FEDERAL REPUBLIC OF NIGERIA

THE LOWER ANAMBRA IRRIGATION PROJECT

DETAILED DESIGN REPORT

ON

MODEL INFRASTRUCTURE IMPROVEMENT WORKS

JANUARY 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

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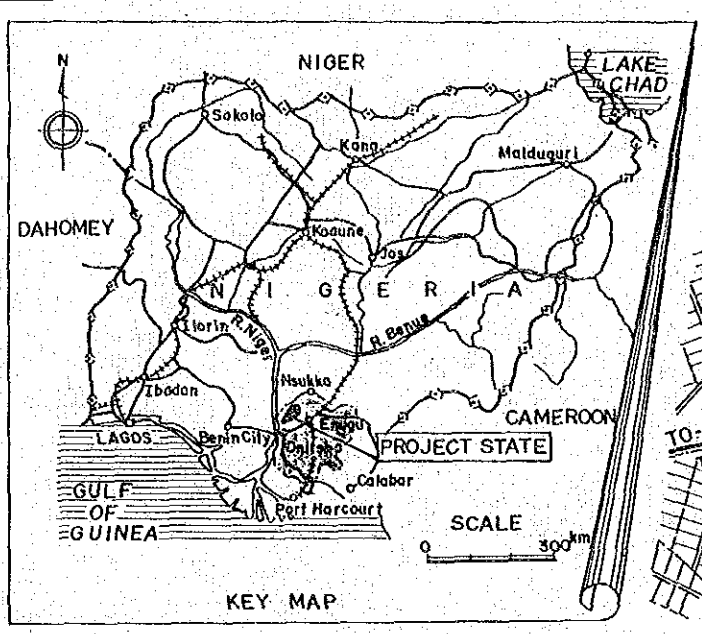

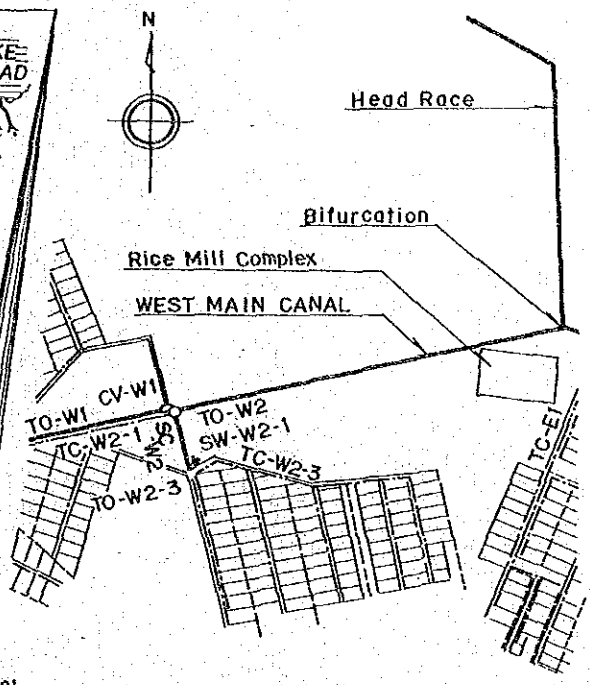

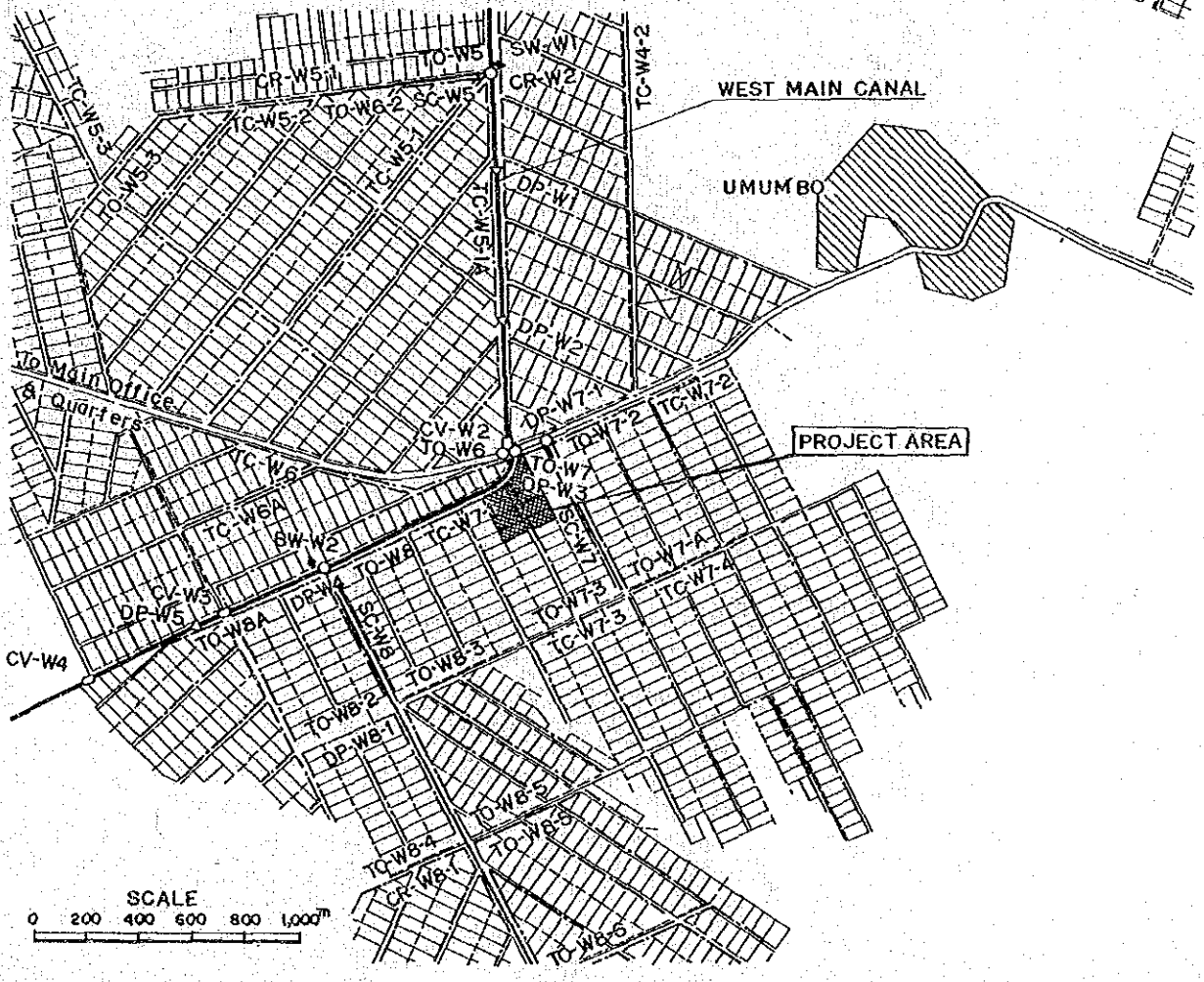

LEGEND

- Head Race and Main Irrigation Canal
- Secondary Irrigation Canal
- Tertiary and Distribution Irrigation Canal
- Drainage Canal
- Trunk Road
- Village Area

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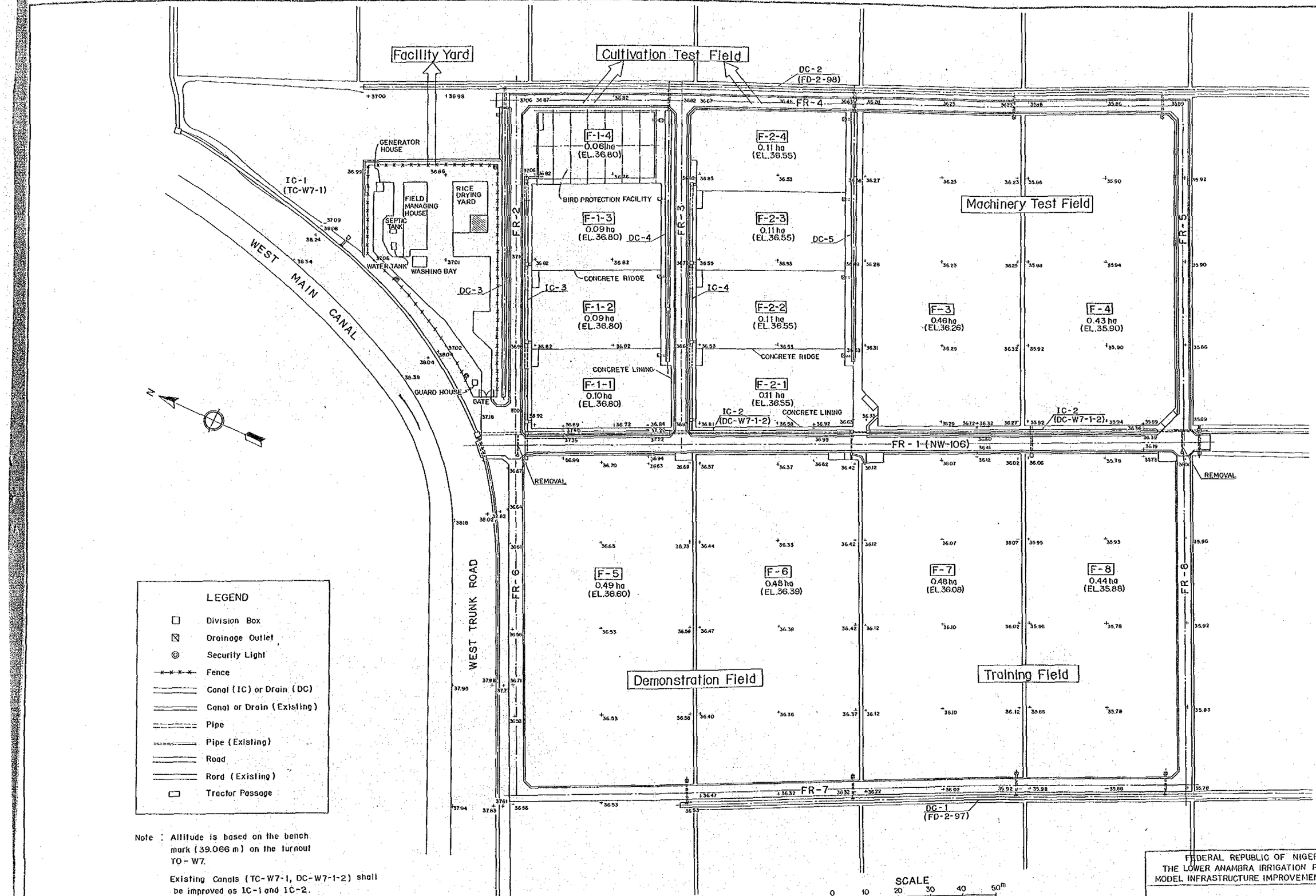
THE LOWER ANAMBRA IRRIGATION PROJECT
MODEL INFRASTRUCTURE IMPROVEMENT WORKS

LOCATION MAP

JAPAN INTERNATIONAL COOPERATION AGENCY | DWG NO.



