REPUBLIC OF INDONESIA

PROJECT
OF
THE CENTER FOR DEVELOPMENT
OF
APPROPRIATE AGRICULTURAL
ENGINEERING TECHNOLOGY

DETAIL DESIGN REPORT

ON

MODEL INFRASTRUCTURE IMPROVEMENT WORK

NOVEMBER 1988

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

The Republic of Indonesia, in accordance with the Fourth Five-year Development Plan (1984-1988), intends to promote mechanization of agriculture, as appropriate to present agricultural conditions and agricultural engineering technology, and further to promote domestic production of agricultural machinery. Accordingly, the Government of Indonesia requested technical cooperation in this matters from the Government of Japan. In response to this, the Government of Japan signed the R/D with the Government of Indonesia on February 7, 1987 and undertook to provide technical cooperation for five years from April 1, 1987.

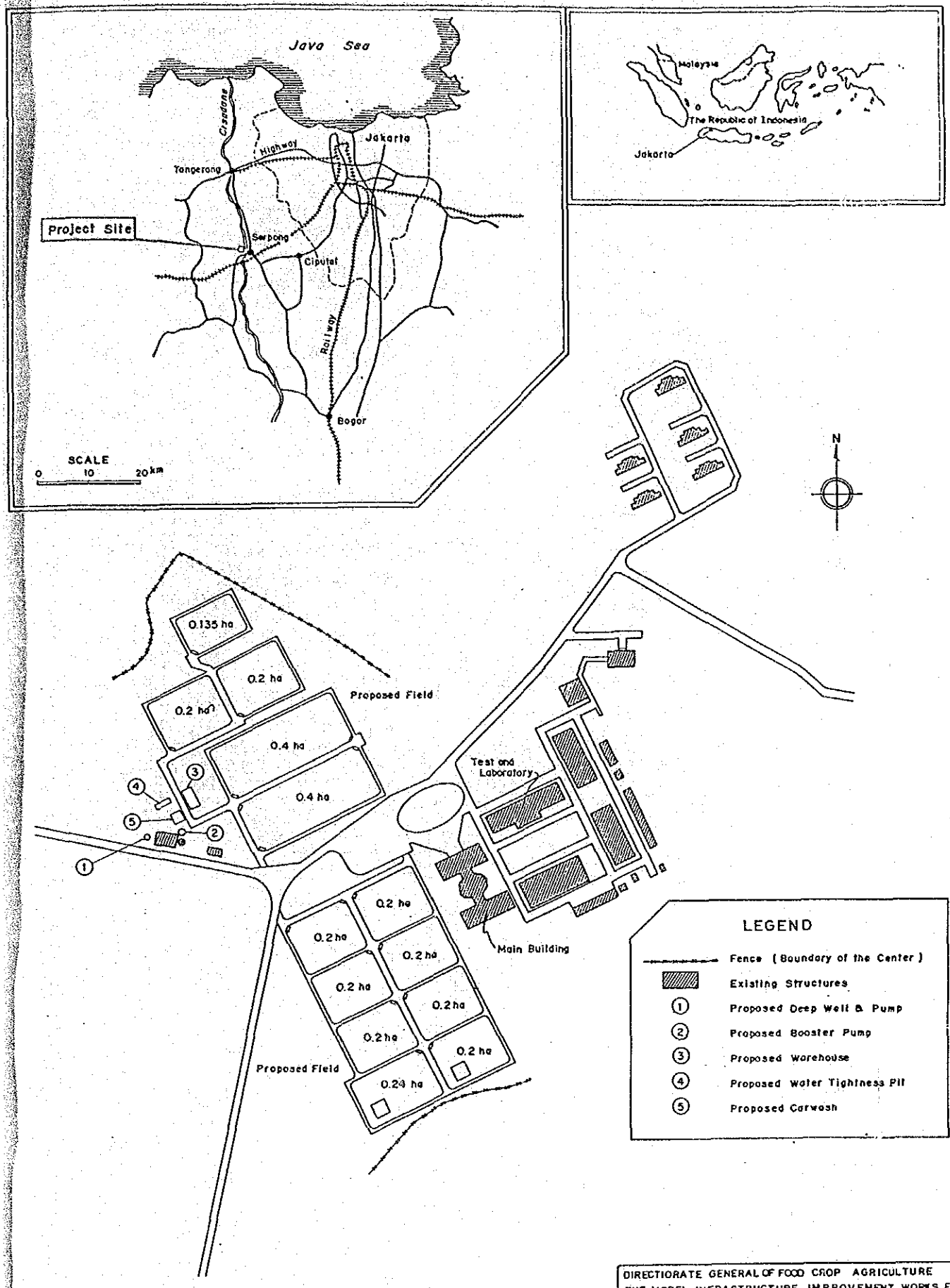
The existing field is not large enough for the necessary experimental testing and evaluation of agricultural machinery and its improvement work was essential. Accordingly, short-term experts were dispatched to site from August 24 to October 2, 1988 to undertake the detailed design of the facilities required.

This report presents the results of the field survey and of the subsequent studies in Japan. We hope that this report will provide the guidance necessary for the infrastructure improvement works.

Finally, we should like to take this opportunity to express our sincere gratitude to all those who were concerned with us for the valued cooperation and assistance that they extended to the experts throughout the survey period.

November 1988

Kazumi Miyamoto
Director,
Agriculture Development
Cooperation Department,
Japan International Cooperation Agency,
JICA



DIRECTIORATE GENERAL OF FOOD CROP AGRICULTURE
THE MODEL INFRASTRUCTURE IMPROVEMENT WORKS FOR THE CENTER FOR DEVELOPMENT OF APPROPRIATE AGRICULTURAL ENGINEERING TECHNOLOGY (ATA - 220)

LOCATION MAP

JAPAN INTERNATIONAL COOPERATION AGENCY | DWG. NO.

Deep Well & Submergible Motor Pump

Existing Reservoir

Booster Pump

Carwash

Water Tightness Test Pit

Existing Farm House

Warehouse with Managing Rooms

Existing Road

Existing Main Building

DP-4 EL. 17.40

DP-3 EL. 18.30

DP-5 EL. 16.00

DP-2 EL. 15.50

SF-7 0.24 ha

SF-5 0.20 ha

SF-3 0.20 ha

SF-1 0.20 ha

SF-8 0.20 ha

SF-6 0.20 ha

SF-4 0.20 ha

SF-2 0.20 ha

NF-1 (EL. 20.43) 0.40 ha

NF-2 (EL. 20.37) 0.40 ha

NF-3 (18.48) 0.20 ha

NF-4 (EL. 18.98) 0.20 ha

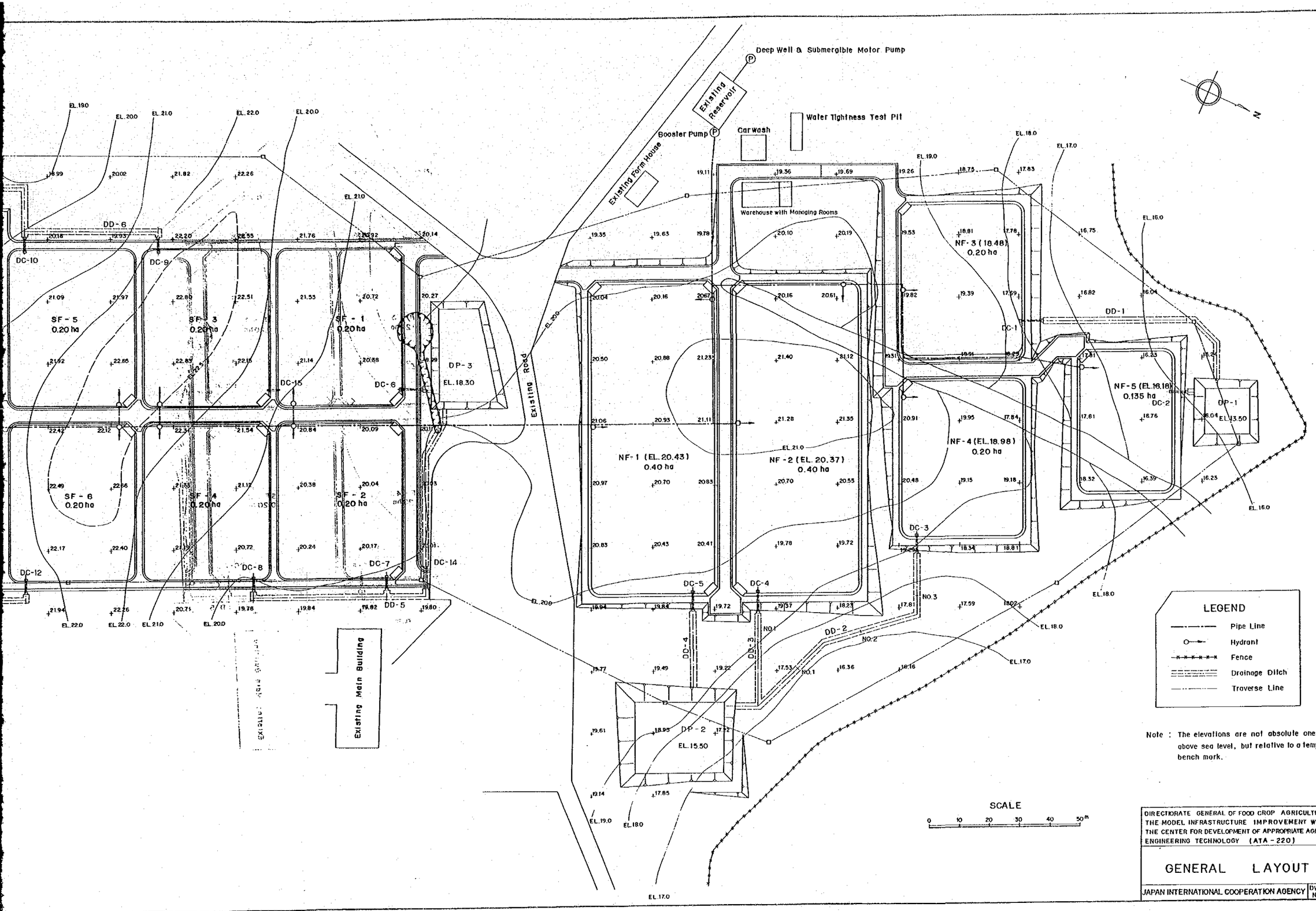
DD-1 DD-2 DD-3 DD-4 DD-5 DD-6 DD-7 DD-8

DC-1 DC-2 DC-3 DC-4 DC-5 DC-6 DC-7 DC-8 DC-9 DC-10 DC-11 DC-12 DC-13 DC-14 DC-15

NO.1 NO.2 NO.3

SCALE

0 10 20 30 40 50m



LEGEND

- Pipe Line
- Hydrant
- Fence
- Drainage Ditch
- Traverse Line

Note : The elevations are not absolute ones above sea level, but relative to a temporary bench mark.

