NO. 001

THE PHILIPPINES

BUREAU OF SOILS AND WATER MANAGEMENT

PILOT INFRASTRUCTURE IMPROVEMENT WORKS

DETAIL DESIGN STUDY

OCTOBER, 1992

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF AGRICULTURE
BUREAU OF SOILS AND WATER MANAGEMENT

PILOT INFRASTRUCTURE IMPROVEMENT WORKS
FOR
SOIL RESEARCH AND DEVELOPMENT CENTER PROJECT
AT TANAY, RIZAL PROVINCE

REPORT
ON
DETAIL DESIGN STUDY

OCTOBER, 1992

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JAPAN INTERNATIONAL COOPERATION AGENCY

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REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF AGRICULTURE
BUREAU OF SOILS AND WATER MANAGEMENT

PILOT INFRASTRUCTURE IMPROVEMENT WORKS FOR SOIL RESEARCH AND DEVELOPMENT CENTER PROJECT AT TANAY, RIZAL PROVINCE

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FOREWORD

The Japanese Government received a request for technical cooperation from the Philippine Government with respect to the Soil Research and Development Center Project for the purpose of grasping the soil characteristics as well as development and dissemination of agricultural management technology necessary for improvement of productivity and profitability of agriculture.

Following the above, both Governments signed the R/D on April 25, 1989 and the technical cooperation commenced on July 1, 1989.

At the time of commencement of the Project, an investigation mission was dispatched in order to conduct the detail design for improvement of pilot infrastructure of the center. The mission was headed by Mr. Yoshimi UENO, technical official, Tropical Agriculture Research Center, Ministry of Agriculture, Forestry and Fisheries.

The present Report compiles the results of site investigations as well as home office works. I wish sincerely that the present Report would serve as a useful reference in realizing the Pilot Infrastructure Improvement Works.

Lastly, I would like to express my deepest gratitude to all the individuals who have offered their kind and valuable cooperation to us during the performance of our investigation works.

October, 1992

Michiyo ARIKAWA
Managing Director,
Agricultural Development
Cooperation Department,
JICA

TOPOGRAPHIC MAP

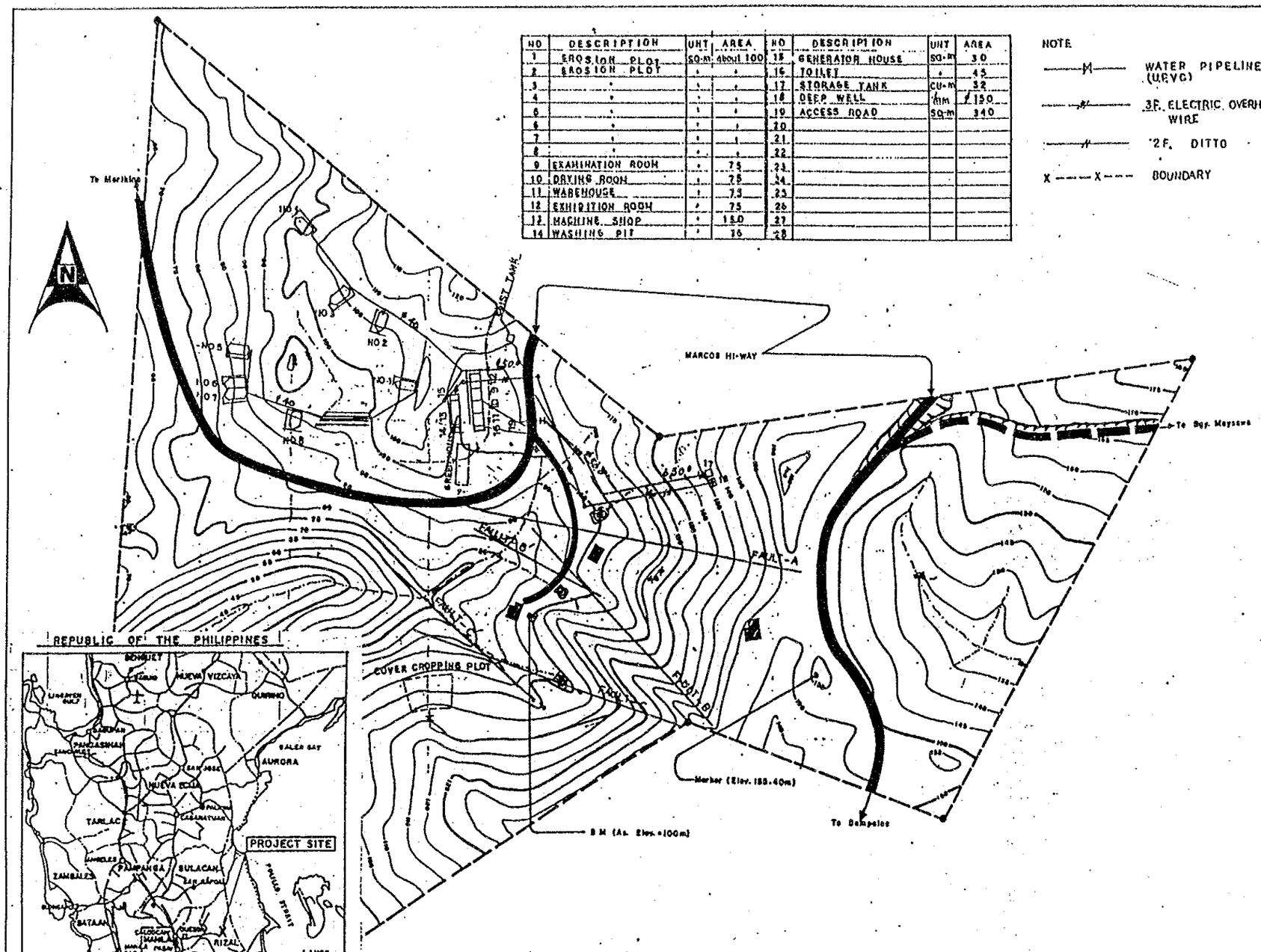
CENTRAL SOIL & WATER RESOURCES RESEARCH STATION

CUYAMBAY, TANAY, RIZAL

NO	DESCRIPTION	UNIT	AREA	NO	DESCRIPTION	UNIT	AREA
1	EROSION PLOT	SQ-m	about 100	15	GENERATOR HOUSE	SQ-m	30
2	EROSION PLOT	"	"	16	TOILET	"	45
3	"	"	"	17	STORAGE TANK	CU-m	32
4	"	"	"	18	DEEP WELL	/m	150
5	"	"	"	19	ACCESS ROAD	SQ-m	340
6	"	"	"	20			
7	"	"	"	21			
8	"	"	"	22			
9	EXAMINATION ROOM	"	75	23			
10	DRYING ROOM	"	75	24			
11	WAREHOUSE	"	75	25			
12	EXHIBITION ROOM	"	75	26			
13	MACHINE SHOP	"	150	27			
14	WASHING PIT	"	16	28			

NOTE

- WATER PIPELINE (U.P.V.C)
- 3F. ELECTRIC OVERHEAD WIRE
- 2F. DITTO
- BOUNDARY



LOCATION MAP

SCALE 1:500,000

SCALE 1:500,000

CONTOUR INTERVAL 5 METERS.

SCALE 1 : 2,000

REPUBLIC OF THE PHILIPPINES
BUREAU OF SOILS AND WATER MANAGEMENT

THE PILOT INFRASTRUCTURE IMPROVEMENT WORKS

SOIL RESEARCH AND DEVELOPMENT CENTER PROJECT

GENERAL PLAN

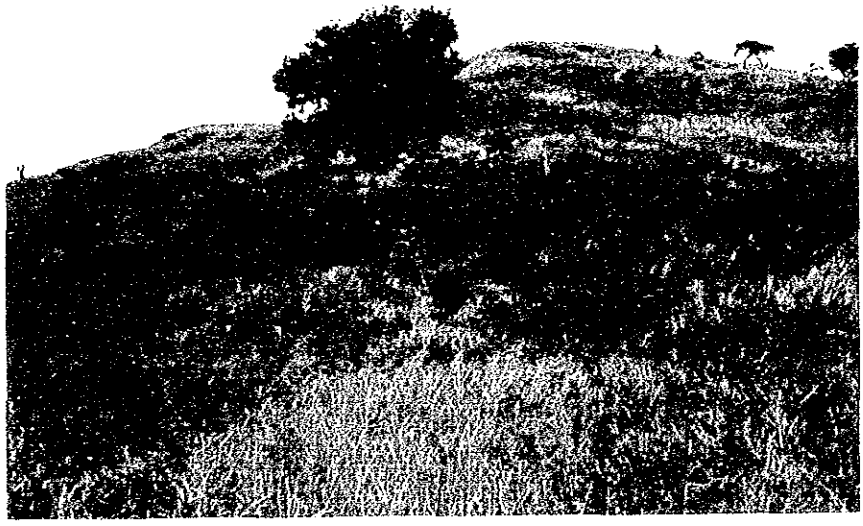
DWG.NO. | DATE

JAPAN INTERNATIONAL COOPERATION AGENCY

CONVENTIONAL SIGNS

- ROAD
- ROAD CUT
- DIRT ROAD
- SPRING
- INTERMITENT CREEK
- CONTOUR LINES
- STATION BOUNDERY.
- P.S. MONUMENT
- FARM POND
- MINI POND
- BUILDING
- RESERVOIR

Location of No. 2 Erosion Plot



Location of No. 3 Erosion Plot

Location of No. 4 Erosion Plot

Location of No. 5 Erosion Plot

Location of No. 6, 7 Erosion Plot

Location of Field Laboratory

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Chapter 1. DISPATCH OF STUDY TEAM

1-1 Background and Purpose of Dispatch of Study Team

The Philippine Government has been aiming at the improvement of productivity and profitability in its agricultural policy. In order to realize these aims, it is necessary to promote the technical development of rational land use system and growth of peasant farmers.

