DESIGN REPORT
ON
THE DETAIL DESIGN SURVEY
FOR
THE STRENGTHENING OF ARTIFICIAL INSEMINATION CENTER PROJECT
IN
THE REPUBLIC OF INDONESIA

MARCH 1987

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

The Government of Indonesia has requested to the Government of Japan to provide technical cooperation in artificial insemination for the purpose of strengthening the functions of the Singosari Artificial Insemination Center in East Java and promoting dairy farming in Indonesia. In response to the request, a technical cooperation period of five years has been started since the record of discussions for the project was signed on February 13, 1986 between both the Government of Indonesia and Japan.

The team, headed by Mr. Masanari Muneyoshi, assistant Director, Design Division, Construction Department, Agricultural Structure Improvement Bureau, MAFF was dispatched to Indonesia from December 8, 1986 to January 16, 1987 for the purpose of detail design of model infrastructure improvement works for water supply facilities, livestock facilities, and pasture fields of the Singosari Artificial Insemination Center.

This report represents the results of the field survey and a subsequent study in Japan. We hope that this report will serve as a guideline for the model infrastructure improvement works.

Lastly, we take this opportunity to express our deep gratitude to the Directorate General of Livestock Services,

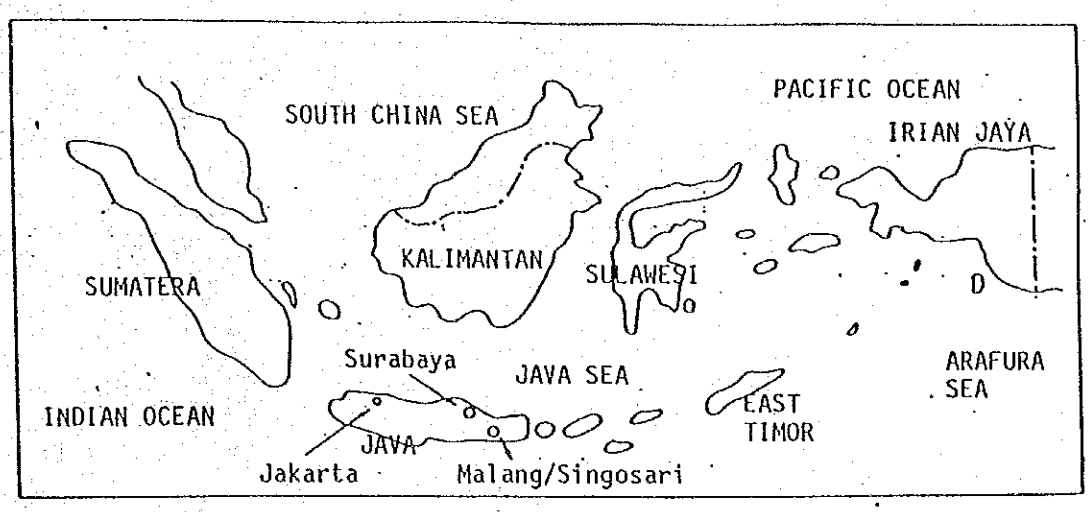
Ministry of Agriculture of Indonesia, the Japanese embassy in Indonesia and all the Japanese experts serving in Indonesia for the close cooperation and assistance they extended to the team throughout the survey period.

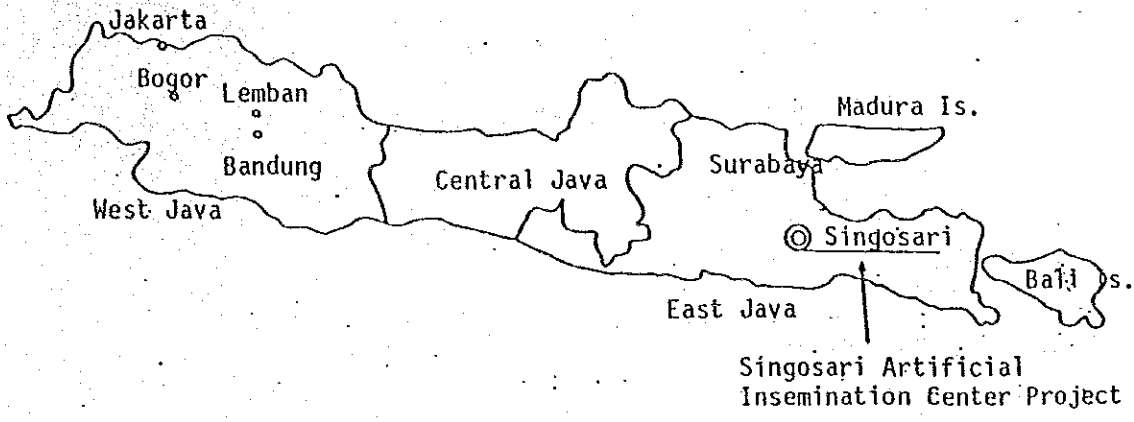
March 1987

Kazumi Miyamoto

Director
Agriculture Development
Cooperation Department,
Japan International Cooperation
Agency

LOCATION MAP OF PROJECT SITE





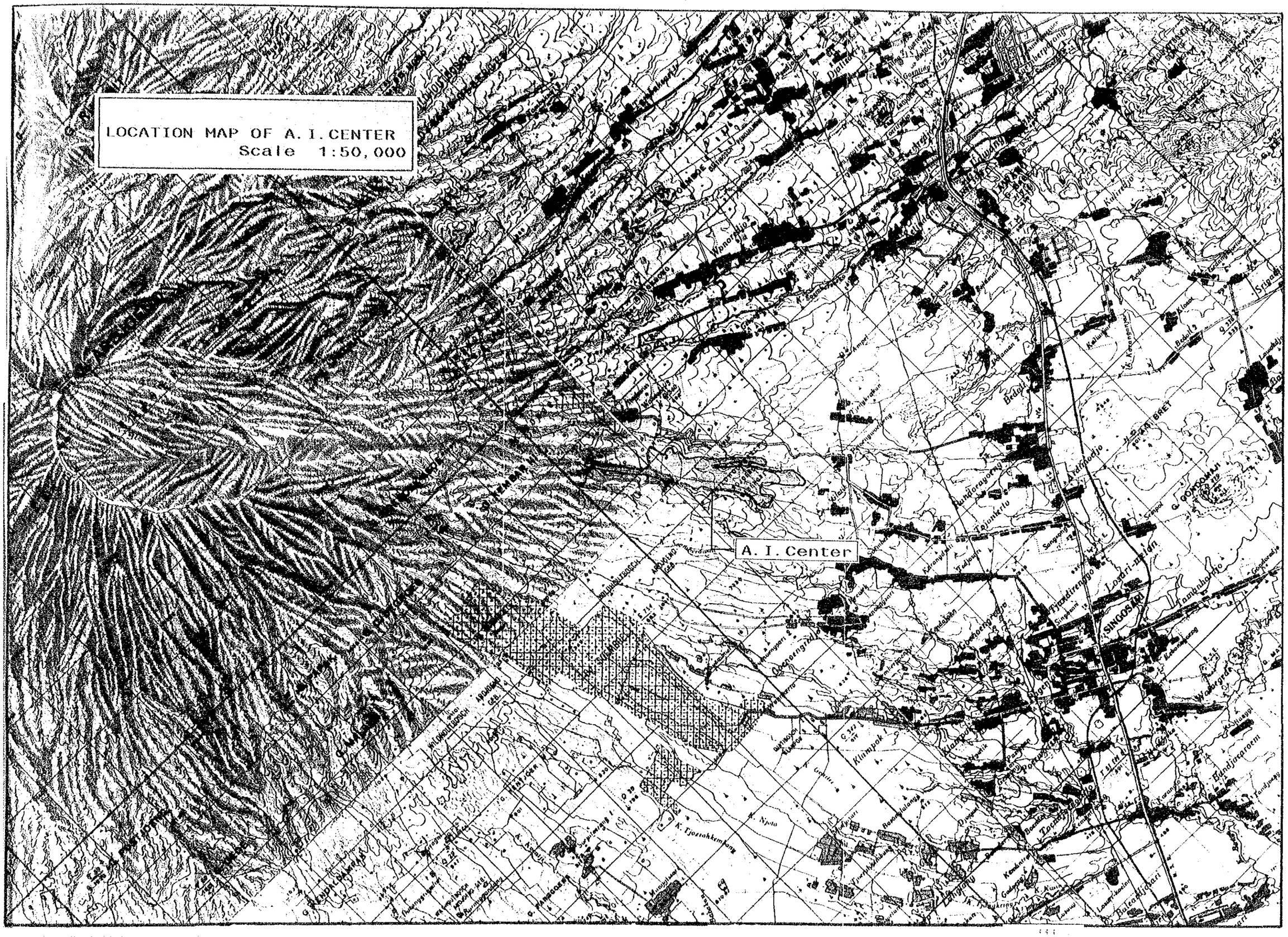
LOCATION MAP
OF
MODEL INFRASTRUCTURE IMPROVEMENT WORKS
ON
STRENGTHENING OF ARTIFICIAL INSEMINATION CENTER PROJECT

SCALE 1: 500,000

0 10 20 30 40 50

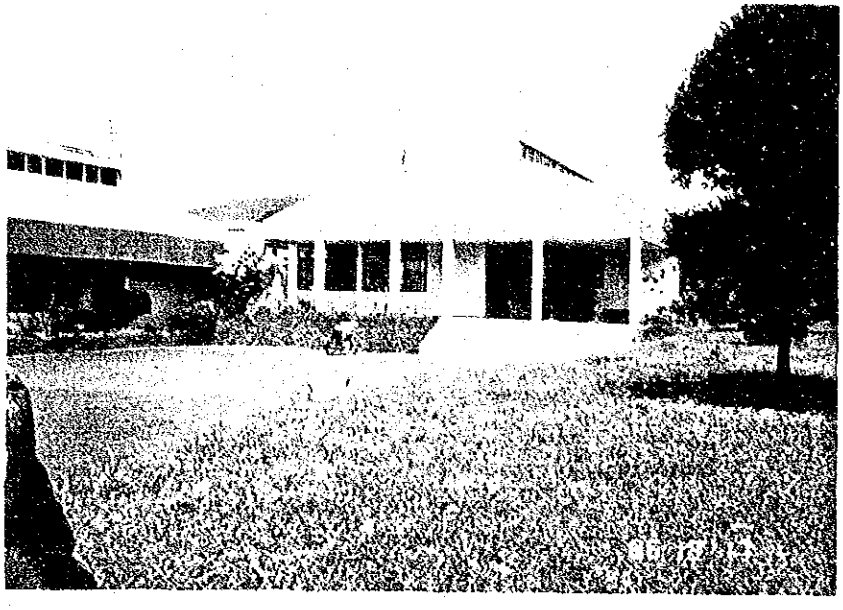
PROJECT SITE (A.I. CENTER)

LOCATION MAP OF A. I. CENTER
Scale 1:50,000

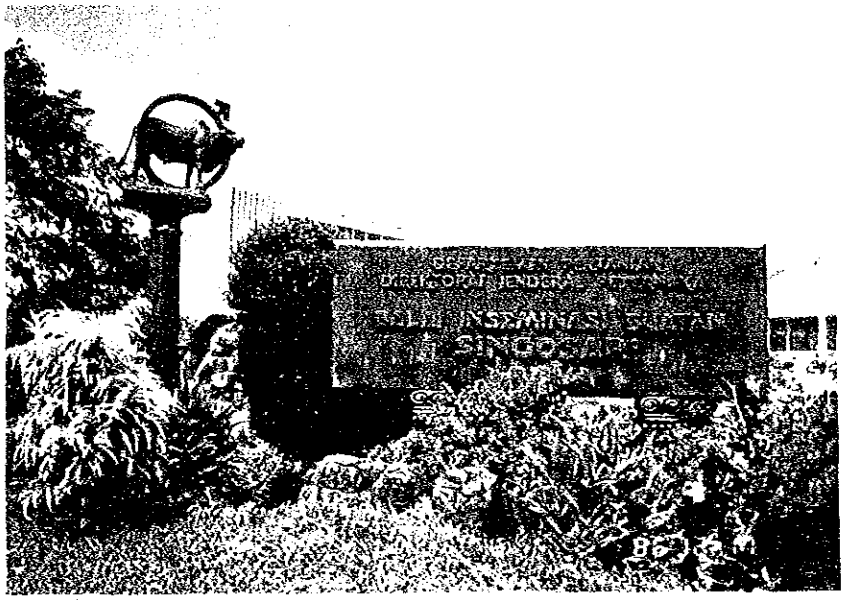


No.1 Courtesy Call to Director General of Livestock Services

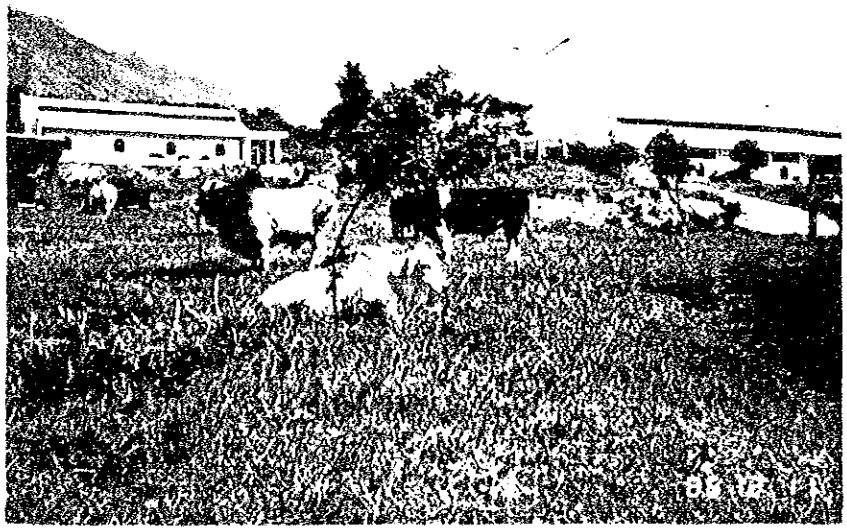
No.2 Submitting of Basic Plan



No.3 Office of Singosari A.I. Center

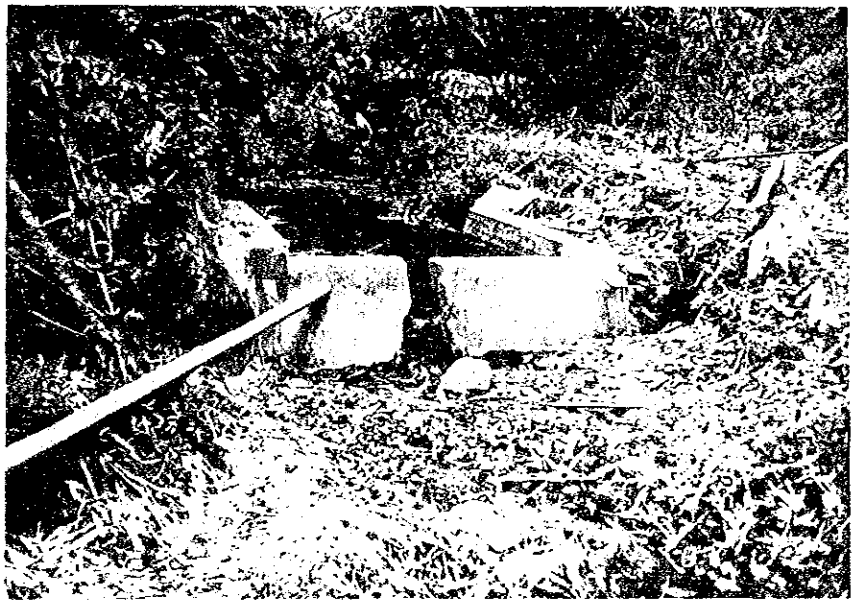


No.4 Name Plate of Singosari A.I. Center



No.5 Bull and Bull Shed

No.6 Damaged Existing Pipe



No.7 New INtake under Construction

No.8 Proposed Site For Installation of Pipeline (Steep Part)