SCALE

0 10 20 30 40 50m

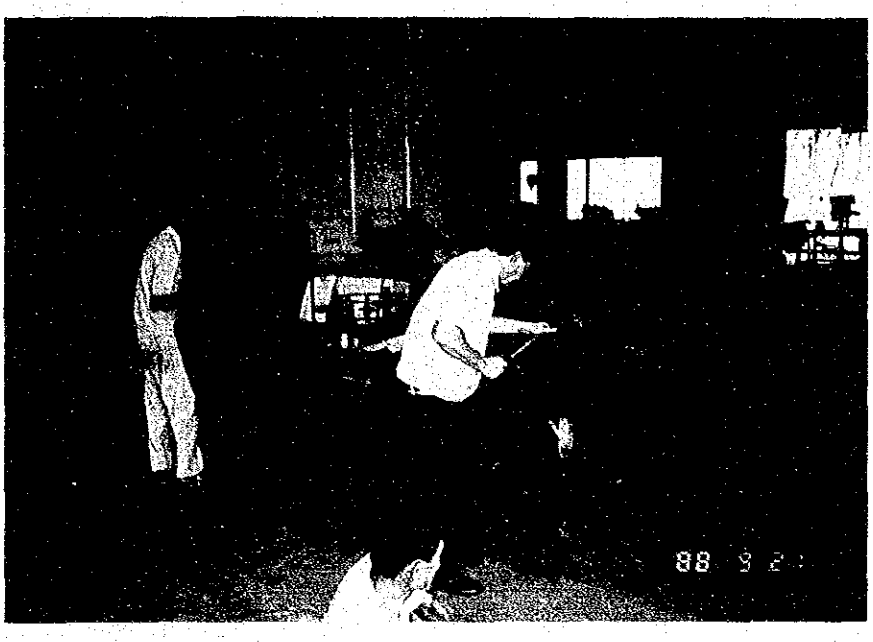
DIRECTIORATE GENERAL OF FOOD CROP AGRICULTURE
THE MODEL INFRASTRUCTURE IMPROVEMENT WORKS FOR THE CENTER FOR DEVELOPMENT OF APPROPRIATE AGRICULTURAL ENGINEERING TECHNOLOGY (ATA-220)

GENERAL LAYOUT

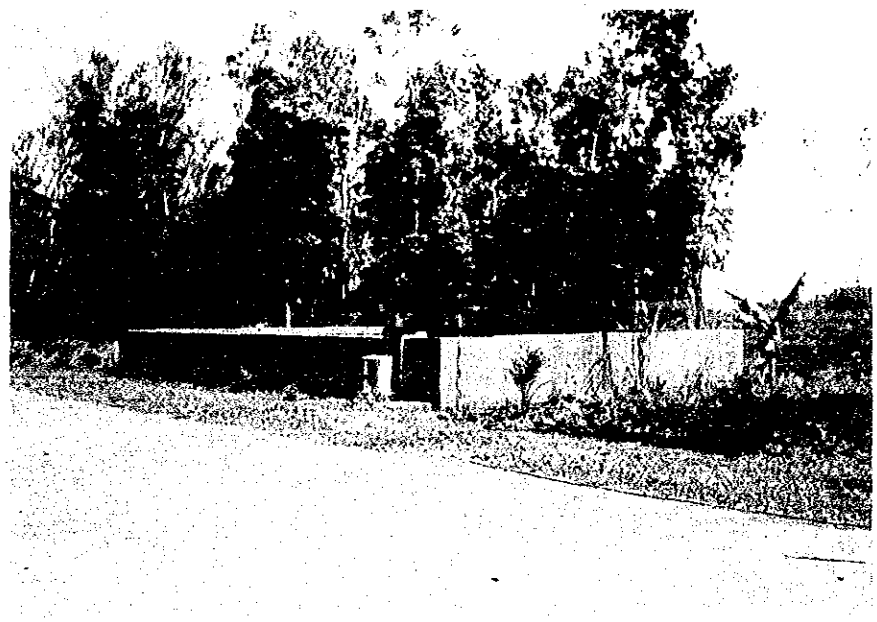
JAPAN INTERNATIONAL COOPERATION AGENCY | DWG. NO.

No.1 Center for Development of Appropriate Agricultural Engineering Technology (CDAET)

No.2 Main Building of CDAET



No.3 Workshop

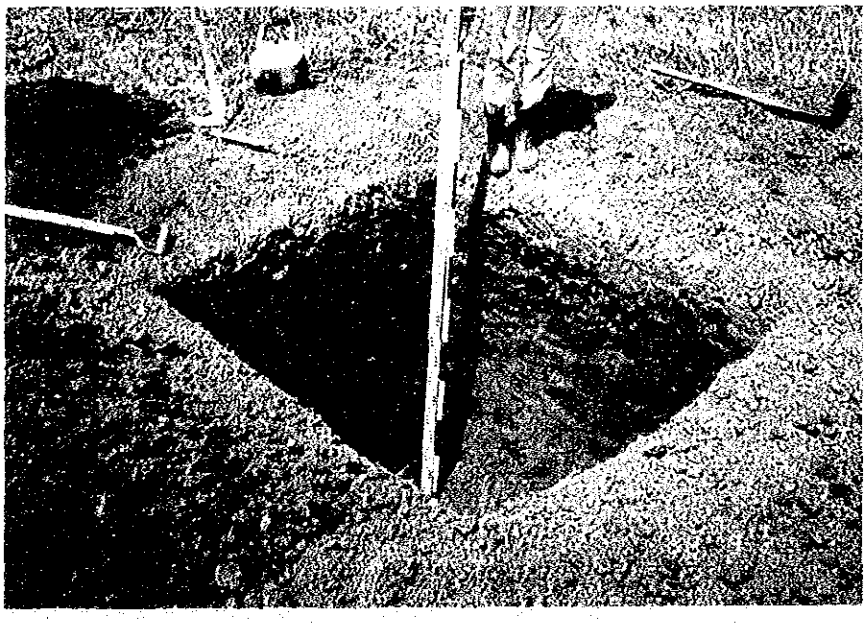


No.4 Concrete Reservoir Tank

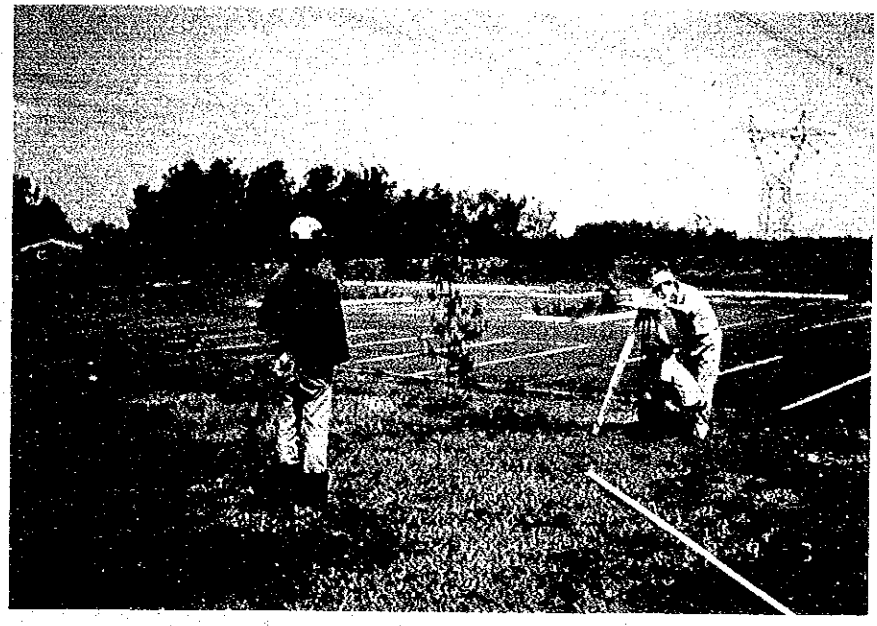
No.5 Southern Field

No.6 Northern Field

No.7 Existing Papaya Field (Southern Field)



No.8 Test Pit for Soil Survey



No.9 Plane Table Survey

No.10 Bearing Capacity Survey with Cone Penetrometer

CONTENTS

CHAPTER 1 BASIC PLAN

The objective of this detail design work is to develop experimental farm plots at the Center where testing and evaluation of agricultural machinery can be conducted. To achieve this objective, the basic concepts of the design are: to prepare level experimental plots; to construct a network of farm roads; to establish efficient water supply facilities for providing irrigation water to the farm plots; and to provide auxiliary facilities necessary for testing and evaluation of agricultural machinery.

During the short experts' stay in Indonesia, they made a series of field surveys, investigations and discussions with Indonesian and Japanese staff concerned. The experts, so far, made rough design on the basis of the result of those surveys and discussions as will be stated hereinafter.

In accordance with the rough design, the detail design was made in Japan. The results are summarized below:

The Model Infrastructure Improvement Works for the Center for Development of Appropriate Agricultural Engineering Technology (C.A.A.E.) (ATA-220).

1.	Land Preparation		
	(a)	Land levelling for upland crops field	A = 0.800 ha
	(b)	Land levelling for rice field	A = 0.535 ha
	(c)	Farm road (W = 5.0 m, Asphalt pavement)	L = 118.0 m
	(d)	Farm road (W = 5.0 m, Gravel pavement)	L = 555.0 m
	(e)	Farm road (W = 2.0 m)	L = 1,512.0 m
2.	Irrigation and Drainage Facilities		
	(a)	Irrigation pipeline (PVC pipe, ϕ100 mm)	L = 477.0 m
	(b)	Hydrant	15 pcs
	(c)	Drainage ditch	L = 462.5 m
	(d)	Drainage pond	5 pcs
3.	Water Supply System		
	(a)	Boring of deep well	L = 200 m
	(b)	Deep well pump	ϕ65 mm
	(c)	Booster pump	ϕ65 mm
	(d)	Pump house	1 pc
4.	Electric Supply System		
	(a)	Steel tape armored cable	440 m
	(b)	Distribution panel	1 set
	(c)	Switch box	1 set

5. Auxiliary Facilities

(a)	Warehouse	1 lot
(b)	Water tightness test pit	1 lot
(c)	Carwash	1 lot

CHAPTER 2 PRESENT CONDITION

2.1 Location

The Center for Development of Appropriate Agricultural Engineering Technology is situated at Pagedangan Village in Legok (Tangerang) of West Java Province. The Center is located at 6°16' south latitude and 106°45' east longitude. It is bounded by rubber plantations and private paddy fields. Serpong, the nearest city to the Center lies approximately 30 km southwest of Jakarta.