Soils maps, etc. have been prepared which are the basis for the planning and implementation of the agricultural development policy. However, the investigation and research system has not been developed fully at the Bureau of Soils and Water Management and thus has not been functioning in an effective manner.

In view of improving the present situation, the Soil Research and Development Center was established. In order to improve the research facilities, research instruments and to upgrade human resources for research and development, the Philippine Government has requested the Japanese Government for technical cooperation.

In response to this request, the Japanese Government dispatched a contact mission in November 1987, signed a record of discussion (R/D) and tentative schedule of implementation (TSI) in April, 1988, and has been performing cooperation activities since July, 1988 which should last for 5 years.

In March, 1990 a mission was dispatched for establishing an implementation program necessary for future management and execution of the Project and the minutes of meeting which summarized the contents of TSI and its problems were prepared and signed.

In order that the subject of the present Project, i.e., the soil investigation, classification and preparation of soil maps, contribute to the improved productivity of the Philippine agriculture, clear indication should be available on the fertility evaluation of the classified soils and soil management method. For soil management, clarification of cropping pattern and moisture

conservation mechanism for prevention of soil erosion becomes necessary.

Soil management

1. Cropping pattern for prevention of soil erosion

   - Frequency of erosion occurrence by land use form
   - Frequency of erosion occurrence by soil type
   - Frequency of erosion occurrence by topography
   - Study of erosion prevention in upland cropping field

2. Moisture conservation

   - Estimation of area of soil moisture deficiency
   - Soil moisture holding in dry season
   - Development of small-scale pond project

At present the Bureau of Soils and Water Management has Tanay Experimental Station situated 40 km south-east from its headquarters in Ultisol zone of Antipolo Mountains of Rizal Province. Ultisol extends in the mountains. Forests and sparsely utilized cogon grass land belong to the Ultisol zone. The total area of cogon grass land is about 9 million ha, mostly found in Ultisol zone, which means 30% of total agricultural land of the country. Existence of cogon grass land is considered to be the result of over-deforestation and excessive slash-and-burn agriculture and at the same time because it lies within the zone of frequent erosion by torrential rains during the rainy season. In view of the above background the present technical cooperation is being implemented.

By improving the experimental field it will become possible to demonstrate effectively to the farmers the actual proof and behavior of soil erosion.

1-2 Members of the Study Team

Members of the study team are as follows:

Name	Assignment	Post
Dr. Yoshimi UENO	Team Leader	Research Division 1, Tropical Agriculture Research Center, MOAF & F
Mr. Takahiro MORITA	Coordination	Technical Cooperation Division, Agricultural Development Cooperation Department, JICA
Mr. Jiro KAWAI	Design of Facilities	Sanyu Consultants, Inc.

1-3 Itinerary

Date	
July 30	Courtesy call to and consultation with JICA office and Japanese Embassy
31	Consultation with Soil Research and Development Center
Aug. 1	Preparation for site investigation
2	Preparation for site investigation
3	Site investigation
4	Consultation with Soil Research and Development Center
5	Preparation of minutes of meeting
6	Signing of minutes of meeting
7	Mr. UENO (Team Leader) and Mr. MORITA (Coordination) left for Japan
8	Preparation of design drawings
9	- ditto -
10	Consultation on design drawings with Soil Research and Development Center

Aug. 11	Consultation on measuring instruments with NIA experts
12	Preparation of design drawings, Consultation with experts
13	- ditto -
14	Site investigation
15	Preparation of design drawings Collection of cost estimate data
16	Arrangement of data
17	Study of design drawings at Soils Center
18	Modification of design drawings Collection of cost estimate data
19	Approval of design report Collection of cost estimate data
20	Preparation of Draft Study Report Collection of cost estimate data
21	Checking of Study Report Collection of cost estimate data
22	Preparation of Study Report Collection of cost estimate data
23	Arrangement of cost estimate data
24	Project cost estimate calculation
25	Investigation at Taney Town Hall and site
26	Rearrangement of Building locations
27	Submission of Study Report (5 copies to Director, Mr. Alcasid, Project Manager, Dr. Conception and Team Leader Mr. Takahashi)
28	Departure for Japan

1-4 Authorities and Institutions Visited and Persons Met

(1) Bureau of Soils and Water Management, Department of Agriculture

Mr. Godofredo N. Alcasid Jr.	:	Director, Headquarters
Dr. Rogelio N. Conception	:	Project Manager, Headquarters
Dr. Raynold Palis	:	Tanay Station Manager cum Head, Soil Erosion Section
Mr. Joseph Rojales	:	Chief, Tanay Station Officer

(2) Soil Research and Development Center, Long Term Japanese Experts

Dr. Tatsuji TAKAHASHI	:	Team Leader
Dr. Shoichi TOKUTOME	:	Soil Survey
Mr. Saneyuki OKUDA	:	Coordinator
Dr. Yujiro ITO	:	Soil & Fertilizer
Dr. Masao YOSHIDA	:	Land Evaluation
Dr. Hiroki IMAI	:	Soil Conservation
Dr. Akira NOGUCHI	:	Agricultural Extension Training

(3) Japanese Embassy in the Philippines

Mr. Yugo MATSUDA	:	First Secretary (Agriculture)

(4) JICA Philippine Office

Mr. Masataka IIJIMA	:	Resident Representative
Mr. Katsumi YOSHIDA	:	Assistant Representative

(5) NIA

Mr. Mamoru FUKUDA	:	Leader, Japanese long term expert

Chapter 2. OUTLINE OF PLOT DESIGN

2-1 Selection of Proposed Project Site

The proposed project site was selected according to the resuits of the preliminary survey mission made for TSI in March, 1990. Tanay Experimental Field as well as Bulacan Field shall be operated for studying soil control including cropping pattern and soil moisture conservation for erosion control.

The Tanay Experimental Field, aiming at experiments of mountain agriculture, is located in Ultisol zone of Antipolo Mountains, Rizal Province about 40 km south-east of Headquarters of the Bureau of Soils and Water Management. The Plan was agreed by both the Governments of the Philippines and Japan on July 1, 1988, on the basis of TSI.

2-2 Key Points in Plot Planning

The following points were carefully studied on the plot planning:

- Study on crops suited to mountain agriculture together with their fertilization. Selection of tree crops and erosion research for mountain orchards.
- Experiments and study to support the Small Impounding Project.
- Study and promotion of cropping pattern for soil control especially for erosion prevention during TSI.

2-3 Details of the Experiments

- Planting of various crops shall be started in considering the Agro-Forestry and the erosion control effects with such plantation shall be observed and their results shall be demonstrated.

- Demonstration of survey results of erosion frequency by slope degrees.

- The Study and demonstration of the hinterland treatment.

- The study and demonstration on the paddy field irrigation under small scale dams, related water balance and paddy fertilizing method.

2-4 Plot Layout and Arrangement

Eight plots have been selected in about 10 ha of the northwest district in the Tanay Experimental Station (32 ha). The proposed 10 ha land areas extend in Ultisol area mostly covered with cogon grass and some forest.

For the present Project the above-mentioned eight plots are selected in the existing heavily eroded land of the northwest area to successfully serve for the study and demonstration.

The standard plot size is about 7.0 m for the width (short side) and 15.0 m for length (long side) with the ratio of two sides at 2.14 and about 100 m^2 in area per plot. The rain water collecting walls shall stand with angle of about 120 degrees, although having some variation according to the local topography in order to prevent accumulation and ponding of rain water in the plot.

The purpose of the respective demonstration plots are as follows:

Plot No. 1 : Plot demonstrating erosion on present cogon covered spils.

The Plot No. 1 serves to make survey and demonstration of the erosion condition on the present cogon growing lands with heavy erosion and poor fertility in Ultisol area.

Plot No. 2 : Plot demonstrating erosion conditions under the traditional farming.

This plot shows the erosion under the traditional rotation farming of upland paddy, cassava, pineapple, etc. in Ultisol areas.

Plot No. 3 : Plot demonstrating erosion control by improved farming.

This plot shows the survey results and effects of erosion control by cover crops.

Plot No. 4 : Plot demonstrating erosion control by introducing green belts.

This plot shows the survey results of erosion control by introducing cover-crop green belts in traditional farming land.

Plot No. 5 : Plot demonstrating erosion control by introducing perennial (tree) crops.

This plot shows the survey results of erosion control by introducing perennial (tree) crops.

Plot No. 6 : Plot demonstrating heavy gully erosion.

This plot shows the survey results of heavy gully erosion advancing on the naked soils.

Plot No. 7 : Plot demonstrating the survey results of erosion control by introducing cover crops.

This plot shows the effects of cover crops on gully erosion prevention.

Plot No. 8 : Plot demonstrating the survey results of control of heavy erosion by latest comprehensive farming method.

This plot shows the survey results of the erosion control by comprehensive improved farming method including green belts, mulching, etc. to prevent heavy erosion and nudation of soils.

The topographical conditions of the respective plots are shown below:

Plot No.	Transversal slope	Longitudinal slope	Direction
No. 1	Horizontal	1:3.33	West
No. 2	Horizontal	1:2.00	South
No. 3	Abt. 3 degr. with left up	1:5.00	Southwest
No. 4	Abt. 4 degr. right up	1:3.33	Northwest
No. 5	Abt. 2 degr. right up	1:2.50	West
No. 6	Horizontal	1:2:00	Southwest by west
No. 7	Abt. 3 deg. right up	1:2.00	Southwest by west
No. 8	Abt. 4 degr. right up	1:2.00	South

Reasoning for 100m^2 per one plot

A series of common farming practices such as ploughing, leveling, sowing, etc. should be practiced in the same way as the ordinary fields, and the minimum 100 m^2 plot is necessary for the purpose. In other respect, surface runoff discharge and soil loss (erosion) which will be caused from one rainfall shall be observed and measured to show the related data explanatorily.