No.9 General View of Foot Path in Tea Plantation

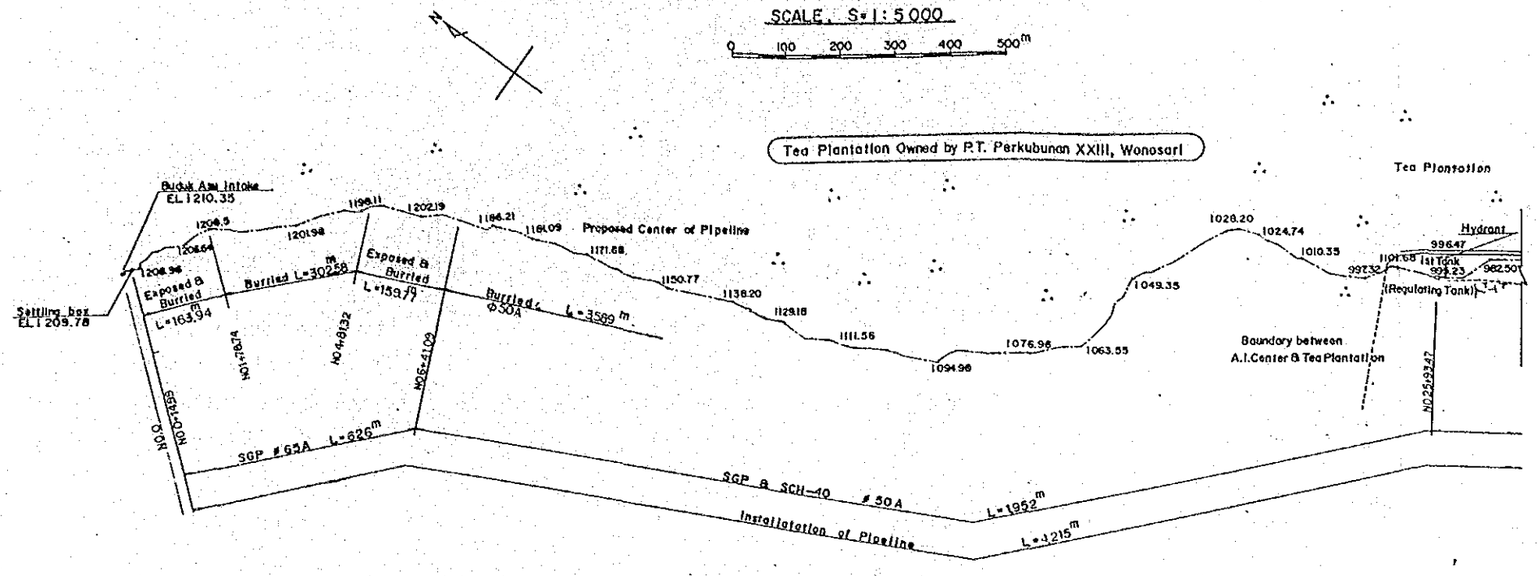
OUTLINE OF MAIN WORK ITEMS

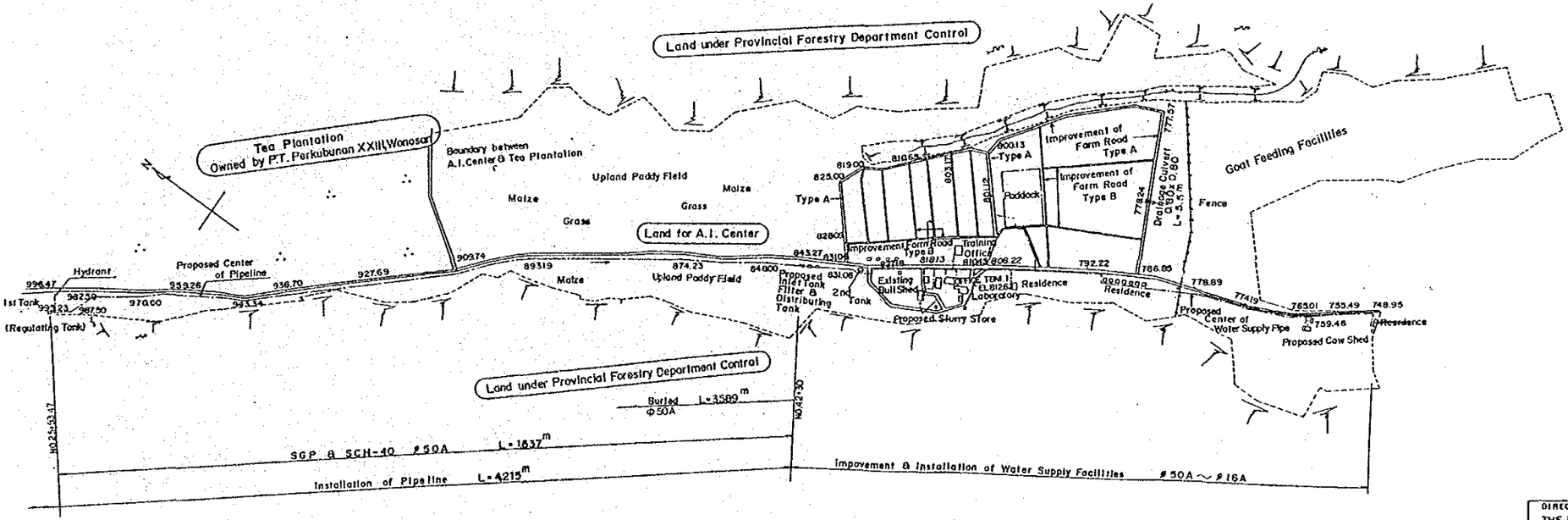
1. IMPROVEMENT OF INTAKE & RELATED STRUCTURES		
1.) Improvement of Intake	1	place
2.) Improvement of Settling Box	1	place
2. IMPROVEMENT OF PIPELINE FACILITIES		
1.) Installation of Pipeline	4.2	Km
2.) Improvement of Related Structures	1	L.S.
3. IMPROVEMENT OF WATER SUPPLY FACILITIES		
1.) Inlet, Filter and Distributing Tanks	3	tanks
2.) Installation of water supply pipes	2.0	Km
3.) Installation of feed pipes	1.0	Km
4.) Improvement of Related Facilities	1	L.S.
4. CONSTRUCTION OF COW SHED FACILITIES		
1.) Cow shed and Training shed	2	houses
2.) Related structures	1	L.S.
5. CONSTRUCTION OF SLURRY STORE		
1.) Slurry Store	3	tanks
2.) Drain Structures	122	m
6. IMPROVEMENT OF FARM ROAD		
1.) Farm road Type A B=3.5 m	1.5	Km
2.) Farm road Type B B=3.0 m	2.3	Km
7. OTHER RELATED FACILITIES		
1.) Drinking Structure at lower place of 1st Tank	1	place
2.) Drinking Structure at Paddock	1	place

GENERAL PLAN
OF
THE STRENGTHENING OF ARTIFICIAL INSEMINATION CENTER PROJECT

SCALE, S=1:5 000

0 100 200 300 400 500m





THE MODEL INFRASTRUCTURE IMPROVEMENT WORKS FOR THE STRENGTHNING OF ARTIFICIAL INSEMINATION CENTER PROJECT

1. IMPROVEMENT OF INTAKE, PIPELINE & RELATED STRUCTURES	
1. Improvement of intake	1 place
3. Improvement of settling box	1 place
2. IMPROVEMENT OF PIPELINE FACILITIES	
1. Installation of pipeline	4.2 km
2. Improvement of related structures	1 L.S.
3. IMPROVEMENT OF WATER SUPPLY FACILITIES	
1. Inlet, filter and distributing tanks	3 tanks
2. Installation of water supply pipes	2.0 km
3. Installation of feed pipes	1.0 km
4. Improvement of related structures	1 L.S.
4. CONSTRUCTION OF COW SHED FACILITIES	
1. Cow shed and Training shed	2 houses
2. Related structures	1 L.S.
5. CONSTRUCTION OF SLURRY STORE	
1. Slurry store	3 tanks
2. Drain structures	122 m
6. IMPROVEMENT OF FARM ROAD	
1. Farm road Type A B=3.5m	1.5 km
2. Farm road Type B B=3.0m	2.3 km
7. OTHER RELATED FACILITIES	
1. Drinking structure at the lower place of 1st regulating tank	1 place
2. Drinking structure at paddock	1 place

DIRECTORATE GENERAL OF LIVESTOCK SERVICES
THE MODEL INFRASTRUCTURE IMPROVEMENT WORKS FOR THE STRENGTHENING OF ARTIFICIAL INSEMINATION CENTER PROJECT

TITLE OF DRAWING

GENERAL PLAN

JAPAN INTERNATIONAL COOPERATION AGENCY TOKYO

DWG. NO 1

CONTENTS

CHAPTER 1 DISPATCHING THE SURVEY TEAM

1-1 Background and Objectives of The Survey

(1) The general tendency toward diversification in food consumption is emphasized in the fourth 5-year development program (REPLITA IV: 1984/85 to 1989/90) of Indonesia. To meet an increase of dairy products consumption, the average yearly rates of increase in livestock production anticipated in this program are 6.1% for meat, 8.8% for egg, and 28.3% for milk. Regarding livestock animals in particular, experiments and researches on artificial insemination and fattening are much needed, and there is a demand for systematic and organizational expansion including the projects designed for diffusion and education purposes.

(2) Indonesia, there are two major artificial insemination centers located in Lembang (aided by New Zealand), West Java, and in Surabaya (aided by Belgium), East Java. Both centers began to produce and distribute frozen semen in 1976. Frozen semens from Lembang are distributed throughout the nation, whereas those from Surabaya had been used in East Java only. The Wonocolo Artificial Insemination Center in Surabaya was in low elevation, which is a bad condition for producing frozen semen, and therefore had been moved to Singosari, Malang Province, since 1979.

In 1982, the movement of its equipment and material was completed, and the production and distribution of frozen semen has been started. At the present time, its frozen semen is widely distributed not only throughout Java Island but also to Sulawesi, Kalimantan, Bali, and Lombok, excluding the West Java. The Lembang Center is well equipped with research appliances, but the equipment of the Singosari Center needs further improvement.

(3) Under these circumstances, the Directorate General of Livestock Services, Ministry of Agriculture, Republic of Indonesia, requested Japan to provide technical cooperation for the Strengthening of Artificial Insemination Center Project at the 8th Annual Consultation on Technical Cooperation and Grant Aid between Japan and Indonesia held in August 1984. The request was focused on intensifying the management of the Singosari Artificial Insemination Center in Malang Province, East Java, in an effort to promote livestock breeding through improvement of techniques involved in artificial insemination.

(4) In order to confirm the details of this request, the Japanese Government sent an agricultural cooperation project contact team to Indonesia for 14 days from October 22, 1984. An agreement was reached on the dispatch of a preliminary survey team at the 9th

Annual Consultation on Technical Cooperation and Grant Aid between Japan and Indonesia held in July 1985. The preliminary survey team conducted a field investigation for 11 days from September 25, 1985, and discussed the fundamental framework of collaboration involved in the request of technical cooperation on a project basis. Also, long-term investigators were sent to Indonesia for 20 days from December 3, 1985, to formulate a cooperation program prior to consultation and investigation being put into practice.

(5) In addition, a practical consultation and investigation mission was dispatched February 6 to 17, 1986, during which period the record of discussion (R/D) was signed on February 13. In this R/D, it was determined that cooperation for the strengthening of Artificial Insemination Center Project in Indoneia should be carried out for five years starting on April 1, 1986. As prescribed in the R/D, three long-term specialists and one short-term specialist are stationed in Indonesia at the present time.

(6) Formulation of activity plans has been in progress to prepare for full-scale execution of the project works. In the Singosari Artificial Insemination Center, various facilities including the water conduct/supply system are deficient, and these are where the Japanese cooperation has been required, leading to the execution

of model infrastructure inprovement works. In order to carry out these improvement works, JICA recently dispatched a detailed design survey team (headed by Masanari Muneyoshi) as part of the strongthening of Artificial Insemination Center Project in Indonesia. Further, the additional record of discussion on the execution of model infrastructure improvement works were officially signed on December 22, 1986, during the survey period.

(7) The objective of dispatching this survey team is to perform a detailed design for improving the facilities of Singosari A.I. Center where is the base of cooperative activities, in order to facilitate the the progress of Japan-Indonesia technical cooperation.

1-2 List of Survey Team Member

Name	Assignment	Dispatched Period	Position
MUNEYOSHI Masanari	Team Leader	Dec. 8,1986∿ Dec.23,1986	Assistant Director, Design Div., Construction Dept., Agricultural Structure Improvement Bureau, MAFF
AOKI Masaaki	Coordination	Dec. 8,1986∿ Dec.23,1986	Staff, Livestock Development Div., Agricultural Development Cooperation Dept., JICA
ISEKI Yoshitami	Water Facility & Field Design	Dec. 8,1986∿ Jan.16,1987	Chief of Overseas Technical Administration Div., Japan Irrigation & Reclamation Consultants Co., Ltd.
ISIDA Tadayoshi	Livestock Facilities Design	Dec. 8,1986∿ Jan.16,1987	Engineer, Overseas Technical Administration Div., Japan Irrigation & Reclamation Consultants Co., Ltd.

The Japanese planning and consultation team for the Project consisting of four (4) members (headed by Mr. Yudo Uematsu), was dispatched from Dec. 8, to 18, 1986, during the survey.

