

THE STUDY
ON
GROUNDWATER DEVELOPMENT
FOR
WATER SUPPLY SYSTEMS
IN
PAPUA NEW GUINEA

The Construction Works of the Water Supply Facilities

AS-BUILT DRAWINGS

E X T R A C T

D R A W I N G L I S T

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JV-A-03	OUTLINE OF PLANNED FACILITIES	
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JV-H-01	WATER TANK	PLAN AND ELEVATION
JV-H-02		DETAILS OF PLUMBING WORKS
JV-S-01	B-1: INSTALLATION OF	SUBMERSIBLE MOTOR PUMP & PUMP PIT

-307-

<input type="checkbox"/>	THE STUDY ON GROUNDWATER DEVELOPMENT FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA	
<input type="checkbox"/>	PILOT PROJECT	
<input type="checkbox"/>	DRAWING LIST	
<input type="checkbox"/>		
Checked	T. Kameoka	AS BUILT DRAWINGS
		JV-A-01
HEBOU & Dai Nippon Construction JV		

BOREHOLE DATA

SITE	STRUCTURE OF BOREHOLE		SCREEN DEPTH		WATER LEVEL		RESULTS OF PUMP TEST		
	DIAMETER	DEPTH	DIAMETER	DEPTH	STATIC	PUMPING	DROWDOWN	DISCHARGE	SPECIFIC CAPACITY
BEREINA	150 (143) mm	28 m	150 (143) mm	11.0 - 17.0 m 23.8 - 26.0 m	5.4 m	9.2 m	3.8 m	298 m ³ /d	76.3 m ³ /d/m
KWIKILA	150 (143) mm	31 m	150 (143) mm	5.1 - 11.1 m 23.1 - 28.1 m	3.7 m	8.3 m	4.6 m	216 m ³ /d	47.0 m ³ /d/m
MUTZING	150 (143) mm	60 m	150 (143) mm	40.8 - 60.8 m	12.0 m	12.0 m	1.0 m	864 m ³ /d	864 m ³ /d/m

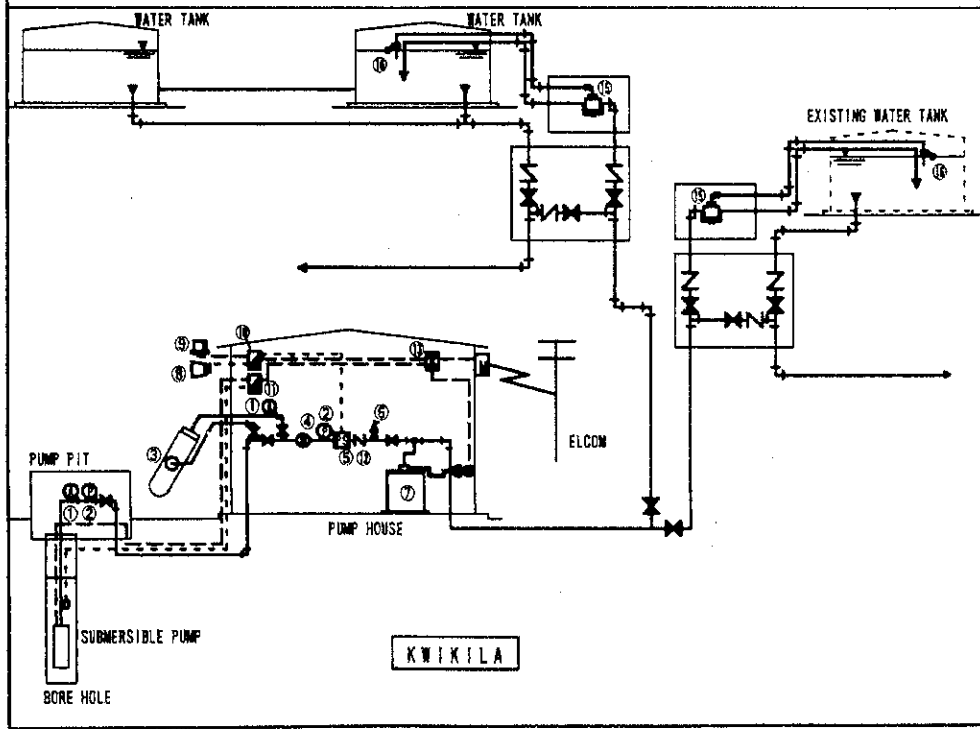
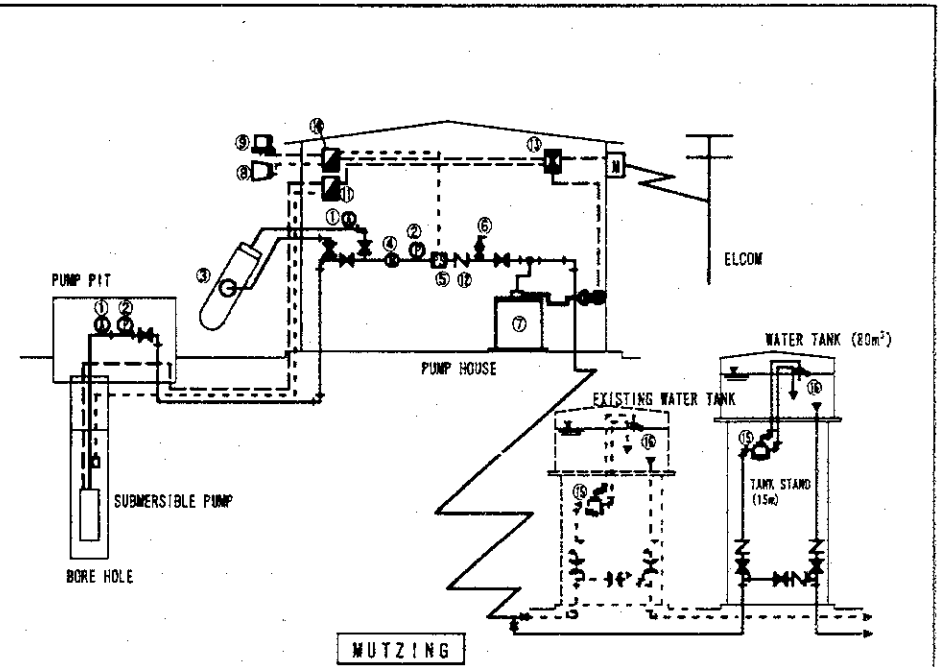
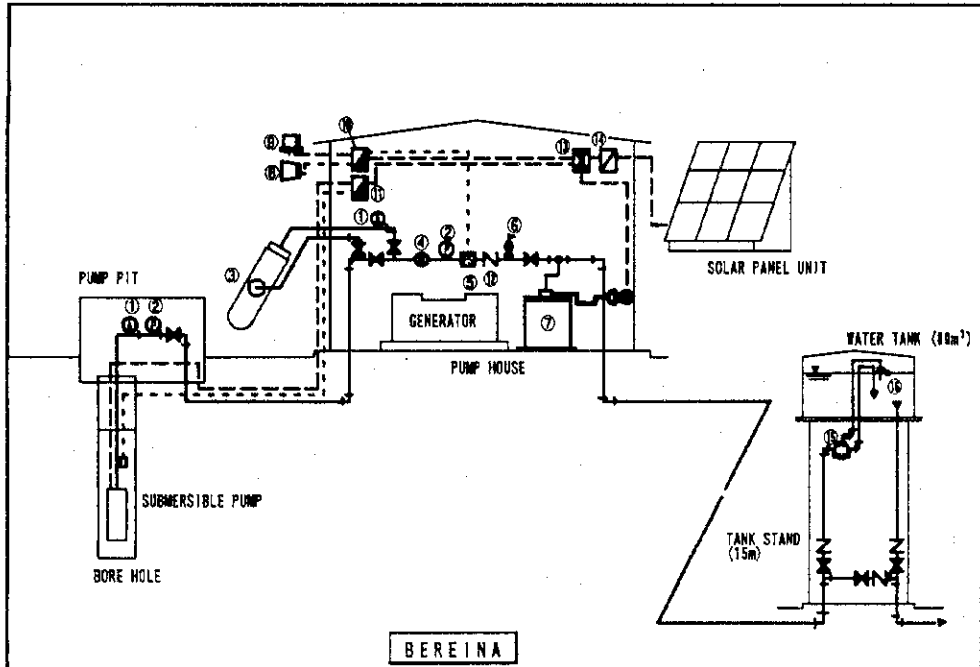
SELECTION OF SUBMERSIBLE MOTOR PUMP AND PUMP INSTALLATION DEPTH