Assuming rainfall at a time as 25 mm, about 30 percent (7.5 mm) of which would flow down as surface runoff, i.e., about 750 lit. of rainwater and several kilograms of soil losses would take place in a unit plot. Such observation works will take 30 to 40 minutes by one person, and the observation works for all eight plots will be a full time work of a day for a person, including preparatory and clearance works. In consequence, one experimental plot shall be 100 m^2 at the most from the viewpoint of observation works, and these figures were determined according to the records and data available in the Philippines. Therefore, the plot for experiment has been taken as 100 m^2.

On the other hand, the Bureat of Soils and Water Management has a plan to construct a small scale dam in the center of the proposed

Project Area, and this dam is to be provided to support the coming Small Impounding Project for its implementation throughout the country.

On the southern slopes, arrowroot, etc. shall be planted to show the effect of vegetation to erosion control.

In view of the above, the plot layout is made within 10 ha of the land as illustrated in the design drawing, and one plot has been taken by about 100 m^2 (7.0 m × 15.0 m) for easy comparison with future plots with the same size.

2-5 Water Intake and Irrigation Facilities

The water intake point shall be at the point with EL135 in the middle of the eastern slope on the north side of the proposed area. According to the Report on Water Resources in Rizal, by Water Resources Committee, the Tanay experimental area, belonging to deep groundwater area, is evaluated to enable wells deeper than 20 m to produce sufficient water. The ground elevation of the proposed site is about EL600 m, and the Sampaloc River originates in this area.

There are three geological faults running east to west near the intake point. Vegetation around there is rather thick and three springs are found on the east slope. The proposed site was decided because, together with the investigation by a test boring to be carried out by a drilling company, it is highly probable that an aquifer could be reached by max. 60 m boring. An application has been made to JICA Manila Office to carry out test drilling in coming November. The test drilling will enable to prepare the final design and dimensions of the well. Temporarily, 60 m deep well and a 62.5 mm diameter submersible pump are assumed. And the design modification shall be made upon the test drilling.

A storage tank of about 32 m^3 stores water to supply each plot and the related facilities by gravity flow. The delivery pipes shall be of hard PVC and laid about 30 cm deep in the ground, and about 100 cm deep for road crossing. The pipes have two diameters of 50 mm and 37.5 mm, respectively. Delivery to each plot shall be made

through valves of 25 mm diameter. The details can be referred to the drawings DC -003 and -006.

2-6 Test Boring

(1) Test Boring Sites

The Study Team requested two local well excavators to conduct field investigation together with studying the Report on Groundwater Survey in Rizal Province, which was prepared by NWRC of NIA. Based on the outcome of the above, Sanyu Consultants Inc. has made further analysis to select two test boring sites, X1 and X2 at the eastern slope of the central part of the Tanay experimental site.

Firstly, a test drilling shall be done at X1 point to check the yield of min. 150 lit./min. when the expected yield cannot be secured, the test boring shall proceed to the point X2.

X1 : This point is located over the fault (F-A) with rich yield availability.

X2 : This point is located between two faults (F-B & C) and expected to encounter aquifer. Two springs are already available.

(2) Specifications of Test Boring

Finished diameters of the test boreholes shall be 75 mm, and the depth shall be about 60 m from the ground surface. The minimum depth of 60 m is required when air lift of water is adopted.

The drilling is made by Down-the-hole hammer of Rotary percussion.

After drilling, the following tests shall be conducted to prepare the detailed specifications for designing of the proposed well and pump. And the collected data and other reference materials should be arranged to present.

1. Electric logging tests
2. Pumping test
3. Layout of casing

(3) Test Boring

To be contracted to a separate entity.

(4) Implementation Period

The implementation will last 30 days between the early part of November, 1992 and the early part of December, 1992.

(5) Deep Well and Pump

Designing and preparation of specifications of the pumping equipment, installation works, etc. shall be made on the basis of the results of the test drilling and also the necessary contract documents shall be prepared for implementation.

(6) Borehole Drilling and Pump Installation

According to the results of the test boring to be carried out in November, the location, design, specifications of the proposed deep well shall be determined to conclude the contract with the well driller.

2-7 Drainage Scheme

Surface drainage water of the plots shall be totally collected into the collecting pits provided at the end of the respective plots. The pits shall be provided with a triangle weir and water gauges to have observation practiced continuously. Drain water from these pits both during the operation and at the time of pit cleaning is of small quantity and thus particular drainage facilities would not be necessary.

2-8 Collecting Pit Scheme

The proposed water collecting pits should collect the total water including not only surface runoff but groundwater by rainfall and irrigation, etc. so as to make observation successful.

The angles and shapes of the plot walls shall be appropriately changed to meet the local topographical conditions with ridges and depressions at the hinterlands to avoid the groundwater accumulation.

Each plot shall have about 100 m^2 in its area with surrounding concrete walls to prevent water from intrusion into the plot. As a result, the water to be collected in the pit will be less than 0.026 m^3/min. and the water will be drained at intervals.

Water of the Plots No. 2 and 4 will run into the storage reservoir, while that of No. 1 and of No. 5 to 8 will flow down through the existing drain ditches. Consequently, there will be no need to provide new drainage facilities. (Refer to Drawings DC -002 and 004 for detail.)

2-9 Plot Reclamation Scheme

The purpose of the Pilot Infrastructure Improvement Works is to provide the concrete framed experimental plots for the measurement of soil erosion. The concrete frame shall have thickness of 15 cm and height of 85 cm, of which 60 cm in the ground. The soils in the frame shall not be disturbed under construction works.

In other words, the soils in the plots shall be kept undisturbed during the construction to meet the project requirements, the top soils in particular.

2-10 Other Appurtenant Structures

(1) The proposed appurtenant structures include field laboratory (study room, drying room, fertilizer storage, show room),

warehouse of farm equipment, vehicle washing lot, generator house, lavatory, etc.

1. Study room	7.5 m × 10 m	=	75	m^2
2. Fertilizer storage	7.5 m × 10 m	=	75	m^2
3. Drying room	7.5 m × 10 m	=	75	m^2
4. Show room	7.5 m × 10 m	=	75	m^2
5. Warehouse of farm equipment	7.5 m × 20 m	=	150	m^2
6. Vehicle washing lot	5 m × 5 m	=	25	m^2
7. Generator house	7.5 m × 3 m	=	22.5	m^2
8. Lavatory	7.5 m × 3 m	=	22.5	m^2
9. Deep well/housing	62.5 mm dia. × 60 m deep/1 unit (The specification revision will be made upon test boring.)			
10. Storage tank	4.0 m × 5.0 m × 1.6 m	=	32.0	m^3

(2) Backup data for calculation of the floor areas

1. Field laboratory 300 m^2 (7.5m × 40m), 4 sections
   Study room 75 m^2: for measuring farming materials like fertilizers, soil improvement agents, agri-chemicals, soil covering agents, etc., and for prearrangement of the works and treatment of samples of crops, eroded soils, surface runoff water, and crushing of sample soils, and for other various purposes.
   Furniture and other instruments: 3 desks (1.2m × 3.6m), 2 Working Tables for balance and crusher (0.9m × 4.5m), 2 Shelves (1.8m width).

   Drying room 75 m^2: for air-drying the materials sampled as mentioned above, Furniture and instrument: 2 Medium size air dryers, 2 Shelves (W1.5m × L4.5m × H1.8m with 4 sections) for air drying, 1 Table (0.9m × 4.5m).

   Store room 75 m^2: for storage of sampling materials as plastic bags in various sizes, plastic vessels in various sizes, glass containers, plastic sheets in various sizes, ropes, labels, test chemicals, etc.

Furniture and instrument: 5 Shelves (W1.8m), 2 Shelves (W1.5m × L4.5m × H1.8m with 4 sections), 1 Working table (0.9m × 4.5m).

Show room 75 m^2: for showing photos of erosion and the countermeasures in success and failure, panels illustrating erosion mechanism and the countermeasures, 3-dimensional model for countermeasures, soil section showing soil degradation by erosion, samples of soil improvement materials and cover crops together with their application illustrations. All of these materials play a vitally important role in the Pilot Project.

Furniture and instrument: 4 Panels (W5.0m × H2.0m), 3 Tables (0.9m × 4.5m), 1 Glass window Shelf (W1.8m).

2. Warehouse for farm equipment, etc. 150 m^2 (7.5m × 20m)

Store area of farm equipment 112.5 m^2 (7.5m × 15m): 3 Tractors for slope with 30 HP and attachment as bottom plough, rotary plough, harrow and trailer, 1 unit each, 5 Trucks, 3 Vehicles for surveying (4WD land cruiser with winch), 2 Hand tractors, 5 Monocycles, 2 small shelves for tool stock (W1.8m), small farm implements like plough, sickles, hammers, poles, etc.

Inspection lot 37.5 m^2 (7.5m × 5m): for inspection of vehicles and farm equipment.

Furniture and instrument: 1 Working table (1.2m × 3.6m) 1 pit for tractor and vehicle inspection.

Chapter 3. DESIGN OF DEMONSTRATION PLOTS

3-1 Irrigation Scheme

3-1-1 Existing and Proposed Irrigation Systems

(1) Existing Irrigation System

Springing water has been used for irrigation of the proposed plot area, and the yield of the above is as small as 0.9 lit/min in total, which has been stored in the small ponds at respective sites. New deep well should be provided so that the demonstration plots can be maintained successfully.

(2) Construction of New Water Delivery System

The demonstration plots require the new water intake and distribution networks independently from the existing system so as to ensure future successful experiments and researches.

(3) In the physical plan of the demonstration plots, the lift pumps and distribution networks are planned at the center of the eastern slope of the north side of the proposed area with pumps and storage tank in the adjoining site at EL 135 m.

The storage tank shall function to keep stable water level to the plots, which will be provided with water through hard PVC pipes with diameters of 50 mm and 37.5 mm.