LEGEND

- Division Box
- Drainage Outlet
- Security Light
- Fence
- Canal (IC) or Drain (DC)
- Canal or Drain (Existing)
- Pipe
- Pipe (Existing)
- Road
- Rord (Existing)
- Tractor Passage

Note : Altitude is based on the bench mark (39.066 m) on the turnout TO-W7.

Existing Canals (TC-W7-1, DC-W7-1-2) shall be improved as IC-1 and IC-2.
Existing Drains (FD-2-97, 98) and Farm Road (NW-106) shall be improved as DC-1, 2 and FR-1

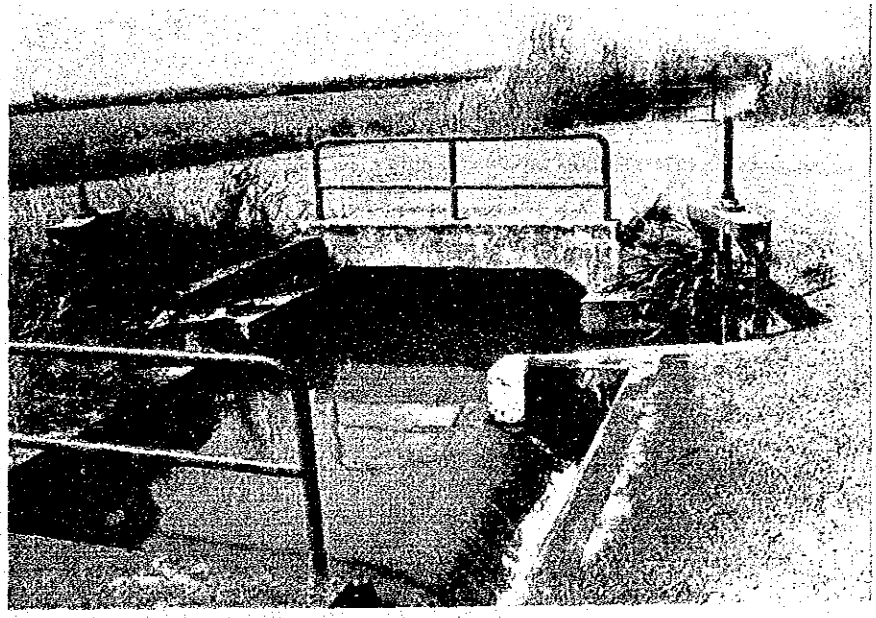
FEDERAL REPUBLIC OF NIGERIA
THE LOWER ANAMBRA IRRIGATION PROJECT
MODEL INFRASTRUCTURE IMPROVEMENT WORKS

GENERAL LAYOUT

JAPAN INTERNATIONAL COOPERATION AGENCY | DWG NO.

Meeting
with General Manager
of AIRBDA

Turnout, TO-W7
on West Main Canal (WMC)

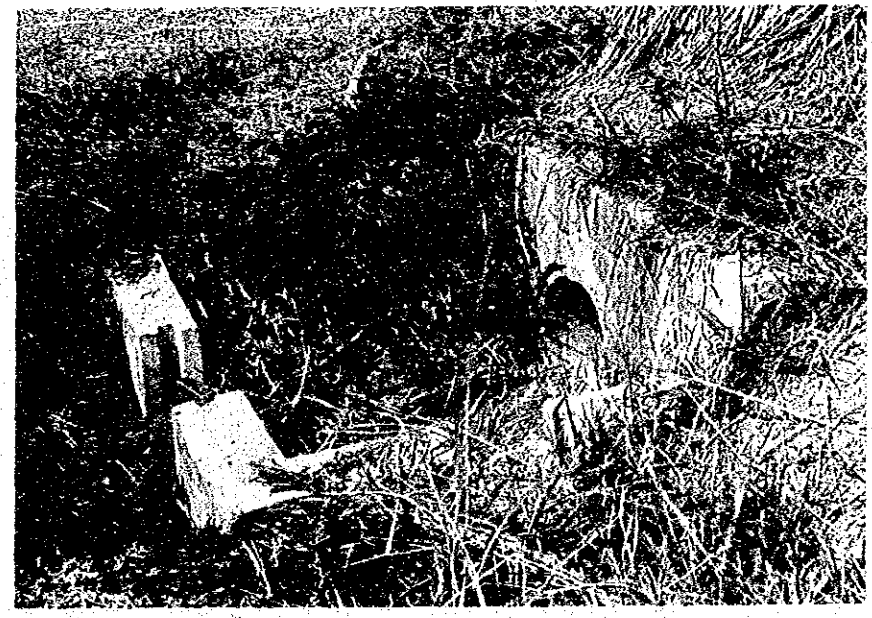


Proposed Facility Yard and Existing Irrigation Canal, TC-W7-1 to be Improved as IC-1

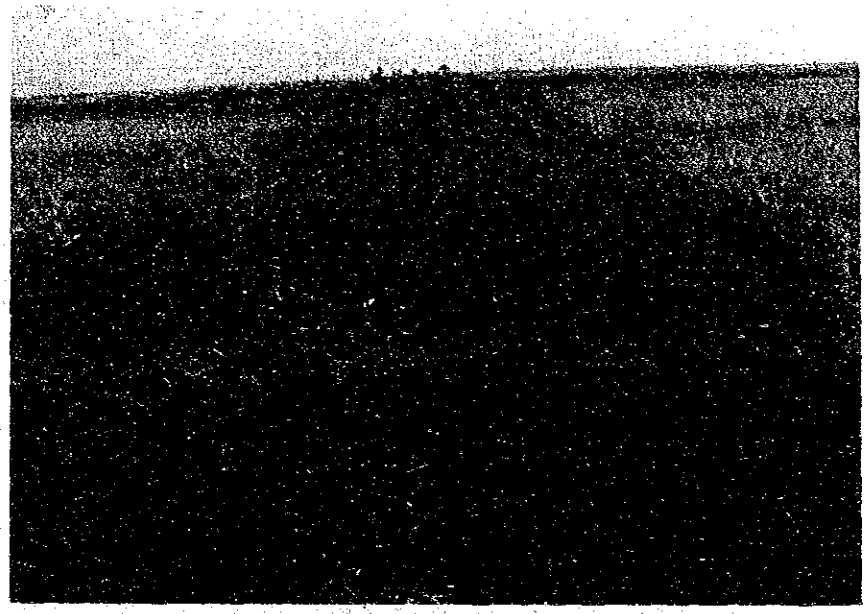
Levelling

Existing Irrigation Canal,
DC-W7-1-2
to be Improved as IC-2
at the Beginning Point

Existing Division Box
and Culvert on DC-W7-1



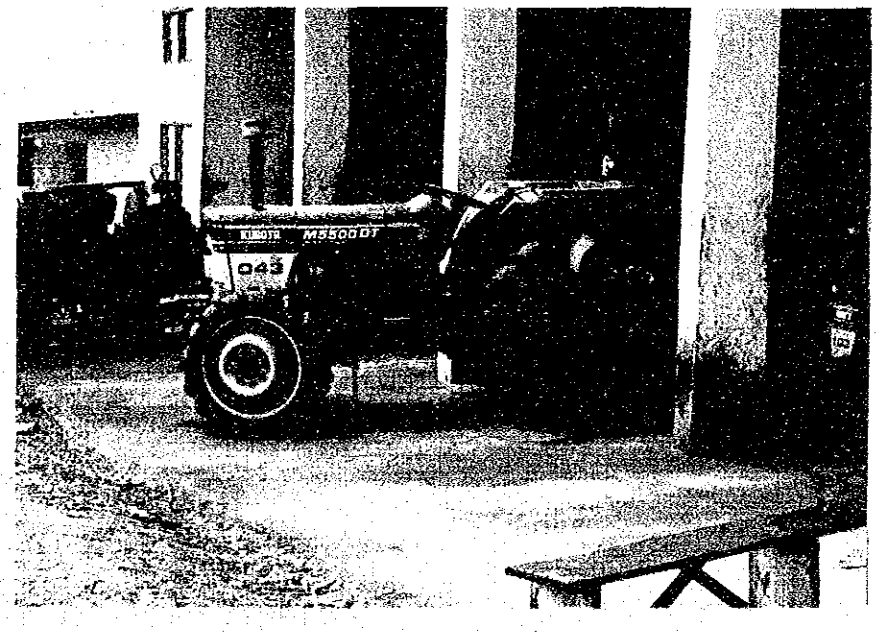
Existing Drainage Canal,
FD-2-98
to be Improved as DC-2



Existing Farm Road
to be Improved as FR-1

Levelling
at Existing Division Box

Tractor for the Project



Harvesting
at the Project Area

Bearing Capacity Survey
with Cone Penetrometer
at Proposed Facility Yard

Construction Machinery
for Lease in Onitsha

Market for Construction
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and Others) in Onitsha

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CHAPTER 1 BASIC PLAN

1.1 Background

Agriculture plays a vitally important role in the Federal Republic of Nigeria as about 55% of the population are engaged, in one way or another, in agricultural activities. With the rapid growth of the population, food production, however, cannot meet the rising demand of the population. Under these circumstances, the Federal Government of Nigeria has put a high priority on agricultural development in its various national development plans. In 1987, the Government undertook a broad survey for project implementation in the Do-Anambra area in the Anambra State. Subsequently a yen credit was provided to implement the Lower Anambra Irrigation Project involving the construction of irrigation facilities and development of paddy fields (net area 3,850 ha) for double culture of rice. In the meantime, further financial commitments were made by Japan for the procurement of agricultural machinery and equipment to the project.

The Federal Ministry of Agriculture, Water Resources and Rural Development has further requested the Government of Japan for a technical cooperation including the despatch of Japanese experts to provide technical guidance on irrigated rice cultivation and extension service as well as the supply of machinery and equipment.

In response to this request, the Japan International Cooperation Agency (hereinafter referred to as "JICA") despatched a Contact Survey Team to Nigeria in June 1987 to assess the progress in the implementation and condition of the Lower Anambra Irrigation Project and for discussions on the Nigerian request. As a result of this mission, JICA decided to provide the necessary cooperation under its project type technical cooperation programme to the Lower Anambra Irrigation Project and in June 1988, it dispatched again a Preliminary Survey Team to discuss the framework of the technical cooperation with the Federal Government of Nigeria. This was followed by the visit of a JICA Implementation Survey Team to Nigeria in October 1988 to discuss the modality of the Japanese technical cooperation in rice cultivation that resulted in the signing of the Record of Discussions (R/D) between both government representatives on November 3, 1988.

