,670 t

/2

O & M cost for irrigation	:	₦70.8/ha
O & M cost for farm machinery	:	₦83.4/ha
O & M cost for rice mill & storage facilities	:	₦51.3/ha
Total		₦205.5/ha ≒ ₦210/ha

/3 Includes the depreciation cost for the farm machineries, rice mill and building facilities.

/4 Inclues OM cost for irrigation facilities and project offices.

Table 23 Meteorological Data, Auchi Area

Item	Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total or Mean
Monthly Mean Rainfall /1	mm	6	20	64	138	164	178	180	134	189	136	20	7	1,236
Design Drought Monthly Rainfall	"	5	17	54	117	140	151	153	114	161	115	17	6	1,050
Numbers of Rainy Days /1	days	1	2	6	9	9	12	15	12	12	9	2	1	90
Monthly Mean Temperature /2	°C	23	26	27	26	26	25	24	24	24	25	25	22	25
Monthly Mean Relative Humidity /3	%	55	64	69	72	80	77	80	80	76	81	74	61	72
Monthly Mean Sunshine Hours, /4 (at Benin Nifor)	hours	6.1	6.4	5.6	6.0	6.1	5.0	4.2	3.3	3.4	4.8	6.8	6.8	5.4
Monthly Mean Sunshine Hours, /4 (at Lokaja)	"	7.2	7.8	7.4	6.9	7.1	6.1	5.3	4.3	5.3	6.6	8.3	7.8	6.6
Monthly Mean Wind Speed /4	km/day	88	132	112	111	86	66	103	88	71	58	47	49	84
Monthly Mean Class A Pan Evaporation /3	mm	6.2	6.9	7.2	6.9	5.8	4.6	3.7	3.5	4.0	3.6	4.5	4.9	5.2

Note : /1 1961 - 1976 Station : Auchi
/2 1974 - 1976 Station : Irrua
/3 1976 Station : Warrake
/4 Date Period : 1951 - 1960, 1971 - 1975

Table 24 Discharge of the Ojo River under 20% Probable Drought Condition

(Unit : m^3/sec)

Month	J	F	M	A	M	J	J	A	S	O	N	D
Discharge	0.43	0.36	0.30	1.22	1.12	1.57	1.46	2.28	2.35	2.23	0.60	0.50

Table 25 Required Farm Machinery for Auchi Project

Description		Required Numbers
1) Tractor and combine		
- Wheel type tractors	60PS class	27
- Wheel type tractors	40PS class	40
- Crawler type tractors	60PS class	3
- Crawler type tractors	40PS class	3
- Self-propelled type combines	100PS class	16
2) Other equipment and attachment		
- Disc plows	26" x 3	7
- Disc harrows	20" x 24	5
- Rotavators	1.8 x 2.0 m	20
- Broad casters	350 ℓ	7
- Swath sprayers	400 ℓ	16
- Dusters	35 kg	5
- Puddling rakes	3.0 m	6
- Rear-mounted mowers	1.8 ~ 2.0 m	6
- Dump trailers	2-ton	20
- Trucks	6-ton	5
- Tool bars	3.0 m	10
- Float wheels		15 (set)
3) Spare parts		L.S.
4) Service tools and equipments		L.S.

Table 26 Main Features of Rice Mill and Storage Facilities for Auchi Project

Main Features	Unit Capacity	Nos.	Total Capacity
1) Receiving equipment Paddy cleaners, receiving bins, etc.	3 t/hr	3	9 t/hr
2) Drying equipment Paddy dryers, tempering bins, etc.	10 t/hr	3	30 t/hr
3) Parboiling equipment Receiving hopper, soaking and steaming tanks, dryers, etc.	0.6 t/hr	3	1.8 t/hr
4) Milling equipment Rice milling unit, packing unit, etc.	1 t/hr	3	3 t/hr
5) Storage equipment Storage silos, aeration system, etc.	1,000 t	5	5,000 t
6) Power supplying plant Control panel, wiring materials, diesel generators.	200 KVA	3	600 KVA

Table 27 Features of Major Project Works, Auchi Project

Major Project Works	Unit	Quantity
1. Civil Works		
Headworks		
Concrete weir, length	m	45
-"- , height	"	5.5
-"- , volume	m3	1,500
Embankment	"	270
Max. intake discharge	m3/sec	1.5
Irrigation canals		
Head race	km	11.7
Main canal	"	7.0
Secondary canal	"	18.6
Tertiary canal	"	46.1
Supply canal	"	219
Drainage canals		
Collector drain	km	31.8
Field drain	"	105.0
Farm road		
Main farm road	km	23.4
Branch farm road	"	155
Paddy field construction	ha	2,100
2. Processing and Storage Facilities		
Rice mill buildings	m2	5,300
Rice mill (1.0 t/hr, 200 KVA)	Nos.	3
3. Office and Related Facilities		
Project office, garage and training center	m2	2,525
Housings for staff	m2	1,600
Warehouse, generator house and workshop	m2	2,550
Motor pool	m2	2,200

Table 28 Diversion Water Requirement of Auchi Project

(Unit : m^3/sec)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Requirement	0.3	0.3	0.2	0.6	0.9	0.8	1.1	1.1	0.5	0.3	0.6	0.4

Table 29 Project Cost for Auchi Project

(Unit: ₦1,000)

Item	Foreign currency	Local currency	Total	(₦/ha)
1. Civil works	6,110	8,050	14,160	(6,743)
2. Processing and storage facilities	2,580	2,910	5,490	(2,614)
3. Initial farm investment	1,880	1,390	3,270	(1,557)
Total	10,570	12,350	22,920	(10,914)

Table 30 Annual Disbursement Schedule of Project Cost, Auchi Project

(Unit: N1,000)

Item	Total Cost			1977			1978			1979			1980			1981			1982			1983		
	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total
1. Civil works	6,110	8,050	14,160	270	39	309	2,868	570	3,438	1,074	2,516	3,590	755	1,857	2,612	557	1,483	2,040	586	1,585	2,171	-	-	-
2. Processing, storage, office facilities	2,580	2,910	5,490	-	291	291	-	873	873	-	147	147	848	1,599	2,447	906	-	906	-	-	-	826	-	826
3. Initial farm investment	1,880	1,390	3,270	-	-	-	-	-	-	359	190	549	269	185	454	481	371	852	1,530	1,394	2,924	241	250	491
Total	10,570	12,350	22,920	270	330	600	2,868	1,443	4,311	1,433	2,853	4,286	1,872	3,641	5,513	1,944	1,854	3,798	1,116	1,979	3,095	1,067	250	1,317

F.C. : Foreign currency in naira equipment

C.C. : Local currency

Table 31 Construction Cost of Civil Works for Auchi Project

(Unit: ₦1,000)

Work item	Foreign currency	Local currency	Total
1. Preparatory works	-	32	32
2. Head works	23	57	80
3. Head race	105	272	377
4. Irrigation canals	185	1,333	1,518
5. Drainage canals	96	1,259	1,355
6. Roads	607	575	1,182
7. Reclamation	896	889	1,785
8. Construction machinery	2,230	-	2,230
Sub-total	4,142	4,417	8,559
9. Engineering services	840	660	1,500
10. Contingencies	1,128	2,973	4,101
Grand total	6,110	8,050	14,160

Table 32 Construction Cost of Processing, Storage and Office Facilities, Auchi Project

Description	Unit	Quantity	Unit Cost (₦)	Amount (₦)
1. Project office	m^2	1,500	144	216,000
2. Garage	"	800	45	36,000
3. Training center	"	200	144	29,000
4. Weather station	"	25	45	1,000
5. Houses for senior staff	"	600	190	114,000
6. Dormitory	"	1,000	190	190,000
7. Warehouse	"	1,800	71	128,000
8. Generator house	"	450	339	153,000
9. Workshop	"	300	191	57,000
10. Motor pool	"	2,200	45	100,000
11. Rice mill buildings	"	5,300		999,000
i) Receiving, clearing & drying house	"	1,800	263	(473,000)
ii) Parboiling house	"	1,200	280	(336,000)
iii) Milling house	"	200	207	(41,000)
iv) Storage house	"	2,100	71	(149,000)
12. Rice mill	LS			1,848,000
13. Contingencies	"			1,619,000
Total				5,490,000

Table 33 Initial Farm Investment, Auchi Project

(Unit: ₦1,000)

Item	Amount
1) Farm inputs	
Seed	59
Fertilizer	
- Compound	88
- Urea	62
Agro-chemicals	
- Fungicide	265
- Insecticide	35
- Herbicide	320
Sub-total	829
2) Farm machinery	1,371
3) Contingencies	1,070
Total	3,270

Table 34 Annual Operation and Maintenance Cost for Auchi Project

(Unit: ₦1,000)

Item	Amount
1. Irrigation & drainage facilities including road	224
2. Project office & related facilities	10
3. Personnell expenses	
i) Nigerian staff	81
ii) Foreign exports /1	150
Total	465

/1 Operation guidance by foreign experts will cover the first three years of operation.