3-1-2 Unit Distribution Water in Demonstration Plots

(1) Plots to Show Erosion and Plantation

In the demonstration plots, the erosion control and plantation shall be presented, and the unit distribution water shall be decided so as to meet both requirements. Under the condition, the rotational method shall not be applied but the whole plots shall be irrigated under the same conditions.

In general, the water demand for plantation plots is larger than the other. And the unit distribution water amount shall be obtained by totaling the peak demand of the above two.

(2) Unit Water Demand (Water Demand in Dry Season)

a. Demonstration plots for erosion control (erosion control plots): 8 plots, each 100 m^2, 800 m^2 in total.

Irrigation water: Average 4.8 m^3/800 m^2/day
Water amount for cleaning the collecting pits: Average 1.0 m^3/8 plots/day.

b. Cover crop demonstration plot 1000 m^2

Irrigation demand: Average 6.0 m^3/day
The backup data of the above estimation is as follows: The usual crop growth requires the water to meet the amount of its potential evapo-transpiration, which varies with those conditions of temperature, humidity, wind speed, etc. And in the tropical zone of southeast Asian countries, such evapo-transpiration is estimated at 0.9 times as much as the amount of evaporation measured by Pan-A evaporation. In those countries, the evaporation is estimated at 7.0 mm/day in the dry season, and the necessary potential evapo-transpiration is obtained as 6.0 mm/day by multiplying 0.9, and this amount of water secures normal plant growth. For erosion control demonstration plots, the irrigation water will be required by 100 m^2 × 8 = 800 m^2 and 800 m^2 × 6.0 mm = 4.8 m^3. And for the cover crop plots of 1000 m^2, 6.0 m^3 of water is required.

The unit water demand in the wet season will never exceed the above values of the dry season because there are adequate rainfall and humidity in the wet season.

3-1-3 Peak Water Demand

(1) Water Demand and Irrigation Period for the Erosion Control Demonstration Plots

Irrigation to the above plots shall be made by 4.8 m^3 per day on an average in the dry season from mid-October to mid-May.

In the wet season, irrigation water will not be required, as measuring the soil losses by erosion is done under natural rainfall, but about 1.0 m^3/day of water will be required for cleaning of the collecting pit.

(2) Water Demand and Irrigation Period for Cover Crop Demonstration Plot

In the dry season, the average 6.0 m^3 of water will be supplied, while in the wet season, less than 6.0 m^3 will be irrigated only for the droughty conditions.

(3) Maximum Daily Water Demand

Irrigation water demand: 4.8 m^3 for erosion control plots and 6.0 m^3 for cover crop plots. (The irrigation for these plots can be supplied only about 5 hours considering the time for setting and putting-away of necessary equipment devices.)
Cleaning water of collecting pit: 1.0 m^3
Cleaning water of farming implements: 1.0 m^3
Other uses: 0.4 m^3

Thus, the maximum daily water demand is estimated at 24.0 m^3 in total.

(4) Design Pumping Water

a) Water for experimental farm

1.	Erosion control plot:	4.8 m^3/day once
2.	Cover crop plot:	6.0 m^3/day once
3.	Cleaning of collecting pit:	1.0 m^3/day once
4.	Cleaning of farming implement:	1.0 m^3/day once
5.	Other Uses:	0.4 m^3/day
	Total	13.2 m^3/day

Detailed backup data can be referred to paragraph 3-1-3.

b) Water for experimental station

1. Trainee farmers:

150 lit × 50 psn = 7500 lit/day

(ref. to Handbook of Municipal Water Supply Engineering)

2. Demand by Employees of the Station:

150 lit × 30 psn = 4500 lit/day

Thus, total demand per day is estimated at 12000 lit/day. This is equivalent to 12 m^3/day.

c) Demand for warehouse of farming equipment

1. Technicians and drivers

10 psn × 150 lit = 1500 lit/day

2. Tractor washing

100 lit/tractor × 3 = 300 lit/day

(Ref. to Standards for Upland Development, MAFF, Japan)

3. Truck washing

100 lit/truck × 5 = 500 lit/day

4. Van-type car washing

350 lit/car × 3 = 1050 lit/day

5. Trailer washing and others

50 lit/vehicle × 4 = 200 lit/day

Total demand per day is estimated at 3550 lit/day. This is roughly equivalent to 3.6 m^3 per day.

a) + b) + c) = 13.2 m^3 + 12.0 m^3 + 3.6 m^3 = 28.8 m^3/day.
Say 30 m^3/day.

d) Maximum daily suppliable water

According to the above-cited standards by Ministry of Agriculture, Forestry and Fisheries, Japan.

(30 + 12 + 3.6) × 1.5 = 43.2 m^3/day, say 44 m^3/day.

e) Pump capacity

$44\ m^3/day \div 5\ h = 8.8\ m^3/h$

$= 147$ lit/min, say 150 lit/min.

3-1-4 Water Intake Facilities

(1) Water Source

The water source for the Project shall be the deep well to be provided at the middle of the eastern slope in the center of Tanay Experimental Plots. Water shall be stored in the storage tank (32 m^3) which is made of RC and provided close to the deep well.

The intake capacity is estimated at 150 lit. per minute.

(2) Water Storage Facilities

The aforesaid RC storage tank with 32 m^3 capacity, from which the water can be supplied by gravity to each plot and other facilities. The capacity computation is shown below.

$32\ m^3/8.8\ m^3$ per hr. = 3.6 hours

(3) Water Distribution

The highest point to be irrigated in the plots is EL 105 m, and the minimum revelation for successful irrigation is EL 130 m considering the head loss in water conveyance. This means that the water head of 20 m at least is required for the water supply. Therefore, the delivery tank shall be installed at the point EL 135 m as shown in Dwg. DC -001.
(Note: EL readings quoted above are different from EL of NAMRIA, because they are based on the temporary bench mark called by the site staff as EL 100 m.)

(4) Pump Type

a) Bore diameter of the pump

$$D = 90\sqrt{Q} = 34.3 \fallingdotseq 40\ mm$$

where $Q = 0.146\ m^3/min$

b) Prime-mover Type

The prime movers of the pump operation can be divided into four types, i.e., motor, engine, hydro-turbine and solar system type.

The specific features of the respective prime-movers are shown in the following table.

The proposed type of the prime-mover is of motor type which is reliable in operation, economical and easy in operation and maintenance.

Table of Comparison of Prime Movers

Prime-mover	Ancillary Equipment	Merits	Demerits	Estimated Cost
Electric Motor	Elevated Tank H=4m Suction Tank	- Easy operation - Economical maintenance - Lower running cost - Simple appurtenances	- Inoperative in stoppage of electric current	P 220,000. (same as engine below)
Engine (Kerosene/Gasoline)	Elevated Tank H=4m Suction Tank	- Easy operation and maintenance - Operative even in stoppage of electric current - Simple appurtenances	- High running cost - Cost for oil consumption 15ℓ/hr×12P=1180P/hr	Pump: P 100,000 Appurtenances: P 120,000 Total: P 220,000
Hydro-turbine	Intake Gate, Water Tank for Turbine Elevated Tank H=6m Pipeline 300m Embankment Protection Work	- Easy operation and maintenance - Inexpensive in operation cost	- Difficult in trouble shooting - Complicated appurtenances	Pump: P 350,000 Appurtenances: P 930,000 Total: P 1,280,000
Solar System	Elevated Tank H=4m Suction Tank	- Inexpensive in operation - Simple appurtenances	- Batteries required for stable operation - Experts required for operation and maintenance	Pump: P 100,000 Solar Panel: P 290,000 Appurtenances: P 120,000 Total: P 510,000

c) Output of the Prime-mover

$$P = \frac{0.222 \times Q \times H}{nP \times Nt} (1 + R)$$

where:

P	:	Required Horsepower	(P.S.)
Q	:	Design Discharge	0.146 m^3/min
H	:	Total Head m	61.6 m
nP	:	Pumping Efficiency	50%
Nt	:	Connecting Efficiency	100%
R	:	Tolerance	25%

$$P = \frac{0.222 \times 0.146 \times 61.6}{0.5 \times 1.0} (1 + 0.25) = 4.99 \doteq 50 \text{ P.S.}$$

d) Decision of Pump Type

Type	:	Submerged pump for deep well
Bore Diameter	:	50 mm
Pumping Capacity	:	0.15 m^3/min
Total Head	:	62.0 m
Power Output	:	5 P.S.
Operation	:	Automatic control

(3) Storage Tank

a) Type: The tank shall function to deliver water to each plot in stable water pressure and have a capacity of at least three hour pumping volume in the dry season.

$$8.8 \text{ m}^3/\text{hr} \times 3 \text{ hr} = 26.4 \text{ m}^3 < 32 \text{ m}^3$$

The design water level in the tank (LWL) is determined to be LWL = 135 m taking into consideration the minimum water head at the terminal of 1.5 kg/cm^2.

b) Spillway

The spillway pipe shall be hard PVC with diameter of 150 mm.

3-1-5 Distribution Pipeline

(1) Delivery method

Water delivery shall be carried out by gravity in using the water head in the storage tank.

(2) Type and Diameter of Pipes

a) Design inside diameter of pipes: Max. static pressure - 3.3 kg/cm^2, Water hammer pressure - 3.3 kg/cm^2 (100% of the max. static pressure)
Consequently, the design inside pressure shall be 6.6 kg/cm^2.

(3) Kind and diameter of Pipes

a) Diameter: When the design discharge is set as 0.146 m^3/min and the diameter D is decided as follows:

$$D = 90\sqrt{Q} = 90\sqrt{0.146} = 34.2 \text{ mm}$$

say 50 mm

b) Kind of pipes

Based on the design inside pressure and diameter, hard PVC pipe shall be utilized considering economy and easiness in handling and construction. Local-made pipes are intended (same quality as JIS K6741 or JIS K6742, 6743).

c) Pipe installation

The pipes shall be buried about 30 cm deep in the ground and about 100 cm at road crossings.