The Japanese technical cooperation mentioned in the R/D will be provided through technical assistance and advice in the following fields:

(1) Irrigation and drainage techniques;

(2) Irrigated rice cultivation techniques;

(3) Extension;

(4) Training;

(5) Agricultural machinery.

To effectively carry out the technical cooperation as mentioned above, it is necessary to construct an experimental farm in the project area. This report shows the detailed design of the experimental farm and its related facilities.

1.2 Purpose and Basic Concept

As mentioned above, this survey was made with the main purpose to formulate the detailed design of the experimental farm and its related facilities to be constructed under Japanese technical cooperation as stipulated in Article IV (1) of the R/D.

The Japanese experts and their assignment as shown on the master plan of the R/D are described below:

Japanese Experts

	Number of persons
1. Team leader	1
2. Coordinator	1
3. Experts	6

Short-term experts will be dispatched when necessity arises.

Assignment of Japanese Experts

(1) Irrigation and drainage techniques

- (i) Development of water management techniques
- (ii) Maintenance of irrigation and drainage facilities
- (iii) Promotion of water control organization

(2) Irrigated rice cultivation techniques

- (i) Selection of appropriate varieties
- (ii) Establishment of standard rice cultivation techniques
- (iii) Improvement of multiple cropping system

(3) Extension

- (i) Planning of extension services
- (ii) Development of extension methods and materials
- (iii) Demonstration of cultivation techniques
- (iv) Promotion of management formation

(4) Training

- (i) Planning of training courses
- (ii) Preparation of curriculum and teaching materials

(5) Agricultural machinery

- (i) Adaptability test of agricultural machinery
- (ii) Operation and maintenance of agricultural machinery

This experimental farm will be the core for the activities of the Japanese experts. This detailed design has been carefully formulated by taking into consideration the above-mentioned activities.

1.3 Summary of Construction Works

(1) Land preparation for test field

(a) Land levelling for paddy field A = 3.56 ha

	(b)	Farm road, type I (Wt = 5.0 m We = 4.0 m Gravel pavement, Improved)	L = 220 m
	(c)	Farm road, type II (Wt = 4.0 m, We = 3.0 m, Gravel pavement, Newly constructed)	L = 490 m
	(d)	Farm road, type III (Wt = 4.0 m, Newly constructed)	L = 400 m
	(e)	Concrete ridge and slope (210 m + 600 m)	L = 810 m
	(f)	Bird protection facility	A = 810 m^2
(2)	Irrigation and drainage facilities		
	(a)	Irrigation canals, type I (Wb = 0.3 m, H = 0.5 m)	L = 135 m
	(b)	Irrigation canals, type II (Wb = 0.3 m, H = 0.3 m)	L = 370 m
	(c)	Drainage canals	L = 660 m
	(d)	Canal related structures	1 set
(3)	Land preparation for facility yard		
	(a)	Embankment	V = 1,300 m^3
	(b)	Gravel pavement (t = 0.1 m)	A = 1,200 m^2
(4)	Farm facilities		
	(a)	Field managing house	1 lot
	(b)	Rice drying yard	1 lot
	(c)	Guard house	1 lot
	(d)	Generator house	1 lot
	(e)	Washing bay for machinery	1 lot
	(f)	Safety facilities (fence, gate, etc.) and others	1 set
	(g)	Electricity, air-conditioning, ventilation system	1 set
	(h)	Water supply, sewerage system	1 set

CHAPTER 2 PRESENT CONDITION

2.1 Location and Topography

The Lower Anambra Irrigation Project is situated in the Uzo-Uwani L.G.A. in the Anambra State. It is located at 6°30' north latitude and 7°00' east longitude. The Anambra State is located in the eastern part of Nigeria, lying approximately 550 km east of Lagos, the capital city. The project area lies approximately 60 km west of Enugu, the capital of the Anambra State, and 40 km north of Onitsha on the River Niger.

The area extends on a gently undulating topography with a land slope from 1/500 to 1/100. The elevation of the proposed experimental farm is about 36 to 38 m.

2.2 Soils and Climate

The soils of the project area consist of lateritic soil extending over the outer tablelands and of grey low land soil (quasi-gley soil) of the central lowland. The land of the proposed experimental farm had been used as paddy fields before the project, and the soil group is classified as dystric gleysols suitable for paddy cropping. The rating of the land classification is Class I with high potential for cropping.

The climate of the project area is of Tropical Savanna characterized by two distinct seasons, the rainy season lasting six months from the end of April to the beginning of November and the dry season during the other six months. The annual rainfall averages approximately 1,400 mm, of which 90% is recorded in the rainy season. The monthly mean temperature with minor seasonal variation ranges from 26°C to 29°C. The average sunshine hours is 5.1 hr/day ranging from 6.7 hr/day in November to 3.4 hr/day in August. The average relative humidity is approximately 79% ranging from 60% in January to 86% in July.

2.3 Agriculture, Irrigation and Drainage

In the project area, shifting cultivation by burning has been mainly practiced to plant yam mixed with cassava and maize. Small scale rice cultivation has been limited in marsh or swamp land, while after the construction of about 3,800 ha of paddy field under the Yen loan project, rice cultivation has been extending along the outskirts of the project area. Traditional farming is still practiced around the houses for self-consumption. The paddy fields developed under the project are cultivated by the farmers nominated by the Land Committee at each cropping period. The average paddy field allocated to each farmer is approximately 1 ha.

The water source of the project is the Anambra River, a tributary of the Niger River. Irrigation water is lifted by the pumping station from the river and carried through the headrace canal of 16.5 km to the bifurcation. Irrigation water is distributed at the bifurcation into the two main canals, then flows through the main, secondary, tertiary and distribution canals to each plot. Drainage water is led through field drains and collector drains to natural streams. The size of a standard plot is 0.5 ha (100 m x 50 m).

2.4 Project Effect

The effects of the project are considered as follows:

(i) Expansion of new arable land,
(ii) Increase of food production,
(iii) Development of farming technique,
(iv) Expansion of rice cropping,
(v) Saving of foreign exchange,
(vi) Extension of education opportunity,
(vii) Rising of living standard
(viii) Conservation of land, and
(ix) Opportunity of establishing farmer's organization, etc.

CHAPTER 3 DETAILED DESIGN

3.1 General

(1) Location

The location of the experimental farm proposed by the JICA long-term survey team will be in an area near the turnout TO-W7 on the West Main Canal, in the northern part of the project area (see Location Map).

This location is judged advantageous for the following reasons.

- easy access from the project office (along the Omor-Umumbo road)
- easy intake of irrigation water (along the West Main Canal)
- efficient demonstration effect near the center of the project area
- lower construction cost due to easy access by the main road (WTR) and comparatively good condition of land-levelling by previous cultivation
- possessing typical features of the project area in topography, soils and so on

(2) Scale

In consideraion of the technical cooperation activities mentioned in the R/D (refer to Chapter 1.2), capability of Japanese experts, construction cost, etc., the scale of the experimental farm is determined at approximately 4.5 ha (including facility yard).

On the technical cooperation activities, water management tests will be made in ordinary farm land, hence the following 4 types of experimental fields are necessary.

- Cultivation test field : tests for varieties, fertilizers, chemical pesticides, etc. will be realized.
- Machinery test field : tests for adaptability, functions, operationability, etc. of agricultural machineries will be made.
- Demonstration field : guidance, extension, exhibition and demonstration of cultivation techniques for farmers will be conducted
- Training field : training for personnel concerned will be implemented

The cultivation test fields shall be equipped with advanced irrigation facilities for conducting the test works and shall be divided into smaller plots for various tests. In order to ensure the effects of the experimental farm on farmers in the project area, the other test fields should have similar conditions as the general plot. For the Japanese experts' activities, each test field will consist of two (2) existing plots for a total area of about 1 ha.

Water requirement test will be made in the demonstration field or training field whenever necessary.

In total, the experimental farm will consist of nine (9) existing plots, out of which eight (8) will be used for field tests and one (1) for the facility yard.

3.2 Experimental Farm

3.2.1 Cultivation test field

Since strict accuracy is required in various test items, the existing two plots of the cultivation test field will be divided into four (4) small plots each, or in total eight (8) sub-plots. Newly constructed fixed levees will be made of concrete in order to reduce maintenance works, to fix sub-plot area and to shut out horizontal seepage. In addition, the inside slope of the existing levee will be covered with concrete for easy maintenance and strict water management. In case that the division of sub-plot becomes necessary, temporary levee will be established. The tolerance in land-levelling will be within ±5.0 cm.

3.2.2 Bird protection facility

(1) Method of bird protection

One sub-plot of the cultivation test field will be equipped with bird protection facility to measure accurately the yield. Comparative study of bird protection methods is shown in Annex A. The selected method is that by portable bird net and fixed concrete post.

(2) Bird net supporting post

Considering the balance of the interference to tractor traffic and ease of the bird net covering work, net supporting posts made of reinforced concrete will be arranged at 5 m x 10 m chequered intervals (refer to Fig. 13).

Galvanized iron wire will be stretched and supported by the net posts. In order to lessen the stretched wire sag, both ends of the wire will be connected to concrete anchors for the required tension. Details can be seen in Annex A and Fig. 13.

3.2.3 Machinery test field

For farm mechanization, the tests for adaptability, efficiency, performance, functions and operationability will be made. The existing ground elevations in the proposed plot F-3 of the machinery test field will be levelled within ±5 cm from the proposed mean ground level. Since all points measured in the plot F-4 are within ±5 cm from the mean level, only local adjustment will be made.

3.2.4 Demonstration field

There will be guidance, extension, exhibition and demonstration of cultivation techniques for farmers in this field. The existing land surface will be levelled to be within ±5 cm from the design ground level. Especially, the levelling of the four corners will be finished carefully.

3.2.5 Training field

Training for personnel in charge of extension services will be carried out here. The existing land surface will be levelled within ±5 cm from the

design ground level. Especially, the levelling of the four corners will be finished carefully.

3.2.6 Farm road

The existing farm road (NW-106), a branch from the West Trunk Road (WTR), passes through the center of the experimental farm. The existing farm road has a width of 5 m with an effective width of 4 m of laterite pavement. However, parts of the road lie below the surface of adjoining fields and have to be raised with laterite layers by at least 0.5 m. Its surface will have an effective width of 4 m of gravel pavement. The improved road will be given the tentative name of FR-1 Farm Road.