Table 35 Net Income per Ha in the Auchi Project Area

(N/ha)

Kind of Crops	Future Without-Project			Future With-Project		
	Gross Returns /1	Production Costs /2	Net Income	Gross Returns /1	Production Costs /3	Net Income
Rice /4						
Direct sowing	301	81	220	1,241.1	506.6	734.5
Transplanting	-	-	-	1,379	595.1	783.9
Yam	1,278	673	605	-	-	-
Cassava	375	144	231	-	-	-
Maize	180	50	130	-	-	-

/1 Economic price of the crop (N/t) multiplied by crop production per ha (t/ha).

/2 Including the cost mainly for seed and labor.

/3 Including the cost for farm inputs and operation and maintenance costs for farm machineries, rice mill and storage facilities.

/4 The net income for rice on future without-project condition is calculated using farm gate price of paddy, while that of future with-project condition is calculated using mill gate price of rice.

Table 36 Estimate of Irrigation Benefit, Auchi Project

Kind of Crops	With-Project			Without-Project			(3)-(6) Net Incremental Income (₦)
	(1) Cult. Area	(2) Net Income	(3) Total Return	(4) Cult. Area	(5) Net Income	(6) Total Return	
Paddy							
Direct sowing	2,200	734.5	1,615,900	100	220	22,000	1,615,900
Transplanting	500	783.9	391,950	-	-	-	391,950
Yam	-	-	-	40	605	24.200	-24,200
Cassava	-	-	-	120	231	27.720	-27,720
Maize	-	-	-	70	130	9,100	- 9,100
Total	2,700		2,007,850	330		83,020	1,924,830 (≒1,925,000)

Table 37 Economic Construction Cost of the Auchi Project

(Unit: ₦1,000)

Cost Item	Foreign Currency	Local Currency	Total
Civil Works	3,970	4,530	8,500
Rice Mill, Storage Facilities and Office Facilities	2,414	1,866	4,280
Initial Farm Investment	1,780	-	1,780
Total	8,164	6,396	14,560

Table 39 Sensitivity Analysis of the Auchi Project

Case	Project Cost	Productivity of Rice	Price of Rice	IRR (%)
1)	0	0	0	7.1
2)	+5%	0	0	6.6
3)	+10%	0	0	6.1
4)	0	-10%	0	4.7
5)	0	0	-10%	4.7

Note: Project Cost :
0 = Original estimate of ₦14.56 million
+5% = ₦15.29 million
+10% = ₦16.02 million

Productivity of Rice :
0 = Original estimate of 5.0 t/ha for transplanting and 4.5 t/ha for direct sowing
-10% = 4.5 t/ha for transplatning and 4.0 t/ha for direct sowing

Price of Rice :
0 = Original estimate of ₦394/t for milled rice
-10% = ₦355/t for milled rice

Table 38 Annual Disbursement of Economic Construction Cost, Auchi Project

(Unit: ₦1,000)

Item	Total Cost	1977	1978	1979	1980	1981	1982	1983
Civil works								
1) Construction works	6,032	16	368	2,202	1,468	989	989	-
2) Engineering services, & administration	1,680	346	388	319	269	247	111	-
3) Physical contingency	788	5	50	286	191	128	128	-
Sub-Total	8,500	367	806	2,807	1,928	1,364	1,228	-
Processing, storage, office facilities								
1) Processing facilities	3,099	-	0	-	1,621	821	-	657
2) Workshop & storage facilities	147	-	147	-	-	-	-	-
3) Office and related facilities	670	202	388	80	-	-	-	-
4) Physical contingency	364	33	80	12	165	41	-	33
Sub-Total	4,280	235	615	92	1,786	862	-	690
Initial farm investment								
1) Agricultural machinery	1,694	-	-	369	258	431	447	189
2) Farm inputs	-	-	-	-	-	-	-	-
3) Physical contingency	86	-	-	18	13	22	23	10
Sub-Total	1,780	-	-	387	271	453	470	199
Grand Total	14,560	602	1,421	3,286	3,985	2,679	1,698	889

Table 40 Typical Farm Budget in the Auchi Project Area (Future With-Project)

	Cult. Area (ha)	Unit Yield (t/ha)	Total Yield (t)	Unit Price (₦/t)	Total Value (₦)
Average Farm Size		(1.2 ha)			
I. Gross Income					
1. Food crops					
Wet season paddy	1.2	5.0	6.0	308	1,848
Dry season paddy	0.8	5.0	4.0	308	1,232
(Sub-total)					(3,080)
2. Tree crops and others					86
Total Gross Income					3,166

	Area (ha)	Unit Amount (kg/ha)	Total Amount (kg)	Unit Price (₦/kg)	Total Cost (₦)
II. Gross Outgo					
1. Farming expenses					
Seed	2.0	35	70	0.31	21.7
Fertilizer					
Urea	2.0	129	258	0.23	59.3
Compound	2.0	200	400	0.21	84
Chemicals					
Insecticide	2.0	3 ℓ/ha	6 ℓ	5.6 ₦/ℓ	33.6
Fungicide	2.0	30	60	4.2	252
Herbicide	2.0	70	140	2.4	336
(Sub-total)					(786.6)
2. Living expenses					
Food consumption /1					841
Other living expenses					388
(Sub-total)					(1,229)
Total Gross Outgo					2,015.6
III. Net Reserve					1,150.4

/1 Includes the value of food crops which are produced by farmers themselves.

Table 41 Project Revenue and Cost (Auchi Project)

Item		Amount (₦1,000)
I) Project Revenue		
1) Sales of rice	8,590 t/1 x ₦560/t	4,810
2) Machinery & water charge	500 ha x ₦270/ha/2	135
Total		4,945
II) Operation Cost		
1) Production cost		
- Farm inputs	2,200 ha x ₦395.3/ha	870
- Farm machinery cost		417
- Rice mill & storage		147
- Depreciation cost /3		318
Sub-total		1,752
2) O & M cost /4	2,700 ha x ₦116.7	315
3) Purchasing cost of paddy from farmer	(2,500 - 130)t x ₦308/t	730
Total		2,797
III) Net Profit		2,148

/1 Rice production (8,680 t) - Self consumption of farmers (90 t) = 8,590 t

/2

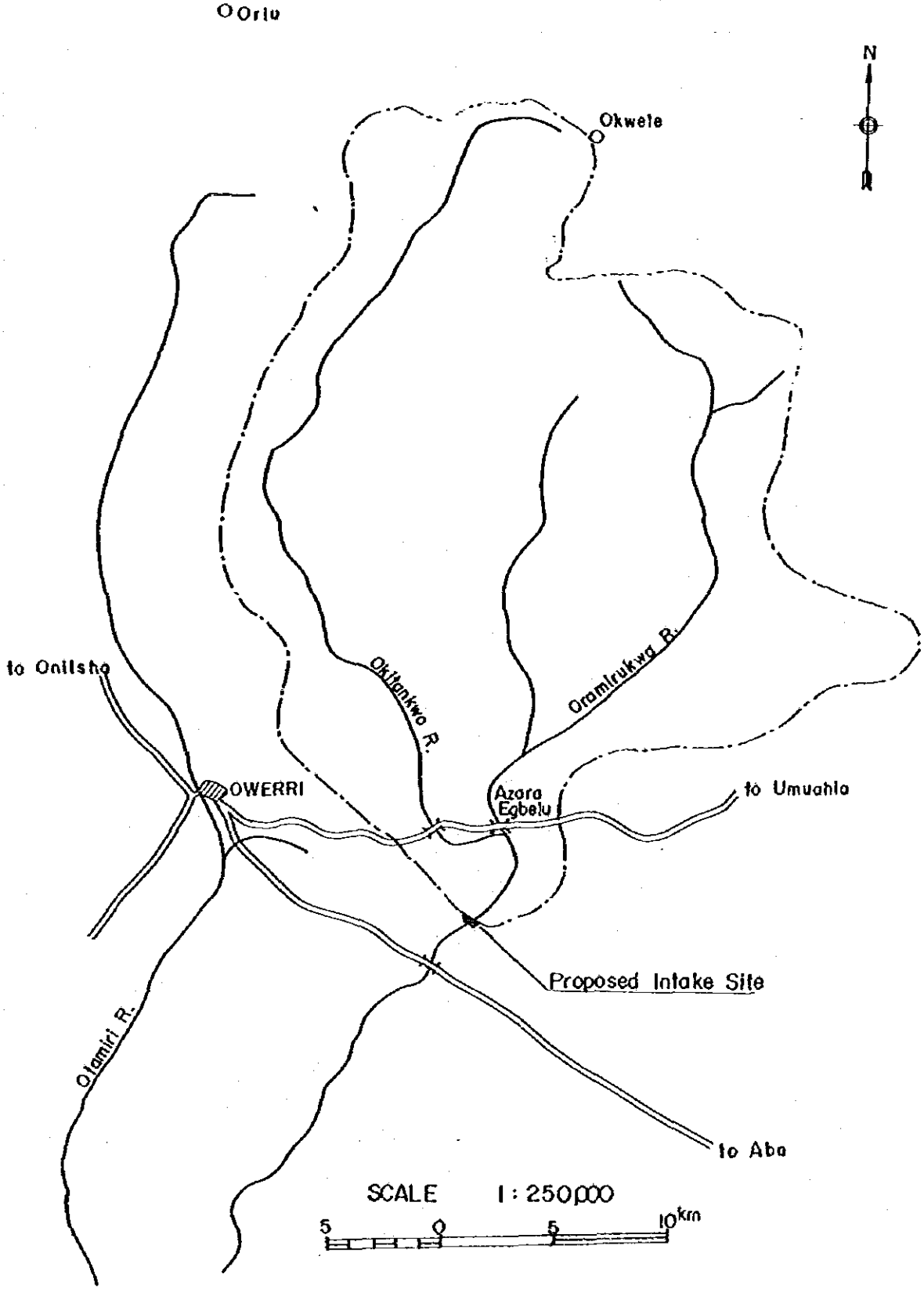
O & M cost for irrigation	:	₦116.7/ha
O & M cost for farm machinery	:	₦ 97.4/ha
O & M cost for rice mill & storage facilities	:	₦59.3/ha
Total		₦273.4/ha ≒ ₦270/ha