1-3 Progress and Schedule of the Study

(1) The study was conducted in two different stages, that is, establishment of a basic plan and detailed design survey. Based on the results of investigation performed by the survey team regarding the facilities of the Singosari Artificial Insemination Center, the basic plan was made in the form of a report on actual conditions and circumstances through discussion among Singosari Center personnel, JICA experts and survey-team. Regarding this basic plan an agreement was reached with the Directorate General of Livestock Services in Jakarka. At the same time, additional descriptions were given to R/D concerning the improvement works for A.I. Center facilities. In accordance with the basic plan, a detailed survey was started thereafter, and a topographical survey, field investigation, data collection, and preliminary design were carried out at the A.I. Center in collaboration with relevant authorities and JICA experts.

The results of this detailed study were compiled into a field report, based on a discussion with the government agencies concerned. The results of a field survey were put on file through home work in Japan for detailed design, leading to the compilation of this report.

(2) Schedule of the Field Investigation

Dec. 8 1986 - The survey team (Mr. M. Muneyosi team leader and three members) arrived at Jakarta with the Planning and Consultation Team for the Project.

Dec. 9 - Courtesy call on JICA office and Courtesy call on Directorate General of Livestock Services, Ministry of Agriculture (DGLS)

- After explanation on the Plan of Operation at the meeting with authorities concerned of Directorate of Livestock Production, the team moved to Surabaya.

Dec.10 - Courtesy call on Consul General of Japan and Courtesy call on the Vice-Governor of East Java, with Head of Livestock Services of the Province of East Java, and after that the team moved to Singosari A.I. Center.

- Team meeting.

Dec.11 - Joint meeting among the JICA experts, the Japanese Consultation Team and the Detailed Design Survey Team.

- Reconnaissance survey on the facilities of the A.I. center and dairy farmers at kp. Watugude.

Dec.12 - Discussion on detailed plan of operation (contents of the survey works and investigation, and

counterparts, etc.) with personnel concerned of the center.

- Reconnaissance survey on the existing intake
- Measuring of water discharge at the intake and the 2nd water tank
- After that, the field investigation, field work and data collection at the site were carried out by three members.

Dec.13
- Joint meeting with the JICA experts, the Consultation Team and the Detailed Design Survey Team.
- Field survey on the center's facilities and pasture field.

Dec.14
- Levelling survey from the intake of the water to 1st water tank.
- Survey on the existing surfaced pipe
- Separated from the planning and consultation team, the planning and consultation team left for Jakarta.

Dec.15
- Measuring of discharge at No.1 and No.2 water tank,
- Levelling from 1st water tank to office,
- Sampling of forage.

Dec.16
- Team internal meeting on a basic plan for detailed design,
- Data arrangement

Dec.17 - Survey on the springs around A.I. center including Wonosari National Tea Plantation XXIII.

Dec.18 - A Report making about the Basic Plan,
- Reconnaissance survey of the Karangkates Multipurpose project and Sengguruh dam.

Dec.19 - A Report making,
- The team moved to Surabaya.

Dec.20 - The team moved to Jakarta,
- Discussion on the report on basic plan at the Directorate of Livestock Services Jakarta,
- Ammendment of the Report.

Dec.21 - Data arrangement

Dec.22 - Meeting for explanation on the Report for Basic Plan and submitted it.
- Signature of a Supplementary Note in the R/D on the technical cooperation for the strengthening of Artificial Insemination Center Project in the Republic of Indonesia.
- Report of Japanese Embassy and JICA office
- Two members of the team, the team leader and coodinator left for Tokyo.
- After that,the field investigation, field work and data collection at the site were continued by two members.

Dec.23 - Two members of the team moved to Malang

Dec.24 - Field survey, topographic survey, data collection and preliminary design.

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Jan. 4 1987 - - ditto -

Jan. 5 - Meeting with the Director of Livestock Production, at Singosari A.I. center

Jan. 6 - One member of the team visited a Pipe maker CV. SPINDO in Surabaya, IBRD water supply project office and Laboratory of Surabaya Water Supply Services.

- Request water quality test for drinking water
- The above member returned to Malang.

Jan. 7 - Continuing the field survey, topographic survey, data collection and preliminary design.

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Jan.11 - ditto -

Jan.12 - Topographic Survey

- Making of Field Report

Jan.13 - Topographic Survey

- Two members of the team moved to Jakarta

Jan.14 - Field report was explained at the Directorate of Livestock Production and submitted

Jan.15 - Reported to Japanese Embassy and JICA Office.

Jan.16 - Two members of the detailed design survey team left for Japan.

1 - 4 List of Personnel Concernned

Directorate General of Livestock services

Drh.Daman Danuwidjaja	Director General of Livestock Services Ministry of Aguiculture
Drh.Soemarmo Poespodihardjo	Director of Livestock Production
Ir.Erwin Soetirto	Director of Livestock Programming
Drh.Soekobagyo	Head of Special Coordinating Team for the Development Assisted Livestock Projects
Drh.Masduki Partadiredja	Director of Animal Health
Drh.R.D.Mangunson	Deputy Director of Livestock Programming for Foreign Aid and Technical Cooperation
Drh.Erik Nursahramdam	Staff of Directorate of Livestock Programming
Drh.Waidi B	- ditto -
Drh.Nur	Staff of Directorate of Livestock Production
Mrs.Made Nuraini	- ditto -
Drh.Sridadi	- ditto -

East Jave Province

Drh.Soeparmanto	Vice Governor of East Jawa Province
Drh.A.Silitonga	Head of Livestock Services of East Jawa Province

Singosari A.I.Center

Drh.Djaman Nedah	Superintendant of Singosari A.I center
Drh.Rohmat Siddiq	Deputy Superintendant of Sirgosari A.I center
Drh.Herliantien	Chief of Production & Distribution
Drh.Amirinsyah	Chief of progeny testing

Mr.Soerapati	Staff of cattle breeding
Mr.Edi Purwanto	Staff of Administration
Mr.Haryadi	- ditto -

Brantas River Basin Development Executive Office

Ir.Roedjito DM	General Manager of BRANTAS River Basin Development Executive office
Ir.Rusfandi Usman	Manager for Planning
Ir.Made Suartha	Assistant for Survey & Investigation
Ir.Kusmarini	Assistant for Monitoring
Ir.Kusmartini	Assistant for Construction

Agraria Office in Prefecture of Malang

Drs.Iman Mukani	Chief of Agraria office in Prefecture of Malang
Drs.Syadjidil	Staff of Agraia office
Mr.Andik Suparmin	- ditto -

D.P.U Cipta Karya in Malang

Mr.Sukadi B.A.E	Staff of D.P.U Cipta Karya in Malang
Mr.Esnyono	Staff of D.P.U. Irigasi in Malang
Drs.Ec Siswoto	- ditto -

East Java IBRD Water Supply Project, D.P.U

Mr.Widianto Adiputra	Project Director of East Java IBRD Water Supply Project,D.P.U

P.T. Tea Plantation XXIII, Wonosari

Mr.R.Suryadi	Director of P.T.Tea Plantation XXIII, Wonosari
Mr.Soetrisno Socherm	Chief of employee

Makers etc.

Mr. S. Yamaguchi	Technical Director P.T.Steel Pipe Industry of Indonesia Surabaya (SPINDO)
Ir. Djoko S.Widodo	Manager of P.T.Krakatau Steel, Jakarta
Ir. Djoko S.Widodo	Manager of P.T.Bakrie & Brothers, Jakarta
Mr. H. Hutabarat	Staff of P.T.Rakintam, Jakarta
Mr. Kai	

Embassy of Japan

Mr. Shoji Suzuki	First Secretary
Mr. Tetsujiro Yokozeki	Consul General of Japan
Mr. Kuriya	Vice Consul of Japan

JICA Jakarta Office

Mr. Hideo Endo	Resident Representative
Mr. Mikihiro Sato	Deputy Resident Representative
Mr. Hiroyo Sasaki	Assistant Resident Representative

Japanese Expert of Singosari A.I. Center

Mr. Hideo Funatsu	Team Leader
Mr. Kazuaki Koike	Expert
Mr. Hiroshi Saito	Expert/Coordinator
Mr. Tamotsu Sakurai	Expert

Livestock Medical Supplies Inspection Program

Mr. Muneo Ogata	Chief Advisor
Mr. Kazuo Sudou	Coordinator

Directorate General of Water Resources Development
Ministry of Public Works

Mr. Katsuhiko Kimura	Colombo Plan Expert Team Leader Directorate of Planning & Programming
Mr. Yoshimi Dokyu	Colombo Plan Expert, Senior Expert Directorate of Irrigation I

CHAPTER 2 PRESENT CONDITION AND BASIC PLAN

2-1 Present Condition of Singosari A.I. Center

(1) In 1974, the Government of Indonesia began to construct an artificial insemination center in Lembang, West Java, under the cooperation in equipment, material, and technonlogy provided by the New Zealand Government. In 1976, the production and distribution of frozen semen started. Then, by means of the equipment and material aided by the Belgian Government, the Wonocolo Artificial Insemination Center was built in the suburbs of Surabaya City, East Java, which is the major livestock industry promotion area together with West Java. In 1978/79, the Wonocolo Center began to produce and distribute frozen semen.

However, some difficulties were found in the land of Wonocolo, where the site is too small and the weather in so hot as causing bulls to lose their sexual desire, a condition not favorable to artificial insemination facilities. Then, the Indonesian Government decided to build a new center in Singosari, about 80 km south of Surabaya. All functions that had been performed in Wonocolo were moved to Singosari, where full-scale operation began in 1984-85. The Indonesian Government looks forward to the operational expansion of the Singosari Center, which is aiming to

produce 245,000 and 555,000 doses of semen a year for dairy cattle and beef cattle respectively under the fourth 5-year development program.

The Singosari Artificial Insemination Center, which is the object of this detailed design, is located in Toyo-marto Village, Singosari County, Malang Province, East Java, where latitude 7° 50' S meets longitude 112° 39" E. The Center is built on the gentle mid-slope of Mt. Arjuno, whose summit is 3.339 m in elevation. The topography of the land around here extends long and narrow from southeast to northwest, and the topographical inclination is about 1/12. The office and laboratory buildings are located in the central lot of the site, whose ground is 813 m in elevation.

The Singosari Center has a site of about 95 ha, of which approximately 30 ha is used for raising goats and 65 ha remains to be used. At the present time, an area of about 20 ha is being cultivated as a forage field, and the rest is used for growing corn, dry rice, and wild grass.

(2) The construction of this center is based on the master plan prepared in 1978/79 by the Animal Husbandry Faculty of Gajah Mada University in Yogyakarta. The major developments of construction are as follows.

1978-79: Prepared Master Plan.

1979-80: Acquired land, prepared detailed design and constructed staff residence and external structures.

1980-81: Installed boundary post, consucted topographical survey, Improved access road, constructed intake facility and water supply facilities and prepared forage field.

1981-82: Office/laboratory buildings, bull shed, and staff domitory and installed feedwater pipe.

1982-83: Built training house and staff domitory and installed feed-water pipe.

1983-84: Constructed bull shed and medical office and paved road with asphalt.

1984-85: Constructed concentrated fodder storehouse, water tank, and paddock.

1986-87: Moved and reconstructed intake facilities.

(3) A general view of the Singosari Artificial Insemination Center is given below.

Name of Center: Balai Inseminasi Buatan Singosari (BIB Singosari)

Administrative District :
Kampung ; Wonomuryo
Desa ; Toyomarto
Kecamatan ; Singosari
Kabupaten ; Malang
Propinsi ; Jawa Timur

Address	:	Tromol Pos No.8, Singosari, Malang, Jawa Timur
Access	:	About 6 Km length using asphalt road from the entrance of Desa Ardimulyo from the National road between Surabaya and Malang.
Purpose of the Center	:	Production and delivery of semen, and the research
Operational Agency	:	Directorate General of Livestock Services, Ministry of Agriculture
Toporaphy	:	Lying halfway up the Arjuno mountain, Gentle slope land spreading to south-east
Elevation	:	700 - 1,000 m (Main office; EL 815 m, Intake site of drinking water ; EL 1,210 m)
Climate	:	Mean yearly temparature ; 22.7°C Max. Temparature ; 32.0°C Min. Temperature ; 15.0°C Mean yearly rainfall ; 2529 mm Mean monthly rainfall ; 211 mm Humidity ; 80-90 % Wind direction ; South (Note: Data from Wonosari Tea Plantation)
Geology and Soil	;	Negogene Tertiary formation with many volcanic members, volcanic rock.
	;	Latosol and regosol, loam including many gravel, Top soil 20-25 cm, B-horizon 65-70cm (Note: Data from survey results and Agraria office)
Vegitation	;	Forage, maize, native grass

(4) The present framework of the Singosari Artificial Insemination Center is shown below.

1) Facilities

Land for A.I. Center (including goat feeding land of 30 ha):			95 ha
Used land for A.I. Center :			65 ha
Planted pasture :	A.	Napier grass	4.92 ha
	B.	Guinea grass	2.78 ha
	C.	Star grass	7.20 ha
	D.	Brachiaria Decumbens grass	1.80 ha
	E.	Kaliandra	3.60 ha
		Total	20.30 ha

Buildings :	Main office	250 m^2
	Laboratory (including laboratory for frozen semen)	400 m^2
	Clinic	70 m^2
	Bull shed (2 houses)	370 m^2
	Concentrated fodder store ware house	50 m^2
	Warehouse	20 m^2
	Garage & generator house	120 m^2
	Training office	278 m^2
	House for staff, Type B (1 house)	120 m^2
	House for staff Type C (4 houses)	280 m^2
	House for staff Type D (8 houses)	400 m^2
	House for staff Type E (1 house)	90 m^2

Water resourses facilities	:	Intake at mountain river	1 place
		Rain water tank	1 place
Water supply facilities	:	Pipeline (ø100∿ø80 mm)	2.6 km
		Pipeline (ø50∿ø32 mm)	1.8 km
		First tank (4 x 2 x 2 m)	1 place
		Second tank (10 x 10 m)	1 place
		Underground water tank for rain water	1 place

2) Staff members of the Singosari A.I. Center

Under control of the Directorate General of Livestock Services, Ministry of Agriculture (Jakarta), the Singosari Artificial Insemination Center is operated by the following staff members and experts.

1.	Technical staff	40 persons
2.	Adminstrative staff	11 persons
3.	Japanese expert	4 persons (including short term expert of 1 person)
	Total	55 persons

3) Number of bulls feeded (capacity of bull shed is 40 heads)

Name	Breed	No. of heads	Producted place
Milking cow	Holstein	3	Netherland
Beef cattle	Brahman	9	Australia
"	Bali	7	Bali island

Name	Breed	No. of heads	Producted place.
Beef cattle	Santa G.	1	Australia
Draft cattle	Ongol	12	Java island
"	Madura	1	Madura island
Total		33 heads	

Remark: The producted places are referred to "Contact Survey on Agricultural Cooperation" published by JICA, Jan. 1985.