2.2 Topography

The Center covers approximately 35 ha and is composed of reddish brown latosol which is surrounded by grayish brown alluvial plains. The latosol forms an almost featureless and undulating area. The gradient is approximately 1/100 in the upper part of the area and 1/30 in the lower part of the area adjacent to the existing paddy field.

2.3 Climate

This area belongs to tropical zone and there is little seasonal variation throughout the year. The climate in this area is mainly influenced by the tropical monsoon. The wet monsoon prevails from November to April and brings heavy rainfall in this area, whereas the dry monsoon prevails from May to October and brings less rainfall. The annual rainfall averages approximately 2,050 mm.

The annual mean temperature is approximately 26.5°C and the monthly mean ranges from 25.5°C to 27°C in the area. The average daily sunshine hours is 7.6 hr/day. The average relative humidity is approximately 81% with minor seasonal variations. The daily wind velocity averages 8.3 km/hr (4.5 knots) with directions frequently from the northwest.

2.4 Soils

The area extends over the upper part of the hilly area, and is physiographically almost level.

The area was formerly used for rubber tree plantation, and is presently under upland crop fields and grass land.

According to the soil classification system in Indonesia, the soil in the area is Reddish Brown Latosol derived from volcanic tuff.

This soil has a dark reddish brown color in the top soil and reddish brown color below the top soil, with a fine texture throughout the profile. No gravels or concretions are contained within the 1.5 m depth. The structure of the soils is weak fine granular, and the permeability is relatively high. The depth of top soil is 10 to 20 cm. The effective soil depth for root development is more than 1 m. Generally these soils have a rather low pH, low cation exchange capacity, and low base saturation degree.

According to the report of the feasibility study on the Cisadane River Basin Development, the land suitability class of the soil is S2 (suitable class) for upland crops and S3 (marginally suitable class) for irrigated paddy. There is no serious limitation for irrigation paddy farming.

2.5 Hydrogeology

This section describes the results of investigations and groundwater studies undertaken as part of the Cisadane River Basin Development Feasibility Study (prepared in September 1987).

2.5.1 Purpose and Method of Study

The main purpose of the study was to evaluate the potential for groundwater development which can contribute to water supply in JABOTABEK and to propose measures for groundwater basin management.

In order to achieve the purposes of the study, collection and analysis of existing data, field investigations and computer groundwater modelling were carried out.

2.5.2 Results of Field Investigation

Three (3) deep inventory boreholes (250 m each) and 3 deep observation boreholes (250 m each) were drilled at Serpong, Pondok Gede and Parungbadak to supplement the hydrogeological data of the non-urbanized area of JABOTABEK.

Eight shallow wells (40 m) were drilled in a profile from Bogor to the Java Sea in order to prepare a profile of geologic and hydrogeologic conditions of the study area.

Another 3 shallow wells were drilled in northern Jakarta. Two were located in the coastal plain and the third was drilled in the parking lot adjacent to Sarinah Department Store, Jl. Thamrin, in order to clarify the soil conditions and to take water samples for analysis.

According to pumping tests at deep drilling sites, well discharge, specific capacity, transmissivity and electric conductivity are as follows:

Drilling Site	Well Discharge m^3/day (l/sec)	Specific Capacity (m^2/day)	Transmissivity (m^2/day)	Electric Conductivity (micromhos/cm)
Serpong	147 (1.7)	3.4	8	1,610
Pondok Gede	260 (3.0)	34.9	190	298
Parungbadak	22 (0.25)	0.7	15	580

Since a screen was set in a thin sandy aquifer in the deeper part (110-240 m) at Parungbadak, well discharge is very low. Although main screen positions were set in deep aquifers (115-240 m), some were set in shallower zones at Pondok Gede (60-66 m) and Serpong (104-110 m). Well discharge of these two boreholes was greater than at Parungbadak.

This indicates that the deeper part (about 110-250 m) of the aquifers is less productive, whereas the shallower part is moderately productive. In addition, the deep aquifer contains slightly saline water at Serpong.

CHAPTER 3 DETAIL DESIGN

3.1 General

The main object of the project is to construct a well-equipped farm for performance and durability tests on farm machinery and training to staff of manufactures of farm machinery and regional technical staff in operation of farm machinery.

The project work involves preparation of 3.0 ha of farmland for trials and demonstrations, construction of irrigation and drainage systems and construction of auxiliary facilities for the Center, of which principal features have been summarized in Chapter 1.

3.2 Farmland Preparation

The farmlands to be used for the testing and training purposes are 3.0 ha consisting of 1.4 ha of unopened land located to the north of the existing road across the Center, called "north area", and 1.6 ha of existing upland crop fields located to the south of the road, called "south area". The north area is planned to be mainly used for performance testing of prototype machinery manufactured in the Center and machinery manufactured by other agents or manufactures. The south area will be used for the purpose of training the staff of manufacturers and regional technical staff in operation of machinery as well as performance and durability tests on the prototype machinery manufactured in the Center. The preparation of farmlands will include land levelling and construction of farm roads.

(1) Size of farm plot

Since performance tests on farm machinery usually need a running distance of 50 m or 100 m and considering the topographic conditions, the length of a farm plot was fixed as 100 m for 2 plots in the north area and 50 m for the other 11 plots. The width of farm plot was fixed as 40 m for economical cut-and-fill and since the most efficient distance for moving soil by bulldozer is about 40 m in land levelling work.

(2) Land levelling work

The land levelling work will be made in the north area, while the farmlands in the south area will be used without land levelling work.

The calculation of earth works for land levelling was made by the ponderable bisector perpendicular (P.B.P.) Method. The results were as follows:

Plot No.	Area of Plot (m^2)	Cut Volume (m^3)	Fill Volume (m^3)
NF-1 (for upland)	4,000	1,228	263
NF-2 (for upland)	4,000	1,758	812
NF-3 (for paddy)	2,000	1,287	349
NF-4 (for paddy)	2,000	1,202	376
NF-5 (for paddy)	1,350	1,064	34
Total	13,350	6,539	1,834

(3) Farm Roads

A 5 m wide asphalt-paved road crosses the Center in an east-west direction. In addition to this, a farm road network consisting of a main farm road, 4 secondary roads and 13 tertiary roads will be constructed in the Center for efficient farm operation.

The main farm road will be constructed between the existing road mentioned above and the newly proposed warehouse. The road will have a length of 118 m and will be paved with asphalt over an effective width of 4 m.

Four secondary roads, SR-1 through SR-4 will be constructed to connect the various farm plots to the said existing road or the main farm road. SR-1 is the extension of the main farm road and will run up to NF-5 farm plot which is located in the north corner of the north area. SR-2 will start at the first turning point of the main farm road and extend to the east corner of the Center bounding the NF-1 and NF-2 plots. The SR-3 will start from the said existing road and run in west-east direction along the northern boundary of the south area. The SR-4 will run from the middle point of the SR-3 to the southern corner of the Center traversing the south area. The total length of the secondary roads will be 555 m. All the secondary roads will be gravel-metalled with an effective width of 4 m.

Thirteen tertiary roads with a total length of 1,512 m will be constructed as foot paths. These roads will also function as the ridges of farmlands. All the roads will be 2-m wide and unpaved.

The principal features of the above-mentioned roads may be summarized as follows:

Main road	Length:	118 m
	Total width:	5 m
	Effective width:	4 m
	Pavement:	Asphalt with a thickness of 5 cm

Secondary roads	Number of roads:	4 Nos.
	Total length:	555 m
	Total width:	5 m
	Effective width:	4 m
	Pavement:	Gravel with a thickness of 10 cm
Tertiary roads	Number of roads:	13 Nos.
	Total length:	1,512 m
	Total width:	2 m
	Pavement:	unpaved

3.3 Irrigation System

3.3.1 Irrigation Water Source

Two water sources for irrigation are conceivable in and around the Center. One is the Cisadane river which is situated 4-km to the east of the Center. The other is groundwater from the aquifer situated at a depth of 60 m below the ground level in the Center.

For the supply of water to the Center, the former would require pumping equipment with a 10-m head and a 4-km long water supply system, while the latter would require a 200-m deep tube well. Comparative studies were made between the above two water sources from the technical and economical viewpoints and the study results showed the attractiveness of the groundwater development over an intake system from the Cisadane river.

3.3.2 Irrigation Water Requirements

From water requirement calculations made for the Rancasumur Area of the Cisadane River Basin Development Project, the unit diversion requirement would be 1.66 lit/sec/ha. This was derived from 1.33 lit/sec/ha of the farm water requirement for the Rancasumur Area, which is located near the Center. Then, taking the operation loss and conveyance loss to be 10% and 3% of the farm water requirement for the Center where a pipeline system will be installed for the delivery of irrigation water, the unit diversion requirement for the project will be 1.53 lit/sec/ha, based on which the total water demand for 3.0 ha which is calculated to be 4.6 lit/sec.

3.3.3 Tubewell

An existing 30-m deep tubewell in the Center produces only 100 lit/min, all of which is required for use of the staff of the Center. A new tubewell is therefore proposed as a source of irrigation water. The tubewell will be sited near another existing well, so that the existing reservoir tank may be incorporated into the future water supply system.

The pumping requirement from the tubewell is calculated on the assumption that water pumped from the tubewell will be impounded by night in the existing reservoir tank to the full capacity of 160 m^3. The water thus impounded will be supplied to the fields in 12 hours by day at a rate of 3.7 lit/sec. The total required water supply to the field however is 9.2 lit/sec for 12-hour operation (4.6 lit/sec x 24/12) and the balance of 5.5 lit/sec between the required water supply and the water supplied from the reservoir tank must be pumped from the tubewell during irrigation.