/3 Includes the depreciation cost for the farm machineries, rice mill and building facilities.

/4 Includes OM cost for irrigation facilities and project offices.

FIGURE

Fig. 1 Oramirukwa River Basin



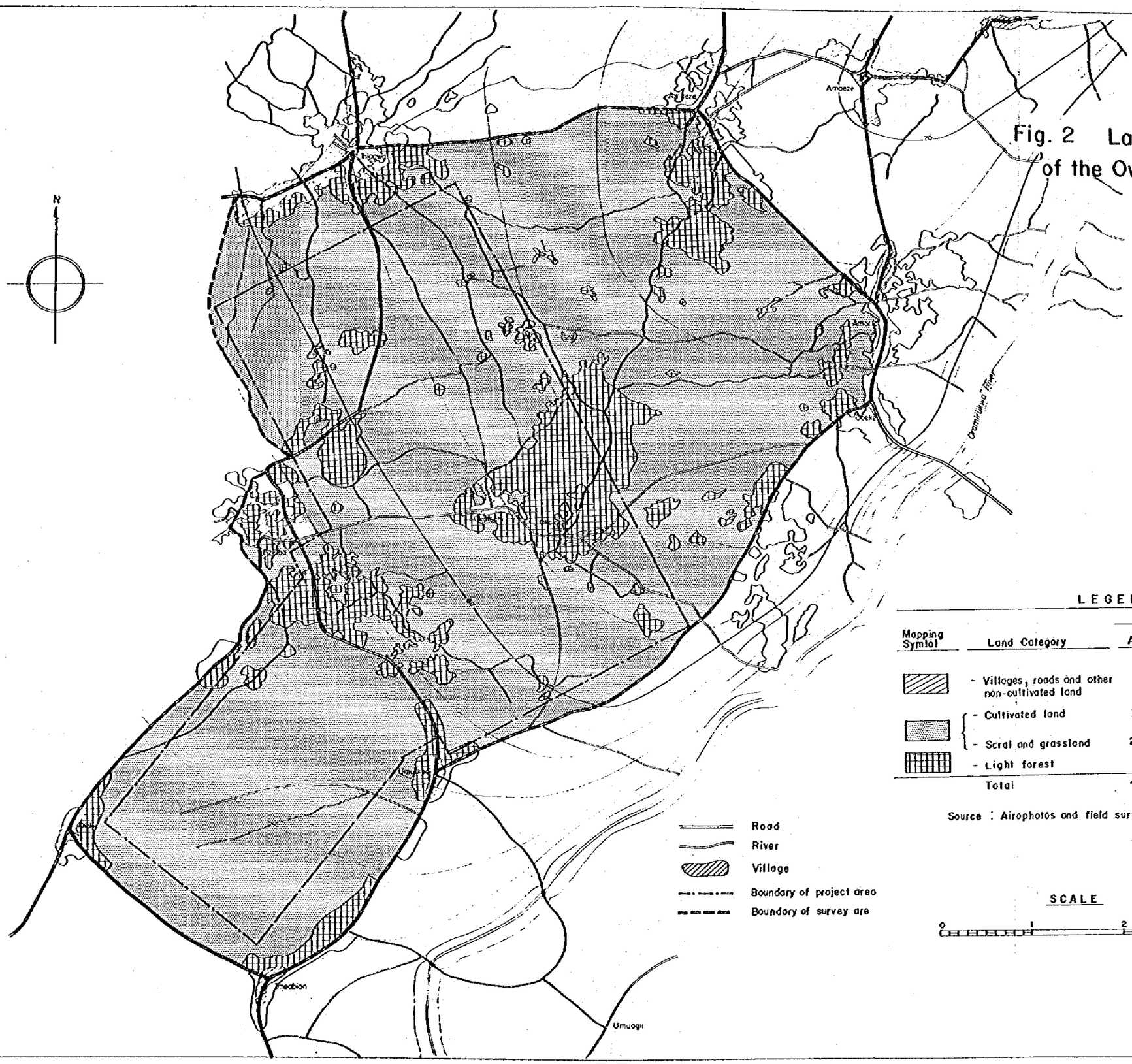


Fig. 2 Land Use Map of the Owerri Project Area

LEGEND

Mapping Symbol	Land Category	Survey Area Area (ha)	Survey Area Proportional Extent (%)	Project Area Area (ha)	Project Area Proportional Extent (%)
	- Villages, roads and other non-cultivated land	90	2	30	1
	- Cultivated land	1,250	25	720	28
	- Scrub and grassland	2,510	57	1,460	56
	- Light forest	750	16	390	15
	Total	4,600	100	2,600	100

Source : Airophotos and field survey

Road
River
Village
Boundary of project area
Boundary of survey are

SCALE

0 1 2 3 km

Fig. 3 Typical Cropping Calendar of the Major Crops

(Owerri Project Area)

	J	F	M	A	M	J	J	A	S	O	N	D
Cassava				x	o		o			x		
Yam			o			o			x			x
Maize			o			o		x			x	
Cocoyam		x			o			o			x	