Fig. 2 - 1 Location of A.I. Center

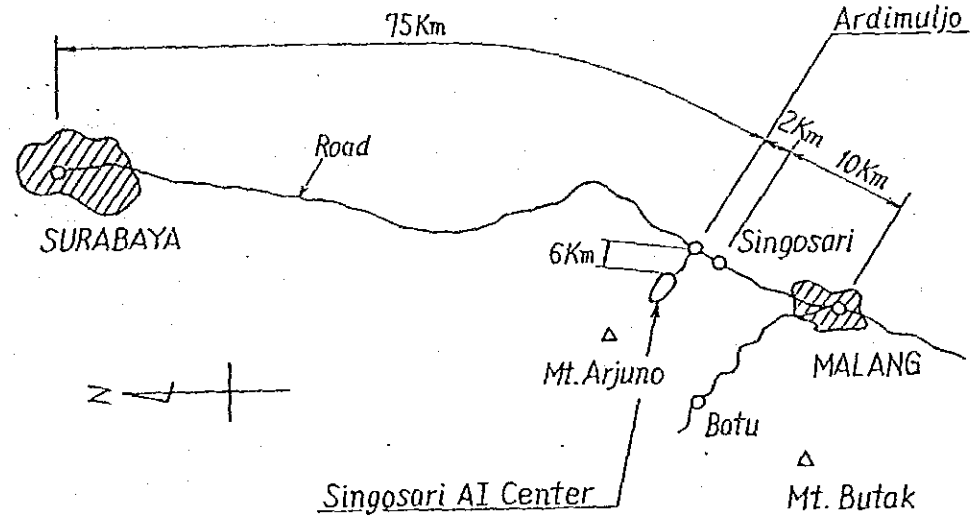
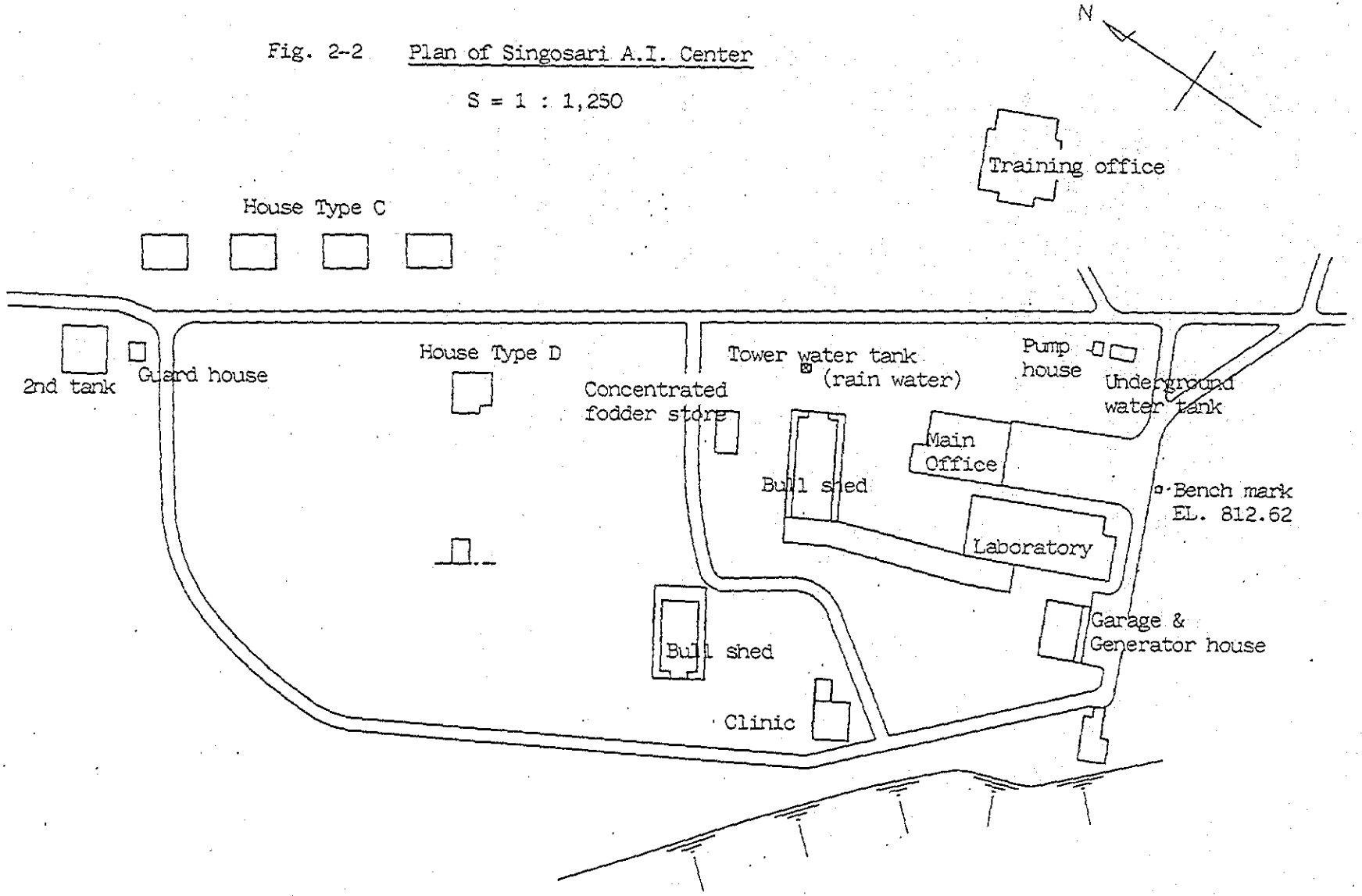


Fig. 2-2 Plan of Singosari A.I. Center

S = 1 : 1,250



2-2 Water Resources

2-2-1 Present Condition

At present, the source of water supply for the Singosari A.I. Center is the surface stream in the valley at the point about 4.4 km northwest of the center. This point of the intake, called Buduk Asu Intake, is located at the foot of Mt. Buduk Asu (EL 1,405 m) on the breast of Mt. Arjuno. Judging from the catchment area (2.6 km^2), the runoff rate of water is low and a sizable volume of rainfall is supposed to permeate under the ground. In the county of Singosari according to information from the Directorate of Irrigation at Malang Province, more water springs are found in the district near Brantas River than in the vicinity of the A.I. Center (the former is on a level lower than the latter). These springs are utilized as the drinking water in this region. However, most of the springs in the district reportedly permeate again into the ground before their stream reaches a distance of 200 m. Therefore, the water intake is established at the point of individual springs in most cases.

The same condition applies to water resources for the A.I. Center. Around here, the surface water overflowing the weir infiltrate into the ground halfway through formation of its stream. At the time when the survey was conducted, a stream on the south of the A.I. Center had run completely dry. The reconnaissance survey on the

Table 2 - 1 RIVER DISCHARGE AND DAILY RAINFALL AT INTAKE

Year : 1986-'87

Date	R	Q	Date	R	Q	Date	R	Q	Date	R	Q
	mm/day	ℓ/s		mm/day	ℓ/s		mm/day	ℓ/s		mm/day	ℓ/s
Dec 1	—		Dec 11	—		Dec 21	2		Jan 1	17	
2	—		12	5	2.0	22	18		2	5	3.8
3	14		13	4		23	11		3	—	
4	—		14	31	※	24	—		4	—	
5	23		15	6	2.6	25	—		5	30	
6	—		16	14	※	26	8	※	6	30	
7	—		17	—	2.1	27	—	1.9			
8	—		18	—		28	7				
9	—		19	—		29	47				
10	—		20	—		30	3				
						31	32				
Total	37			60			188	Monthly (225mm)			

Note : Average monthly rainfall in December is 311 mm
Data source of daily rainfall is P.T. Tea Plantation Wonosari
Discharge with * were measured at water tank

Table 2-2

RECORD OF MONTHLY RAINFALL

EL: 950m STATION: Wonosari Tea Plantation

Unit mm

Month \ Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986				Mean
Jan	389	331	479	234	442	365	298	323	596	393	393	460	638	404	394	497				415
Feb	397	110	445	397	410	463	361	351	357	182	263	298	295	522	202	212				329
Mar	394	416	363	253	519	308	399	348	303	283	186	384	391	450	302	509				363
Apr	130	81	294	299	640	272	74	149	251	165	162	215	482	333	128	256				246
May	363	220	593	104	274	10	147	426	374	41	170	18	325	103	22	25				201
June	132	34	76	34	—	11	182	203	242	3	113	—	19	23	139	240				91
July	17	—	50	88	13	—	1	146	11	79	176	—	6	50	114	111				54
Aug	15	1	113	224	118	52	—	64	15	2	13	—	—	4	32	22				42
Sept	5	18	204	141	152	2	23	95	99	38	198	—	24	309	42	39				87
Oct	780	5	106	250	366	191	40	100	65	65	24	—	118	339	81	68				162
Nov	410	101	459	225	534	362	145	160	23	129	347	10	186	279	246	304				245
Dec	540	202	385	440	384	119	262	552	244	328	367	366	244	268	278	225				311
Total	3172	1519	3567	2689	3755	2155	1932	2917	2580	1708	2412	1751	2729	3084	1980	2508				2529

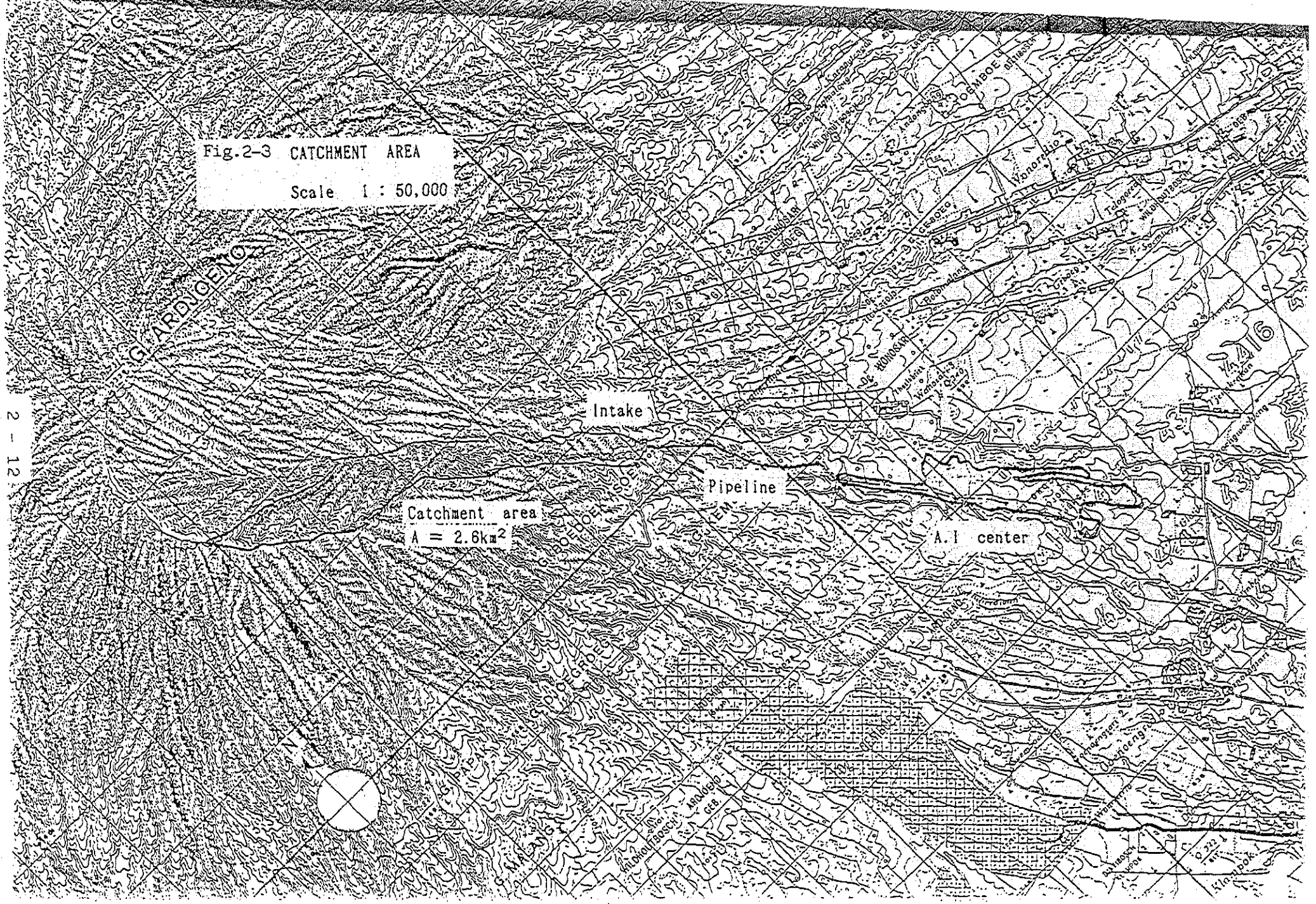


Fig.2-3 CATCHMENT AREA

Scale 1 : 50,000

ground surface water and subsurface water near the mountain river was carried out for the water utilization. But the possibility of those water resources is estimated to be considerably low. Considering the long and narrow form of topography and the conditions of land use, it was determined that the present weir site is suitable as a site of water intake.

2-2-2 Measured Discharge and Rainfall

The Table 2-1 shows the river discharge measured at the intake as compared with the rainfall in the catchment area observed during the survey period.

2-2-3 Water Quality

The water quality test for its resources has already been made by the Water Supply Services in Surabaya at the request of the Singosari Artificial Insemination Center. Test samples were collected at two different points (intake and laboratory) in October 1986. As evident from the test results, all samples collected from the intake were below the allowable level as the drinking water, but those collected from the laboratory contained not only coliform group but also ammonia and phenol exceeding the standard level.