(4) Facilities at Plots

a) The pipes with 25 mm dia. shall be used for irrigation at the upper ends of the plots, while for cleaning the collecting pits at the lower ends of the plots.

b) Flow measuring

A triangle weir and two float type water level gauges shall be placed to practice continuous observation.

c) Stop valve

Water control shall be made by a stop valve with diameter of 25 mm at each end of pipeline.

(5) Hydraulic Design

i) Estimation of Various Head Losses

a) Friction loss (h_f) in using the Hazen-Williams Formula

$$h_{f1} = 10.666C^{-1.85} \cdot D^{-4.87} \cdot Q^{1.85} \cdot L \times 1.05 = 5.107 \text{ m}$$

where: h_{f1} : Friction head loss m
C : Velocity coefficient 140 (PVC pipe)
D : Pipe diameter 50 mm
Q : Design discharge 0.0018 m^3/sec
L : Pipe length 235 m

$$h_{f2} = 10.666C^{-1.85} \cdot D^{-4.87} \cdot Q^{1.85} \cdot L \times 1.05 = 0.528 \text{ m}$$

where: h_{f2} : Friction head loss m
C : Velocity coefficient 140 (PVC pipe)
D : Pipe diameter 37.5 mm
Q : Design discharge 0.00027 m^3/sec
L : Pipe length 200 m

$$h_f = h_{f1} + h_{f2} = 5.107 + 0.528 = 5.635 \text{ m}$$

b) Diversion loss (h_b)

In using diversion pipes with 62.5 mm and 8.0 m length, friction loss per diversion pipe is about 0.08 m (Standard of Upland Irrigation, MAFF, Japan)

c) Hydrant Loss (h_r)

0.225 m by Standard of Upland Irrigation, MAFF, Japan.

ii) Total Head Loss (h_f)

Total Head Loss can be expressed by the following equation:

$$h_f = h_f + h_b + h_r = 5.635+0.08+0.225 = 5.940 \text{ m} \doteq 6.0 \text{ m}$$

iii) Terminal Water Head

1.5 kg/m^2 (15 m in terms of water head)

EL (135 - 110) - 6.0 = 19 m > 15 m O.K.

3-1-6 Utilization of Irrigation Facilities

The irrigation scheme is made as above by providing the pumping facilities for water intake and storage tank for stable water head. And the water conveyance pipes and valves are provided to secure steady discharge to each plot.

3-2 Drainage Scheme

3-2-1 Existing and proposed Drainage Systems

1) Existing Drainage System

The drained water has been eliminated by gravity through road side natural ditches running along the local road leading to Sampaloc in taking the course through the topographically low-lying lands. The existing ditches, although having no clear waterways for free run-down, have no particular problems in their functions

2) Proposed Drainage System

The proposed farming plots are about 800 m^2 and the water to be used for erosion control is not so large in its amount as that for irrigated plots. Consequently, the independent drainage

system is not necessarily required for the said plots. The water drained from the buildings and facilities shall be eliminated via the existing drain ditches.

3-2-2 Unit Drainage Discharge

1) Maximum Rainfall (Table-1)

The maximum rainfall observed by rain gage stations at Antipolo, Rizal for the last ten years is shown as follows:

Item	Period	Rainfall(max)	Date
Daily rainfall	1981 - 1991	342.4 mm	Oct. 18, 1985

No records were available on three (3)- and one (1)-hour rainfalls. Refer to Table-2.

2) Drainage Criteria

The drainage criteria shall define that three (3)-hour rainfall should be eliminated within three (3) hours. According to the data of Sabang Baliwag Bulacan, the basic rainfall is estimated at 96.5 mm/3 hrs.

3) Unit Drainage Discharge

The unit drainage discharge is computed by the Rational Equation.

$$Q = \frac{1}{3.6} \times f \cdot r \cdot A \times \frac{1}{3} = 6.254 \text{ m}^3/\text{sec/km}^2$$

where, Q : $m^3/sec/km^2$
f : Runoff discharge 70%
r : 3-hrs rainfall (mm)
A : Catchment Area (km^2)

$$Qmax = Q \times 1.7 \text{ (Modification Factor)}$$

$$Q = 6.254 \text{ m}^3/\text{sec/km}^2 = 0.062 \text{ m}^3/\text{sec/ha}$$

$$Qmax = 0.062 \text{ m}^3/\text{sec/ha} \times 1.7 = 0.104 \text{ m}^3/\text{sec/ha}$$

4) Triangle Weir

Since each plot is about 100 m^2 in its area, the inflow to the collecting pit is obtained as follows:

$$0.104\ m^3/sec/ha \times 0.01 = 1.04\ \ell/sec/plot \quad \cdots\cdots (1)$$

and assuming the maximum rainfall as 100 mm/10 min. and in case of runoff discharge by 100 percent:

$$100\ m^2 \times 0.10\ m / 600\ sec \doteq 16.7\ \ell/sec \quad \cdots\cdots (2)$$

In comparing the above (1) with (2), the results is (2)>(1).
So, the case (2) shall be studied.

Overflow-Depth	Calculation	90° Weir (ℓ/sec)	60° Weir (ℓ/sec)
20 cm	$Q = 81.2 \times 0.20^{5/2}$ $= 1.452\ m^3/min$ $= 24.2\ \ell/sec$	24.2	$24.2 \times 2/3 = 16.1$
15 cm	$Q = 81.2 \times 0.15^{5/2}$ $= 0.707\ m^3/min$ $= 11.8\ \ell/sec$	11.8	$11.8 \times 2/3 = 7.8$
10 cm	$Q = 81.2 \times 0.10^{5/2}$ $= 0.257\ m^3/min$ $= 4.28\ \ell/sec$	4.28	$4.28 \times 2/3 = 2.85$

As a result of the study, the measurement of the proposed drain ditches shall be 20 cm × 20 cm. And the triangle weirs with 60-degrees will successfully meet the requirements.

5) Water Level Gauges

The water level gauge with dry batteries as power sources and 20 cm dia. standard float shall be installed at collecting pit and outlet ditch.

3-3 Farm Plot Reclamation Scheme

3-3-1 Land Use Pattern of Plots

On the reclaimed farm plots, a variety of tests and experiments will be conducted on the proposed eight plots of the following types.

Plot No. 1 : Plot Demonstrating erosion on present cogon covered soils

Plot No. 2 : Plot Demonstrating erosion on traditional farming

Plot No. 3 : Plot Demonstrating erosion control by improved farming

Plot No. 4 : Plot Demonstrating erosion control by green belts with traditional farming

Plot No. 5 : Plot Demonstrating erosion control by perennial crop cultivation

Plot No. 6 : Plot Demonstrating heavy gully erosion (process and present condition)

Plot No. 7 : Plot Demonstrating erosion control by introducing cover crops contour cultivation

Plot No. 8 : Plot Demonstrating general effects of fully erosion control by latest soil conserving farming method

The aforesaid various types of demonstration plots are utilized to extend the technology obtained by the experiments to the local farmers through the pilot infrastructure consolidation project in assuming the mountain area agriculture.

① Demonstration of the effects of erosion control by execution of improved farming in view of future agro-forestry to be developed in the area.

② Demonstration of frequency erosion occurrence by slopes.

③ Demonstration of ideal treatment method of hiterlands of the plots.

Quality training and education will be able to be given to the local farmers in comparative study of the time-serially arranged data and records of the experiments with the present conditions observed.

3-3-2 Plot Reclamation Method

1) Plots

Each plot shall have short side of 7.0 m and long side of 15.0 m with an approximate ratio of 1:2 for the two sides, and about 100 m^2 in size, downside half of which shall be prepared for demonstrating erosion, while upstream half of which shall be cogon growing land. And such a plot shall be surrounded with concrete wall so as to prevent the plot from rain water erosion.

The collecting pits shall be constructed at the down-end of the sloped plot to collect total of the rain water on the plot and lost soils for measuring.

Excavation for the concrete wall shall be carried out carefully and prudently by manpower, particularly to maintain the natural state of the inside of the plot. Water-stop shall be placed at the concrete joints of the wall so as to prevent outside water from intrusion. The concrete of the wall shall be of reinforced concrete. (For detail refer to Drawing DC -003.)

The side walls of the collecting pit shall be provided in trapezoidal form which can stand against erosion soil pressure to keep stability of the structure.

2) Collecting Pit

The collecting pit is provided so as to collect the total of rain water on the plot and lost soils from the plot for making precise measurement of their volumes. The upper slab of the pit shall be of reinforced concrete and its inside shall be finished with water-proof mortar. A manhole shall be provided with iron-made cover to prevent rain water from intrusion and the said cover

shall weigh around 20 kg for easy manual handling. Inflow to the pit shall be always be measured by 2 water level gauges and the triangle weir. (Refer to Drawing DC -003.)

3-3-3 Present Problems

Lost soils into the pit shall be carried away by manpower to spoil dump site near the plot. The soil volume to be dumped will become considerable in the experiment period of five years.

The Tanay experimental site is big with 32 ha, but it is urgently required to provide spoil dump sites to accommodate the volume.

Access roads to the plots cannot be provided easily due to steep slope of the site (1:2), and each plot shall be provided with its own spoil dump site and keep the natural conditions of the plot as much as possible.

3-3-4 Characteristic Features of Pilot Infrastructure Improvement Works

The proposed Pilot Infrastructure Improvement Works primarily aim to demonstrate and extend a variety of latest technology to the local farmers. As a general rule, when the necessary facilities for demonstration and objects of demonstration have been prepared, the project is considered to be completed. However, since such erosion control technology as cover crops, agro-forestry, minor improvement of local topography, which is to be demonstrated in the Project, fluctuate in their control capacity as time flows, the time serial change of their control functions should be surveyed, analyzed, and evaluated. In this connection, the present Project will not be finished at the completion of the facilities, but it should be the start for demonstration and verification. This is the characteristic feature of the present Project.