Remarks: o——o Seeding period

x——x Harvesting period

Source : Data from Regional Agricultural Office and farm survey

Fig. 4 Proposed Cropping Pattern

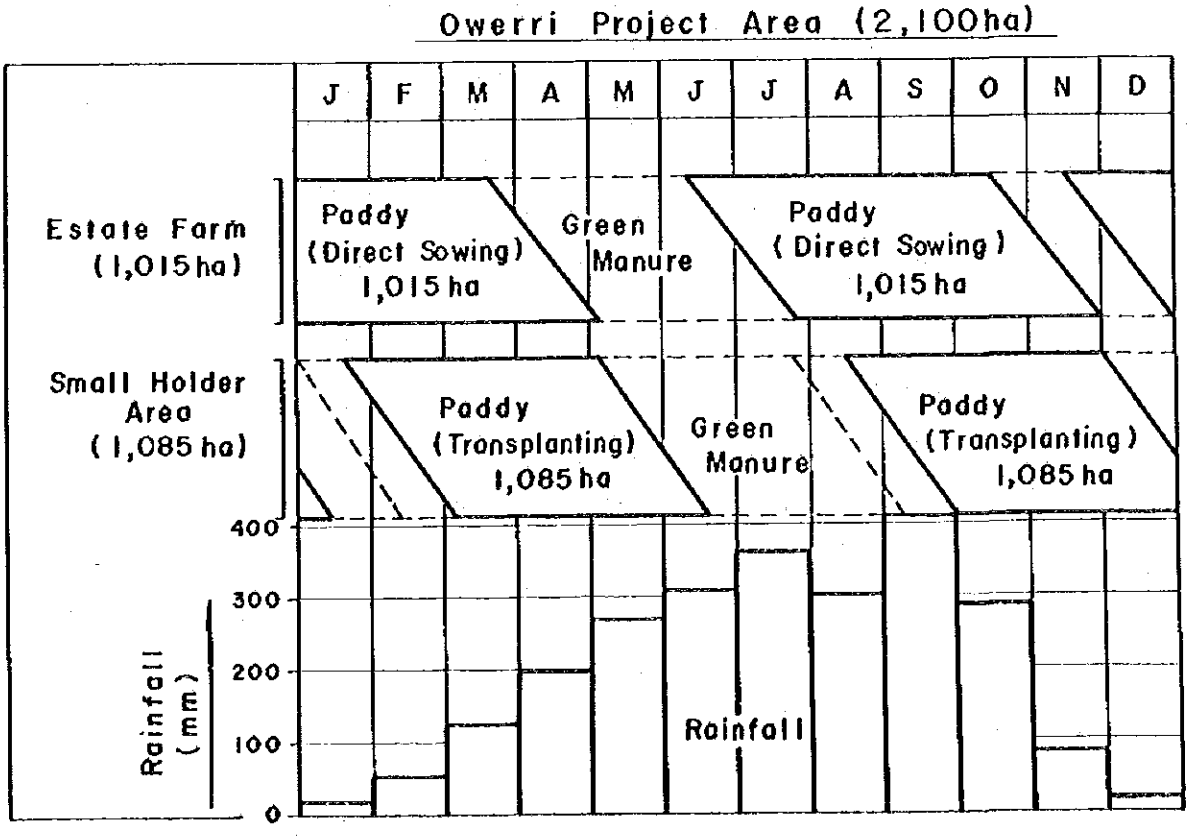
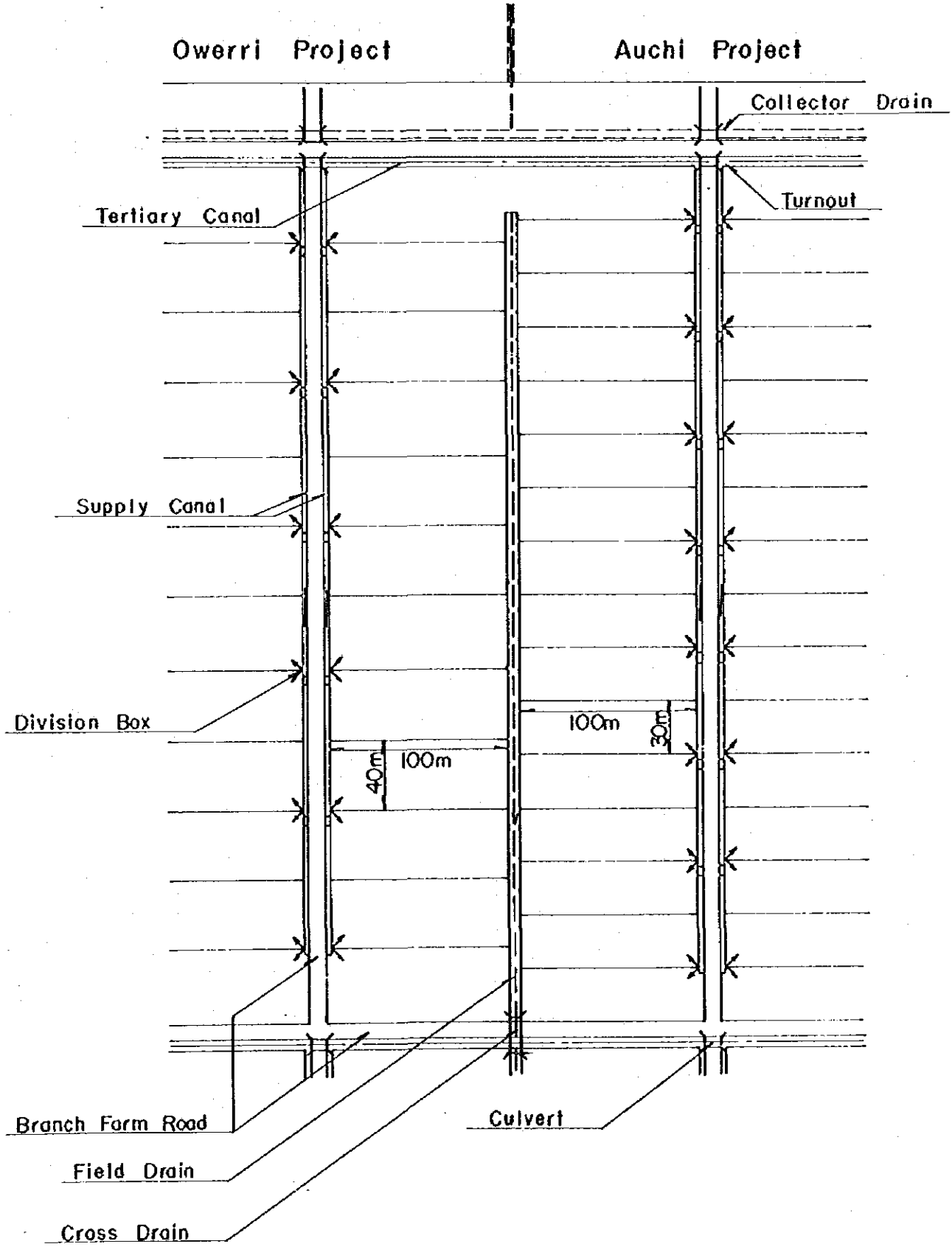