A road network surrounding the experimental farm will be newly constructed for effective demonstration, and easy operation and maintenance. Two farm roads to service the small plots of the cultivation test field will be also newly constructed.

The layout, profile and typical cross section of each road are shown in Fig. 1, 2 and 3, and the dimensions are as follows:

No.	Length (m)	Type	Width (m)	Effective Width (m)	Pavement and Thickness	Height above Field (m)	Remarks
FR - 1	220.0	I	5.0	4.0	Gravel 10cm	min. 0.5	Improved
FR - 2	99.0	II	4.0	3.0	Gravel 10cm	min. 0.5	New
FR - 3	96.0	II	4.0	3.0	Gravel 10cm	min. 0.5	New
FR - 4	201.0	II	4.0	3.0	Gravel 10cm	min. 0.5	New
FR - 5	96.0	II	4.0	3.0	Gravel 10cm	min. 0.5	New
FR - 6	101.0	III	4.0	-	-	min. 0.3	New
FR - 7	203.0	III	4.0	-	-	min. 0.3	New
FR - 8	97.0	III	4.0	-	-	min. 0.3	New

3.2.7 Irrigation system

(1) Intake

Irrigation water will be drawn from the turnout TO-W7 located at the No. 25 + 195.00 (reduced distance 5,195 m) of the West Main Canal (WMC). The design water level at the existing downstream box of the turnout TO-W7 will be 38.38 m as the original design water level is. This box is connected through the culvert with the box at beginning point of the tertiary canal TC-W7-1.

(2) Approach canal

The tertiary canal TC-W7-1 will be used partly as an approach canal (IC-1) for the experimental farm. The approach canal will start from the beginning box and end at the division box to the distribution canal DC-W7-1-2. This canal (134.5 m long) will be lined with

concrete for minimizing water loss, effective irrigation and easy operation and maintenance.

(3) Distribution canal and feeder canal

The upper stream of the existing distribution canal DC-W7-1-2, which length is 220.0 m from the beginning point to the third existing division box, will be used as irrigation canal (IC-2) for the experimental farm. This canal as well as the approach canal will be lined with concrete. The downstream end will be connected with the existing earth canal. In addition to the improvement of the existing canals, two feeder canals for the cultivation test field will be newly constructed.

(4) Division box

The division box distributing water to each plot will be newly constructed except the usable existing boxes.

(5) Irrigation culvert

The culvert will be settled at the crossing of the canal and the road.

(6) Tractor passage

The tractor passage for the entrance of machinery from the farm road to the plot will be prepared.

(7) Summary

The layout, profile and the typical section of each irrigation canal are shown in Fig. 1, 4 and 5, and the dimensions are as follows. The previous design discharge is adopted as it is for this design.

No.	Length (m)	Type	Base Width (m)	Height (m)	Side Slope Gradient	Discharge (l/s)	Canal Gradient	Remarks
IC-1	134.5	I	0.3	0.5	1.0	105	av. 1/400	Improved
IC-2	220.0	II	0.3	0.3	1.0	35	av. 1/200	Improved
IC-3	74.0	II	0.3	0.3	1.0	35	1/370	Newly constructed
IC-4	72.5	II	0.3	0.3	1.0	35	1/370	Newly constructed

3.2.8 Drainage system

(1) Drainage canal

The two existing drainage canals, FD-2-97 and 98, run along the western and eastern edges of the proposed experimental farm. Of those drainage canals, some parts have reduced cross sectional area caused by sediment, therefore improvement work will be carried out to conform with the original design section at least. The downstream end of the

canals will be adjusted with the existing drainage canals respectively.

Two drainage canals for the small plot of the cultivation test field will be newly constructed. One new drain for the facility yard will be also constructed.

The design unit drainage discharge is 5.4 l/s/ha at the 10-year probability. The drainage canal will be designed as such to ease maintenance works.

(2) Drainage outlet

The drainage outlet will be provided at each plot, otherwise the new surrounding road would shut out the ponding water. The drainage outlet crossing the levee will be also settled at the small plots of the cultivation test field for smooth and easy drainage. At the drainage outlet, a pipe will be buried and a concrete box will be put inside the plot.

(3) Summary

The layout, profile and the typical section of each drainage canal are shown in Fig. 1, 6 and 7. The dimensions are as follows:

No.	Length (m)	Base Width (m)	Depth (m)	Side Slope Gradient	Remarks
DC - 1	155.0	0.3	Minimum 0.4	1 : 1.0	Improved
DC - 2	250.0	0.3	Minimum 0.4	1 : 1.0	Newly constructed
DC - 3	90.5	0.3	Minimum 0.4	1 : 1.0	Newly constructed
DC - 4	80.5	0.3	Minimum 0.4	1 : 1.0	Newly constructed
DC - 5	80.5	0.3	Minimum 0.4	1 : 1.0	Newly constructed

3.3 Farm Facilities

3.3.1 Facility yard

The arrangement of the field managing house, rice drying yard, washing bay for machinery, gate, fence, guard house, generator house, water tank, septic tank, etc. is shown in Fig. 14. The facility yard designed will ensure smooth and effective activities of the experts.

The facility yard will be embanked with laterite and will be paved partly with gravel.

3.3.2 Field managing house

The field managing house will be built in order to store chemical pesticides, fertilizers, farm implements and materials, agricultural machineries, etc. and to carry out simple tests. The field managing house with a floor area of 144 m^2 will consist of a storage for farm implements

and materials, a storage for fertilizers, a garage, a test room and a toilet.

Structure of the house will be as below.

Wall	:	reinforced concrete block masonry
Foundation	:	reinforced concrete continuous footing
Girder	:	reinforced concrete girder on the top of the wall
Roof	:	timber truss and corrugated cement sheet roofing

(1) Storage for farm implements and materials

The storage for farm implements and materials such as hoes, sickles, mowing machines, sprayers, bird nets, sacks and bands, will be furnished with a shelf. The size of the storage will be 4 m x 5 m.

(2) Storage for fertilizers

The storage for fertilizers will have a space of 3 m x 5 m to store fertilizers for two cropping periods.

(3) Garage

The garage will have a space for two tractors with attachment and repair work, a shelf for spare parts, and a slide door of 5 m wide. The floor size will be 10 m x 7 m.

(4) Test room

The test room will be 5 m x 7 m to arrange some simple test equipment, a cabinet for chemical pesticide, a testing table, and other items.

(5) Toilet

The size of toilet will be 2 m x 2 m. A water closet, a wash basin and a small lift pump for water supply will be arranged in this room.

3.3.3 Rice drying yard

To dry harvested paddy by sunshine and wind, the rice drying yard will be made of concrete slab. A part of the yard (5 m x 5 m) will be covered with a roof. The area of the concrete floor will be 10 m x 15 m (150 m^2) as calculated below.

Paddy yield per 1 ha	5 t/ha x 1 ha = 5 t
Volume equivalent	5 t ÷ 0.8 = 6.25 m^3
5 cm thick lying for drying	6.25 m^3 ÷ 0.05 m = 125 m^2
Footpath and allowance	25 m^2
Total	150 m^2

3.3.4 Washing bay for machinery

The washing bay for machinery will be of concrete with 3 m x 4 m dimensions to wash agricultural machineries, cars, and other vehicles.

3.3.5 Security facilities

In order to prevent the materials and equipment from being stolen, a fence will be erected around the facility yard and a gate will be provided. A small guard house (1.5 m x 1.5 m) will be constructed near the gate. Three light poles will be installed around the facility yard for security.

3.3.6 Electric and plumbing installation

(1) Power supply system

Electric power will be supplied by a 5 kVA generator. In consideration of repair and inspection, two generators will be provided and driven alternately. The generators will be installed in the generator house.

Electricity will be supplied to the indoor systems including lights, air-conditioner, exhaust fans in the field managing house and lights in the guard and generator houses and the outdoor lights.

(2) Water supply system

Water will be supplied from an elevated water tank (0.5 m^3) mounted on the roof of the toilet and distributed to the test room, toilet and washing bay for machinery. Another water storage tank (5 m^3) constructed underground, will receive water from the water tank lorry. A small pump will be installed to lift water from the storage tank to the roof tank. The main features of the pump will be as summarized below.

Type	:	self priming turbine pump with combined motor
Diameter	:	32 mm
Capacity	:	100 l/min
Total head	:	10 m
Rating power of motor	:	0.4 kW

(3) Sewerage system

After passing through a septic tank, waste water from the toilet will be drained together with the sewage of the testing room. Water from the washing bay for machinery and rainfall will be drained through a drainage pipeline connected to the drainage canal. Seepage pit will not be provided considering low permeability of soil.

(4) Air-conditioning and ventilation

An air-conditioner and an exhaust fan will be provided in the test room, and another exhaust fan will be in the toilet.

3.4 Construction Plan

3.4.1 Construction method

(1) Work item

Construction works for the experimental farm will comprise the following items.

- Land preparation of experimental test fields and construction/ improvement of farm roads, irrigation and drainage canals.

- Construction of farm facilities (field managing house, rice drying yard, washing bay for machinery, etc.)

Construction works may also be divided into the following categories.

- Civil works

  Earth works
  Concrete works

- Architectural works

  Concrete works
  Concrete block masonry
  Metal works
  Structural steel works
  Carpentry and joinery works
  Fence works
  Plastering and painting
  Electric and plumbing installations

(2) Construction condition

- All the construction work will be performed on a contract basis.
- The contractor will have a site office during the construction period.
- The construction period will be limited within six months.
- Equipment, construction machinery and materials will be procurable in Nigeria.
- The location and size of the land for the contractor's site office, storage place for materials, warehouse, etc. will be determined in consultation with JICA.
- The cost of electricity and water for the works shall be covered by the Indirect Cost of the contractor.

(3) Construction machinery

The following machineries shall be used for land levelling, construction of farm roads, embankment of facility yard, concrete works, etc.

- Truck	:	For carrying equipment and materials
- Dump truck	:	For carrying laterite, gravel, sand and soil into the site
- Bulldozer	:	For land grading, embankment and levelling
- Motor grader	:	For levelling
- Backhoe	:	For excavation, loading and unloading of equipment and materials
- Power shovel	:	For excavation and loading

- Road roller : For compaction

- Concrete mixer : For concrete mixing

The construction machineries possessed by the Anambra-Imo River Basin Development Authority (AIRBDA) will be made available, if necessary.

3.4.2 Construction time schedule

The required time for construction of the experimental farm and farm facilities is estimated at approximately 7 months including preparatory and demobilization periods as shown in the next figure and summarized below:

Work Item	Required Time (month)
Preparatory period for the contract	1.0
Preparatory period for construction	0.5
Construction period	4.5
Running test period	0.5
Demobilization period	0.5
Total	7.0

Construction period is desirable to be from October to March to avoid works in the rainy season, so that the preparatory period for the contract should be finished by the middle of September.