Under the conditions, not only the survey and measurement of the lost soils and surface runoff from the plots within the erosion control frames but facilities in and out of the frames for effective demonstration of maintenance, cropping, growth investigation are necessary.

Chapter 4. CONSTRUCTION WORKS AND IMPLEMENTATION PLAN

4-1 Construction Method

The project works are the land consolidation works consisting mainly of earthwork, and a pumping station is planned to be located a little apart from the plots which shall be irrigated with water distributed through pipelines.

The construction works include land consolidation of the 8 plots with concrete walls at four sides and with collecting pits at the downmost end of each plot to continuously measure outflow runoff and lost soils from the plots. All of these facilities are small in their scale.

In view of the work items and scale, contractors can execute the works successfully, and judging from the construction period and the work volume, the machinery for the works will be available with the contractors.

Among various work items, test well drilling shall be carried out beforehand, and water level and yield shall be observed for determining the specifications of the pumping equipment. Such prior procedures are necessary for early procurement, and installation of the pumping equipment within the construction period.

In other respect, the engineers/technicians to be assigned to the Project should have rich experience so as to ensure the quality of the land consolidation works.

4-2 Implementation Plan

4-2-1 Pilot Plot Reclamation

Firstly, the land surrounding the proposed plots shall be so carefully prepared by manpower as not to disturb the inside earth of

the plot frames. Secondly, concrete forms shall be set to place concrete for making plot frames.

Backfill for the inside of the frames shall be carried out with 60 kg compactors for sufficient compaction and the earth returned prudently to the complete original state.

All the side walls and bottom of the collecting pits together with their slabs shall be made with reinforced concrete. And all concrete shall be placed in situ. The inside of the pits shall be finished with water-proof mortar.

4-2-2 Ancillary Buildings

1) Roofing Works

The roofs shall be made in wooden truss structure with plain wooden planks and thatched with corrugated galvanized iron sheets.

2) Main Structure

The foundation works shall be made with continuous footing. Headbeams and lintels shall be in reinforced concrete.

3) Walls

The walls shall be constructed with concrete blocks with mortar finish and paint.

4-2-3 Well Boring

The specifications of the lift pump equipment for the proposed well shall be decided after the design of the well is prepared on the basis of the test well drilling. When the contract on the Project construction works is concluded, the order shall be placed on the well excavation works and equipment procurement.

4-2-4 Water Distribution Pipes

Piping for water distribution shall be made in laying local-made unplasticized PVC pipes in about 30 cm depth from the ground

surface, and the earth cover shall be more than 100 cm at road crossings.

4-2-5 Power Transmission Line

The transmission lines shall be of aerial type and power in 3-phase and 440V shall be transmitted from the power station to pumping station and drying room as well as to repair shop.

4-2-6 Concrete Works

Concrete works shall be made for plot walls, collecting pits, storage tanks, building foundation, housing, etc. and these concrete works shall be carried out using 0.3 m^3 capacity portable mixer.

4-2-7 Stone Works

Wet masonry works shall be applied to all stone works with 20 - 30 cm dia. cobbles.

4-2-8 Block Works

Block works shall be mainly applied to the building walls. The foundation shall be of strip footing in reinforced concrete. The walls shall be finished with mortar (outside) and mortar and paint (inside).

4-2-9 Implementation Plan

The construction period shall be decided depending upon progress of drilling works of the well and delivery of the pumping equipment, which may take about three (3) months, and the implementation plan is shown in Table-5.

Chapter 5. CONSTRUCTION COST ESTIMATE

5-1 Conditions of Construction Cost Estimate

Following conditions were adopted in estimating the construction cost.

5-1-1 Scope of Construction Cost Estimate

The land expropriation cost and the cost for construction supervision are not included in the present estimate.

5-1-2 Unit Costs

All unit costs are inclusive of

- material costs
- labor costs, and
- costs of machinery and equipment.

5-1-3 Scope of Works

a) Preparation Works

- Mobilization and demobilization including cleaning
- Site surveying

b) Pump Facilities

- Well drilling
- Pump installation
- Ancillary works, electric facilities, huts, etc.
- Storage tank and piping works

c) Electric Works

- Generator installation
- Fuel tank installation
- Aerial wiring work
- House building

d) Distribution Pipe Works

All the piping including valves, air vents is to be buried underground at a depth of 30 cm except for at road crossings where the burying depth shall be 100 cm.

e) Plot Construction

- Peripheral wall in reinforced concrete
- Collecting pit in reinforced concrete
- Installation of a triangle weir and two water level gauges

f) Ancillary Works

- Study room, show room, drying room, fertilizer storage, farm equipment warehouse, lavatory, etc. (Foundation and beams in reinforced concrete, walls in concrete blocks, and roofs in wooden truss with corrugated iron sheet)
- Access road in gravel pavement

5-2 Construction Cost

5-2-1 Unit Costs (Table-3)

The unit costs are based on the prices prevailing in August, 1992. Also the unit costs of the Bulacan Project contract was studied as reference. Some unit costs were obtained from actual hearing in the market.

5-2-2 Indirect Expenses

Construction works by a private enterprise is assumed here. The indirect expenses are taken to be 30% of the direct expenses and about 20% of the total construction cost. The indirect expenses shall comprise the following items:

- Temporary works at site
- Temporary buildings
- Material and equipment transport
- Insurance
- Site personnel costs
- Head/branch office costs

- Taxes
- Profit

5-2-3 Contingency

Contingency fee shall account for the extra cost likely to be incurred in consideration of the difference between the estimate based on test boring and the actual costs. The amount of contingency is taken to be 10% of the sum of direct and indirect expenses.

5-2-4 Construction Cost

Summary of Construction Cost

1. Preparation Works	L.S.	823,000	Pesos
2. Erosion Plot	L.S.	1,201,000	〃
3. Buildings	L.S.	3,481,000	〃
4. Deep Well	L.S.	560,000	〃
5. Water Supply Works	L.S.	617,000	〃
6. Generator Works	L.S.	700,000	〃
7. Electrical Works	L.S.	510,000	〃
8. Ancillary Works	L.S.	35,000	〃
Sub Total		7,927,000	〃
9. Indirect Expenditures (30%)		2,378,000	〃
Total		10,305,000	〃
10. Contingency (10% of Total)		1,030,000	〃
Grand Total (Pesos)		11,335,000	〃
Grand Total (Yen at 1 peso = 4.847 Yen)		(¥54,940,000)	

TABLES

Table-1 Exchange Rate per Local Currency Unit

Month	Yen TTS	Trade Days a month	Average Rate
February / 92	3.159957	15	0.2106638
March / 〃	3.534655	18	0.1963697
April / 〃	3.733853	19	0.1965185
May / 〃	3.820422	18	0.2122456
June / 〃	4.288067	20	0.2144033
July / 〃	4.569455	22	0.2077025
Total			1.2379034

1.2379034 ÷ 6 Months = 0.2063172

Rate : 1 Peso = 1 / 0.2063172 = 4.847 yen

Table-2 RAINFALL RECORD (Maximum)

STATION : Antipolo, Rizal

	Daily (24 Hrs.)	
Year	Amount	Date
1981	20.3	July 4
1982	10.1	September 6
1983	6.9	August 14-15
1984	96.5	August 16
1985	342.4	October 18
1986	86.4	August 22
1987	168.1	August 29
1988	266.0	October 24
1989	105.6	September 11
1990	64.2	June 21
1991	120.2	August 17

Table-3

UNIT COST CONSTRUCTION MATERIALS AND EQUIPT. (1ncl. labor cost)

1	Concrete (210kg/cm^2)	cu.m.	3,250.00
2	- do - (160kg/cm^2)	cu.m.	2,900.00
3	Mortar	cu.m.	4,800.00
4	Reinforced Steel Bars 10mm dia.	kg	20.00
5	Reinforced Steel Bars 12mm dia.	kg	20.00
6	Form	sq.m.	350.00
8	Sand	cu.m.	450.00
9	Gravel	cu.m.	780.00
10	Cobble Stone	cu.m.	1,000.00
11	Concrete Block (t=150)	piece	35.00
13	Plywood	sq.m.	240.00
14	Hard Wood	cu.m.	22,000.00
15	G. T. Sheet for Roofing	sq.m.	500.00
18	Wooden Door	piece	4,500.00
20	Steel Window	sq.m.	2,600.00
22	Excavation (manpower)	cu.m.	320.00
24	Embankment (manpower)	cu.m.	320.00
25	Clearing	sq.m.	50.00
27	Backfilling (manpower)	cu.m.	55.00
29	Compaction (manpower)	sq.m.	72.00
30	Tree cutting	sq.m.	200.00
42	UPC Pipe (3" dia.)	m	760.00
43	- do - (1" dia.)	m	260.00
44	UPC elbo/flange/socket (3" dia.)	piece	570.00
45	- do - (1" dia.)	piece	330.00
73	Gasoline	liter	12.65
74	Diesel Oil	liter	8.10
75	Electric rate	kwh	3.60
79	Fiberglass Insulation (t=25)	sq.m.	480.00
80	Pre-painted Color Sheet	sq.m.	940.00
81	RVC tile	sq.m.	700.00

UNIT LABOR WAGES

1	Ordinary Labor	man. day	162.00
2	Skilled Labor	man. day	170.00
3	Driver (truck)	man. day	205.00
4	Construction Machine Operator	man. day	235.00
5	Welder	man. day	210.00
6	Mortar Man	man. day	205.00
7	Foreman	man. day	285.00
8	Surveyor	man. day	210.00
9	Mechanic	man. day	230.00
10	Electrician	man. day	230.00
11	Boring Engineer	man. day	325.00
12	Steelman	man. day	210.00
13	Carpenter	man. day	225.00