Ammonia is discharged mainly in the form of human and

Table 2-3

RESULTS OF WATER ANALYSIS

(By water supply services in Surabaya)

(1/2)

Item	Unit	Permissible Value	Sesult of analysis		
Collected Date Place			Oct.2,'86 Laboratory	Oct.2,'86 Intake	Jan.5,'87 Intake
(Phisical Examination)					
1. Colour	Unit	50	5	5	
2. Taste			Normal	Normal	
3. Odour			Normal	Normal	
4. Turbidity	mg/lt	25	-	-	
(Chemical Examination)					
1. Hydrogen ion density	(PH)	6.5-9.2	7.09	7.22	6.84
2. Total solid	mg/lt	1,500	81	104	
3. Potassium Permanganate $KMnO_4$	"	10	3.11	2.39	
4. Carbon dioxide CO_2	"	0	-	-	
5. Calcium Carbonat $CaCO_3$	"	187.5	26.05	28.06	
6. Calcium Ca		200	6.36	5.12	
7. Magnesium Mg	"	150	2.47	3.70	
8. Iron Fe	"	1	0.03	None	
9. Manganese Mn	"	0.5	None	None	
10. Copper Cu	"	1.5	None	None	
11. Zinc Zn	"	15	None	None	
12. Chloride Cl	"	600	3.91	5.86	
13. Sulfuric SO_4	"	400	2.0	1.50	
14. Hydrogen sulfide H_2S	"	0	None	None	
15 Fluorine F	"	1.0-2.0	-	-	
16. Ammonia NH_4	"	0	0.12	0.0	0.13

Item		Unit	Permissible Value	Result of analysis		
Collected Date Place				Oct.2,'86 Laboratory	Oct.2,'86 Intake	Jan.5,'87 Intake
17. Nitric Acid	NO_3	mg/lt	20	0.02	0.02	0.06
18. Methy nitrite	NO_2	"	0	None	None	
19. Phenol		"	0.002	0.004	None	0.01
20. Arsenic	As	"	0.05	None	None	
21. Lead	Pb	"	0.10	None	0.002	
22. Selenium	Se	"	0.01	None	None	
23. Chromium	Cr	"	0.05	None	None	
24. Diazocompound	CN	"	0.05	None	None	
25. Cadomium	Cd	"	0.01	None	None	
26. Mercury	Hg		0.001	None	None	
27. Coliform group		apm/ 100cc		None	None	2,400

animal waste, being gradually tranformed into nitrogen nitrate through oxidation. The fact that a lot of ammonia is contained in the water suggests that the water has been relatively recently contaminated by human and animal waste.

Phenol is a substance rarely present in the natural water. Contamination by phenol is mostly attributable to drainage from the factories producing glass and medicine. A polyethylene tank sterilized with boiling water was presumably used as a container of collected samples, and that is perhaps the reason why phenol was detected.

Regarding coliform group, Dr. Koike (expert from JICA) conducted a cultivation test in the laboratory after collecting the contaminated water at the intake on December 12, 1986. The test results have proved that this contamination is attributable to a simple falling backterium since no growth of coliform bacteria such as colon bacilli and salmonellae is recognizable.

For the purpose of confirmation, JICA asked the Water Supply Services in Surabaya on 5 January 1987 to retest 3 liters of water which had been collected from resources on the same day. The retest, focusing on five subjects of analysis was conducted with 10 pieces of bottle (300 cc/bottle) that were used for distilled water in the laboratory. The results of the retest are shown in the

Table 2-3. As evident from these results, the retested water contains ammonia, nitric ion, phenol, and coliform bacilli, suggesting that installation of some filtering equipment is necessary.

The water used in the laboratory shall also be available for washing test tubes and other appliance that come in contact with semen. This makes it necessary to install a KSP-type filter (1,000 l/hr) that is directly connected to pipeline.

2-3 Intake Facilities

2-3-1 Present Condition

Construction of a new intake weir is now under way at the site 60 m upstream from the existing intake weir. The old weir is subject to a large volume of incoming earth and sand, but it has no scouring sluice downstream from the intake pipe. At the upstream site there is some space where a settling basin can be established, and perhaps all these are the reasons why a new intake dam is now under construction at this point. The structure of both old and new intake weir is made of masonry works (0.8 to 1.0 m in high). Regarding their foundation, however, the old weir is established on a sound rock, while the new one is founded on a spot where a lot of gravel is contained. The structure

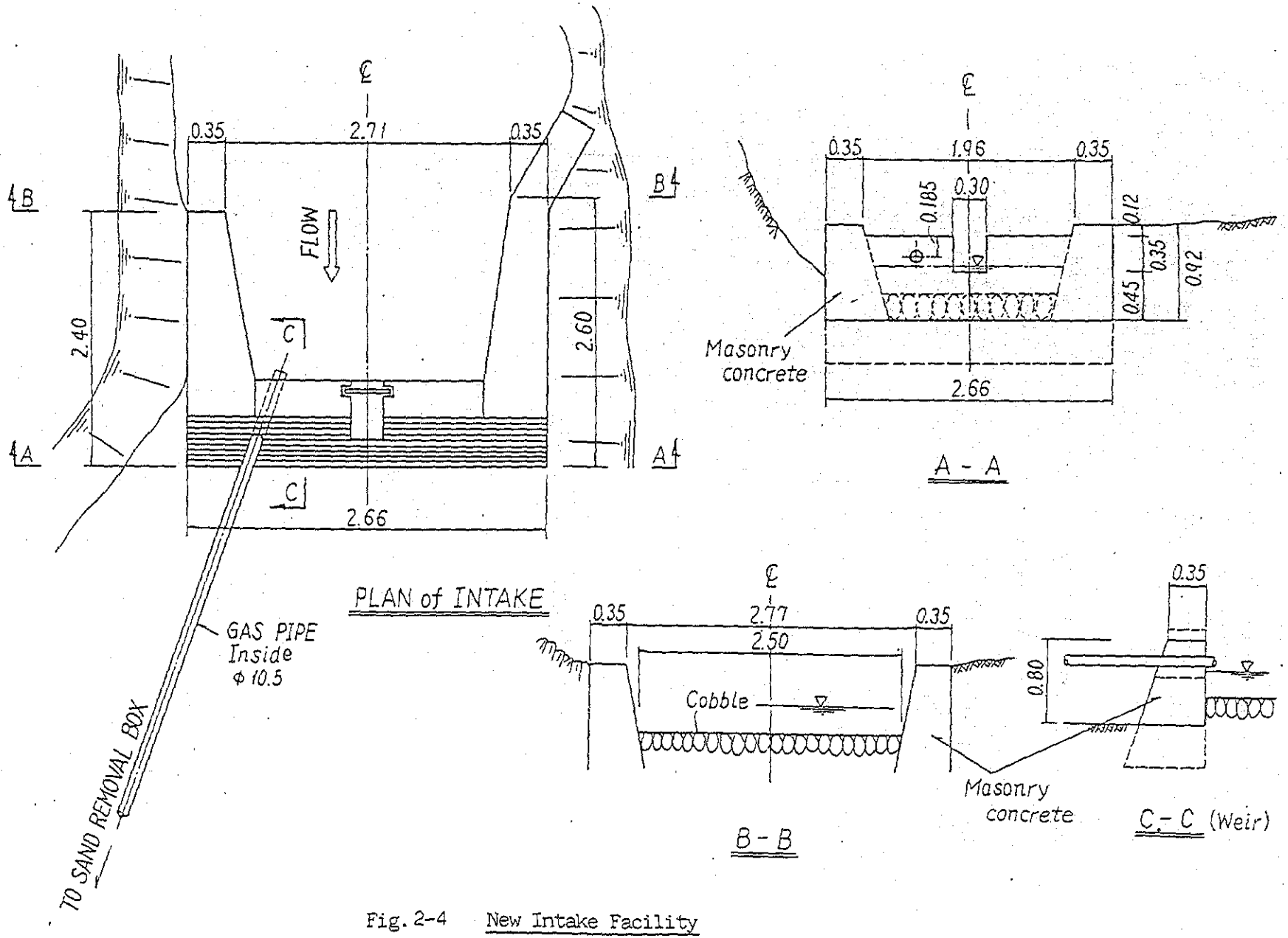
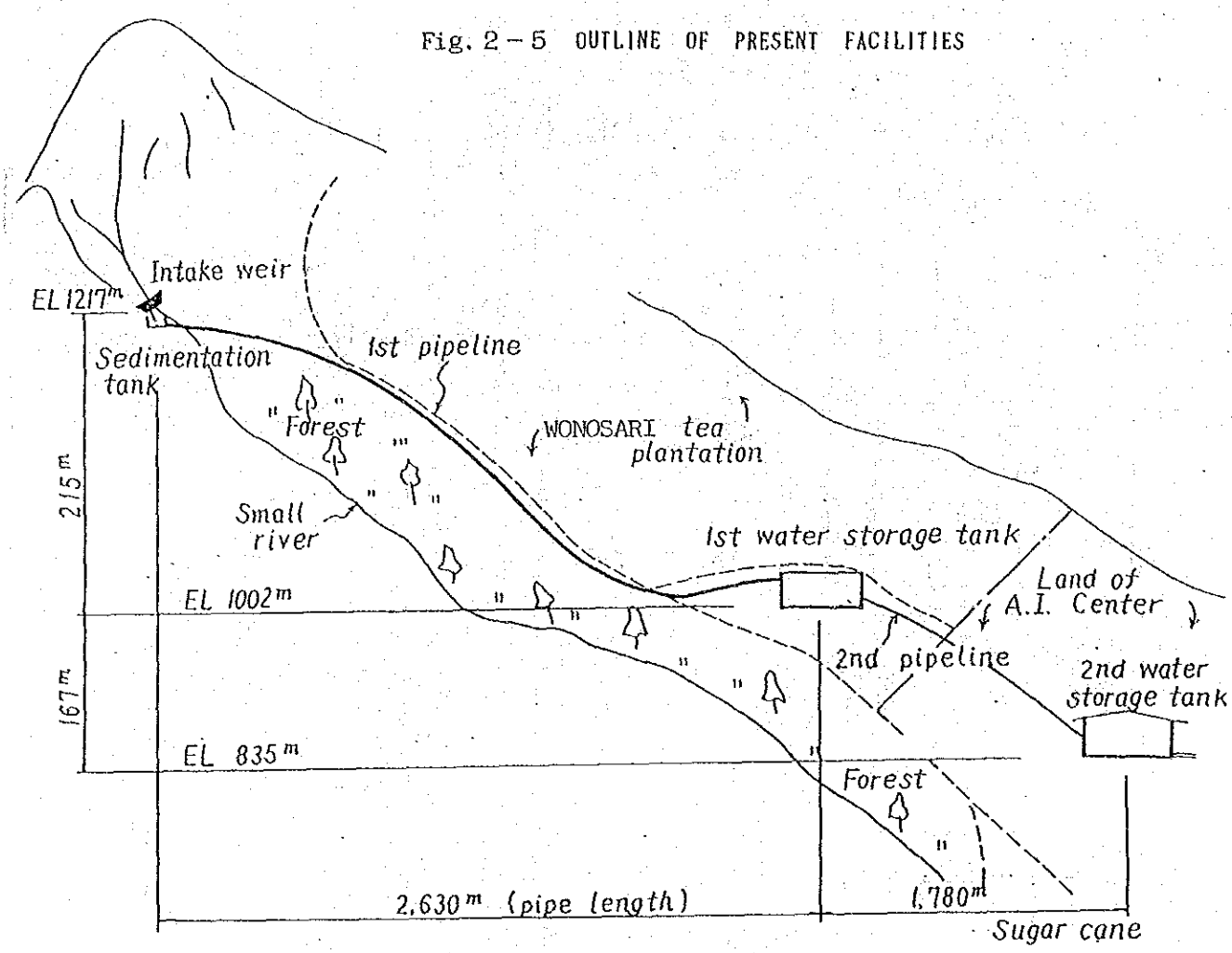


Fig. 2-4 New Intake Facility
S = 1:50

Fig. 2 – 5 OUTLINE OF PRESENT FACILITIES



1. Intake Structure

NAME	Structure	Scale	Elevation	C.A	Q
Weir	Cobble concr.	L=2.7, H=0.80m	1,217m	2.6km^2	1.9l/s
Sedimentation tank	ditto	B=2.0, H=1.00m L=4.5	1,216m	–	1.9

2. Pipeline Structure

Name	Pipe	Dia. inside	Length	Head	Slope	Damage
1st pipeline	Carbon steel	100-80mm	about 2,630m	215m	1/12.3	many
2nd pipeline	ditto	50-32mm	about 1,780m	167m	1/10.7	a few

3. Water storage tank

Name	Structure	Capacity	Elevation	Q	Remark
1st water storage tank	Concrete & brick	16m^3 x 2	1,002m		Intake facility
2nd water storage tank	ditto	100m^3	835m	1.3l/s	Water supply Facility

of the water cut off wall is unknwon, and it seems that water leakage is a little greater in the new weir than in the old one.

At the point about 20 m upstream from the new intake weir, there is some rock exposing on the river bed, suggesting that the base rock of the new weir is not deep enough. Although the new weir is still under construction, its downstream river bed has already been erroded, indicating that some foot protection work is necessary.

A sand settling box is under construction in a space on the right bank immediately downstream (about 10 m) from the new intake weir.

All construction materials are conveyed by manpower using a foot path along the steep river valley about the length of 700 m in the mountain. Therefore the condition of construction will seems hard from the view points of the condition of access road and no presence of supervisor.

Masonry concrete is used for the construction of new settling box and so the improvement work by waterproof mortal on inside wall and bottom, and the blow off box closed to the river bed shall also be improved for the safety structure in the river land.

The structure of the new intake weir under construction and an outline of the pipelines established downstream are shown in the Figure 2-5.

2-3-2 Application of Intake Discharge

With regard to the permission of intake discharge, the following certificate was issued by the Governor of East Java on Dec. 23, 1980. (Document Code: SURAT-IJlN No. 503.611.24/4569/190/80)

Valid period for intake:		Oct. 14, 1980 to Oct. 13, 1982 (2 years)
Intake discharge	:	4 ℓ/sec
Purpose of Use	:	Drinking and washing for cattle Utilization in the laboratory Irrigation of pasture field living

On the other hand, according to the Inventory of Intake Facilities prepared by the Brantas Irrigation Project, DPU Province. (Document Code: Inventorisasi Sumber-Sumber Air dan Sumber Boor, Oct. 28, 1986), the water supplied to A.I. Center shall be used for drinking and living purposes and the intake discharge is designated as follows.

No. of site	:	No.15
Name of intake weir	:	Sbr. Buduk Asu
Max. intake discharge	:	Max. 3 ℓ/sec
Min. "	:	Min. 2 ℓ/sec

2-3-3 Capacity of the Facilities

The following descriptions based on the present river flow and intake discharge and consumption can be pointed out now.

(1) The river flow on December 12, after 6 consecutive days of no rainfall, was 2.0 l/s in spite of the rainy season. This is an expremely low against the specific discharge of 0.077 m^3/sec/100 km^2.

(2) The river flow on January 2, after 6 consecutive days of uninterrupted rainfall (totalling 111 mm), was 3.8 l/s. This is equvalent to the specific discharge of 0.146 m^3/sec/100 km^3.

(3) The river flow on December 27 (halfway through the above period) is estimated at 1.9 to 2.0 l/s according to the observed inflow in the 2nd water tank.

(4) The monthly rainfall in December during the survey period was 225 mm, that is, about 70% of the average monthly rainfall (311 mm) in December.