Construction Time Schedule

Item	Q'ty	1st month	2nd month	3rd month	4th month	5th month	6th month	7th month
1. Tender and/or contract		Contract procedure						Reporting
2. Temporary work			Mobilization					Demobilization
3. Experimental farm	4.5ha							
1) Experimental field	3.6ha			Levelling				
2) Concrete ridge and slope	810m							
3) Bird protection facility	810m²				Foundation	Support		
4) Farm road	1,110m		Survey, Stripping Embankment, Gravel pavement					Finish
5) Irrigation canal	510m			Embankment	Excavation	Concrete	lining	
6) Drainage canal	660m				Excavation			
7) Canal related structures	54nos							
4. Farm facilities								
1) Facility yard	2,400m²		Embankment					Gravel
2) Field managing house	144m²			Foundation/Floor	Block masonry/Girder Truss/Roof		Finishing	
3) Rice drying yard	150m²			Foundation/Floor	Steel Structure		Painting	Roof
4) Guard house	2.3m²				Foundation	Block masonry	Finishing	
5) Generator house	6.0m²				Foundation	Block masonry	Finishing	Electric installation
6) Washing bay for machinery	12m²							
7) Fence, gate, etc.	190m							
8) Electric & plumbing installation	L.S							
5. Completion survey, mapping and running test								

CHAPTER 4 COST ESTIMATE

4.1 General

Necessary materials and equipment for the construction work can be procured in Nigeria.

The unit price was estimated according to the market price survey carried out by the survey team at Onitsha and Enugu in November, 1988 (refer to the clause 4.3).

The currency conversion rate employed in this estimate is;

US$1.0 = ₦6.1 = ¥122 (as of 23 November, 1988)
accordingly, ₦1.0 = ¥20, ¥1.0 = ₦0.050.

This rate was obtained based on the bank conversion rate of $1.0 = ₦5.94 ~ 6.50, and on the international conversion rate of $1.0 = ¥121.3 ~ 122.4.

4.2 Project Cost

The total project cost is estimated as follows. The breakdown of the project cost is summarized in the following table and the bill of quantities is shown in the clause 4.4.

Total project cost	₦1,290,000
Equivalent Japanese yen currency	¥25,800,000

PROJECT COST

Item	Naira	Equivalent Japanese Yen
A. CONSTRUCTION COST	1,118,000	22,360,000
1. Direct Cost	860,000	17,200,000
1.1 Experimental Farm	(411,800)	(8,236,000)
1.1.1 Land preparation	57,200	1,144,000
1.1.2 Concrete ridge	54,800	1,096,000
1.1.3 Bird protection facility	31,000	620,000
1.1.4 Farm road	178,000	3,560,000
1.1.5 Irrigation canal	38,200	764,000
1.1.6 Drainage canal	6,100	122,000
1.1.7 Canal related structure	46,500	930,000
1.2 Farm Facilities	(448,200)	(8,964,000)
1.2.1 Facility yard	108,600	2,172,000
1.2.2 Field managing house	120,800	2,416,000
1.2.3 Rice drying yard	20,000	400,000
1.2.4 Washing bay for machinery	1,500	30,000
1.2.5 Security facility	57,000	1,140,000
1.2.6 Electric and plumbing installations	140,300	2,806,000
2. Indirect Cost (30% of 1. Direct Cost)	258,000	5,160,000
B. CONTINGENCY (10% of A)	111,000	2,220,000
C. MISCELLANEOUS (5% of A + B)	61,000	1,220,000
GRAND TOTAL	₦1,290,000	¥25,800,000

Note: 1. US$1.0 = ₦6.1 = ¥122
2. Indirect Cost includes cost of indirect temporary works.

4.3 Material and Labor Cost

(1) Material Cost

November, 1988

Item	Unit	Unit Price (₦)	Remarks
Sand	m^3	40	
Gravel	m^3	80	
Stone	m^3	50	
Timber	m^3	600	
Cement	bag	30	50 kg
Concrete Block, 9 inch	piece	1.8	
Reinforcement Bar	ton	3,200	
Steel Material for structure	ton	4,500	
Wire Net	m^2	10	for fence
Wire Net, 1/2 inch mesh	m^2	7	for bird net
Steel Pipe, ϕ25	m	14	
Steel Pipe, ϕ50	m	24	
Steel Pipe, ϕ100	m	50	
PVC Pipe, ϕ40	m	4	
PVC Pipe, ϕ50	m	5	
PVC Pipe, ϕ75	m	8	
PVC Pipe, ϕ100	m	11	
PVC Pipe, ϕ150	m	29	
Gasoline	lit	0.42	
Diesel oil	lit	0.35	
Lubricant	lit	3.7	
Grease	kg	12	

(2) Labor Cost

November, 1988

Item	Unit	Unit Price (₦)
Common Laborer	man. day	10
Skilled Laborer	man. day	20
Foreman	man. day	30
Mason	man. day	20
Concrete Worker	man. day	20
Carpenter	man. day	20
Steel Worker	man. day	25
Painter	man. day	20
Plumber	man. day	25
Welder	man. day	25
Electrician	man. day	25
Operator (Truck)	man. day	30
Operator (Heavy Machinery)	man. day	30
Assistant Operator	man. day	10

4.4 Bill of Quantities

Item	Unit	Q'ty	Unit Price (Naira)	Amount (Naira)
1. EXPERIMENTAL FARM				
1.1 Land Preparation				57,200
(1) Land Levelling	ha	3.56	15,000	53,400
(2) Finishing for Ridge	m	380	10	3,800
1.2 Concrete Ridge and Slope				54,800
(1) Excavation	m^3	150	20	3,000
(2) Embankment	m^3	90	60	5,400
(3) Backfill	m^3	120	10	1,200
(4) Concrete, class B	m^3	79	400	31,600
(5) Concrete, class C	m^3	6.4	350	2,240
(6) Form for Concrete	m^2	320	30	9,600
(7) Reinforcement Bar	ton	0.44	4,000	1,760
1.3 Bird Protection Facility				31,000
(1) Excavation	m^3	62	10	620
(2) Backfill	m^3	57	10	570
(3) Concrete, class A	m^3	0.8	450	360
(4) Concrete, class B	m^3	6.7	400	2,680
(5) Concrete, class C	m^3	1.7	350	595
(6) Form for Concrete	m^2	79	30	2,370
(7) Reinforcement Bar	ton	0.43	4,000	1,720
(8) Structural Steel	kg	19	7	133
(9) Galvanized Iron Wire	kg	54	7	378
(10) Bird Net	m^2	1,300	15	19,500
(11) Painting	m^2	1.0	14	14
(12) Others	L.S.			2,060
1.4 Farm Road				178,000
(1) Stripping	m^3	450	20	9,000
(2) Embankment, Laterite	m^3	2,030	60	121,800
(3) Gravel Pavement	m^2	2,360	20	47,200
1.5 Irrigation Canal				38,200
(1) Excavation	m^3	100	20	2,000
(2) Embankment, Laterite	m^3	110	60	6,600
(3) Concrete, class B	m^3	74	400	29,600
1.6 Drainage Canal				6,100
(1) Excavation	m^3	150	20	3,000
(2) Embankment	m^3	50	60	3,000
(3) Backfill	m^3	10	10	100
1.7 Canal Related Structure				46,500
(1) Excavation	m^3	130	10	1,300
(2) Backfill	m^3	100	10	1,000
(3) Concrete, class B	m^3	27	400	10,800
(4) Concrete, class C	m^3	5.8	350	2,030
(5) Form for Concrete	m^2	250	30	7,500
(6) Reinforcement Bar	ton	0.67	4,000	2,680
(7) Stoplog	m^3	0.40	600	240
(8) RC Pipe, D400	m	90	180	16,200
(9) PVC Pipe, D150	m	80	30	2,400
(10) Sand Filling	m^3	5	60	300
(11) Others	L.S.			2,050
Sub-total				411,800

Item	Unit	Q'ty	Unit Price (Naira)	Amount (Naira)
2. FARM FACILITIES				108,600
2.1 Land Preparation for Facility Yard				
(1) Stripping	m^3	240	20	4,800
(2) Embankment, Laterite	m^3	1,300	60	78,000
(3) Gravel Pavement	m^2	1,200	20	24,000
(4) Drainage Ditch	L.S.			1,800
				120,800
2.2 Field Managing House				
(1) Excavation	m^3	53	10	530
(2) Backfill	m^3	31	10	310
(3) Concrete, class A	m^3	36	450	16,200
(4) Concrete, class C	m^3	9.2	350	3,220
(5) Form for Concrete	m^2	110	30	3,300
(6) Reinforcement Bar	ton	1.2	4,000	4,800
(7) Wire Mesh	m^2	144	15	2,160
(8) Timber	L.S.			6,300
(9) Slate Roof	L.S.			5,040
(10) Concrete Block Masonry	m^2	220	60	13,200
(11) Door and Window	L.S.			11,200
(12) Finishing and Painting	L.S.			24,000
(13) Testing Bed, Shelf, etc.	L.S.			22,500
(14) Scaffolding/Others	L.S.			8,040
				20,000
2.3 Rice Drying Yard				
(1) Excavation	m^3	9	10	90
(2) Concrete, class A	m^3	20	450	9,000
(3) Concrete, class C	m^3	7.6	350	2,660
(4) Form for Concrete	m^2	32	30	960
(5) Reinforcement Bar	ton	0.01	4,000	40
(6) Wire Mesh	m^2	150	15	2,250
(7) Floor Finishing	m^2	150	2.6	390
(8) Steel Material	kg	50	7	350
(9) Steel Pipe D100	m	27	50	1,350
(10) Painting	m^2	9	14	126
(11) Timber	L.S.			790
(12) Slate Roof	m^2	36	25	900
(13) Scaffolding/Others	L.S.			1,094
				1,560
2.4 Washing Bay for Machinery				
(1) Excavation	m^3	3	10	30
(2) Concrete, class A	m^3	1.9	450	855
(3) Concrete, class C	m^3	0.7	350	245
(4) Form for Concrete	m^2	5	30	150
(5) Reinforcement Bar	kg	58	4	232
(6) Floor Finishing	m^2	12	2.6	31
(7) Others	L.S.			17
2.5 Security Facilities				57,000
2.5.1 Fence, etc.				51,900
(1) Fence	m	190	250	47,500
(2) Gate	no.	1	2,400	2,400
(3) Sign Board, etc.	L.S.			2,000