UNIT PRICES OF CONSTRUCTION EQUIPMENT

No.	Item	Unit	Price in Pesos
1	Bulldozer (6t)	per day	6,500
2	- do - (9t)	per day	8,250
3	- do - (11t)	per day	10,000
4	Backhoe (0.35 cu.m.)	per day	12,500
5	- do - (0.4 cu.m.)	per day	14,000
6	- do - (0.5 cu.m.)	per day	16,000
7	- do - (0.6 cu.m.)	per day	17,500
11	Dump Truck (4t)	per day	5,560
12	- do - (8t)	per day	9,650
13	Truck (2t)	per day	4,950
14	- do - (4t)	per day	5,340
15	- do - (6t)	per day	5,850
25	Vibrating Plate Compactor (50-60 kg)	per day	750
26	- do - (70-80 kg)	per day	830
27	Concrete Mixer (0.5 cu.m.)	per day	420
28	- do - (0.6 cu.m.)	per day	500
29	Concrete Vibrator (engine)	per day	205
30	- do - (electric)	per day	180

Table-4

WORK SCHEDULE FOR DETAILED DESIGN

ITEM	SEPTEMBER 5	10	15	20	25	30	OCTOBER 5	10
[I]DETAILED DESIGN								
EROSION PLOT								
BUILDING								
GENERATOR/ELECTRICAL WORKS								
DEEP WELL/WATER PIPELINE								
[II]COST ESTIMATE								
CONSTRUCTION COST								
PROJECT COST								
[III]REPORT								
DETAILED DESIGN (JAPANESE)								
〃 〃 (ENGLISH)								
TENDER DRAWING								10/9
CONTRACT TERMINATION								▲

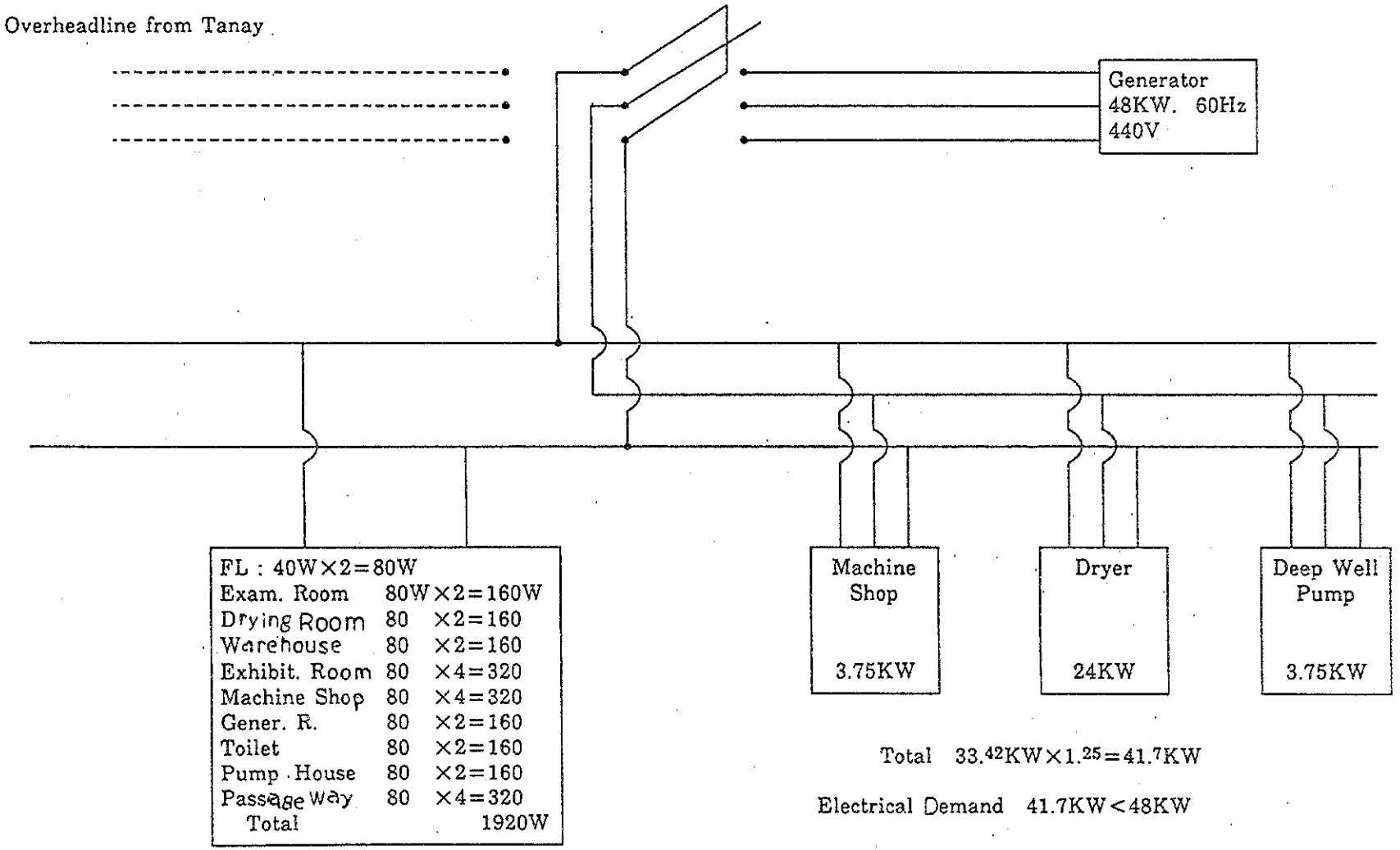
Table-5

IMPLEMENTATION SCHEDULE

Item \ Year / Month	1992			1993				
	10	11	12	1	2	3	4	
1. Test Boring								
Bidding / Contract								
Drilling								
Aquifer Pumping Test								
2. Erosion Plots, & Laboratory Works								
Bidding / Contract								
Preparation Works								
Erosion Plot								
Building Works								
Deep Well Works								
Water Pipeline Works								
Electrical Works								
Running Test								
Inspection								

Table-6

The Diagram for Electrical Demand

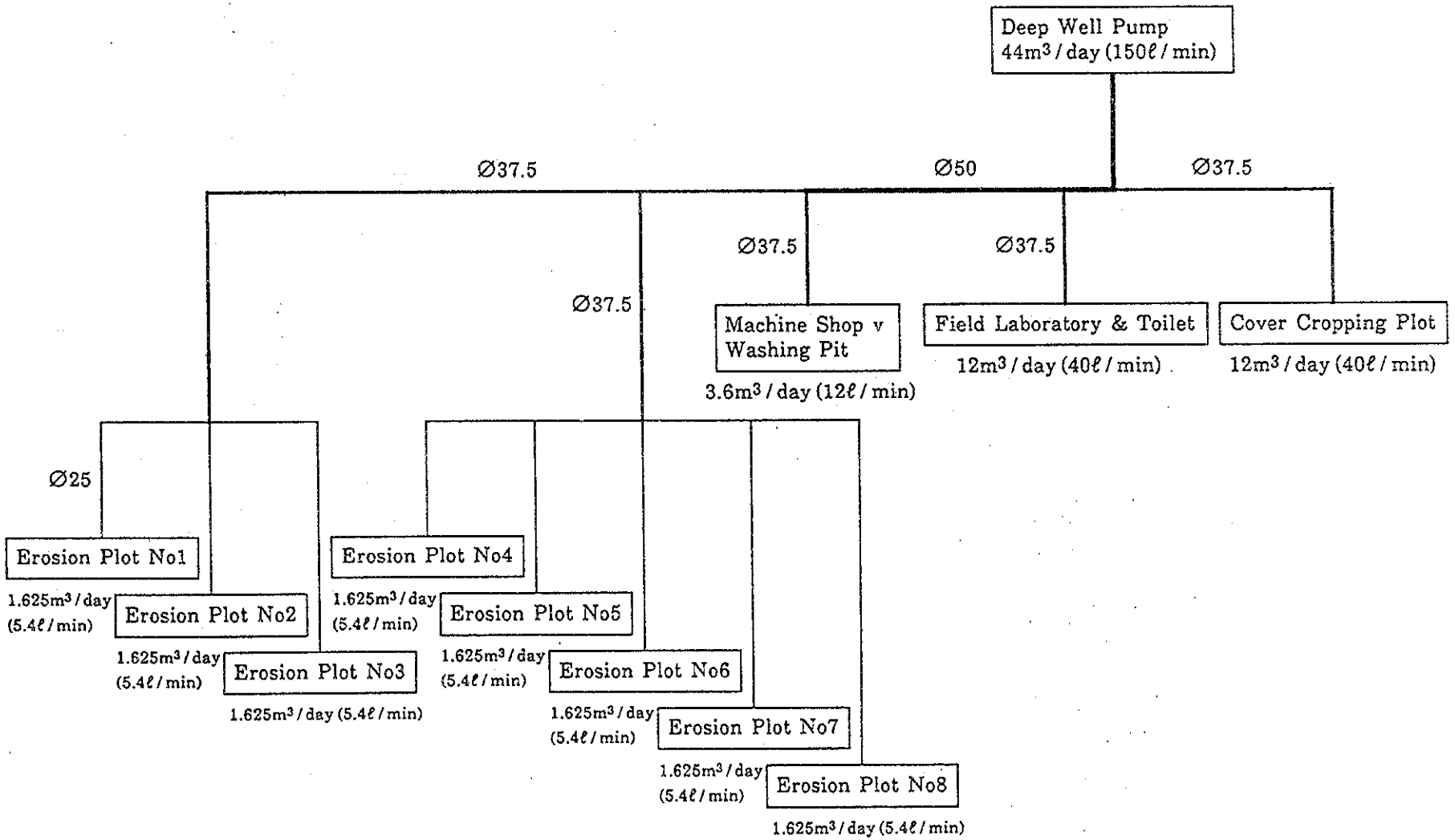


Total $33.42\text{KW} \times 1.25 = 41.7\text{KW}$

Electrical Demand $41.7\text{KW} < 48\text{KW}$

Table-7

The Diagram for Water Demand



ANNEXES

MINUTES OF DISCUSSIONS
ON
THE PILOT INFRASTRUCTURE IMPROVEMENT WORKS
FOR
SOIL RESEARCH AND DEVELOPMENT CENTER PROJECT
IN
THE REPUBLIC OF THE PHILIPPINES

The Detail Design Survey Team (hereinafter referred to as "The Team") has been organized by Japan International Cooperation Agency (hereinafter referred to as "JICA") for the purpose of formulating detailed plan on the Pilot Infrastructure Improvement Works for the Soil Research and Development Center Project (hereinafter referred to as "The Project").