(5) During the survey period, an overflow was observed several times in the downstream 2nd water tank (including the inflow of 2.8 l/s on January 2).

(6) In view of the specific discharge, a sizable quantity of water is supposed to permeate into the ground. Estimation of a river flow, therefore, requires a long-range measurement practiced throughout the year.

(7) Excluding the water used for pasture field irrigation, the maximum daily requirement of water for downstream is estimated at 0.6 l/s (see 3-1 of Chapter 3).

(8) According to the results of observation in December (minimum: 1.9 l/s), a stable quantity of flow during the dry season is assumed to decline by half.

In view of the conditions described above, the maximum capacity of pipeline shall be set at 3.0 l/s in design. The present intake capacity is 3.6 l/s (as observed), and so there will be no difficulty in achieving the maximum 3.0 l/s if the downstream pipeline are improved.

As there is a large volume of ground water, it is necessary to measure the minimum river discharge during the dry season. The discharge of 2.0 l/s in early December, when there was lack of rainfall, is presumably close to the basic flow. Therefore, the minimum river discharge during the dry season is assumed at 50% of this discharge of 2.0 l/s.

$$Q_{min} = 2.6\ km^2 \times 0.00077\ m^3/s/km^2 \times 0.5$$
$$= 0.001\ m^3/sec$$
$$= 1.0\ l/sec\ (Specific\ discharge\ 0.038\ m^3/s/100\ km^2)$$

2-4 Pipeline Facilities

2-4-1 Present Conditions

The pipelines now in use, made of light steel pipe, were installed in March 1981 and are 80 mm in diameter and 3,000 m in length for apstream and 50 mm in diameter and 1,400 m in length for downstream. The pipe with a diameter of 32 to 100 mm is partially installed and some portions are repaired with PVC pipe.

The upstream pipeline is exposed on a steep slope of the valley, and there are many aqueducts. To ensure the dydraulic gradient for water conveyance, most of the pipes are installed at a constant incline. The socket-type screw-cut joints are noticeably damaged. These damages are presumably attributable to sliding of supports, deficient construction of socket joints, no provision of air valves, and pipe materials not resistant enough to water pressure.

As a treatment for damage, semicircular steel pipes have been fixed with bolts, thereby preventing leakage. Now, a stopgap remedy is seen at a few spots, where rubber sheets are coiled round and fastened with wire only.

The greater part of the downstream pipline is buried under the cultivated ground and wild grass land, and therefore damages in the downstream pipeline are not so great as those in the upstream pipeline. However, water grooves caused by leakage are observed sporadically on

the buried pipe, suggesting that reinstallation of the entire pipeline is neccssary. The buried steel pipes, 50 and 32 mm in diameter, are connected with the 2nd water tank, which is set up just upstream the A.I. Center.

2-4-2 Leaking Ratio

The following table shows the actual measured discharge at the point of intake and the 1st and 2nd water tanks.

Table 2-4 Measured Discharge

Date of Measurement	River Discharge	Intake Discharge	Inflow into 1st Tank	Inflow into 2nd Tank	Remarks
Dec. 12, 1986	2.0 ℓ/s	L[1](1.9) ℓ/s	- ℓ/s	1.3 ℓ/s	
15, 1986	-	-	2.0	1.9	
17, 1986	-	-	1.6	-	
27, 1986	-	-	-	1.3	
Jan. 2, 1987	3.8	L[1](3.6)	2.9	-	

Remark L[1] : notes 95% of river discharge

Based on the above observations, the leaking ratio of upstream and downstream sections is calculated as follows.

Upstream $1 - \frac{2.9}{3.8 \times 0.95} = 20\%$

(Where : intake efficiency : 0.95)

Downstream $1 - \frac{2.9}{2.0} = 5\%$

As abvious from the above calculation, the rate of river discharge is exceedingly low. To make an effective use of the limited water resources available now, not only a change of pipe diameters but also reinstallation of the entire pipeline are necessary. In principle, it is recommendable that a new pipeline should be buried underground for the sake of safety and maintenance.

2-4-3 Water Tanks

(1) At the present time, water storage tanks are set up in two different places. They were not established at the same time. It seems that only the upstream tank was used for distributing water at the begining.

1st tank: Two units of 14 m^3 tank were built in March 1981.

2nd tank: One unit of 100 m^3 tank was built in February 1985.

The blow off facilities fixed to the upstream tank does not function well and therefore a large volume of sedimented sand and mud is being removed by manpower from the upper manhole. During the survey period, the water in the tank was shallow, only about 30 cm in deep, making it possible to remove earth and sand by manpower. It is necessary, however, to fit the tank with a new blow off valve and blow of pipe. The blow off pipe, in particular, must be extended to the place where it is free from the surrounding earth and sand.

The structure of this water tank: both top and bottom plates are made of thin reinforced concrete: the side wall is composed of masonry concrete (2 m high). The interior of this structure needs water-proof mortar work.

JICA was requested by the local office to set up a drinking water facilities at three points upstream from the first water tank. As illustrated in Figure 2-5, high hydrostatic pressure (215 m) acts on the upstream pipe, and therefore it is technically impossible to set up such facility around there. It is possible to set up it at some points near the intake where hydrostatic pressure is low, but it is not advisable to do so in such depths of a mountain where maintenance and control are by no means easy. Technically speaking, it is practicable to utilize the water whose pressure is reduced by the 1st tank, so bubblers can be installed by means of the existing pipes at some points 15 to 20 m downstream from the 1st tank apart from the main pipeline.

(2) The 2nd water tank located downstream, made of masonary concrete, has a capacity of 100 m^3 and was constructed at the terminal of the pipeline. Directly beneath this tank there are houses for Project staff. The difference in elevation between this houses and the bottom slab of 2nd tank is as short as 3 m, of which quired hydraulic pressure

is not enough to deliver water to houses.

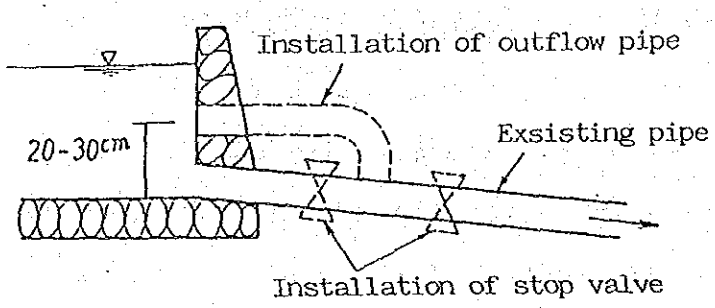
As a preventive measure against permeation of impurities, the lid of the 2nd tank is entirely covered with zinc roof, but this measure is insufficient. When the water flow downstream through the pipeline, a large quantity of air is drawn into the pipe, disturbing the smooth flow of water and the water is drawn out with mixed air. Therefore, it is necessary to install air valves on the upstream pipeline.

The volume of stored water in the tank is largely affected by usage of water by the downstream. During the suvey period, the 100 m^3 tank became empty in a whole day and night (in 24 hours). In the latter half of the survey period, however, the tank was not found emptied because of an increase of inflow, and the water often overflowed the tank from the top of the side wall. It is necessary to install a spillway gate.

(3) The water tank is designed to store water as well as to release water pressures. It noticeably has the following structural problems.

a. The water outlet is installed in the lowermost part of the bottom slab. The earth and sand carried by the upstream water get into the downstream main pipeline. Consequently, there is rather a small volume of sand left in the water

tank. As a preventive measure against mingling of earth and san in the pipe, it is advisable, for the time being, to fix stop valves at two spots as well as to mount a new intake pipe 20 to 30 cm above the bottom slab. Until a new tank is built, such a measure would be enough to stop earth and sand from getting in.



b. Although a bypass in furnished, the tank will be emptied of its water because there is no stop valve fixed to the tank outlet. Since the water tank is originally meant for reducing water pressure, it is not advisable to use bypasses too much.

c. The tank is not equipped with a spillway during a large volume of inflow, the water overflows the tank from the wall top. Considering the structure of a masonry concrete wall, this is not recommendable because the backfill soil around the tank becomes saturated. It is neces-

sary to provide a side weir on the wall top to drainout water through a drain pipe.

2-5 Water Supply Facilities

2-5-1 Present Conditions

(1) As pointed out before, the 2 nd water storage tank ($V = 100\ m^3$) located just upstream from the A.I. center was always empty at the initial stage of this survey. In view of the estimated quantity of water consumption ($13\ m^3$) in the A.I. Center at present, this was presumably attributable to the waste of water occurring at various points. The major reason causing this is the large diameter (ϕ 32 mm) of the main downstream water supply pipe, suggesting that most of the waste of water had flowed away downstream. There is a goat feeding facility (managed by the provincial government) located in some part of A.I. Center's downstream site. This facility uses the excess water from the A.I. Center, and it seems that a large volume of excess water is flowing down into this facility. Another reasons are the leakage from the joints of exposed pipe and the insufficient water control at each terminal of the pipes.

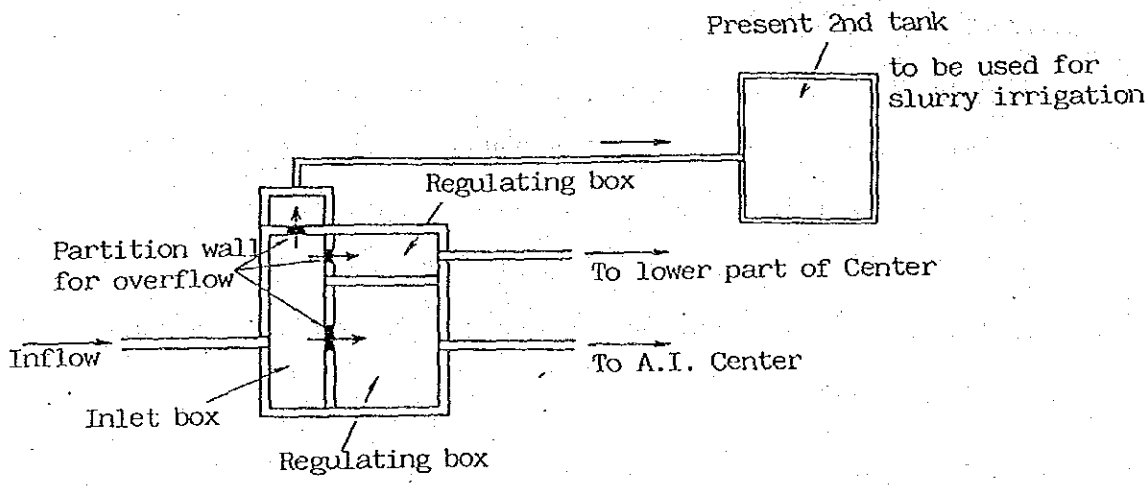
Improvement of water supply facilities is necessary in order to obtain a required quantity of water for use in the A.I. Center. The following methods are

recommendable.

a. Installation of two water storage tanks: one (about 41 m^3) for exclusive use by the A.T. Center and the other (about 9 m^3) to be used by the goat feeding facilities.

b. Both tanks shall be equipped with a overflow weir, thereby allowing individual water intake. The tanks shall have specific mechanism (such as stop log or elevation gap between weir tops) that would give prority to water untilization by the A.I. Center.

c. The excess water shall all be diverted to the existing 2nd water tank and used as the diluting water for slurry irrigation.



(2) The pipeline has three water storage facilities: the settling box connected to the upstream intake, the 1st water tank (pressure regulating tank) on the madway, and the

tank performs depositing and flushing functions, thereby preventing the inflow of earth and sand. The results of water analysis, however, show that values of some items exceed the standard level for the drinking water, suggesting that it is necessary to build a filter reservoir. Yet considering the necessity of maintenance and management, only the water used by the A.I. Center shall be filtered through this facility.

The present tank is covered with a zinc roof. To prevent from mingling of impurities and filthy things, it is advisable that the proposed water distribution tank shall be covered with concrete.

(3) Regarding the water supply pipes with in the A.I. Center, the pipe with the same diameter (32 mm) as the inflow pipe which extends to the 2nd water storage tank is installed up to the terminal, ranging over 1,200 m approximately. The average piping inclination from the 2nd tank to the terminal is 1/13.5, and such condition likely causes much of the water to be utilized by the downstream facilities.

In the Center, as in the upstream facilities, the joints of exposed pipe are damaged and a leak of

water is found at many points. Those conditions suggest that it is necessary to install the pipes underground.

The pipe diameter ought to be determined through a review of the water utilization plan. In General, the pipe diameter tends to become smaller from the upstream. A system causing no trouble in upstream water utilization should be established by choosing a proper pipe diameter and reinstalling a new pipe.

2-5-2 Utilization of Water

(1) The following table shows the measured inflow of water into the 2nd water tank which is located in the A.I. Center.

Date of Measurement	Inflow to 2nd Tank	Remarks
Dec. 12, 1986	1.3 ℓ/s, 112 m^3	
" 15, "	1.9 " , 164 "	
" 17, "	1.5 " , 130 "	
" 27, "	1.3 " , 112 "	
Jan. 6, 1987	2.8 " , 242 "	Overflow from tank

(2) Rough estimation of water consumption is as follows,

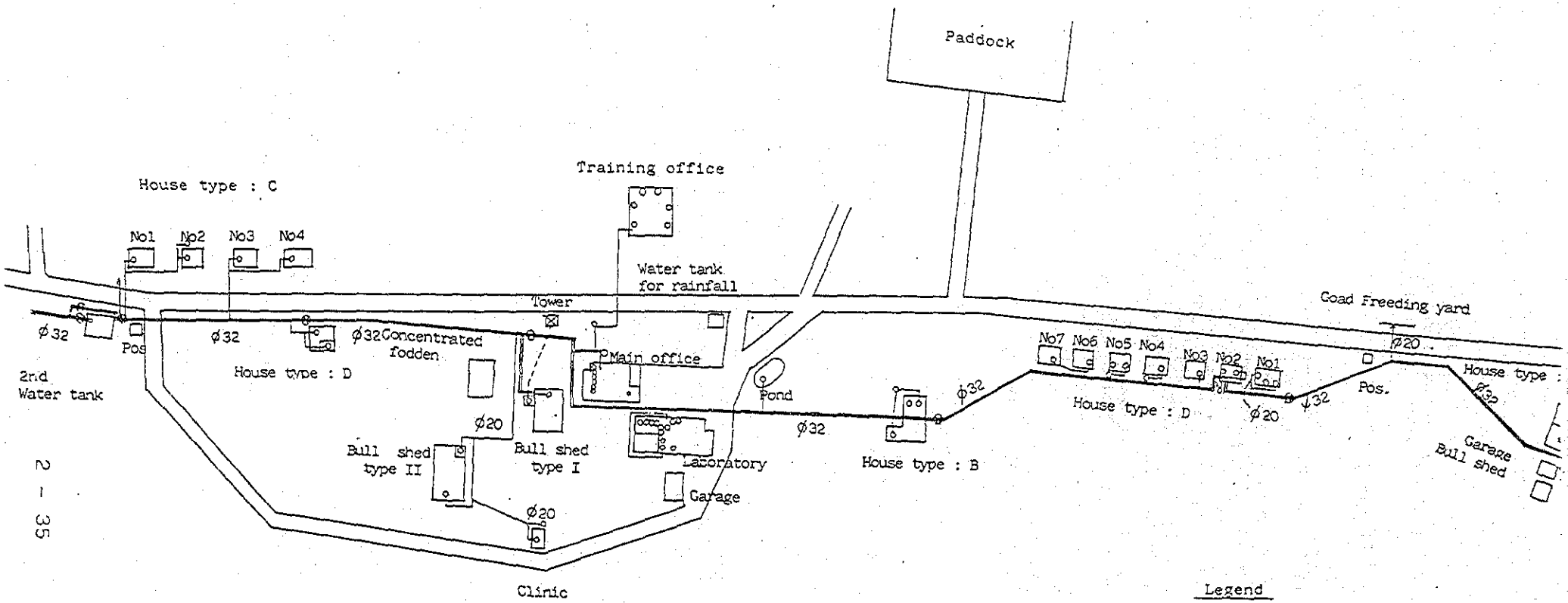
Bull	: 33 head x 60 ℓ/head	= 1,980 ℓ/day
Office	: 53 person x 30 ℓ/person	= 1,590 "
Washing of apparatus :		= 1,000 "
Training office :		= 1,500 "

Domitory :	14 houses x 5 person x 80 ℓ/person	= 5,600	ℓ/day
Others :	10%	= 1,330	"
	Total	13,000	(=13m^3)

The above two tables suggest that approximately 10% of the incoming water is consumed by the A.T. Center at the present time. Most of the water is presumably consumed for utilization by the downstream goat feeding facility, distribution to the forage field, and mere ineffective discharge.