From the results of a pumping test done on a test well drilled in Serpong, under the Cisadane River Basin Development Project, the transmissibility (T) was conservatively estimated at 10 m^2/day with 24 m of screen pipe. Applying this transmissibility to the design of the project tubewell, the size of casing pipe and the length of screen pipe would be ϕ200 mm and 48 m respectively, which should suffice as calculated below.

$$Q = \frac{2\pi \cdot T \cdot s}{2.3 \log R/r}$$

$$= \frac{2\pi \times 20 \times 30}{2.3 \log 300/0.1}$$

$$= 471 \text{ m}^3\text{/day}$$

$$\fallingdotseq 5.5 \text{ lit/sec}$$

where, Q : Production (m^3/day)

T : Transmissibility, 20 m^2/day

s : Drawdown in well, which is estimated at 30 m based on the result of the above-mentioned pumping test.

R : Radius of cone of depression, 300 m

r : Radius of well, 10 cm

The pumping head in the well is estimated at 60 m at the maximum, which is the sum of the natural groundwater table (15 m below the ground surface), the drawdown in the well (30 m), and the head loss in the well (50% of the drawdown).

The above-design is shown in DWG No. 13.

3.3.4 Reservoir

The existing concrete reservoir tank at the west corner of the Center has 25-cm thick walls, is rectangular 14.5 m long, 9.5 m wide, and 1.15 m effective depth, giving an effective storage capacity of 158 m^3. The reservoir tank is in good condition and will not require any repair and improvement for its future use.

3.3.5 Pipeline System

The pipeline system has been designed to distribute irrigation water to each farmland plot from the reservoir tank. The system consists of two pipelines; PL-1 for the south area and PL-2 for the north area. PL-1 will start from the booster pump installed at the reservoir tank and run along the roads MR, SR-2 and SR-4 as shown in DWG No. 6. The total length of PL-1 will be 329.5 m. PL-2 will be branched off PL-1 after 50-m and extend to the northernmost plot NF-5. The total length of PL-2 will be 147.5 m. Both PL-1 and PL-2 are designed with ϕ100 mm PVC pipe and a design pressure of 7 kg/cm^2. The results of study on selection of pipe and hydraulic calculations on the pipeline system are detailed in ANNEX A.

A hydrant will be installed in each farm plot except for plots NF-1 and NF-2, in which two hydrants will be installed, because their sizes are double those of other farm plots. The angle valve used for the hydrant will be protected by a concrete pipe as shown in DWG No. 8.

3.3.6 Submersible Pump

A submersible pump will be installed in the proposed tubewell. The main design data of the pump will be as summarized below.

(1)	Type of pump:	Submersible type
(2)	Diameter of pump:	65 mm
(3)	Capacity of pump:	330 lit/min.
(4)	Total head:	80 m
(5)	Capacity of motor:	2 pole, 7.5 kW 3 phase, 380 V 50 Hz
(6)	Operational water level of well:	60 m below ground surface

The submersible pump will be installed at the top of the steel riser pipe 1-m below the operational water level of well. The steel riser pipe will be fixed to the concrete pedestal provided at the top of well as shown in DWG No. 13.

A non-return valve will be provided at the foot of the steel riser pipe and above the screen to stop return water flow when the pump is stopped. The check valve will be of the flap type. In addition, a hand operated sluice valve will be provided at the head of the distribution pipeline for operation as a discharge valve for maintenance of the pump. The sluice valve will be of the gate valve type.

The submersible pump will be started automatically and stopped by means of a water level detecting device provided in the existing reservoir tank and the tubewell. Manual starting and stopping of the pump will also be possible from the control panel by changing over the selecting switch.

3.3.7 Booster Pump

For supply of water from the reservoir tank to the pipeline system, a booster pump will be installed at the reservoir tank. The main features of the pump will be as follows:

(1)	Type of pump:	Horizontal shaft, single suction volute pump
(2)	Diameter of suction pipe:	65 mm
(3)	Diameter of discharge pipe:	50 mm
(4)	Capacity of pump:	500 lit/min
(5)	Total head:	25 m
(6)	Capacity of motor:	2 pole, 5.5 kW, 3 phase, 380 V, 50 Hz
(7)	Pressure tank:	2 kgf/cm^2 of initial

The booster pump will be installed in the eastern corner of the existing reservoir tank. The pump motor will be mounted on an operation platform is a bottom word than stage. The operation platform will be constructed at the same height as that of the tank wall, 1.525 m from the ground surface as shown in DWG No. 13.

A pressure tank will be provided on the discharge pipeline to keep the pressure in the pipe at the designed one and to supply water to the pipeline without pump operation when the water demand is small. If the water demand is small and the pressure in the pressure tank becomes higher than the set value, the booster pump will be stopped automatically by the pressure switch provided on the pressure tank.

A flap valve will be provided at the end of suction pipe to prevent reverse flow when the pump is stopped. A hand operated sluice valve will also be installed at the head of the discharge pipeline and operated as the discharge valve and for the maintenance of pump. The sluice valve will be of the gate valve type.

The pump will be operated automatically by means of a water level detecting device and pressure switch provided in the existing reservoir tank and another pressure switch provided on the pressure tank. Manual starting and stopping of the booster pump will also be possible from the control panel by changing over the selecting switch.

3.3.8 Electric Supply System

Electric power for both tubewell and booster pumps will be taken from the existing "M-2" panel located in the Laboratory and Testing.

A 50 mm^2 power cable was selected to ensure that the line voltage drop which will be caused by the surge of current of the pump motors when starting is within ±ten (10) percent of the rated voltage of 380 V. Steel tape or wire armored type power cable is proposed for preventing damage to the power cable from external shocks and/or pressure underground.

A pump control panel will be provided for controlling operation of and distribution of electric power to both tubewell and booster pumps.

3.4 Drainage Ditches and Ponds

3.4.1 Daily Rainfall

The maximum day's rainfall recorded in Serpong was 153 mm in December 1986. Probabilities of daily rainfall obtained from the records of the 16 years from 1973 until 1988 at the Serpong meteorological Station are as follows.

Probability	Daily Rainfall	Remarks
2 years	93 mm/day	. 1973 - 1988
5 years	112 mm/day	. 16 data
10 years	126 mm/day	. Thomas Plot Method
20 years	139 mm/day	

For the design of drainage, 10 years probability is commonly used, therefore, the design rainfall for drainage of 126 mm from the above table will be used.

3.4.2 Design Unit Drainage Discharge

For drainage on the farm, drainage of daily rainfall within 24 hours is to be applied. The design unit drainage discharge was obtained from the following formula:

$$Q = 10 \times f \times r \times A/(3,600 \times T)$$

where;

Q	:	Design unit drainage discharge	
f	:	Runoff rate	0.8
r	:	Daily rainfall	126 mm/day
A	:	Unit area	1.0 ha
T	:	Time required for drainage	24 hrs.

$\therefore Q = 0.012\ m^3/s/ha$

3.4.3 Design Capacity of Drainage Ponds

Water drained through the drainage ditches will be collected into drainage ponds so as not to discharge into the surrounding private farmlands. Five drainage ponds are proposed to be excavated for this purpose within the Project area.

In order to determine the scale of the ponds, the daily rainfall with 10 years probability was applied. The design unit drainage volume to be collected was obtained from the following formula:

$$V = 10 \times f \times r \times A$$

where, V : Design unit drainage volume

f, r, A: Define as above

$\therefore V = 1,008\ m^3/ha$

The size of drainage ponds required will be as follows:

Drainage Pond	Drainage Area	Capacity
DP-1	0.35 ha	350 m^3
DP-2	1.00 ha	1,000 m^3
DP-3	0.70 ha	700 m^3
DP-4	0.51 ha	510 m^3
DP-5	0.38 ha	380 m^3

3.5 Auxiliary Facilities

3.5.1 Warehouse with Managing Room

In order to accommodate agricultural equipment, machinery and materials such as implements, tractors, tillers, harvesters, fertilizers, insecticides, etc., a warehouse with a floor area of 96 m^2 will be built in the Center. In addition to this, a managing room with a floor area of 32 m^2 will be provided for management of the above.

The dimensions will be as follows:

Warehouse:	12 m x 8 m
Managing room:	8 m x 4 m

3.5.2 Water Tightness Test Pit

In order to carry out tests for water tightness of agricultural machinery, a water tightness test pit will be constructed in the Center. The test pit will be of reinforced concrete with the following dimension:

Water tightness test pit:	12 m x 4 m

3.5.3 Carwash

In order to wash vehicles, agricultural machinery, etc., a carwash will be constructed in the Center. The carwash will be of concrete with the following dimensions:

Carwash:	8 m x 8 m

3.6 Construction Plan

3.6.1 Construction Method

a. The works for the Center for Development of Appropriate Agricultural Engineering Technology will comprise the following construction works:

- Farm land preparation and farm road construction to form the experimental farm for studies on development of agricultural machinery
- Preparation of irrigation and drainage facilities consisting of irrigation pipelines with hydrants and drainage ditches with drainage ponds
- Development of water resources by drilling a deep well and by installing a deep well pump and a booster pump with a pump house
- Installation of electric supply system including steel tape armored cable, distribution panel and switch box
- Auxiliary facilities including warehouse, water tightness test pit and carwash

b. The construction plan is made based on the detailed design and also the following conditions:

- All the construction work will be performed on a contract basis.
- The construction work will be carried out by a local contractor.
- The construction work will be completed in four months.
- All equipment, construction machinery and materials will be procurable in Indonesia.

c. Construction machinery shall be applied to land levelling, construction of farm roads, concrete work, drainage pond excavation, etc.

- Dump track (4 t)	: For carrying purchased gravel and sand into the site
- Bulldozer (15 t)	: For land grading and road embankment
- Motor grader (3.1 m)	: For land levelling and road levelling
- Road roller (10 t)	: For compaction of road
- Backhoe (0.6 m^3)	: For excavation of farm pond
- Concrete mixer	: For concrete work
- Vibrator	: - ditto -
- Rotary type drilling machine	: For drilling a deep well

d. The bulk factors of soil will be follows:

Soil Property	Natural Grand Soil	Excavated Soil	Compacted Soil
Sand	1.0	1.2	0.95
Sandy soil with Gravel	1.0	1.25	0.9
Gravel	1.0	1.2	1.0
Clay (general)	1.0	1.35	0.9
Clay (in the farm)	1.0	1.35	1.0

e. The location and size of the land for the contractor's site office, house accommodation for laborers, storage place for materials, warehouse, etc. will be determined in consultation with the officials of the Center.

f. The cost of electricity and water for the works shall be covered by the Temporary Work Cost of the contractor, however, if the contractor wants to use facilities of the Center, consultation with officials of the Center will be required.

g. Before drilling of the deep well, the existence of the ground water layer shall be confirmed by electric prospecting survey. After establishing the deep well (casing), the well will be washed and cleaned well, and a pumping test carried out.