Fig. 5 Typical Layout of Farm Unit



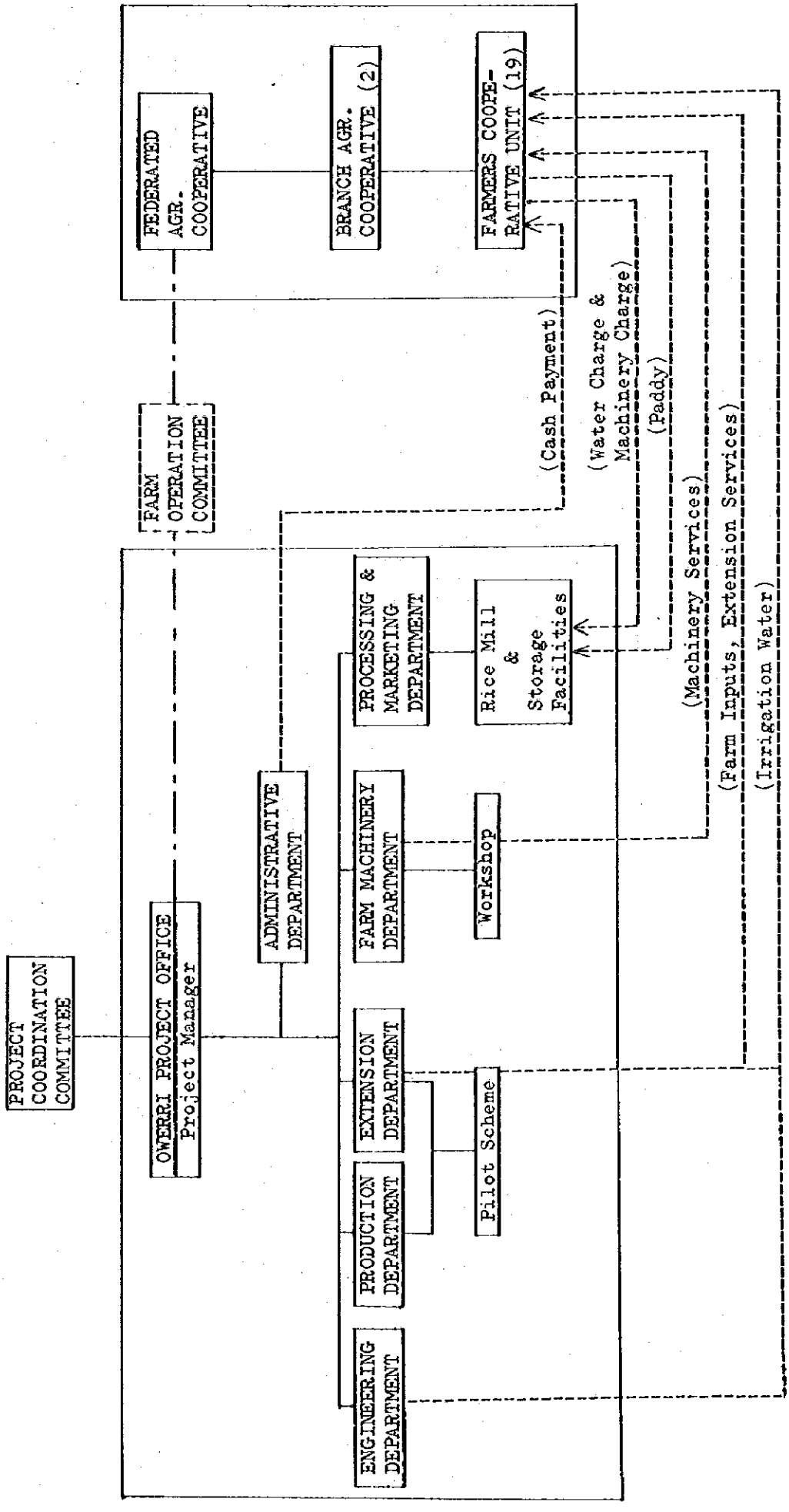


Fig. 6 Proposed Organization for Owerri Project

Fig. 7 Implementation Schedule for Owerri Project

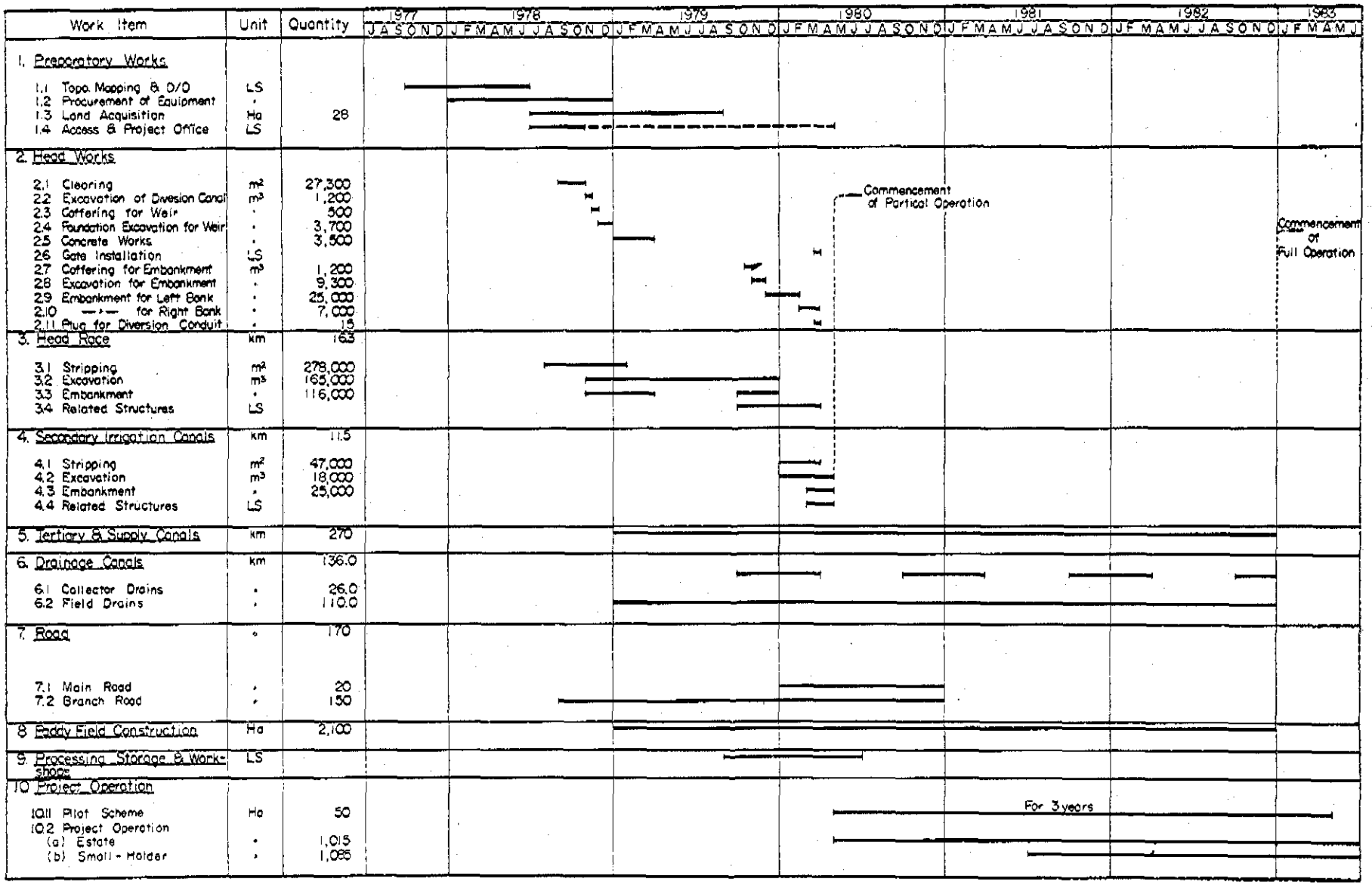


Fig. 8 Orle - Edion River Basin

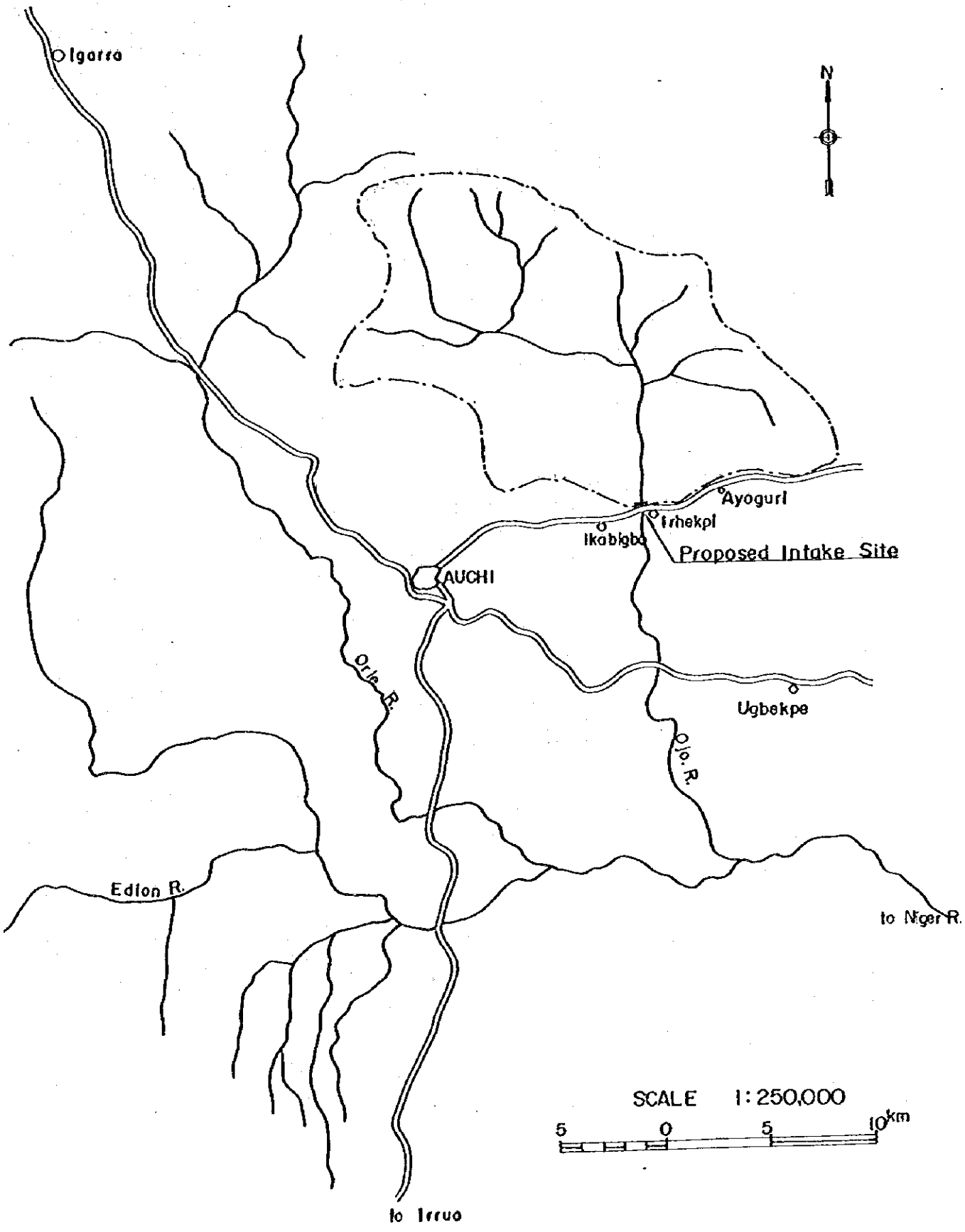
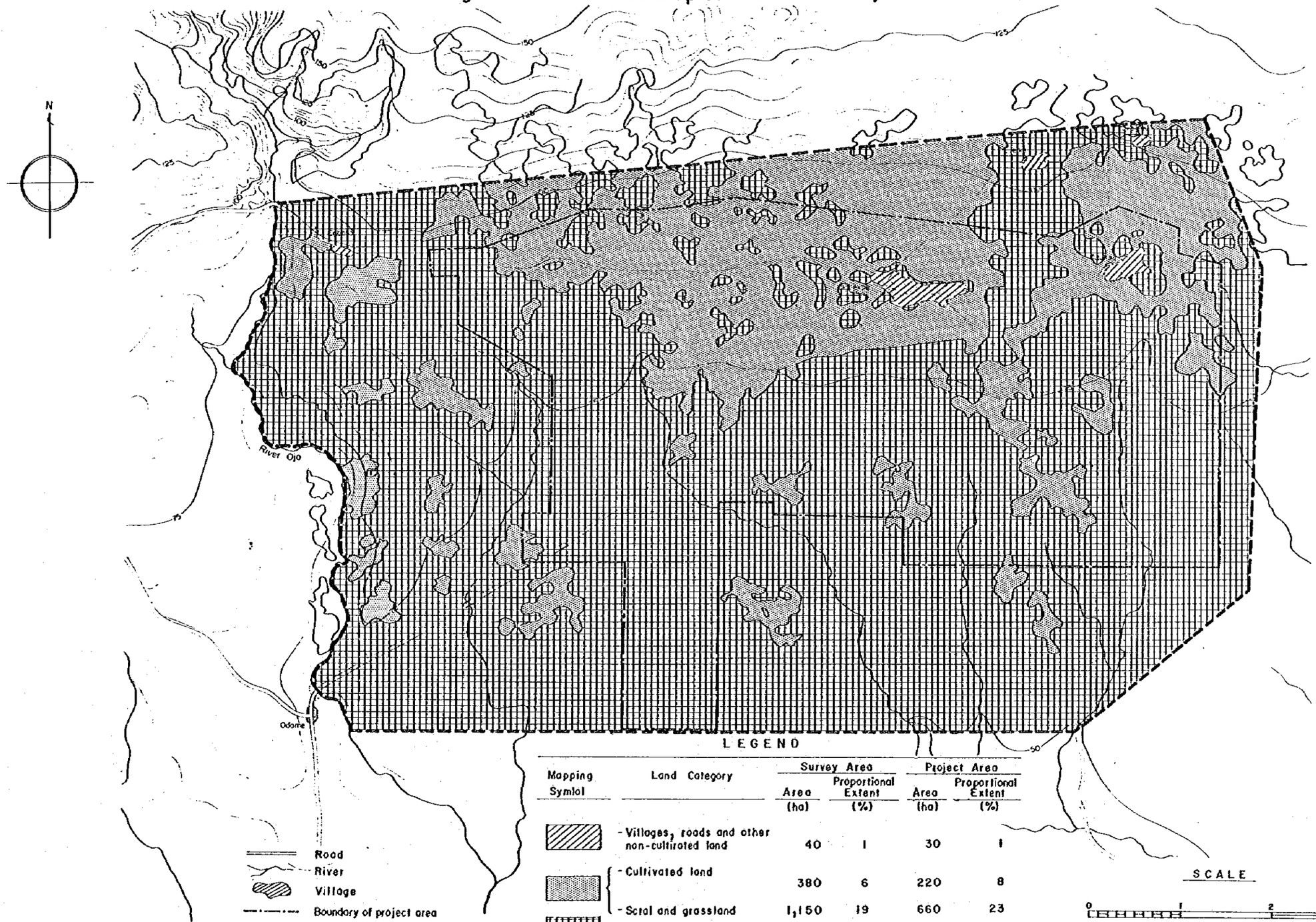