Item	Unit	Q'ty	Unit Price (Naira)	Amount (Naira)
2.5.2 Guard House				5,100
(1) Excavation	m^3	3.2	10	32
(2) Concrete, class A	m^3	1.3	450	585
(3) Concrete, class C	m^3	0.3	350	105
(4) Form for Concrete	m^2	10	30	300
(5) Reinforcement Bar	ton	0.07	4,000	280
(6) Wire Mesh	m^2	2.3	15	34
(7) Concrete Block Masonry	m^2	10	60	600
(8) Timber	L.S.			71
(9) Slate Roof	L.S.			156
(10) Door and Window	L.S.			1,800
(11) Finishing	L.S.			1,100
(12) Others	L.S.			37
2.6 Electric and Plumbing Installations				140,300
2.6.1 Generator House				8,900
(1) Excavation	m^3	6	10	60
(2) Concrete, class A	m^3	2.6	450	1,170
(3) Concrete, class C	m^3	0.6	350	210
(4) Form for Concrete	m^2	19	30	570
(5) Reinforcement Bar	ton	0.13	4,000	520
(6) Wire Mesh	m^2	6	15	90
(7) Concrete Block Masonry	m^2	22	60	1,320
(8) Timber	L.S.			168
(9) Slate Roof	L.S.			300
(10) Door and Window	L.S.			2,400
(11) Finishing	L.S.			1,900
(12) Others	L.S.			192
2.6.2 Electric Installations				86,700
(1) Field Managing House	L.S.			6,300
(2) Generator House	L.S.			450
(3) Guard House	L.S.			420
(4) Generator	no.	2	26,000	52,000
(5) Outdoor System	L.S.			6,500
(6) Prevention Light	no.	3	3,600	10,800
(7) Electric Cable for Light	L.S.			5,200
(8) Pump Control Panel	L.S.			5.030
2.6.3 Plumbing Installations				35,400
(1) Elevated Water Tank	no.	1	3,000	3,000
(2) Storage Water Tank	no.	1	7,000	7,000
(3) Pump for Water Lifting	no.	1	5,000	5,000
(4) Septic Tank	no.	1	5,500	5,500
(5) Pipeline System	L.S.			14,900
2.6.4 Air-conditioning and Ventilation Installations				9,300
(1) Cooler	no.	1	7,500	7,500
(2) Exhaust Fan, etc.	L.S.			1,800
Sub-total				448,260
GRAND TOTAL				860,060

CHAPTER 5 CONTRACT DOCUMENTS (DRAFT)

5-1 Contract (Draft)

5-2 Technical Specifications (Draft)

5-1 Contract (Draft)

CONTRACT

FOR

CONSTRUCTION OF MODEL INFRASTRUCTURE IMPROVEMENT WORKS

ON

THE LOWER ANAMBRA IRRIGATION PROJECT

IN

NIGERIA

JAPAN INTERNATIONAL COOPERATION AGENCY

CONTRACT

For Construction of Model Infrastructure Improvement Works
on the Lower Anambra Irrigation Project in Nigeria

This Contract is executed on the ____ day of _____ 1989 at _____ between Japan International Cooperation Agency, Technical Cooperation Team by Team Leader as its authorized representative of JICA, hereinafter called "JICA" of the one part, and _____ whose office is situated at _____

Represented by _____

Nationality _____ Title _____

hereinafter called "the Contractor", of the other part.

Both parties mutually agree under the terms of this Contract as follows:

Article 1 (a)

DESCRIPTION OF WORKS

The Contractor shall carry out the construction of model infrastructure improvement works, hereinafter called "the Works", consisting of land preparation, irrigation and drainage facilities, farm facilities and their related structures for the Lower Anambra Irrigation Project.

Article 1 (b)

JICA agrees to employ the Contractor and the Contractor agrees to perform the Works as specified below.

1.	Land Preparation for Fields			
	(a) Land levelling for experimental field	A	=	3.56 ha
	(b) Farm road (W = 5.0 m, Gravel pavement)	L	=	220 m
	(c) Farm road (W = 4.0 m, Gravel pavement)	L	=	490 m
	(d) Farm road (W = 4.0 m)	L	=	400 m
	(e) Concrete ridge and slope (210 m + 600 m)	L	=	810 m
	(f) Bird protection facility	A	=	810 m^2
2.	Irrigation and Drainage Facilities			
	(a) Irrigation canal (Wb = 0.3 m, H = 0.5 m)	L	=	135 m

(b)	Irrigation canal (Wb = 0.3 m, H = 0.3 m)	L = 370 m
(c)	Drainage canal (Wb = 0.3 m, H = min. 0.4 m)	L = 660 m
(d)	Division box	21 pcs
(e)	Culvert	18 pcs
(f)	Drainage outlet	15 pcs
3.	Land Preparation for Facility Yard	
(a)	Embankment	V = 1,300 m^3
(b)	Gravel pavement	A = 1,200 m^2
4.	Farm Facilities	
(a)	Field managing house	1 lot
(b)	Rice drying yard	1 lot
(c)	Guard house	1 lot
(d)	Generator house	1 lot
(e)	Washing bay for machinery	1 lot
(f)	Safety facilities (fence, gate, etc.)	1 set
(g)	Electricity, air-conditioning, and ventilation system	1 set
(h)	Water supply, sewerage system	1 set
5.	General Works (Preparatory works, temporary works and other common works)	L.S.

The details of the above terms are given in the attached drawings and specifications.

Article 1 (c)

The following documents shall be deemed to form, be read and construed as Part of the Contract:

i) Contract
ii) Technical Specifications
iii) Drawings
iv) Bill of Quantities

Article 2

CONTRACT PRICE

The Contract price is fixed in ₦ _____
(Say Naira _____).

Overheads, profits and any duties and taxes shall be included in the Unit Prices of the Bill of Quantities.

Article 3

PERFORMANCE BOND

As a security for faithful performance of the Works under this Contract, the Contractor has on the execution of this Contract deposited a performance bond with JICA of ₦ _____ (_____) in cash, or in lieu thereof a Bank Guarantee issued by the _____ _____ bearing the number _____ and dated _____ in the amount of ₦ _____ (_____ _____) which represents five (5) percent of the Contract Price, the name of the issuing bank and the form of the bank guarantee are to be approved by JICA.

JICA will return the Performance Bond or the Bank Guarantee to the Contractor as the case may be at the end of the twelve (12) months after final acceptance of the Works by JICA as stipulated in Article 19 of this Contract, provided that the completed Works shall not show any defect or damage caused through the fault of the Contractor, or through the fault of any new Contractor in the case of termination of Contract by JICA under Article 4.

Should the Contractor be in default, JICA shall have the right to demand payment of all or any part of the Performance Bond. In addition, the Contractor shall remain liable for the full loss sustained by JICA.

Article 4

COMPLETION TIME

The Contractor agrees to commence the Works at the site within ten (10) days from the date of signing of this Contract (Commencement date) and the Contractor agrees to satisfactorily complete the Works within ___ days (completion time) after the date hereof which will become due on _____ 1990 (completion date).

If it is clear that the Contractor is failing to fulfill his obligations within the period referred to in the preceding Article, the Contractor shall inform JICA of this as soon as possible and if JICA agrees that the delay is due to such causes as natural calamity or others for which the Contractor is not liable, a reasonable extension of time shall be approved. In this case, the sum referred to in Article 15 shall not be collected.

Article 5

CONSTRUCTION METHOD AND TEMPORARY WORKS

The construction method, including the implementation schedule and plan of the temporary works such as installation of temporary facilities, offices, warehouses, construction roads, electric wiring, etc. shall be submitted by the Contractor and approved by JICA at least one (1) week in advance of the commencement of the Works.

Article 6 (a)

PROCESS OF CARRYING OUT OF WORKS

The Contractor shall carry out the works in accordance with the drawings and specifications referred to in Article 1 (c). And in any cases where it is necessary for carrying out such works as are not mentioned therein for the purpose of promoting the present construction or for reasons of established practices, the Contractor shall carry out the said work under the direction of JICA. In cases where the Contractor has any doubt about the plans for construction, the Contractor shall ask JICA for the necessary directions before commencing the work on that part for which there exists some doubt.

Article 6 (b)

COMPLIANCE WITH STATUTES AND REGULATIONS

In the execution of the works mentioned in Article 6 (a), the following conditions will prevail:

1. General conditions of contract issued by the Federal Government of Nigeria for works of civil engineering construction Volume 1 (1975).

2. General specification on construction of roads and bridges issued by the Federal Government of Nigeria for civil engineering construction Volume II.

3. Schedule of daywork rates carried out incidental to contract work issued by the Federation of Building and Civil Engineering Contractors in Nigeria (1971).

4. The standard electrical specification (1972).

Article 7

CARE OF WORKS

The Contractor shall follow the directions of JICA or the Engineer to be appointed by JICA (hereinafter called "the Engineer"). As to materials for construction, the Contractor shall use only those inspected and approved by JICA or the Engineer. If any defective work has been done as the result of using any materials which have not been inspected by the Engineer, the Contractor shall be liable to change the materials or repair the works at his own cost and responsibility. The construction shall be carried out in accordance with approved techniques and durability shall be the principal aim as regards the construction.

Article 8

EMPLOYMENT OF WORKMEN

As for the workmen to be hired by the Contractor for the works, the Contractor shall assume the responsibility as entrepreneur or employer, as provided for by laws and regulations in Nigeria.

Article 9

SUB-LETTING

The Contractor shall not assign or sublet to a third party the whole or part of the construction, unless the Contractor has obtained prior written approval from JICA.

Article 10

DAMAGES TO PERSONS OR PROPERTIES

If any damages are caused to JICA or a third party, materials or buildings, through carelessness on the part of the Contractor during the course of works or transportation of materials, the Contractor shall be liable to repair or compensate such damages at his own expense by the date appointed by JICA or the third party.

Article 11

MODIFICATION OF PLAN

If JICA finds it necessary to make modifications to the construction design, quantities and/or materials and so forth during the course of construction, JICA has the right to order such modification of the Works by the Contractor, and such order shall be made in writing from JICA to the Contractor.

JICA agrees to adjust upwards or downwards the necessary expense for such modification to the Contractor, which will be estimated by unit prices in the Bill of Quantities of this Contract in the case of modification of quantities of construction works.

If the Contract does not contain any rates applicable to the extra or additional work, then suitable prices shall be agreed upon between JICA and the Contractor. In the event of disagreement, the Engineer shall fix such prices as shall in his opinion be reasonable and proper.

Also the extension of the completion time due to the modification shall be given by JICA who shall have the sole right to decide the number of days of such extension.