3.6.2 Construction Time Schedule

The required time for construction of the works for the infrastructure of the Center for Development of Appropriate Agricultural Engineering Technology is estimated at approximately 5.5 months including preparatory and demobilization periods as shown in the next page, and as summarized below:

Work Item	Required Time (Month)
Preparatory period for the contract	1.0
Preparatory period for construction	0.5
Construction period	3.5
Running test period	0.2
Demobilization period	0.3
Total	5.5

CONSTRUCTION TIME SCHEDULE

Item	Q'ty	1st Month	2nd Month	3rd Month	4th Month	5th Month	6th Month
1. Tender and Contract			Tendering				Reporting
2. Temporary work			Mobilization			Running Test	De-mobilization
3. Land preparation							
- Land leveling for upland field							
- Land leveling for rice field							
- Farm road, Asphalt pavement							
- Farm road, Gravel pavement							
- Farm road, Earth							
4. Irrigation and drainage facilities							
- Irrigation pipeline, PVC pipe							
- Hydrants							
- Drainage ditches							
- Drainage pond							
5. Water supply system							
- Boring of deep well							
- Deep well pump						Installation	
- Booster pump						Installation	
- Pump house							
6. Electric supply system							
- Steel tape armoured cable							
- Distribution panel						Installation	
- Switch box						Installation	
7. Auxiliary facilities							
- Warehouse							
- Water tightness test pit							
- Carwash							
- Others							

CHAPTER 4 COST ESTIMATE

4.1 General

In the detailed survey by the Team in Indonesia, it was clarified that all the necessary materials and equipments for the construction work could be procured in Indonesia. According to the unit price survey and work quantity calculation carried out by the survey team, the whole construction cost is estimated as presented in the following sections.

The currency conversion rate employed in this estimate is;

US $ 1.0 = Rp. 1,706 = ¥ 134.45 (as of Sep. 30, 1988).

4-2 Project Cost

(Unit : Rp.)

A. CONSTRUCTION COST	Rp.	268,793,000
1 Direct Cost	Rp.	206,764,000
1-1 Land Preparation	(Rp.	43,895,000)
1-1-1 Land Levelling	Rp.	4,500,000
1-1-2 Farm Road	Rp.	39,395,000
1-2 Irrigation and Drainage Facilities	(Rp.	31,377,000)
1-2-1 Pipeline & Hydrant	Rp.	18,379,000
1-2-2 Drainage Ditch	Rp.	3,967,000
1-2-3 Drainage Pond	Rp.	9,031,000
1-3 Water Supply System	(Rp.	74,975,000)
1-3-1 Deep Well	Rp.	34,890,000
1-3-2 Submersible Pump	Rp.	33,863,000
1-3-3 Booster Pump	Rp.	6,222,000
1-4 Electrical Supply System	(Rp.	14,347,000)
1-4-1 Electrical Cable	Rp.	13,423,000
1-4-2 Switch Box	Rp.	924,000
1-5 Auxiliary Facilities	(Rp.	42,170,000)
1-5-1 Warehouse	Rp.	28,314,000
1-5-2 Water Tightness Test Pit	Rp.	4,301,000
1-5-3 Carwash	Rp.	1,135,000
1-5-4 Exterior Electric & Plumbing Work	Rp.	3,420,000
1-5-5 Contractor's Camp Facilities	Rp.	5,000,000
2 Indirect Cost (30 % of 1 Direct Cost)	Rp.	62,029,000
B. CONTINGENCY (10 % of A)	Rp.	26,879,000
C. MISCELLANEOUS (5 % of A+B)	Rp.	14,784,000
GRAND TOTAL	Rp.	310,456,000
(equivalent to Japanese yen currency)	¥	24,467,000

Note : US$ 1.0 = Rp. 1,706 = ¥ 134.45

4.3 Material Cost

Item	Unit	Unit Price (Rp.)	Remarks
Gasoline	lit	385	
Diesel	lit	200	
Lubricant	lit	1,200	
Grease	kg	2,700	
Sand	m3	12,000	
Gravel (Small)	m3	12,000	
Gravel (Large)	m3	15,000	
Cement	bag	570	40 kg
Reinforcement Bar	kg	600	
Deformed Reinforcement Bar	kg	550	
Steel Wire	kg	1,600	
Asphalt	kg	350	
Steel Plate	kg	740	
Nail	kg	1,200	
Wooden Plate	m3	250,000	
Timber	m3	200,000	
Concrete Pipe ø 300 mm	m	19,100	
Concrete Pipe ø 500 mm	m	40,800	
Brick	piece	45	10 kf/cm2
PVC Pipe ø 25 mm	m	2,000	
PVC Pipe ø 50 mm	m	4,950	
PVC Pipe ø 75 mm	m	9,650	
PVC Pipe ø 100 mm	m	12,900	
Steel Pipe ø 80 mm	m	21,000	

4.4 Labor Cost

Item	Unit	Unit Price (Rp.)	Remarks
Foreman (Civil Work)	day	5,000	
Carpenter	day	4,000	
Mason/Plaster Worker	day	4,000	
Steel Worker	day	4,500	
Skilled Labour	day	3,000	
Common Labour	day	2,500	
Odd Man	day	2,500	
Foreman (Mechanical Work)	day	5,000	
Mechanician	day	4,000	
Electrician/Plumber	day	4,000	
Operator (Heavy Machinary)	day	4,500	
Assistant Operator	day	3,500	
Operator (Light Machinary)	day	4,000	
Driver	day	3,500	
Plumber	day	4,000	
Asphalt Worker	day	4,000	
Painter	day	4,000	

Item	Unit	Q'ty	Unit Price (Rp.)	Amount (Rp.)	Remarks
1 LAND PREPARATION					
1-1 Land Levelling for Flat Field	ha	0.8	3,170,453	2,536,362	for NF-1 & NF-2
1-2 Land Levelling for Steep Field	ha	0.535	3,669,219	1,963,032	for NF-3, NF-4 & NF-5
1-3 Main Farm Road (118.0 m)					
1-3-1 Stripping (t=100)	m3	84.79	863	73,174	
1-3-2 Embankment	m3	507.59	4,680	2,375,521	
1-3-3 Asphalt Pavement	m2	472	10,885	5,137,720	t = 50 mm
1-4 Secondary Farm Road (555.0 m)					
1-4-1 Stripping (t=100)	m3	318.35	863	274,736	
1-4-2 Excavation	m3	392.74	1,557	611,496	
1-4-3 Embankment	m3	1,569.18	4,680	7,343,762	
1-4-4 Gravel Pavement	m2	2,220	2,175	4,828,500	t = 100 mm
1-5 Tertiary Farm Road (1,512.0 m)					
1-5-1 Stripping (t=100)	m3	601.39	863	519,000	
1-5-2 Excavation	m3	649.2	1,557	1,010,804	
1-5-3 Embankment	m3	3,679.54	4,680	17,220,247	
Sub-Total				43,894,355	(say Rp. 43,895,000)
2 IRRIGATION AND DRAINAGE FACILITIES					
2-1 Earthwork					
2-1-1 Excavation	m3	756	2,300	1,738,800	
2-1-2 Backfill	m3	708	1,800	1,274,400	
2-1-3 Sandfilling	m3	43	17,300	743,900	
2-2 Pipe & Hydrant Setting					
2-2-1 Foreman	m.d	8	5,000	40,000	
2-2-2 Plumber	m.d	4	4,000	16,000	
2-2-3 Concrete Cutter	m.d	8	4,000	32,000	
2-2-4 Skilled Labour	m.d	8	3,000	24,000	
2-2-5 Common Labour	m.d	12	2,500	30,000	
2-3 Pipe & Fitting					
2-3-1 PVC Pipe, ø 100, AZ, Bell End	m	477	12,900	6,153,300	
2-3-2 TS Tee, ø 100 x ø 100	nos	1	74,550	74,550	
2-3-3 TS Tee, ø 100 x ø 75	nos	3	56,350	169,050	
2-3-4 TS Bend, ø 100, 90 degrees	nos	1	28,350	28,350	
2-3-5 TS Valve Socket, ø 100	nos	21	23,600	495,600	
2-3-6 SP ø 80, Both Male End	m	59.3	21,000	1,245,300	
2-3-7 Malleable Tee, ø 100 x ø 100	nos	2	115,200	230,400	
2-3-8 Malleable Tee, ø 100 x ø 80	nos	7	158,400	1,108,800	
2-3-9 Malleable Tee, ø 80 x ø 80	nos	4	70,200	280,800	
2-3-10 Malleable Reducer, ø 100 x ø 80	nos	5	81,000	405,000	
2-3-11 Malleable Reducer, ø 80 x ø 65	nos	16	46,800	748,800	
2-3-12 Malleable Reducer, ø 65 x ø 50	nos	1	28,100	28,100	
2-3-13 Malleable Bend, ø 80, 90 degrees	nos	8	50,400	403,200	
2-3-14 Malleable Bend, ø 50, 90 degrees	nos	1	30,300	30,300	
2-3-15 Malleable Nipple, ø 100	nos	2	64,800	129,600	
2-3-16 Malleable Nipple, ø 80	nos	6	37,800	226,800	
2-3-17 Malleable Nipple, ø 65	nos	16	25,200	403,200	
2-3-18 Malleable Nipple, ø 50	nos	1	15,200	15,200	
2-3-19 Malleable Socket, ø 80	nos	4	33,300	133,200	