The Team has, so far, made a series of site reconnaissance and discussion with authorities concerned of Filipino as well as Japanese experts in order to determine the location and the scale of the facilities. As the result of the discussions and field survey, both side formulated the Basic Plan as per attached.

The Team will jointly proceed with your staff to conduct further field surveys and investigations at the site and make the detailed design on the basis of results of those surveys. After completion of the detailed design and assessment of its cost estimated by JICA, you will be informed of its result through the JICA Philippines Office.

Manila, August 6, 1992

Mr. Yoshimi Ueno
Leader,
Detailed Design Survey Team,
Japan International Cooperation Agency

Mr. Godofredo N. Alcasid, Jr.
Director,
Bureau of Soils and Water Management,
Department of Agriculture

I . OBJECTIVE

The Team aims at formulating detailed plan on the Pilot Infrastructure Improvement Works of the pilot farm in Tanay experiment station, Rizal, for the Soil Research and Development Center Projcet.

This pilot farm will enable the Project to demonstrate and display the soil management and water conservation techniques to farmers based on the result of the activities conducted in the Project.

In this aspect, the Team conducted surveys and discussions on a framework of the pilot farm.

II . OUTLINE OF THE PILOT FARM

Attached Figure show the outline of the pilot farm.

The detailed design of the pilot farm will be completed by the remaining one member of the Team after consultation with the Philippine side and JICA Technical Cooperation Expert Team.

III . STRUCTURE

1. Pilot Farm

The 8 erosion plots which are about 40m² ~ 260 m² will be constructed to demonstrate and display the field treatment techniques for preventing soil erosion and the data of erosion.

2. Water supply system

Because the existing irrigation system is not sufficient for the pilot farm, the security of water resources and the stability of water supply is necessary.

In the water supply system, the water should be pumped up first to the reservoir from deep well, and then distributed to the pilot farm, the exhibition farm of cover crops and the attendant facilities through pipe line.

And the power source should be a generator.

3. Attendant facilities

The machine shed of the agricultural machinery for field management and the field laboratory is necessary for ①Conducting sample treatment to get demonstrate data, ②Preparation and stock of materials for field management ③Displaying to farmers should be constructed.

IV. TENTATIVE SCHEDULE

The tentative schedule and procedure of the construction works are shown in Table 1.

V. OTHERS

The Government of the Philippines should take full resposibility on the following items on the execution of the Pilot Infrastructure Improvement Works.

1) To resolve any problems which will arise during and after the construction works.
2) To assign counterparts during the construction period.
3) To maintain the pilot farm properly with the advise of JICA Technical Cooperation experts after the completion of the construction.

TABLE 1

OUTLINE OF THE TENTATIVE SCHEDULE ON PILOT INFRASTRUCTURE IMPROVEMENT WORKS OF SOIL RESEARCH AND DEVELOPMENT CENTER PROJECT

Month	Japanese side	Philippine side
1992		
August	-Detail Design Survey (Basic Plan of construction work)	
	-Report of the Survey Team (Outline of construction work)	-Preparation of Form A1 for JICA expert on construction supervision
September	-Detail Designing in Japan	
October	-Submitting Final Report -Consultation with Ministry of Foreign Affairs	-Receiving Final Report -Request of construction work (through JICA Philippines Office)
November	-Exchange of Note Verbal	
December	-Dispatching Expert on construction supervision	
	-Remittance of the budget	
	-Start of construction work	
1993		
March	-Completion of construction work	

August 27, 1992

MR. GODOFREDO N. ALCASID, JR.
Director
Bureau of Soils and Water Management
Department of Agriculture
Elliptical Road, Diliman
Quezon City

Subject: The Pilot Infrastructure Improvement Works for the Soil Research and Development Center Project

Dear Sir:

In line with the Basic Plan for the Pilot Infrastructure Improvement Works for the Soil Research and Development Center Project submitted on August 6, 1992, the Detailed Design Survey Team together with your staff have conducted field survey and the data collection during the period of July 30 to August 27.

In this regard, the Team herewith submit results of the major activities undertaken and some of its findings . These results and findings, however, are presented on a tentative base and will be finalized in home office, after the conduct of further detailed analysis.

The plan will be finalized on the basis of such analysis and the detailed design and cost estimation in accordance with the attached schedule in the Basic Plan.

Lastly, we would like to express our heartfelt appreciation to you and your staff for the kind cooperation extended to the team during our field activities in the Philippines.

Yours sincerely,

JIRO KAWAI
Detailed Design Survey Team
for the Soil Research and
Development Center Project

cc: Project Manager
Agricultural Development Cooperation Department, JICA
Resident Representative of JICA in the Philippines

BUREAU OF SOILS AND WATER MANAGEMENT

THE PILOT INFRASTRUCTURE IMPROVEMENT WORKS FOR THE SOIL RESEARCH AND DEVELOPMENT CENTER PROJECT

PRELIMINARY BASIC PLAN REPORT

AUGUST 1992

1. Major Activities and Findings

(1) Topo-Survey

- 1/2000 scale topo-survey of the Tanay Soil Experimental Station which is 32 ha. in area has been satisfactory completed by the station officers, involving eight (8) erosion plots, deep well pump, water pipeline, generator house, field laboratory and other related facilities.

- Since the control point is identified as C.P. in Figure D-1, it is assumed that C.P. marks is approximately EL100 ± 0.10 but the elevation can be estimated to be about 600 m above mean sea level by means of the topo map (using the 1/5000 published topo map by NAMRIA).

(2) Erosion Plots

As indicated in Figure-1, eight (8) erosion plots have been selected within the area of 10 ha in the project site. The standard typical plot in accordance with the requirements of the Soil Erosion Test Code is about 100 sq.m in area, about 7 m in width and about 14 m in length . Additional details of the catch-pit are given in Figures D-2 and 12.

(3) Deep Well and Pipeline

Based on the groundwater map published by the National Water Resources Council, the project site is considered to be along the ranges of deep well areas (greater than 20 m depth) as shown in Figure D-13.

Two (2) experts with extensive experience in drilling of deep wells carefully examined the surrounding area of the three (3) springs on the steep incline facing East, where three (3) faults (Fault-A, B and C) are located, with a thick-wood as shown in General Plan. In conclusion, the location selected for the deep well shown as No. 18 of the General Plan is located near fault-A, with a distance of less than 50 m. At present, the spring is continuously producing about 5 l/min. of underground water. Consultant proposed the conduct of test boring to JICA Manila office, of No. 18 (EL.133 m) in order to confirm underground water level and quantity.

Alignment of the pipeline is shown in General Plan and D-4 Drawings on the basis of site examination, operation and maintenance. It is designed to use unplasticized polyvinyl/chloride pipe of ø62.5 mm, ø37.5 mm and ø25 mm in size. Total length of the pipeline is about 1,200 m in linear measure. Details of pipeline are shown in the General Plan, D-4 and D-12 drawings. Water distribution system is scheduled to be gravity type.

(4) Filed Laboratory

Filed laboratory itself has four applications - examination room, drying room, warehouse, exhibition room. Total area of the field laboratory is 300 sq.m. with each room having an area of 75 sq.m. Details of the field laboratory is shown in Figure D-1, 5 and 6.

(5) Pump and Generator

Pump shall be specified on the basis of water demand and generator shall be specified on the basis of electrical demand. Both equipment requirements will be finalized in the home office after further detailed analysis. Water storage tank will be made of reinfoced concrete with capacity of about 30 ~ 50 cu.m. depending on water demand and site situation. The location of the tank is shown in No. 17 of the General Plan.

Electric distribution system is proposed to be overhead wire as shown in Figure of the General Plan.

(6) Machine Shop

Details of the machine shop is shown in Figure D-1 and 8 and the area is 150 sq.m. with washing pit.

2. Schedule of the Home Office Work

The team will conduct a more detailed analysis of the collected data and prepare the detailed design and draft report by September 25, 1992. The final report will be submitted to the JICA Head Office, Tokyo by the beginning of October.

3. Request to the Bureau of Soil and Water Management (BSWM)

The following arrangement are requested from BSWM to expedite the immediate implementation of the project:

- For BSWM to submit the application for building permit to the municipality concern as soon as possible.
- To resolve any problems that will arise during and after construction works.
- To assign counterpart personnel during the construction period.
- To maintain the pilot farm properly with the advise of JICA Technical Cooperation experts after the completion of the Construction.

WORK SCHEDULE FOR THE DETAILED DESIGN

DESCRIPTION \ YEAR / MONTH	1992 AUGUST	1992 SEPTEMBER	1992 OCTOBER
I. DETAILED DESIGN			
1-1 DETAILED DESIGN & DRAWINGS		———	
1-2 CONSTRUCTION PLAN		———	
1-3 CONSTRUCTION COST ESTIMATE		———	
1-4 PROJECT COST ESTIMATE		———	
1-5 PREPARATION OF BID DOCUMENT		———	
1-6 DRAWING OF THE DRAFT REPORT		———	
II. REPORT			
2-1 SUBMISSION OF DRAFT REPORT			△
2-2 SU BMISSION OF FINAL REPORT			△