Article 12

PRICE ADJUSTMENT

If the costs of materials and works have risen sharply as a result of Naira-devaluation against the US Dollar in Nigeria, JICA at the request of the Contractor, is open to negotiation on reasonable adjustment of a part of the Contract price on the basis of unit prices in the Bill of Quantities. However, the adjustment rates will be subject to total approval from JICA.

Article 13

RIGHT TO RESCIND CONTRACT AND PENALTY

In cases where the Contractor fails to fulfill his obligations under this contract, JICA may rescind the whole or part of the Contract.

In such a case, JICA may collect from the Contractor, as a penalty, a sum of 10 percent (10%) of the amount of rescinded construction in addition to the amount of rescinded construction. When the damage sustained to JICA on account of nonfulfillment of Contract by the Contractor exceeds the sum referred to in the preceding sentence, JICA may further demand from the Contractor payment of the excess.

Article 14

FULFILLMENT OF OBLIGATIONS BY THIRD PARTY

In cases other than provided for in the preceding Article, where the fulfillment of obligations by the Contractor is regarded to be difficult, JICA may have a third party fulfill the whole part of the Contractor's obligations, at the cost of the Contractor. Even if liability of the Contractor exceeds the Contract price of construction referred to in Article 2 in consequence of this, the Contractor may not raise any objection to it.

Article 15

LIQUIDATED DAMAGES FOR DELAY

In cases other than provided for in Article 13, where the Contractor fails to complete the construction on his own responsibility within the time limit referred to in Article 4, the Contractor shall be liable for payment of a sum equivalent to 0.05 percent (0.05%) of the Contract price of construction referred to in Article 2, per day of delay within a period fixed by JICA.

Article 16

DAMAGE CAUSED BY NATURAL CALAMITY, ETC.

In cases where serious damage occurs to the completed part of the works, or the materials, tools, etc., already carried into the field of construction, the Contractor shall promptly inform JICA of the fact. If such damage is caused by natural calamity, such as an earthquake, a flood, a war, an epidemic, or a general trade strike, rioting or other unavoidable reasons, while it is concluded that the Contractor has taken normal precautions to avoid the occurrence of such damage, JICA shall be liable for the amount of the damage which shall be fixed through negotiations between JICA and the Contractor.

Article 17

REPORT FOR COMPLETION OF CONSTRUCTION

At the time of completion of the construction, the Contractor must report to JICA promptly in writing.

Article 18 (a)

INSPECTION

The work at any stage shall be subject to inspection to be conducted by JICA or the Engineer appointed by JICA, in the presence of the Contractor, and necessary labor and articles required for such an inspection shall be provided by the Contractor.

Article 18 (b)

In cases where the work fails to pass the inspection referred to in the preceding paragraph, the Contractor shall carry out necessary repairs at his own cost, under the direction of JICA.

Article 19

DATE OF COMPLETION OF CONSTRUCTION AND OBLIGATION THEREAFTER

The date of Completion of Construction shall be regarded as that on which the final work, including removal of temporary construction and cleaning, has passed the inspection referred to in Article 18, and on that date the object of the construction shall be delivered to JICA by the Contractor. For a period of one year thereafter, any defect in the construction, the cause of which, in the opinion of JICA, is judged to be attributable to faulty or inadequate techniques or materials employed by the Contractor, shall be immediately repaired or improved at the cost of the Contractor.

Article 20

PAYMENT

JICA agrees to effect payments for the Works to the Contractor in the following manner:

a. Advance Payment, to be effected upon the bringing of equipment and materials required for the Works and properly stored at the job site by the Contractor, and of value estimated by JICA,
Naira _____ (₦ _____)
which corresponds to thirty (30) percent of the Contract Price shall be paid upon signing of this Contract at the request of the Contractor.

b. Interim Payment, to be effected according to the progress of the Works satisfactorily executed by the Contractor and accepted by JICA,
Naira _____
(₦ _____) which corresponds to thirty (30) percent of the Contract Price shall be requested for payment once during the course of construction at the request of the Contractor. If the

value of the executed construction works estimated by JICA is less than fifty (50) percent of the Contract Price, interim payment shall be reduced by the full amount of advance payment, balance of which correspond to value of the executed construction works.

c. Final Payment, to be effect upon the satisfactory completion of the Works by the Contractor and accepted by JICA. The remainder of Naira _____

_____

(₦ _____) which corresponds to forty (40) percent of the Contract Price, shall be paid after the Final Certificate by JICA for payment to the Contractor.

Payment under (b) and (c) shall be effected within ten (10) days after the respective acceptance of the Works by JICA.

Taxes payable by the Contractor, if any, shall be deducted at source by JICA on each payment.

It is expressly understood that payments by JICA do not mean acceptance of responsibilities under this Contract.

Article 21
SETTLEMENT OF DISPUTES

If there arises any dispute with regard to this Contract or the Drawings or Specifications referred to in Article 1 (c), JICA and the Contractor shall make efforts for settlement of the dispute by mutual consultation.

Article 22
ARBITRATOR

Should JICA and the Contractor fail to reach a mutual agreement on such dispute as mentioned in the preceding Article, then it shall be referred to an Arbitrator or Arbitrators acceptable to and appointed by both JICA and the Contractor, and the decision of this Arbitrator or these Arbitrators shall be binding on both JICA and the Contractor.

THE CONCLUSION OF THE CONTRACT

Revenue stamp duty of the Contract will be paid by the Contractor. Two copies of the Contract shall be prepared with the signature of both parties to each of the copies, one copy to be held by each party.

....., (Date)

EMPLOYER	CONTRACTOR
_____	_____
Japan International Cooperation Agency	Director of (Name of Company)
WITNESS BY	WITNESS BY
_____	_____
	JICA Short Term Expert

5-2 Technical Specifications (Draft)

TECHNICAL SPECIFICATIONS

FOR

CONSTRUCTION OF MODEL INFRASTRUCTURE IMPROVEMENT WORKS

ON

THE LOWER ANAMBRA IRRIGATION PROJECT

IN

NIGERIA

JAPAN INTERNATIONAL COOPERATION AGENCY

TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS

PART 1 SPECIAL PROVISION

1-01 APPLICATION

These specifications are applicable to "Construction of Model Infrastructure Improvement Works on the Lower Anambra Irrigation Project in Nigeria". Main work quantities are stipulated in Article 1 of the Contract. Specifications entered in the drawing shall be treated in reference to these technical specifications.

1-02 THE ENGINEER

"The Engineer" means the engineer who was appointed to supervise the works by JICA.

1-03 SITE REPRESENTATIVE OF THE CONTRACTOR

Site representative of the Contractor shall be well qualified in construction or have enough experience of construction. The Contractor shall submit the career history of a site representative to the Engineer for his approval.

1-04 WORK SCHEDULE

The Contractor shall submit his work schedule before the commencement of the works at the job site. If the Contractor intends to change the work schedule, the approval from the Engineer shall be obtained prior to modification of the schedule.

Also the Contractor shall submit the machinery scheme including number and kind of machinery and proposed period of use.

1-05 The Contractor shall exercise the utmost care so that his construction operations will not damage any existing structure except such structures as specified to be dismantled. Any damages to existing structures or facilities shall be made good by the Contractor at his expense.

1-06 If it is necessary in the prosecution of the work to interrupt or to obstruct the flow of existing irrigation canals, the flow of artificial drains and the drainage of the surface, the Contractor shall provide for the same during the progress of the work in such a way that no damage shall result to either public or private interests. For any neglect to provide for either artificial canal or drainage which he may interrupt, he shall be held liable for all damages which may result there from during the progress of the work.

1-07 The Contractor is expected to visit the location of the work and make his own estimate of the facilities needed for the work. In the successful execution of the construction, the Contractor is expected to familiarize himself with local conditions, availability of labor, transportation facilities, water and electric supply, uncertainties of weather and other contingencies. From investigations, made at site, it is believed that topographical conditions are approximately as shown on the drawings, but the nature of the materials and the depth of satisfactory

foundations, are not guaranteed. It is expressly understood that JICA will not be responsible for any deduction, interpretation, or conclusions made by the Contractor. JICA does not guarantee that other materials will not be encountered or that the proportions of the several materials will not vary from those indicated by the drawings.

1-08 Elevations referred to the datum plane are to be determined from benchmarks established by JICA or the Engineer at the site of the work.

1-09 SETTING-OUT

The Contractor shall be entirely responsible for accurate setting-out of the works including staking of centerlines for canals and roads, etc. based on the information supplied on the Drawings and the instructions given by the Engineer.

All stakes, benchmarks, etc., placed by the Engineer in laying out the works shall be carefully guarded and preserved by the Contractor, and if stakes or marks are misplaced or rendered useless through the carelessness or negligence of the Contractor or his agents, employees or workmen, they shall be replaced by the Contractor at his expense.

The Contractor shall execute the work to the lines and grades given by the drawings and/or Engineer. The Contractor shall, at his own expense, furnish all stakes, templates, pattern, platforms and labor that may be required in setting or laying out any part of the work.

The costs of conforming to the requirements of this Clause shall be entered in the Bill of Quantities.

1-10 DRAWINGS TO BE FURNISHED BY THE CONTRACTOR

The Contractor shall submit the drawings of centerline survey results and longitudinal section in two copies for the construction of canals and roads, etc.

Construction of any part of the above works shall not commence until the Drawings have been approved by the Engineer, and thereafter no change shall be made to any drawing so approved without permission of the Engineer.

In addition to the above, during execution of the work, the Contractor shall at his own expense prepare reinforcement drawings based on the Drawings supplied by JICA as needed for performance of the works.

These reinforcement drawings shall include such bar placing drawings, bar lists and any other reinforcement drawings as may be required to facilities fabrication and placement of reinforcement.

All reinforcement drawings prepared by the Contractor shall be submitted to the Engineer for approval. All costs incurred by the Contractor in complying with the requirements of this Clause shall be deemed to be included in the Bill of Quantities.

The Contractor shall prepare and submit to the Engineer the As-Built Drawings which conform to the final state of the works at the time when the works have been completed and delivered to the Employer. The Contractor may use the original sheets of the design drawings prepared by the Engineer as part of the As-Built Drawings modifying them and conforming to the final state of the works. The cost for preparing As-Built Drawings shall be included in the Contract Price.

1-11 ASSISTANCE TO ENGINEER'S STAFF

The Contractor shall render all necessary assistance to the Engineer and shall provide as required by and for use of the Engineer, sufficient quantities of pegs, poles, straight edges, stagings, moulds, templates, profiles and all other requisites for checking the Contractor's setting out and the measurement of the Works.

The cost of all labor and materials required by the Engineer for the said purposes shall be borne by the Contractor. All cost incurred by the Contractor in complying with the requirements of this Clause shall be deemed to be included in the Bill of Quantities.