Item	Unit	Q'ty	Unit Price (Rp.)	Amount (Rp.)	Remarks
2-4 Hydrant Box					
2-4-1 Hydrant Valve, ø 65	nos	15	114,400	1,716,000	
2-4-2 Reinforced Concrete Pipe, ø 300	m	3.3	19,100	63,030	
2-4-3 Reinforced Concrete Pipe, ø 500	m	4.4	40,800	179,520	
2-4-4 Gravel Filling	m3	0.74	15,000	11,100	
2-4-5 Concrete (1:3:6)	m3	0.84	61,824	51,932	
2-5 Crossing of Existing Road					
2-5-1 Removal of Asphalt Pavement	m2	12	1,575	18,900	
2-5-2 Asphalt Pavement	m2	12	10,885	130,620	
2-6 Drainage Ditch					
2-6-1 Excavation	m3	277	2,300	637,100	
2-7 Drainage Pond					
2-7-1 Excavation	m3	5,710	1,557	8,890,470	
2-7-2 Embankment	m3	30	4,680	140,400	
2-8 Drainage Culvert					
2-8-1 Excavation	m3	119	2,300	273,700	
2-8-2 Backfill	m3	92	1,800	165,600	
2-8-3 Sand Filling	m3	19	17,300	328,700	
2-8-4 Gravel Filling	m3	1.1	16,850	18,535	
2-8-5 Stone Masonry	m3	1.1	64,775	71,253	
2-8-6 Concrete (1:3:6)	m3	6.4	61,824	395,674	
2-8-7 Form for Concrete	m2	98	4,744	464,912	
2-8-8 Reinforcement Concrete Pipe, ø 300	m	72.5	22,216	1,610,660	
Sub-Total				31,376,755	(say Rp. 31,377,000)
3 WATER SUPPLY SYSTEM					
3-1 Deep Well					
3-1-1 Mobilization of Equipment	LS			400,000	
3-1-2 Drilling, ø 300	m	64	100,000	6,400,000	
3-1-3 Drilling, ø 200	m	136	75,000	10,200,000	
3-1-4 Casing Pipe, ø 200	m	64	65,000	4,160,000	GSP medium class
3-1-5 Casing Pipe, ø 100	m	88	35,000	3,080,000	GSP medium class
3-1-6 Screen, Johnson Type	m	48	150,000	7,200,000	
3-1-7 Bentonite	ton	1	1,000,000	1,000,000	
3-1-8 Hexamethafosfate	kg	50	5,000	250,000	
3-1-9 Logging of Well	m	200	2,500	500,000	
3-1-10 Installation of Pipe & Screen	LS			500,000	
3-1-11 Development & Cleaning the Well	LS			500,000	minimum 60 hours
3-1-12 Pumping Test	LS			500,000	minimum 72 hours
3-1-13 Water Quality Test & Analysis	LS			100,000	
3-1-14 Well Protection & Finishing	LS			100,000	
3-2 Submersible Pump					
3-2-1 Submersible Motor Pump	nos	1	11,309,000	11,309,000	Q = 330 l/min.
3-2-2 Steel Riser Pipe	m	80	18,800	1,504,000	ø 2.5", galvanized
3-2-3 Base of Submersible Pump	LS			100,000	
3-2-4 Installation of Submersible Pump	LS			10,000	
3-2-5 Control Panel	set	1	20,940,000	20,940,000	

Item	Unit	Q'ty	Unit Price (Rp.)	Amount (Rp.)	Remarks
3-3 Booster Pump					
3-3-1 Booster Pump	set	1	2,321,000	2,321,000	Q = 500 l /min.
3-3-2 Steel Pipe	m	10	25,140	251,400	ø 75, galvanized
3-3-3 Gate Valve	nos	1	240,000	240,000	ø 75
3-3-4 Stop Valve	nos	1	231,000	231,000	ø 75
3-3-5 Flexible Flange	nos	1	190,000	190,000	ø 75
3-3-6 Pressure Gauge	nos	1	15,800	15,800	ø 75
3-3-7 Pressure Tank	nos	1	2,750,000	2,750,000	8 kgf/cm2
3-3-8 Installation of Booster Pump	LS			22,000	
3-3-9 Pumphouse & Base of Booster Pump	LS			200,000	
Sub-Total				74,974,200	(say Rp. 74,975,000)
4 ELECTRICAL SUPPLY SYSTEM					
4-1 Electrical Cable					
4-1-1 Steel Armoured Cable	m	440	26,150	11,506,000	4-core, 50 mm2
4-1-2 Steel Pipe	pcs	12	24,150	289,800	ø 1.5", 6 m/pc
4-1-3 Socket for Steel Pipe	pcs	13	725	9,425	
4-1-4 Galvanized Steel Pipe	pcs	3	30,480	91,440	ø 1.5", 6 m/pc
4-1-5 Excavation and Backfilling	m	380	2,550	969,000	
4-1-6 Removal & Laying of Asphalt Road	m2	27	9,170	247,590	
4-1-7 Miscellaneous Materials	LS			308,880	
4-2 Switch Box	set	1	924,000	924,000	indoor wall mounted type
Sub-Total				14,346,135	(say Rp. 14,347,000)
5 AUXILIARY FACILITIES					
5-1 Warehouse					
5-1-1 Soil Excavation	m3	75	2,500	187,500	
5-1-2 Backfill	m3	38	1,500	57,000	
5-1-3 Soil Disposal	m3	37	500	18,500	
5-1-4 Embanking under Grade Slab	m3	3	1,500	4,500	
5-1-5 Hardcore	m3	21	18,000	378,000	
5-1-6 Concrete	m3	46	65,000	2,990,000	
5-1-7 Reinforcement Bar	ton	2.98	670,000	1,996,600	
5-1-8 Levelling of Lean Concrete	m2	57	6,000	342,000	t = 50 mm
5-1-9 Form for Concrete	m2	233	12,000	2,796,000	
5-1-10 Brick Masonry, 1/2B	m2	185	8,000	1,480,000	
5-1-11 Cement Plaster to Wall	m2	457	3,000	1,371,000	
5-1-12 Cement Plaster to Floor	m2	4	3,000	12,000	
5-1-13 Concrete Floor Troweling	m2	96	1,000	96,000	
5-1-14 Cement Tile for Floor	m2	28	2,800	78,400	
5-1-15 Plywood Ceiling, 5 mm	m2	32	8,500	272,000	
5-1-16 Wood Door, Top Hung Wood Sliding	nos	1	650,000	650,000	3.8 m (w) x 3.0 m (h)
5-1-17 Wood Flush Door with Transom	nos	2	350,000	700,000	0.8 m (w) x 2.5 m (h)
5-1-18 Wood Flush Door with Transom	nos	3	250,000	750,000	0.6 m (w) x 2.5 m (h)
5-1-19 Jalousie Window with Transom	nos	1	100,000	100,000	0.6 m (w) x 1.5 m (h)
5-1-20 Jalousie Window with Transom	nos	4	200,000	800,000	1.2 m (w) x 1.5 m (h)
5-1-21 Metal Grill with Expanded Metal	nos	5	300,000	1,500,000	
5-1-22 Asbestos Roof Deck	m2	181	10,000	1,810,000	
5-1-23 Steel Purlin	ton	1.61	1,500,000	2,415,000	
5-1-24 Oil Painting	m2	214	3,000	642,000	

Item	Unit	Q'ty	Unit Price (Rp.)	Amount (Rp.)	Remarks
5-1-25 Emulsion Painting	m2	316	2,000	632,000	
5-1-26 Lighting Fixture, Fluorescent Lamp	nos	6	47,300	283,800	40 W, pendant
5-1-27 Lighting Fixture, Fluorescent Lamp	nos	2	41,300	82,600	40 W, ceiling mounted
5-1-28 Lighting Fixture, Fluorescent Lamp	nos	1	39,600	39,600	20 W, wall mounted
5-1-29 Lighting Fixture, Incandescent Lamp	nos	1	33,000	33,000	40 W, in glass globe
5-1-30 Receptacle, Single	nos	4	26,400	105,600	
5-1-31 Receptacle, Duplex	nos	3	52,800	158,400	
5-1-32 Tumbler Switch	nos	6	14,400	86,400	
5-1-33 Panelboard	nos	1	437,000	437,000	
5-1-34 PVC Insulated Wire in PVC Conduit	m	138	7,500	1,035,000	2.5 mm
5-1-35 PVC Insulated Multi-core Flat Cable	m	27	360	9,720	2C/2.5
5-1-36 Water Closet	nos	1	174,240	174,240	
5-1-37 Faucet, ø 15	nos	2	15,480	30,960	
5-1-38 Cock, ø15	nos	1	15,480	15,480	
5-1-39 Floor Drain, ø 50	nos	1	13,200	13,200	
5-1-40 Kitchen Sink	nos	1	300,000	300,000	
5-1-41 Gate Valve, ø 20 in Valve Casing	nos	1	24,400	24,400	
5-1-42 Manhole, Brick Made, 500 x 500	nos	1	30,000	30,000	
5-1-43 Gas Cock	nos	1	15,800	15,800	
5-1-44 Galvanized Steel Pipe, ø 15	m	12	1,080	12,960	
5-1-45 Galvanized Steel Pipe, ø 20	m	3	2,900	8,700	
5-1-46 PVC Drain Pipe, ø 50	m	6	6,500	39,000	
5-1-47 PVC Drain Pipe, ø 100	m	7	17,500	122,500	
5-1-48 Septic Tank & Seepage Pit	nos	1	900,000	900,000	
5-1-49 Others	LS			2,278,800	
5-2 Water Tightness Test Pit					
5-2-1 Soil Excavation	m3	108	2,500	270,000	
5-2-2 Backfill	m3	23	1,500	34,500	
5-2-3 Soil Disposal	m3	85	500	42,500	
5-2-4 Hardcore	m3	8	1,500	12,000	
5-2-5 Concrete	m3	19	65,000	1,235,000	
5-2-6 Levelling of Lean Concrete	m2	65	5,000	325,000	t = 50 mm
5-2-7 Form for Concrete	m2	86	12,000	1,032,000	
5-2-8 Reinforcement Bar	ton	1.41	670,000	944,700	
5-2-9 Hook, D12	nos	19	20,000	380,000	
5-2-10 Gate Valve, ø 50	nos	1	24,400	24,400	
5-3 Carwash					
5-3-1 Soil Excavation	m3	21	2,500	52,500	
5-3-2 Hardcore	m3	9	1,500	13,500	
5-3-3 Concrete	m3	11	65,000	715,000	
5-3-4 Form for Concrete	m2	14	12,000	168,000	
5-3-5 Reinforcement Bar	ton	0.23	670,000	154,100	
5-3-6 Catch Basin, Brick Made	nos	1	30,000	30,000	500 x 500
5-3-7 Soil Disposal	m3	2	500	1,000	

Item	Unit	Q'ty	Unit Price (Rp.)	Amount (Rp.)	Remarks
5-4 Exterior Electric & Plumbing Work					
5-4-1 Outdoor Electric Power Service Cable	m	90	6,800	612,000	PVC installed
5-4-2 Handhole, Brick Made	nos	2	50,000	100,000	700 x 700
5-4-3 Outdoor Receptacle, Duplex	nos	2	53,600	107,200	
5-4-4 Street Light with Wood Pole	nos	1	472,800	472,800	FL 20 W incl photo switch
5-4-5 Galvanized Steel Pipe, ø 20	m	110	2,900	319,000	
5-4-6 Gate Valve, ø 20 in Valve Casing	nos	1	24,400	24,400	
5-4-7 Faucet, ø 20	nos	2	11,200	22,400	
5-4-8 PVC Drain Pipe, ø 75	m	35	6,480	226,800	
5-4-9 Open Seepage Pit	nos	1	175,000	175,000	Q = 50 m3 (effective)
5-4-10 Others	LS			1,360,320	
5-5 Contractor's Camp Facilities	LS			5,000,000	
Sub-Total				42,169,780	(say Rp. 42,170,000)
Total				Rp. 206,764,000	