Fig.2-6 Present Water Supply Facilities in A.I.Center

(No Scale)



Legend

- Road
- Water Supply pipe 32
- Water Supply pipe 20
- ⊗ Stop Valve
- ○ Water tap

2-6 Cattle Shed Facilities

(1) In the frame of the model infrastructure improvement works for the strengthening of artificial insemination center project, 10 head of new cows will be breeded for training purposes. A 10-head cow shed and a training shed shall be constructed for this purpose.

The cow shed is proposed to be established at the verge of the A.I. Center site, on a vacancy of 1,400 m^2 in area, with 759.5 m in elevation 50 m back from the asphalt road.

The cattle shed facilities will be simple wooden buildings that is expected to become a model of farm-houses in the neighborhood.

Cow shed (10 head)	: 85 m^2
Training shed (5 head)	: 35 m^2
Fence	: 135 m

(2) Slurry store

In order to increse the harvest of pasture, the cattle waste (excreta) must be restored to be fertilized the forage field. For this purpose, a new slurry store tank is proposed to be installed.

The volume of the tanks is decided based on storing days of excreta, which is estimated at 15 days in an average. When operating slurry tanker, the quantity

of diluting water, labourer and other factors should be taken into consideration.

Bull shed, Type-I (24 head)	:	16.8 m^3 x 2 barrels
Bull shed, Type-II (16 head)	:	11.2 m^3 x 2 barrels
Cow shed	:	7.0 m^3 x 2 barrels

2-7 Improvement and Irrigation Plan for Model Pasture Field.

(1) The persent A.I. Center site has an area of 95 ha, of which about 20 ha is used as a forage field. The topographical condition, sectional formation, and field inclination of this forage field are relatively favorable. But its farming road is not will provided and therefore many parts of the field meet difficult in access by tractors.

(2) Improvement of forage field management and utilization as well as development of farming roads should basically be given high prionity in the model forage field improvement works.

There are pretty many sites with potentials for forage field reclamation. In view of the topographical conditions and other factors as mentioned above, however, the A.I. Center is well capable of reclaiming a forage field by its own efforts. It is advisable that the existing forage fields should be renewed as much as possible, thereby increasing the harvest of the pasture.

(3) For the above reason, improvement of farm roads are planed in formulating the model pasture field improvement works.

(4) considering the capacity of water resources and the circumstances of water utilization as described above, it is by no means easy to irrigate the forage field

with fresh water.

It is desirable, however, that the water for washing away the excreta of cattle should be used as much as possible for irrigation in the grassland, thereby giving a boost to the growth of grass.

There is a rainwater tank now installed. The water collected in this tank can be used for irrigation. It is advisable that both excreta and water for washing purposes should be diluted with the rainwater to 10 times as thin and used for irrigating and fertilizing the grassland.

For this purpose, the introduction of a slurry tanker is essential.

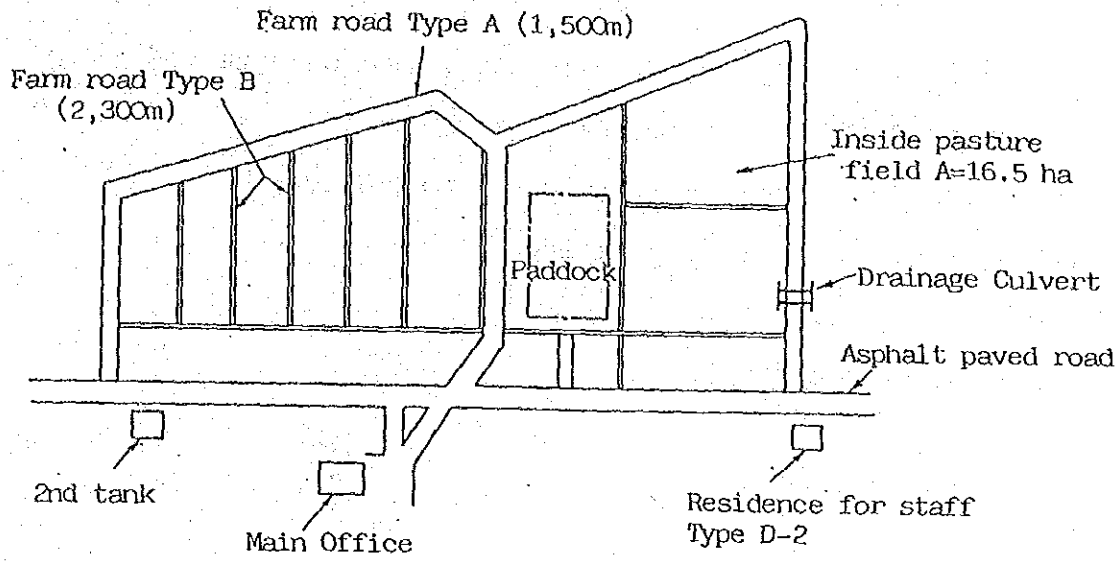
(5) The farm roads shall be constructed in the main forage field which is located on the north of the A.I. Center. The following illustration shows a schematic arrangement of the farm roads network.

Crushed stone is used for the pavement of farm roads.

Farm road Type-A : total width 3.5 m, pavement width 3.0 m, pavement thickness 0.15 m

Farm road Type-B : total width 3.0 m, pavement width 2.5 m, pavement thicknes 0.10 m.

The existing routes is applied to the new farm roads. The type-A road, however, is planed to form a straight line through selection of its route.



2-8 Introduction of Slurry Store for Model Pasture Field Irrigation

As forementioned, it appears difficult to irrigate the forage field with fresh water, considering the capacity of water resources and the the trends of water utilization. It is desirable, however, that cattle excreta and washing water shall be used as much as possible for irrigation in the grassland, thereby stepping up the growth of grass. These circumstances lead to the following proposals, that is, both fresh water collected in the rainwater tank and excess water stored in the 2nd tank shall be used for irrigation and cattle excreta shall be used for grassland irrigation and fertilization after being diluted with the rainwater 3 to 5 time as thin. For this purpose, it is necessary to introduce a slurry tanker.

The specifications of the slurry tanker (capacity: 2,200 l) are given below.

Name: Trailer type riding tractor (tank wagon type) equipped with an excrement sprinkler

Model: Bauerpuhp Tanker M22V (high-pressure type)

Sprinkling system: Rear sprinkling

Tank capacity: 2,200 l

Applicable tractor: 25 ps

Fig. 2-7 Present Pasture Field

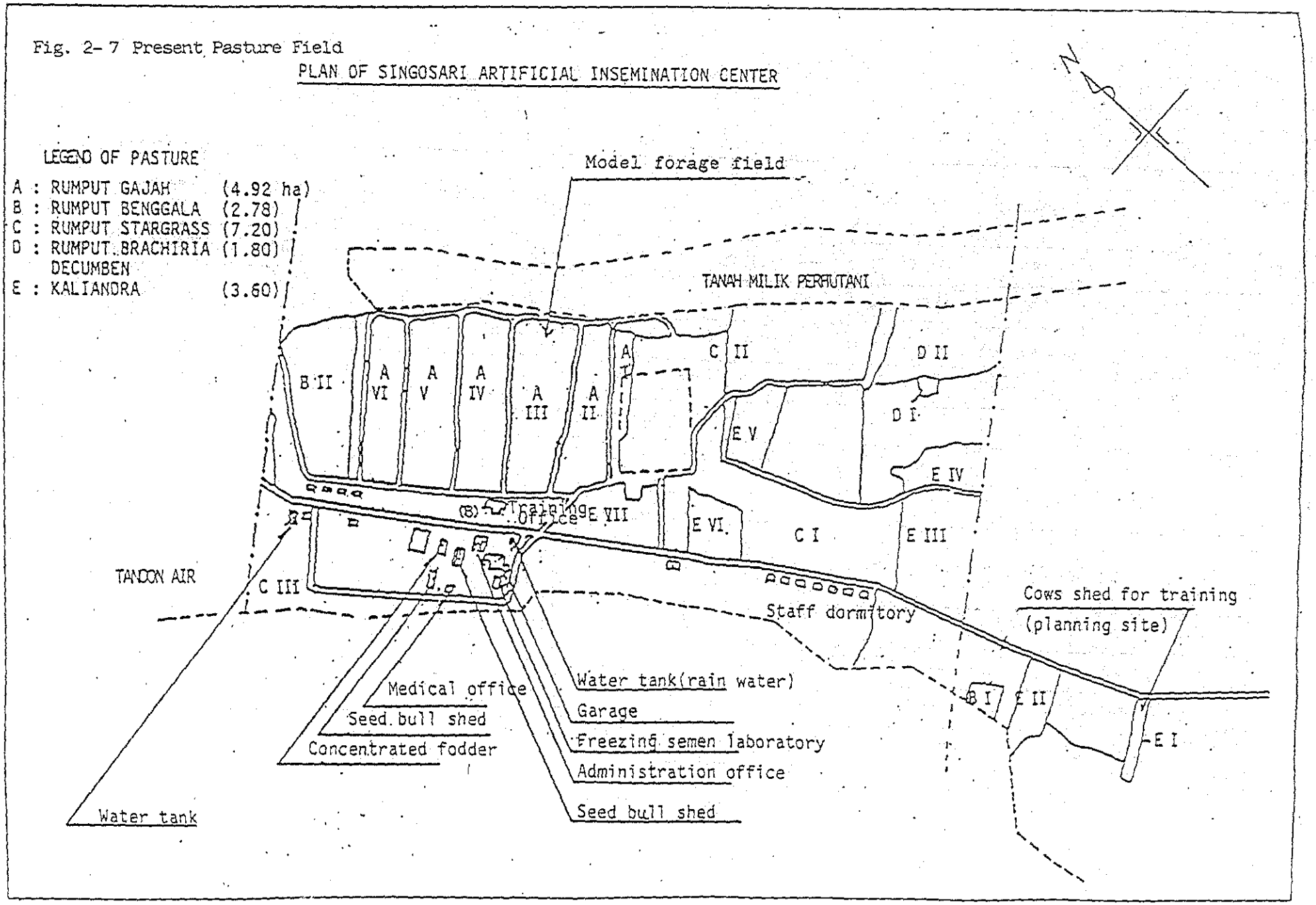


Table 2-5 Soil Test Analysis For A.I.Center (At Bogor Soil Laboratory, Feb. 23, 1983)

Item	Soil Properties			PH		105℃ Dry Sample (in 100g)						
						Organic Ingredient			HCℓ 2.5%		BRAY	Calcium Carbonate
	Sand	Silt	Clay	H_2O	KCℓ	C	N	C/N	Phosphoric	Potassium	Phosphoric	
	%	%	%			g	g	Ratio	mg	mg	ppm	g
Test Result	48	40	12	5.9	4.9	1.7	0.15	12	8	37	6	——
Judgement	Loam			Normal Weak Acid		A Little	A Little	Normal	Normal	Normal	A Little	

Item	Positive Ion Exchauge Valve								Basic Saturation	Remarks
	105℃ Dry Sample meq/100g									
	Component of Exchange Positive Ion					1 N, KCℓ Solution		Capacity of Positive Ion Exchnge CEC		
	Ca	Mg	K	Na	S	Al	H		%	
Test Result	6.8	2.3	1.3	0.1	10.5	0.08	——	22.8	46	
Judgement	Normal	Much	Very Much	A Little					Normal	

2-9 Basic Plan of Improvement of A.I. Center

The basic plan of the improvement shall conform to those described in the "Field Report" which had been submitted to the Indonesian authorities. The summary of the report and the proposed improvement works are given below.

(1) Intake Facilities

a. The weir now under construction by the Indonesian side shall be used as an intake weir.

b. The intake weir and the settling box shall be improved for the following pursoses.

- Protecting the downstream water cushion of the weir
- Installation of a steel screen
- Arrangement of a space for driftwood treatment
- Mortar waterproofing inside the settling box
- Repairing the blow off of the settling box

c. The maximum, average, and minimum water supply shall be determined considering the limited discharge of river flow. These data shall be reflected in the design of facilities.

(2) Pipeline Facilities

a. Alteration of the pipe diameter, reinstallation of the entire pipeline, and improvement of the 1st water tank shall be executed in order to use the most of the limited water resources available.

b. As a general rule, the pipes being installed anew shall be buried under the ground.

c. The pipeline shall be installed not only under the narrow path along the circumference of an adjacent tea plantation but also partially under the farm road for a distance of about 1,900 m and, therefore, it is necessary to discuss with the Indonesian authorities concerned.

d. The items of improvement works are as follows.