1-12 REPORTS

The Contractor shall submit daily or weekly reports to each work section to the Engineer.

These reports shall contain, but not be limited to, the following data: Weather conditions, staff and labor force employed on the Works, materials used, work in progress, work in preparation, laboratory test data, accidents, photographs and all other information relevant to the progress of the Works.

The payment of all costs incurred by the Contractor in complying with requirements of this Clause shall be deemed to be included in the Bill of Quantities.

1-13 FIELD TESTS AND INSPECTIONS

The field tests in accordance with the specifications and the demands of the Engineer shall be the responsibility of the Contractor. The charges for such field tests shall be included in the Bill of Quantities.

1-14 CLEARANCE OF THE WORK SITE

Upon completion of the works, the Contractor shall clear the site within period of construction.

1-15 COMMON TEMPORARY WORKS AND SITE EXPENSES

The Contractor shall price the general works in the Bill of Quantities covering all costs and expenses for preparatory works, common temporary works and other common site expenses such as:

- Mobilization and demobilization of equipments (Clauses 2-03 and 2-05)

- Maintenance of temporary access roads and Construction of haul roads (Clause 2-02)

- Land hiring for the Contractor's yard

- Construction, maintenance and subsequent removal of offices, stores, workshops, staff quarters and labor camps with fencing (Clauses 2-03 and 2-04)

- Installation, operation, maintenance and subsequent removal of water and electric supply system for the Contractor's offices, workshops, staff quarters and labor camps (Clause 2-03)

- Centerline survey and furnishing of drawings (Clauses 1-09 and 1-10)

- Assistance to Engineer's staff for certificates (Clause 1-11)

- Setting out canals, roads and structures and staking of reference pegs (Clause 1-09)

- Field tests including provision of testing apparatus, testing engineer, labor and consumables (Clause 1-13)

- Submitting periodical reports and color photographs (Clause 1-12)

- Other works but not limited.

PART 2 GENERAL CONSTRUCTION FACILITIES

2-01 SCOPE

This part covers the construction and/or maintenance of access roads, setting up of Contractor's camp facilities, providing camp security and the disposition of the Contractor's various facilities at the end of the Contract.

2-02 ROADS

(a) The Contractor shall improve, repair and widen, if necessary, existing roads to satisfactorily meet his haulage requirements. He shall also construct all other roads within the construction area which he deems necessary in the prosecution of his work. The improving, widening and maintaining of existing roads and constructing and maintaining new roads shall be made by the contractor at his expense and on his responsibility during the construction under the contract.

2-03 CONTRACTOR'S CAMP FACILITIES

(a) If the Contractor deems necessary, he shall grade his camp site; construct his office, employees' housing, warehouses, machine and repair shops, fuel storage tanks; and provide such other facilities that the Contractor deems necessary for maintaining health, peace and order in the camp and work areas.

(b) The location, construction, operation and maintenance of such camps and facilities within the Lower Anambra Irrigation Project shall be subject to the approval of the Engineer. At least ten (10) calendar days prior to the date on which the Contractor desires to begin to work on any feature of camp construction, the Contractor shall submit for the approval of the Engineer drawings and specifications in sufficient detail to permit determination of the suitability of the construction in compliance with these specifications, and no camp construction of any kind shall be undertaken until such drawings and specifications have been approved by the Engineer.

2-04 CAMP SECURITY

The Contractor shall provide his own security force to the extent that he deems necessary for maintaining peace and order in the camps and work areas and to safeguard materials and equipment including fencing.

2-05 DISPOSITION OF CAMP AND CONSTRUCTION FACILITIES

After the completion of the work covered by the Contractor, the entire camp of the Contractor, including its water supply system, quarters, warehouses, shops and other facilities therein; and all other temporary installations at work areas shall be removed by the Contractor and the site shall be cleared.

PART 3 CARE OF WATER DURING CONSTRUCTION

3-01 SCOPE

In accordance with specifications contained in this part, the Contractor shall care the water during construction so that construction work can be performed in areas free from water. Care of water during construction shall include provision for drainage and pumping system for dewatering foundation areas and the construction of temporary bulkheads necessary for the protection of construction operations from encroachment by water.

3-02 DRAINAGE AND PUMPING

The Contractor shall be responsible for dewatering the foundation areas so that work may be carried on in a suitably dry condition, drainage and/or pumping all water during the process of construction until its completion. The contractor shall construct drainage ditches, holes, or culverts; furnish, operate, and maintain at his own expense all necessary pumps, to keep all work areas in ample dry condition, and prior to final acceptance of the work by the Contracting Officer, the Contractor shall remove, fill or plug all temporary drainage structures and pumping equipment at his expense.

3-03 PAYMENT

No separate payment shall be made for the care of water during construction. But the cost of furnishing, constructing, operating, maintaining, and removal of temporary drainage structures, canals, and pumping system necessary to keep construction operations free from water shall be included in the Bill of Quantities.

PART 4 OPEN EXCAVATION AND FOUNDATION PREPARATION

4-01 SCOPE

In accordance with the Specifications contained in this part, and as shown on the drawings, or otherwise directed by the Engineer, the Contractor shall perform all required open excavation and foundation preparation pertinent to the construction work.

4-02 OPEN EXCAVATION

(a) General

Open excavation under these Specifications consists of the removal, hauling, dumping, and satisfactory disposal of all materials from required excavations for irrigation canals, drainage canals and miscellaneous excavations for other structures included under this Contract. Open excavation shall be performed to the lines and grades shown on the drawings or established by the Engineer. The Engineer may modify slopes of excavation to fit conditions encountered during construction. Such changes or modifications shall not be considered by the Contractor as a basis for additional compensation over and above the unit prices bid. All necessary precautions shall be taken to preserve the ground outside the specified lines and grades in the soundest possible conditions.

(b) Foundation in Loose Material

When the surfaces of excavation upon or against which concrete or stone masonry or embankment fill is to be placed consist of loose materials, the said loose materials shall be removed or replaced with suitable materials and compacted in a manner satisfactory to the Engineer. The cost of removing the loose materials shall be paid for under the pertinent bid items for open excavation. The cost for the replacement with suitable materials and the compaction of the same shall be paid for under the pertinent bid items for fill.

4-03 DISPOSITION OF EXCAVATION MATERIALS

(a) Spoil Areas

The Contractor shall submit for the approval of the Engineer locations, areas, drawings and other necessary specifications of spoil area which the Contractor proposes to use for the works under this Contract, and any kind of disposition shall not be undertaken before obtaining the said approval. Excavated material not suitable for fill or otherwise not needed shall be wasted in approved spoil areas. Spoil piles shall be constructed to the stable slopes of the materials being wasted. Any spoil pile exceeding two (2) meters in height shall not be performed. Spoil material shall be spread and graded so that surface drainage will not be concentrated and will not create and/or accelerate undesirable erosion in spoil areas.

4-04 DEMOLITION, REMOVAL AND DISMANTLING

When specified in the drawings or by the Engineer, existing concrete structures, such as concrete culvert, division boxes, etc., shall be demolished and disposed of accordingly.

4-05 FOUNDATION PREPARATION

(a) Fill on Earth

All horizontal and sloped earth surfaces, upon which embankment materials is to be placed or other foundation surfaces whose locations are specifically indicated by the Engineer, shall consist of undisturbed or compacted material and shall be clean, damp, free from standing or running water and free from organic matter; and shall be suitable as a foundation for the material to be placed upon them.

(b) Concrete

All horizontal and sloped earth surfaces upon which concrete is to be placed shall be undisturbed or of approved compaction, clean and damp, free from standing or running water, and shall be otherwise suitable as a foundation for the concrete to be placed upon them.

4-06 MEASUREMENT FOR PAYMENT

Open Excavation

A survey of the areas to be excavated shall be made by the Contractor prior to the commencement of the work under this Contract, and all measurements of excavation shall be based on this survey without regard to any change that may occur during the prosecution of the work. All such surveys shall be subject to check and approval by the Engineer. Volumes will be computed and shall be the amount between the original ground determined by the survey and the slopes, lines and grades shown on the drawings or established by the Engineer.

PART 5 BACKFILL AND EARTHFILL

5-01 SCOPE

In accordance with the specifications contained in this part and as shown in the drawings or otherwise directed by the Engineer, the Contractor shall furnish and place the earthfill for construction work, backfill for related structures. No work of fill and backfill shall be commenced without prior approval of the Engineer. The slope of the embankment shall be finished to the designed gradient by providing fixed rules.

5-02 EARTHFILL

Earthfills shall be constructed to the lines, grades and cross sections indicated on the drawings, unless otherwise directed by the Engineer. The Engineer may increase or decrease the slopes of the fill or make such other changes in the design as may be deemed necessary to produce a stable structure. Change in quantities of materials resulting from prescribed changes in section, shall not make cause for claims for increased unit prices. Unless otherwise specified, no point on the surface of the completed earthfill shall be more than 5 cm and less than -5 cm in distance from the designated surface, provided that the canal waterway section shall not be reduced at any point from the designated lines and levels. Within the above tolerance, surfaces shall have smooth regular shape free from sharp changes.

The fill material shall be dumped and spread in horizontal layers having an uncompacted thickness of not over 20 cm. When material is spread, chunks larger than 10 cm in size shall be broken down by approved means or removed.

5-03 BACKFILL

Backfill, as used herein, is defined as refill for structures, culverts, division boxes, etc. such as concrete. The materials used for backfill shall be free from roots, stones of more than five (5) centimeters in diameter, and other objectionable materials and subject to the approval of the Engineer. Backfill materials shall be placed in layers, each layer being not more than twenty (20) centimeters thick before compaction, thoroughly compacted by means of power tampers or by other means approved by the Engineer.

5-04 MEASUREMENT FOR PAYMENT

(1) Earthfill

(a) Measurement

Measurement for payment of earth fill will be calculated on the number of cubic meters of material placed between the foundation lines as determined on the basis on drawings or a survey made after completion of the excavation and foundation preparation and the lines, grades and slopes shown on the drawings. No allowance will be made for foundation or embankment settlement.

(b) Payment

Payment shall constitute full compensation for all works in connection with the excavation from borrow areas including clearing, grubbing and stripping of borrow areas, hauling, stock-piling, rehandling, foundation preparation, placing, spreading, sprinkling, drying, breaking up, compacting, removal of objectionable material, and all other works required for the construction, protection and maintenance of the fills.

No adjustment in payment will be made for substitution of materials and for additional compaction.

(2) Backfill

Measurement for payment of backfill shall be calculated on the number of cubic meters of materials placed between the original ground line or designated line of backfill, and the structure and the neat pay lines of excavation shown in the drawings. Payment will be made on the unit price bid per cubic meter of backfill.