4-6 Unit Price

Excavation (by Manpower) Rp. 2,300 /m3

Item	Q'ty	Unit	Unit Price	Price	Remarks
Common labour	0.85	m.d	2,500	2,125	
Foreman	0.035	m.d	5,000	175	
Total				2,300	

Backfill (by Manpower) Rp. 1,800 /m3

Item	Q'ty	Unit	Unit Price	Price	Remarks
Common labour	0.6	m.d	2,500	1,500	
Foreman	0.06	m.d	5,000	300	
Total				1,800	

Sand filling Rp. 17,300 /m3

Item	Q'ty	Unit	Unit Price	Price	Remarks
Sand	1.0	m3	15,000	15,000	
Hauling	1.0	m3	500	500	
Common labour	0.6	m.d	2,500	1,500	
Foreman	0.06	m.d	5,000	300	
Total				17,300	

Stripping (t = 100 mm) Rp. 863 /m3

Item	Q'ty	Unit	Unit Price	Price	Remarks
Per ha					
Labour Foreman	0.1	m.d	5,000	500	for Earth Work
Common	2	m.d	2,500	5,000	
Foreman	0.21	m.d	5,000	1,050	for Bulldozer
Bulldozer *	17.54	hr	48,843	856,706	
* Production 57 m3/hour					
Total hours = 10,000 m2 * 0.1 m / 57 m3					
= 17.54 hr					
			Total	863,256	/ha for 1,000 m3 = Rp. 863 / m3
Total				863	

Embankment of Farm Road Rp. 4,680 /m3

Item	Q'ty	Unit	Unit Price	Price	Remarks
Stripping borrow area	1.0	m3	230	230	
Hauling	1.0	m3	1,230	1,230	
Spreading & compaction	1.0	m3	2,200	2,200	
Finishing	1.0	m3	1,020	1,020	
Total				4,680	

Hauling per m3 (l = 50 m) Rp. 500 /m3

Item	Q'ty	Unit	Unit Price	Price	Remarks
Common labour	0.2	m.d	2,500	500	
Total				500	

Operation Cost, Bulldozer 15 ton class Rp. 48,800 /hr

Item	Q'ty	Unit	Unit Price	Price	Remarks
Equipment	1/0.7	hr	30,000	42,857	
Diesel oil	19.9	lit	200	3,980	
Lubricant	0.4	lit	1,200	480	
Grease	0.02	kg	2,700	54	
Operator	1/5.6	m.d	4,500	804	
Assistant operator	1/5.6	m.d	3,500	625	
Total				48,800	

Operation Cost, Motor Grader Rp. 46,306 /hr

Item	Q'ty	Unit	Unit Price	Price	Remarks
Equipment	1/0.7	hr	30,000	42,857	
Diesel oil	8.3	lit	200	1,660	
Lubricant	0.21	lit	1,200	252	
Grease	0.04	kg	2,700	108	
Operator	1/5.6	m.d	4,500	804	
Assistant operator	1/5.6	m.d	3,500	625	
Total				46,306	

Operation Cost, Hydraulic Shovel 0.6 m3 Rp. 47,320 /hr

Item	Q'ty	Unit	Unit Price	Price	Remarks
Equipment	1/0.7	hr	30,000	42,857	
Diesel oil	12	lit	200	2,400	
Lubricant	0.416	lit	1,200	499	
Grease	0.05	kg	2,700	135	
Operator	1/5.6	m.d	4,500	804	
Assistant operator	1/5.6	m.d	3,500	625	
Total				47,320	

Operation Cost, Road Roller 10 ton — Rp. 45,732 /hr

Item	Q'ty	Unit	Unit Price	Price	Remarks
Equipment	1/0.7	hr	30,000	42,857	
Diesel oil	6	lit	200	1,200	
Lubricant	0.16	lit	1,200	192	
Grease	0.02	kg	2,700	54	
Operator	1/5.6	m.d	4,500	804	
Assistant operator	1/5.6	m.d	3,500	625	
Total				45,732	

Removal of Asphalt Pavement — Rp. 1,575 /m2

Item	Q'ty	Unit	Unit Price	Price	Remarks
Common labour	0.6	m.d	2,500	1,500	
Tools etc.	5	%		75	
Total				1,575	

Stripping Borrow Area for Farm Road Embankment (t = 100 mm) — Rp. 231 /m3

Item	Q'ty	Unit	Unit Price	Price	Remarks
Per 400 m3					
Labour Foreman	0.5	m.d	5,000	2,500	
Common	1.5	m.d	2,500	3,750	
Foreman	0.1	m.d	5,000	500	
Bulldozer 15 ton	1.75	hr	48,843	85,475	
			Total	92,225 / 400 m3	
Total				231	

Hauling for Farm Road Embankment — Rp. 1,230 /m3

Item	Q'ty	Unit	Unit Price	Price	Remarks
Per 100 m3					
Labour Foreman	0.5	m.d	5,000	2,500	for Earth Work
Common	1.5	m.d	2,500	3,750	
Foreman	0.1	m.d	5,000	500	for Equipment
Bulldozer 15 ton *	2.38	hr	48,843	116,246	
			Total	122,996 / 100 m3	

* Hauling distance 70 m

Total	1,230

Spreading & Compaction for Road Embankment — Rp. 2,200 /m3

Item	Q'ty	Unit	Unit Price	Price	Remarks
Per 100 m3					
Labour Foreman	1.0	m.d	5,000	5,000	for Earth Work
Common	3.0	m.d	2,500	7,500	
Foreman	0.3	m.d	5,000	1,500	for Equipment
Bulldozer 15 ton	2.38	hr	48,843	116,246	
Road Roller 10 ton	1.96	hr	45,775	89,719	51 m3/hr
			Total	219,965 / 100 m3	

Total	2,200

Finishing for Farm Road Embankment — Rp. 1,018 /m3

Item	Q'ty	Unit	Unit Price	Price	Remarks
Per 100 m3					
Labour Foreman	0.5	m.d	5,000	2,500	for Earth Work
Common	2.5	m.d	2,500	6,250	
Foreman	0.08	m.d	5,000	400	for Equipment
Motor Grader	2.00	hr	46,349	92,698	50 m3/hr
				101,848 / 100 m3	

Total	1,018

Stone Masonry Rp. 64,775 /m3

Item		Q'ty	Unit	Unit Price	Price	Remarks
Labour	Foreman	0.05	m.d	5,000	250	
	Mason	0.12	m.d	4,500	540	
	Ass. Mason	1.2	m.d	4,000	4,800	
	Common	2.2	m.d	2,500	5,500	
Stone		1.2	m3	15,000	18,000	
Cement		6.53	bag	4,000	26,120	
Sand		0.54	m3	12,000	6,480	1:3 Mortar
Tools, etc.		5	%		3,085	
Total					64,775	

Form for Concrete Rp. 4,744 /m2

Item	Q'ty	Unit	Unit Price	Price	Remarks
Preparation	1.0	m2	3,088	3,088	
Erection & Removal	1.0	m2	1,656	1,656	
Total				4,744	

Form for Concrete, Preparation Rp. 3,088 /m2

Item		Q'ty	Unit	Unit Price	Price	Remarks
Per 10 m2						
Labour	Carpenter	1.5	m.d	4,000	6,000	
	Common	1.5	m.d	2,500	3,750	
	Foreman	0.1	m.d	5,000	500	
Wooden	Plate	0.16	m3	250,000	40,000	
Wooden	Plunk	0.2	m3	200,000	40,000	
Nail		2.0	kg	1,200	2,400	
				Total	92,650	/10 m2/3 times
Total	Per m2/1-time use				3,088	

Form for Concrete, Erection & Removal Rp. 1,656 /m2

Item	Q'ty	Unit	Unit Price	Price	Remarks
Per 10 m2					
Labour Carpenter	0.7	m.d	4,000	2,800	
Common	1.5	m.d	2,500	3,750	
Foreman	0.1	m.d	5,000	500	
Wooden bracing	0.01	m3	200,000	2,000	
Nail	1.5	kg	2,400	3,600	
Steel wire	1.5	kg	1,600	2,400	
Miscellaneous	10	%		1,505	
			Total	16,555 / 10 m2	
Total				1,656	

Land Levelling (Flat Field) Rp. 3,170,453 /ha

Item	Q'ty	Unit	Unit Price	Price	Remarks
Labour Foreman	0.31	m.d	5,000	1,550	
Common	9.5	m.d	2,500	23,750	
Surveyor	0.5	m.d	6,500	3,250	
Ass.surveyor	0.5	m.d	2,500	1,250	
Common	19.6	m.d	2,500	49,000	E/work,field ditch
Carpenter	0.53	m.d	4,000	2,120	
Timber	0.0742	m3	200,000	14,840	
Nail	0.16	kg	1,200	192	
Bulldozer, 15 ton	51.6	hr	48,843	2,520,299	
Motor Grader,3.1ton	9.2	hr	46,349	426,411	
Miscellaneous	4.2	%		127,792	
Total				3,170,453	

Land Levelling (Steep Field) Rp. 3,669,219 /ha

Item	Q'ty	Unit	Unit Price	Price	Remarks
Labour Foreman	0.31	m.d	5,000	1,550	
Common	9.5	m.d	2,500	23,750	
Surveyor	0.5	m.d	6,500	3,250	
Ass.surveyor	0.5	m.d	2,500	1,250	
Common	19.6	m.d	2,500	49,000	
Carpenter	0.53	m.d	4,000	2,120	
Timber	0.0742	m3	200,000	14,840	
Nail	0.16	kg	1,200	192	
Bulldozer, 15 ton	61.4	hr	48,843	2,998,960	
Motor Grader,3.1ton	9.2	hr	46,349	426,411	
Miscellaneous	4.2	%		147,896	
Total				3,669,219	

Asphalt Pavement Rp. 10,885 /m2

Item	Q'ty	Unit	Unit Price	Price	Remarks
Lower sub-grade	1.0	m2	3,264	3,264	
Upper sub-grade	1.0	m2	1,297	1,297	
Asphalt spray & finishing	1.0	m2	6,324	6,324	
Total				10,885	