Fig. 9 Land Use Map of the Auchi Project Area



LEGEND

Mapping Symbol	Land Category	Survey Area Area (ha)	Survey Area Proportional Extent (%)	Project Area Area (ha)	Project Area Proportional Extent (%)
	- Villages, roads and other non-cultivated land	40	1	30	1
	- Cultivated land	380	6	220	8
	- Scrol and grassland	1,150	19	660	23
	- Light forest	4,590	74	1,940	68
	Total	6,160	100	2,850	100

Source : Airaphotos and field survey

Fig. 10 Typical Cropping Calendar of the Major Crops

(Auchi Project Area)

	J	F	M	A	M	J	J	A	S	O	N	D
Yam	o———		——o			——x						——x
Cassava		——x		o———		——o			——x			
Maize			o———		——o		——x		——x			
Rice			o———		——o		——x		——x			

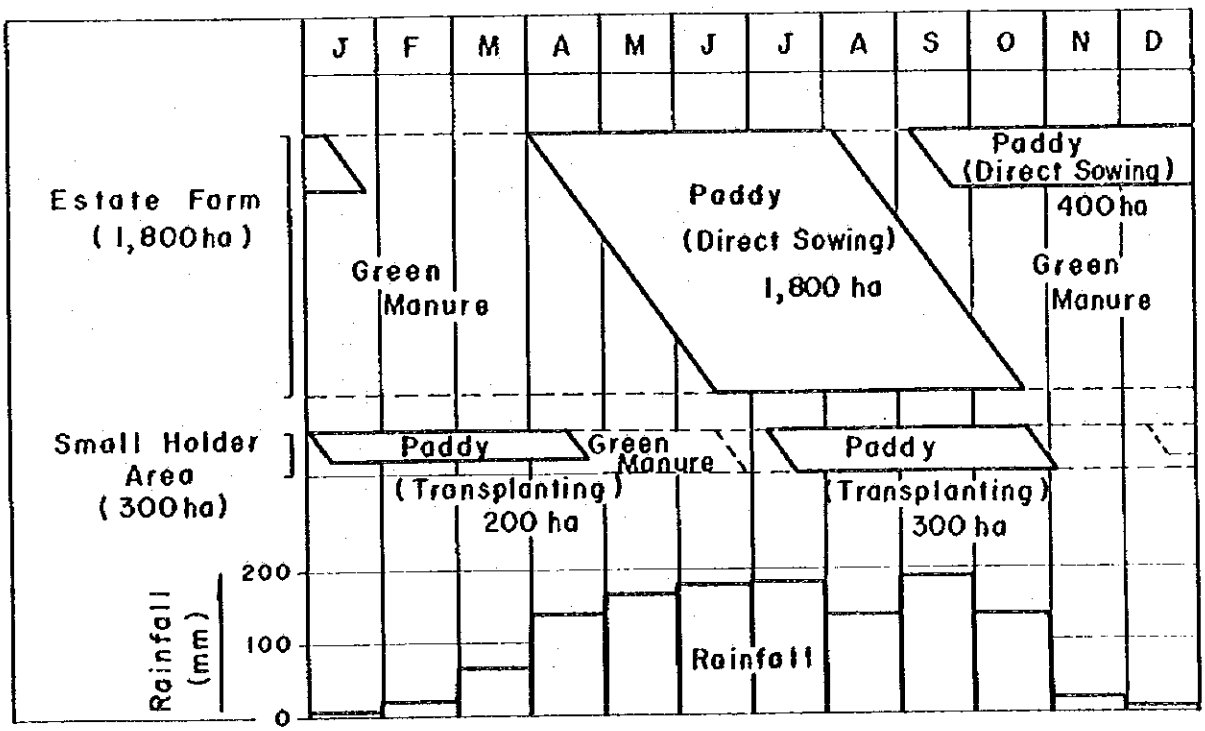
Remarks: o——o Seeding period

x——x Harvesting period

Source: Data from Regional Agricultural Office and farm survey

Fig. 11 Proposed Cropping Pattern

Auchi Project Area (2,100ha)