- Pipeline reinstallation (50 and 65 mm in diameter and 4,200 m in length)
  (Exposed section about 300m long and buried section about 3,900 m long)
- Placing of anchor concrete and establishment of steel supports
- Fixing of blow off valves, air valves, and stop valves
- Mortar waterproofing on inside of the 1st water tank
- Repair of blow off and spill way of the 1st water tank

(3) Water Supply Facilities

a. The 2nd water tank (100 m^3), established at the tail end of the pipeline, is not performing its function satisfactorily. Factors causing this inadequate function include: lack of its inflow

Discharge is estimated at 1.3 l/sec (110 m^3/day), which is not enough to meet water utilization requirements of the A.I. Center under the current water supply system.

b. To obtain a satisfactory quantity of water as required by the A.T. Center, it seems there is no effective remedy other than changing the current water supply system.

c. For this purpose, an adequate water distribution tank for exclusive use by the A.I. Center must be installed, and a system with priority given to the utilization of this facility must be established. In addition, it is necessary to provide feeder pipes to each consumer pipe separately. It can be said that if such a system is employed, it would cause no substantial difficulties in the utilization of downstream water.

d. It is necessary to improve a system as well as to intensify water managements.

e. The following are on the list of facilities to be improved.

- Installation of a inlet tank and a diversion facility
- Installation of a filter tank and a distributing tank

- Reinstallation of both water supply and feeder pipes for exclusive use by the A.T. Center
- Installation of a water distribution pipe for use by the goat feeding facilities (including partial utilization of the existing pipes)
- Installation of air valves
- Repair of the 2nd water tank

(4) Cattle Shed Improvement Works

a. Construction of a cow shed (housing 10 head) for training purposes

b. Installation of an slurry store

(5) Improvement of Form Road and Irrigation Plan for Model Pasture Field

a. Improvement of the farm road will be made

b. Reclamation of the pasture field will be implemented independently by the A.I. Center itself

c. Irrigation and fertilization of the grassland will be made utilizing the washing water and cattle excreta diluted with excess water 3 to 5 times thinner (through the 2nd water tank, existent rainwater tank, and slurry store)

(6) Introduction of a slurry Tanker for Model Pasture Field Irrigation

A trailer type riding tractor (tank wagon type with a

capacity of 2,200 l) equipped with an excreta sprinkler shall be introduced as a part of the supply of equipment and material under the grant basis

(7) Improvement of Other Related Facilities

a. Installation of water drinking facilities in the vicinity of the 1st water tank

b. Installation of cattle's drinking facilities in the paddock

CHAPTER 3 DETAILED DESIGN

3-1 Detailed Design on Improvement Works of Facilities

3-1-1 Intake Facilities

The weir now under construction shall be utilized as intake facilities, so only a small-scale repair work suffices.

(1) Repair of intake weir

a. The foot protection and apron located downstream from the new weir shall be improved with masonry concrete. The weir has a structure wherein the overflowing water directly hits the intake pipe, and therefore the pipe shall be protected with masonry concrete entirely.

- Improvement of the foot protection and apron:

  masonry concrete
  2.7 m wide, 1.0 m long, 1.0 thick;
  equipped with a cutoff

- Protection of the intake pipe:

  masonry concrete
  0.6 m wide, 0.8 m high, 1.0 m thick

b. The weir is now equipped with a stop log 30 cm wide and 30 cm high. To obtain the designed maximum intake discharge (3 ℓ/sec) constantly, the elevation of weir located at the centre shall be heightened by 36 cm additionally with concrete (see the "hydraulic review" mentioned later).

c. Fragments of bamboos and miscellaneous trees are drifting down the stream, so it is necessary to set up a steel screen at the point 1.5 m upstream from the weir. The section of the screen shall be identical with that of the river.

- Section : 2.6 m in upper width x 2.2 m in lower width x 1.0 m in height
- Steel Material : L-50 x 50 x 6 with reinforcement bar (welded)
- Mesh : 15 cm in width x 30 cm in height

The vacancy on the left bank shall be prepared to be used as a lot (2 x 3 m) for incinerating the driftwood.

(2) Repair of the settling box

a. There is a settling box established in a space on the right bank 11 m downstream from the new weir. The elevation gap between the river bed and the bottom slab of the box is about 1 m. The shape and structure of this box are as follows.

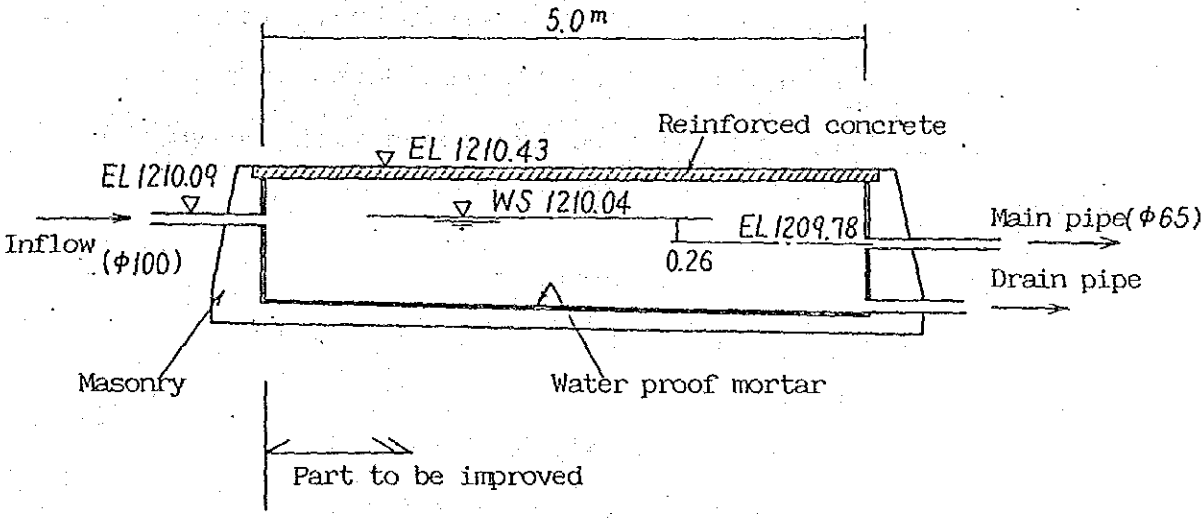
- Shape : rectangular box with 2.0 m wide 5.0 m long, 1.1 m high.
- Structure : side wall and bottom slab: masonry concrete, top slab: reinforced concrete.

b. For the purpose of control of discharge, a valve shall be fixed to the main pipe at some point upstream from the settling box.

c. A waterproof mortar sha be plastered to the bottom slab and side wall inside the rectangular box. A mortar bond shall be used for adhesion.

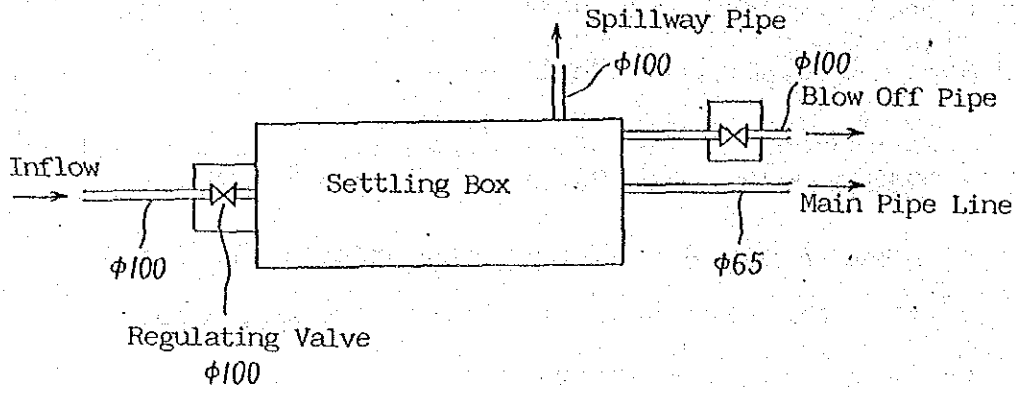
- Waterproof mortar coat : 26 m^2 in area, 1.5 mm in thickness, 1.2 in mix proportion

d. To step up the sand depositing effect, the level of the main pipe shall be installed heightening by 10 cm from the existing one.



e. The present box lacks in safety because its wall is too low and the blow off valve box is too close to the river bed. A new blow off box shall be installed directly downstream from the settling box.

f. The box shall be equipped with a vinyl chloride pipe (ϕ100 mm) which functions as an excess water outlet.



(3) Some pipes are exposed on the dry river bed. These pipes, including the main pipe located downstream from the settling box, must be protected with masonry concrete.

- Cross section of masonry concrete :

  40 m (upper width) x 1.0 m (lower width) x 1.0 m (height)

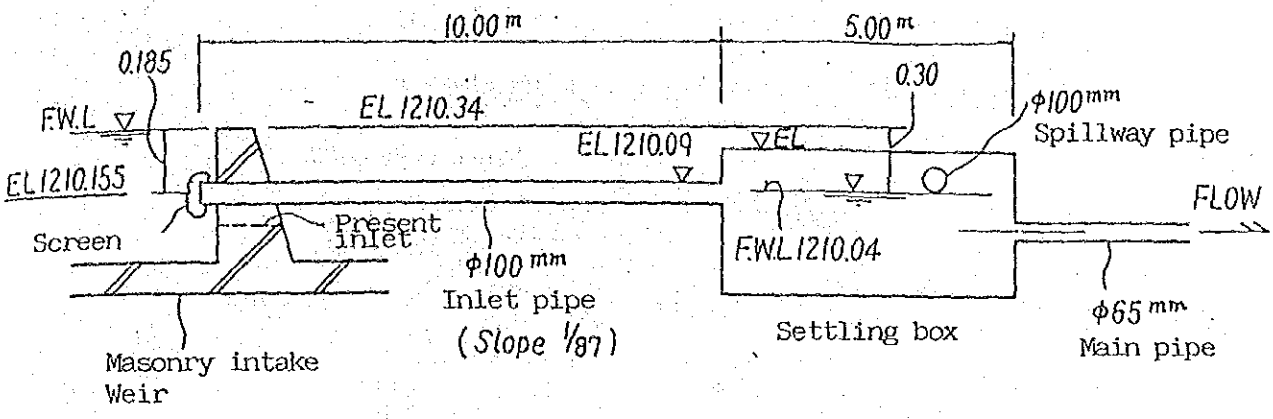
- Length of protective masonry :

Intake to settling box	ℓ = 6 m
Downstream from the box	ℓ = 6 m
Total	ℓ = 12 m

(4) Hydraulic review of the intake

A steel pipe 100 mm in diameter is installed at a length of 10 m from the settling box to the intake weir which is now under construction. It is necessary to review the hydraulic conditions of this pipe.

a. In case of maximum design discharg.



If the water comes up to the weir top, the effective head between the intake and the box inlet will be 0.30 m as illastrated in the above figure, leading to an excess of inflow discharge. The approximation of orifice inflow in given below.

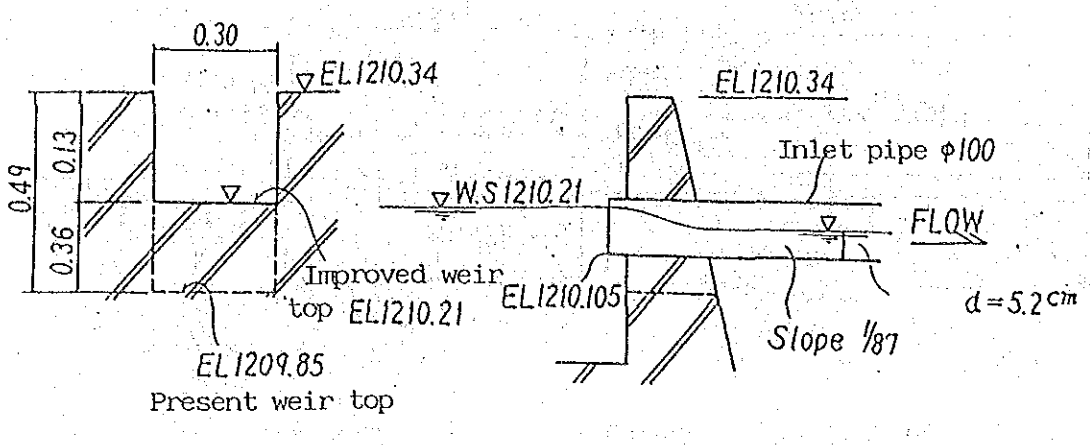
$$Q = C \times A \times \sqrt{2gh}$$

then,

$$Q = 0.6 \times 0.007854 \times \sqrt{2 \times 9.8 \times 0.3}$$

$$= 0.011 \text{ m}^3/\text{s} > \text{maximum design discharge, } 0.003 \text{ m}^3/\text{s}$$

Trom the intake to the settling box, therefore, the water shall flow down freely throgh the pipe, and the elevation of the existing weir shall come up to the top end of the intake pipe.



With the maximum design discharge, steel pipe diameter, and installation slope (I) being set at 3ℓ/sec, 100 mm, and 1/87 respectively, the water depth (d) can be written as follows.

$$\frac{Q \cdot n}{I^{1/2} \cdot r^{8/3}} = \frac{0.003 \times 0.013}{0.107211 \times 0.0003393} = 1.072$$

therefore,

$d/r = 1.049$

$d = 1.049 \times 0.05 = 0.052m$

$A = \alpha \times r^2$

$= 1.6683 \times 0.05^2 = 0.004171m^2$

$V = Q/A = 0.719m/s$

$hv^2 = V^2/2g = 0.026m$

When the inflow loss (hi) and the inlet strainer loss (hs) are involved, the required water level (W.S) can be written as follows.

$W.S = EL1,210.105 + d + fi \times V^2/2g + fs \times V^2/2g$

$= EL1,210.105 + 0.052 + 1.0 \times 0.026 + 1.0 \times 0.026$

$= EL1,210.209 \fallingdotseq EL1,210.21m$

With the upstream water depth being denoted by D, the full-flow conditions of a pipe can presumably be expressed as

$$H/D > 1.2$$

In that instance, the water level exceeds EL 1210.22 m, which applies to the case where the discharge exceeds 6ℓ/sec.

b. Capacity of spillway

$D = 0.1m$, $d/D = 0.9$, $I = 1/5$, $n = 0.012$

$A = 2.9781 \times 0.05^2 = 0.00745m^2$

$R = 0.5961 \times 0.05 = 0.0298$

$$V = 1/n \times I^{1/2} \times R^{2/3} = \frac{1}{0.012} \times 0.4472 \times 0.0961 = 3.58m/s$$

$$\therefore Q = 0.00745 \times 3.58 = 0.027m^3/s = 27ℓ/s$$

c. Discharge control

Prevention of a flood influx shall be performed, in principle, by controlling the water level at the intake weir. With a new valve being mounted on some spot upstream from the settling box, a flood control can be implemented by opening or closing the valve. The influx discharge can also be checked by observing the depth of overflowing water in the inlet tank, which is located just upstream from the A.I. Center