Gravel Pavement (t = 100 mm) Rp. 2,176 /m2

Item	Q'ty	Unit	Unit Price	Price	Remarks
Per 100 m2					
Labour Common	0.34	m.d	2,500	850	
Mason	1.25	m.d	4,000	5,000	
Foreman	0.15	m.d	5,000	750	
Gravel	11.0	m3	16,000	176,000	
Motor Grader	0.33	hr	46,349	15,295	
Tamper/Rammer	1.25	day	15,758	19,698	
			Total	217,593 / 100 m2	
Total		per m2		2,176	

Concrete (1:3:6) Rp. 61,824 /m3

Item	Q'ty	Unit	Unit Price	Price	Remarks
Cement	5.6	bag	4,000	22,400	
Sand	0.52	m3	12,000	6,240	
Gravel	0.99	m3	12,000	11,880	
Labour Common	4.0	m.d	2,500	10,000	
Foreman	0.2	m.d	5,000	1,000	
Tools, etc.	20	%		10,304	
Total				61,824	

Concrete (1:4:8) Rp. 56,496 /m3

Item	Q'ty	Unit	Unit Price	Price	Remarks
Cement	4.4	bag	4,000	17,600	
Sand	0.53	m3	12,000	6,360	
Gravel	1.01	m3	12,000	12,120	
Labour Common	4.0	m.d	2,500	10,000	
Foreman	0.2	m.d	5,000	1,000	
Tools, etc.	20	%		9,416	
Total				56,496	

Asphalt Spray & Finishing (t = 50 mm) Rp. 6,324 /m2

Item	Q'ty	Unit	Unit Price	Price	Remarks
Per 100 m2					
Labour					
Asphalt Worker	22.82	m.d	4,000	91,280	
Common	22.52	m.d	2,500	56,300	
Asphalt pitch	9.38	ton	49,500	464,310	
Gasoline	2.1	lit	385	809	
Tamper/Rammer	1.25	day	15,758	19,698	
			Total	632,396 / 100 m2	
Total		per m2		6,324	

Upper Sub-Grade (t = 50 mm) Rp. 1,297 /m2

Item	Q'ty	Unit	Unit Price	Price	Remarks
Per 100 m2					
Labour Common	0.5	m.d	2,500	1,250	
Gravel	6.32	m3	15,000	94,800	
Motor Grader	0.3	hr	46,349	13,905	
Tamper/Rammer	1.25	day	15,758	19,698	
			Total	129,652 /100 m2	
Total		per m2		1,297	

Completion by Tamper & Rammer Rp. 15,759 /day

Item	Q'ty	Unit	Unit Price	Price	Remarks
Tamper/Rammer	1.0	day	10,000	10,000	
Gasoline	4.1	lit	385	1,579	
Lubricant	0.15	lit	1,200	180	
Operator	1.0	m.d	4,000	4,000	
Total				15,759	

Reinforcement Bar Rp. 671 /kg

Item	Q'ty	Unit	Unit Price	Price	Remarks
Per ton					
Labour Steel Worker	6.5	m.d	4,500	29,250	
Common	6.1	m.d	2,500	15,250	
Reinforcement bar	1.03	ton	600,000	618,000	
Steel wire	5.0	kg	1,600	8,000	
			Total	670,500 / ton	
Total		per kg		671	

Gravel Filling Rp. 16,850 /m3

Item	Q'ty	Unit	Unit Price	Price	Remarks
Labour Common	0.2	m.d	2,500	500	for spreading
Common	0.4	m.d	2,500	1,000	for compaction
Foreman	0.01	m.d	5,000	50	
Gravel	1.02	m3	15,000	15,300	
Total				16,850	

Excavation of Drainage Pond — Rp. 1,557 /m3

Item	Q'ty	Unit	Unit Price	Price	Remarks
Per 100 m3					
Labour Foreman	0.8	m.d	5,000	4,000	for Earth Work
Common	3.0	m.d	2,500	7,500	
Foreman	0.14	m.d	5,000	700	for Equipment
Backhoe, 0.6 m3	3.03	hr	47,370	143,531	33 m3/hr
			Total	155,731	/100 m3
Total		per m3		1,557	

Concrete Pipe, ø 300 mm — Rp. 22,216 /m

Item	Q'ty	Unit	Unit Price	Price	Remarks
Per 10 pieces (12.5 m)					
Labour					
Skilled worker	3.0	m.d	4,000	12,000	
Common	5.0	m.d	2,500	12,500	
Concrete pipe	10	nos.	19,100	191,000	
Collar	10	nos.	4,530	45,300	
Cement	0.8	bag	4,000	3,200	
Sand	0.04	m3	12,000	480	
Tools, etc.	5	%		13,224	
			Total	277,704	/12.5 m
Total		per m		22,216	

CHAPTER 5 TENDER DOCUMENTS (DRAFT)

5-1 Contract

5-2 Technical Specification

5-1 Contract (Draft)

CONTRACT
FOR
CONSTRUCTION OF INFRASTRUCTURE IMPROVEMENT WORKS
ON
THE PROJECT OF THE CENTER FOR DEVELOPMENT OF APPROPRIATE AGRICULTURAL ENGINEERING TECHNOLOGY (ATA-220)
IN
INDONESIA

INDONESIA OFFICE

JAPAN INTERNATIONAL COOPERATION AGENCY

CONTRACT

For Construction of Infrastructure Improvement Works
on the Project of the Center for Development of Appropriate
Agricultural Engineering Technology (ATA-220) in Indonesia

This Contract is executed on the ____ day of _____ 1989 at JICA Indonesia Office between

Japan International Cooperation Agency, Indonesia Office by Mr. Yasuo KITANO Title Resident Representative as its authorized representative of JICA Indonesia Office, 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 infrastructure improvement works, hereinafter called "the Works", consisting of land preparation, irrigation and drainage facilities, water supply system, electrical supply system and auxiliary facilities for the Center for Development of Appropriate Agricultural Engineering Technology (ATA-220).

Article 1 (b)

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

1. Land Preparation

(a)	Land levelling for upland crops field	A	= 0.800 ha
(b)	Land levelling for rice field	A	= 0.535 ha
(c)	Farm road (W = 5.0 m, Asphalt pavement)	L	= 118.0 m

(d)	Farm road (W = 5.0 m, Gravel pavement)	L = 555.0 m
(e)	Farm road (W = 2.0 m)	L = 1,512.0 m
2.	Irrigation and Drainage Facilities	
(a)	Irrigation pipeline (PVC pipe, ϕ100 mm)	L = 477.0 m
(b)	Hydrant	15 pcs
(c)	Drainage ditch	L = 463 m
(d)	Drainage pond	5 pcs
3.	Water Supply System	
(a)	Boring of deep well, ϕ200 mm	L = 200 m
(b)	Deep well pump	ϕ65 mm
(c)	Booster pump	ϕ65 mm
(d)	Pump house	1 pc
4.	Electrical Supply System	
(a)	Steel armored cable	440 m
(b)	Distribution panel	1 set
(c)	Switch box	1 set
5.	Auxiliary Facilities	
(a)	Warehouse	1 lot
(b)	Water tightness test pit	1 lot
(c)	Carwash	1 lot
6.	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 Rp. _____

(Say Rupiah _____)

which consists of:

a. Construction cost based on the Bill of Quantities in Rp. _____ (Say Rupiah _____)

and

b. Indonesia value added tax, namely P.P.N. in Rp. _____ (Say Rupiah _____).

Overheads, profits and other duties and taxes except P.P.N. 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 Rp. _____ (_____) in cash, or in lieu thereof a Bank Guarantee issued by the _____ _____ bearing the number _____ and dated _____ in the amount of Rp. _____ (_____ _____) 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 _____ 1989 (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 on construction works execution of the public works in Indonesia (Supplement State Paper No. 14571).

2. General regulations on inspection of construction materials for construction of buildings in Indonesia.

3. Local construction regulations.

4. Decision No. 12/1977 of the President of the Republic of Indonesia.

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 Indonesia.

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 Rupiah-devaluation against the US Dollar in Indonesia, 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 of in 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,
Rupiah _____ (Rp. _____)
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, Rupiah _____ (Rp. _____) 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 Rupiah _____ _____ (Rp. _____) 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) day 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.

Jakarta, _____(Date)_____

EMPLOYER	CONTRACTOR
_____	_____
Yasuo KITANO Resident Representative Japan International Cooperation Agency Indonesia Office	Director of (Name of Company)
WITNESS BY	WITNESS BY
_____	_____
	JICA Short Term Expert

5-2 Technical Specifications (Draft)

TECHNICAL SPECIFICATIONS

FOR

CONSTRUCTION OF INFRASTRUCTURE IMPROVEMENT WORKS

ON

THE PROJECT OF THE CENTER FOR DEVELOPMENT OF APPROPRIATE AGRICULTURAL ENGINEERING TECHNOLOGY (ATA-220)

IN

INDONESIA

INDONESIA OFFICE

JAPAN INTERNATIONAL COOPERATION AGENCY

TECHNICAL SPECIFICATIONS

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PART 1 SPECIAL PROVISION

1-01 APPLICATION

These specifications are applicable to "Construction of Infrastructure Improvement Works on the Project of the Center for Development of Appropriate Agricultural Engineering Technology (ATA-220) in Indonesia". Main work quantities are stipulated in Article 1 of these 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 an existing water supply pipe, 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 natural or artificial pipeline 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 pipelines 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 Lump Sum Price of the Site Expenses 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 pipeline 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 item of Site Expenses in the Bill of Quantities.

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 aud 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 Site Expenses 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 he deemed to be included in the Site Expenses 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 fields test shall be included in the item of Site Expenses 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 Temporary Works and Site Expenses of 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) /1

- Land hiring for the Contractor's yard

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

- 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)

Note /1: This item shall be priced in the item of Temporary Works in the Bill of Quantities.

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

- Setting out pipeline, 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)

- Submit of 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 same shall be the responsibility of the contractor during and up to the completion of all construction work 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 Center for Development of Appropriate agricultural Engineering Technology 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 item of Temporary Works as indicated 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 pipelines , electrical wires, roads, drainage ponds 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 the Engineer, existing concrete and/or stone masonry structures, such as concrete masses, stones, 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 and/or Stone Masonry

All horizontal and sloped earth surfaces upon which concrete and/or stone masonry 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 and/or stone masonry 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 the 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. Generally, a tolerance of plus or minus 0.05 meter from the slope lines and grades shown on the drawings will be allowed in the finished surfaces of the embankments except that the tolerances shall not be continuous over an area greater than twenty (20) square meters.

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, pipelines and electrical wires. 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 of 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.