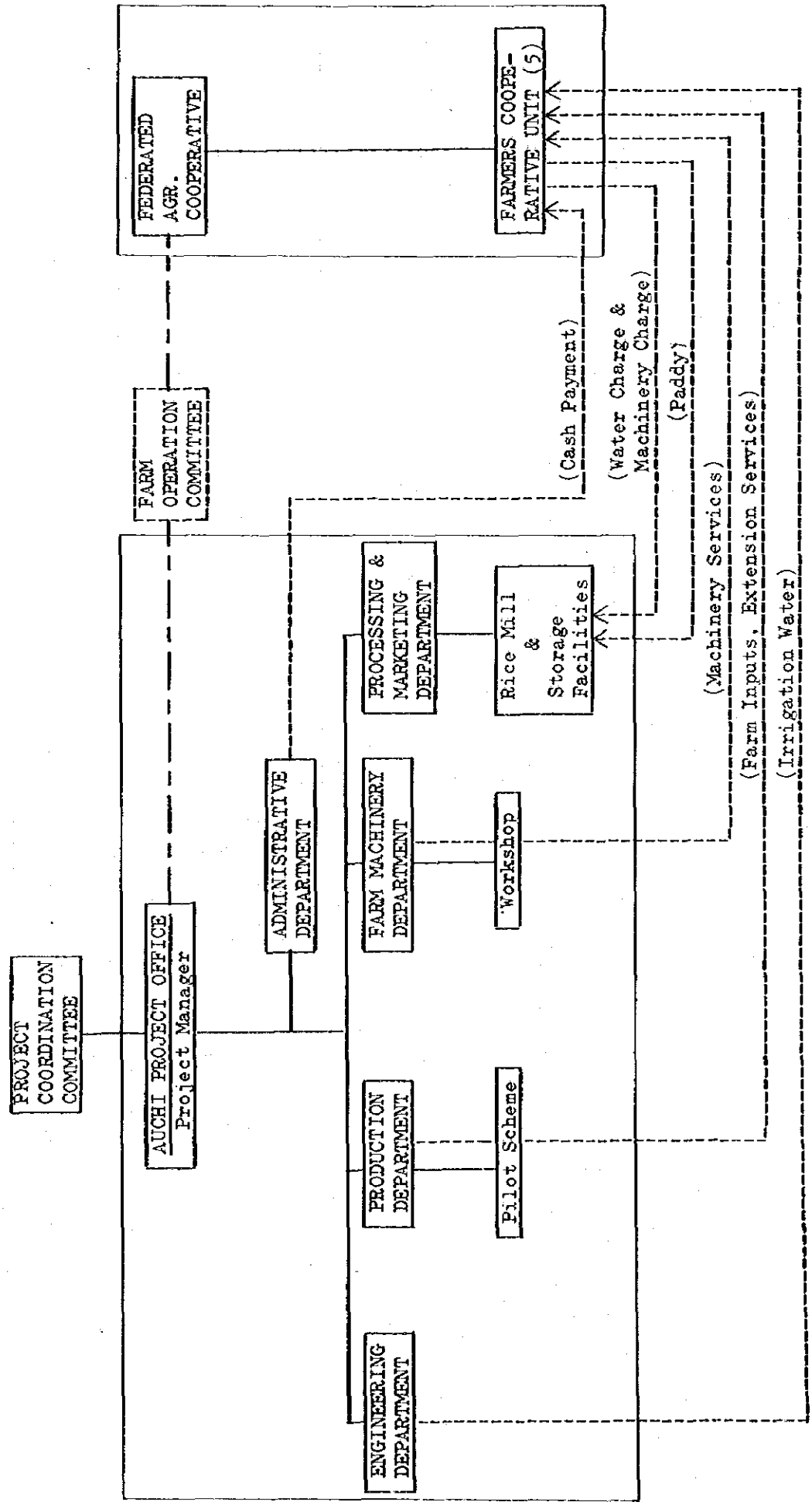
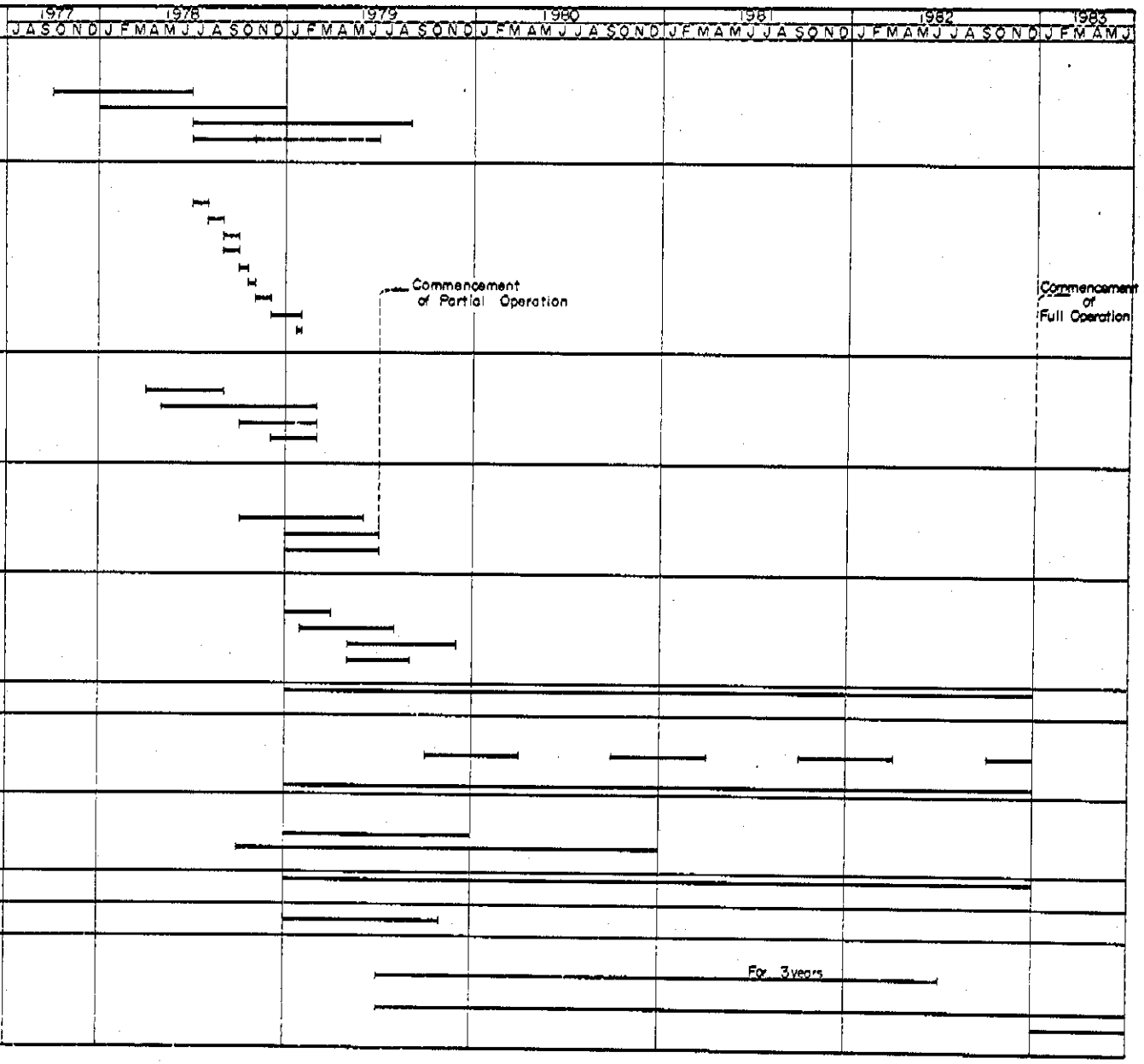


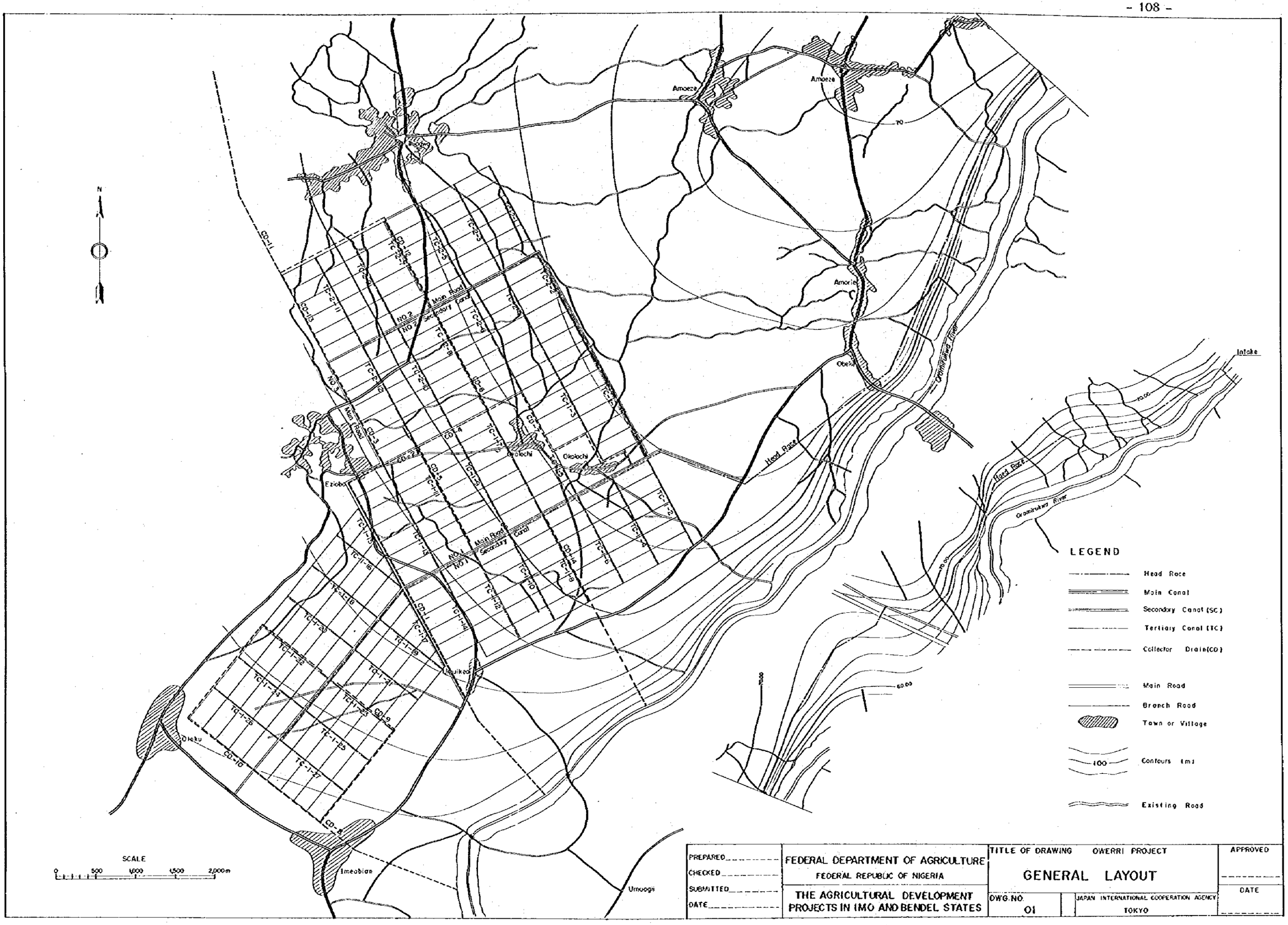
Fig. 12 Proposed Organization for Auchi Project

Fig. 13 Implementation Schedule for Auchi Project

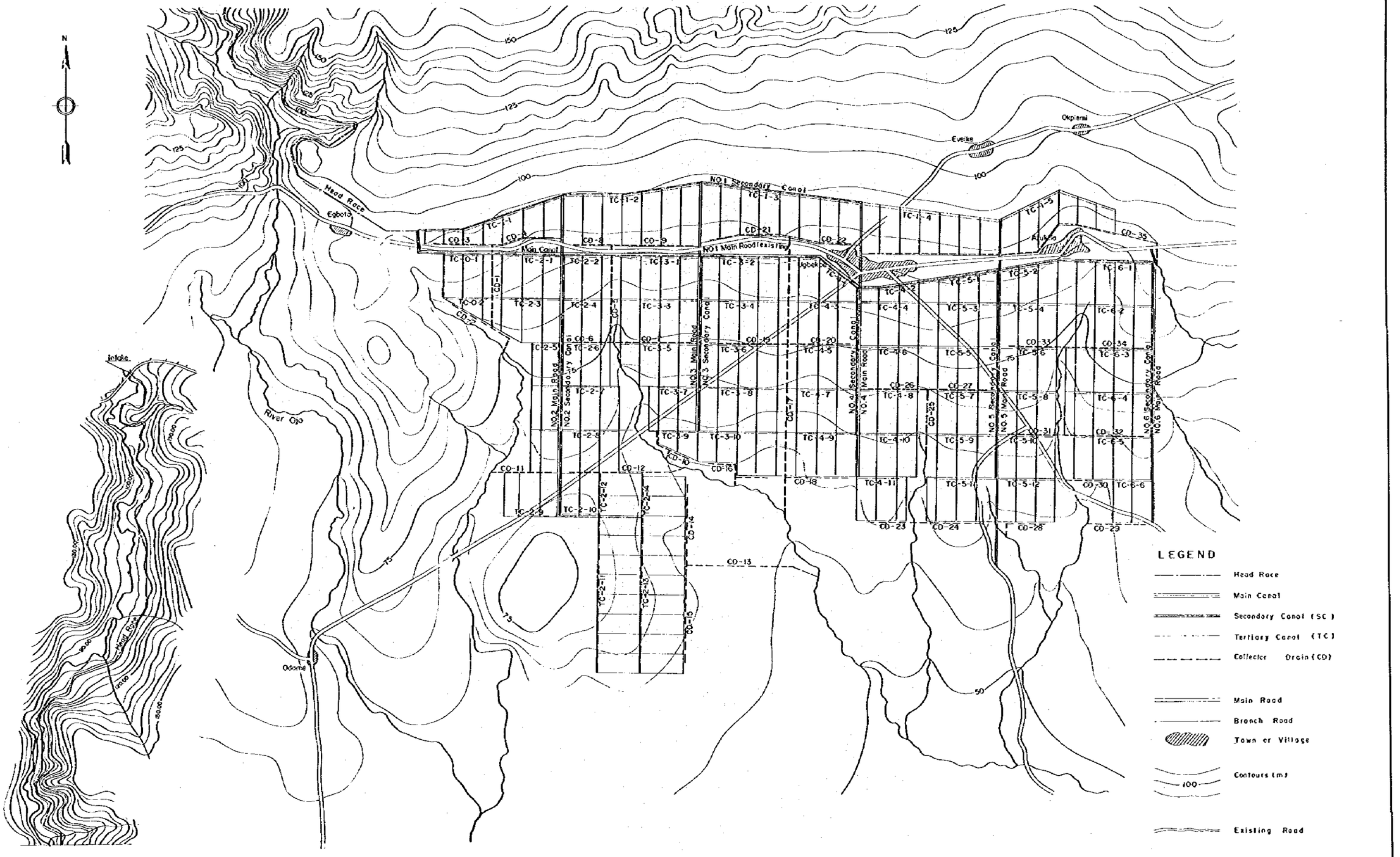
Work Item	Unit	Quantity
1. Preparatory Works		
1.1 Topo. Mapping & D/D	LS	
1.2 Procurement of Equipment	"	
1.3 Land Acquisition	Ha	14
1.4 Access & Project Office	LS	
2. Head Works		
2.1 Clearing	m²	520
2.2 Intake Str. Excavation	m³	440
2.3 —·— Concrete Works	"	500
2.4 —·— Embankment	"	270
2.5 Excavation of Diversion Canal	"	850
2.6 Cattering	"	600
2.7 Weir Foundation Excavation	"	1,000
2.8 —·— Concrete Works	"	1,100
2.9 Gate Installation	LS	
3. Head Race	km	11.7
3.1 Stripping	m²	139,000
3.2 Excavation	m³	95,000
3.3 Embankment	"	96,000
3.4 Related Structures	LS	
4. Main Irrigation Canal	km	7.0
4.1 Stripping	m²	58,000
4.2 Excavation	m³	27,000
4.3 Embankment	"	124,000
4.4 Related Structures	LS	
5. Secondary Irrigation Canals	km	17.9
5.1 Stripping	m²	43,000
5.2 Excavation	m³	75,000
5.3 Embankment	"	52,000
5.4 Related Structures	LS	
6. Tertiary & Supply Canals	km	270
7. Drainage Canals	"	
7.1 Collector Drains	"	
7.2 Field Drains	"	
8. Road	"	178.4
8.1 Main Road	"	23.4
8.2 Branch Road	"	155.0
9. Paddy Field Construction	Ha	2,100
10. Processing Storage & Workshops	LS	
11. Project Operation		
11.1 Pilot Scheme	Ha	50
11.2 Project Operation		
(a) Estate	"	1,800
(b) Small-Holder	"	300



DRAWING



PREPARED	FEDERAL DEPARTMENT OF AGRICULTURE FEDERAL REPUBLIC OF NIGERIA	TITLE OF DRAWING OWERRI PROJECT GENERAL LAYOUT	APPROVED
CHECKED			
SUBMITTED	THE AGRICULTURAL DEVELOPMENT PROJECTS IN IMO AND BENDEL STATES	DWG.NO. 01 JAPAN INTERNATIONAL COOPERATION AGENCY TOKYO	DATE
DATE			



PREPARED	FEDERAL DEPARTMENT OF AGRICULTURE	TITLE OF DRAWING AUCHI PROJECT	APPROVED
CHECKED	FEDERAL REPUBLIC OF NIGERIA	GENERAL LAYOUT	
SUBMITTED	THE AGRICULTURAL DEVELOPMENT PROJECTS IN IMO AND BENDEL STATES	DWG.NO. 02	DATE
DATE		JAPAN INTERNATIONAL COOPERATION AGENCY TOKYO