SITE	STRUCTURE OF BOREHOLE	EXPECTED DROWDOWN	PUMP WATER LEVEL	TOTAL HEAD (SURFACE/SUB-SURFACE)	PUMP INSTALLATION DEPTH
BEREINA	300 L/min × 45 m (432 m ³ /d)	5.7 m	11.1 m	25 + 20 = 45 m	20 m
KWIKILA	280 L/min × 85 m (280 m ³ /d)	6.1 m	9.8 m	45 + 20 = 65 m	20 m
MUTZING	250 L/min × 40 m (360 m ³ /d)	8.4 m	12.4 m	22 + 18 = 40 m	18 m

OUTLINE OF PLANNED FACILITIES

SITE	EXISTING WELL	PUMP PIT	POWER SOURCE	PUMPING HOUSE	RISING MAIN PIPELINE	WATER STORAGE TANK		FENCE		DISTRIBUTION PIPELINE	PUBLIC FAUCET	DEMOLITION
						GROUND TANK	ELEVATED TANK	BLOCK FENCE	WIRE NET FENCE			
	S-01	S-01		F-01 G-01	(m)	H-01 H-02	H-01 H-02			(m)		
BEREINA	1	1	SOLAR SYSTEM + GENERATOR	1	50 m	-	80 m ³ , 15 m × 1	117.2 m	-	3,439 m	9	-
KWIKILA	1	1	ELCOM	1	2,570 m	60 m ³ × 2	-	-	141.9 m	1,428 m	1	GROUND TANKS (114 m ³ , 45 m ³)
MUTZING	1	1	ELCOM	1	570 m	-	80 m ³ , 15 m × 1	-	85.2 m	2,875 m	4	-
DARU	-	-	-	-	-	-	-	-	-	135 m	2	-

<input type="checkbox"/>	THE STUDY ON GROUNDWATER DEVELOPMENT FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA	
<input type="checkbox"/>	PILOT PROJECT	
<input type="checkbox"/>	OUTLINE OF PLANNED FACILITIES	
<input type="checkbox"/>	AS BUILT DRAWINGS	JV-A-03
Order T. Yamada	HEBOU & Dai Nippon Construction JV	

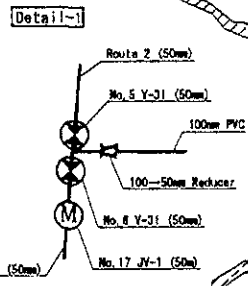
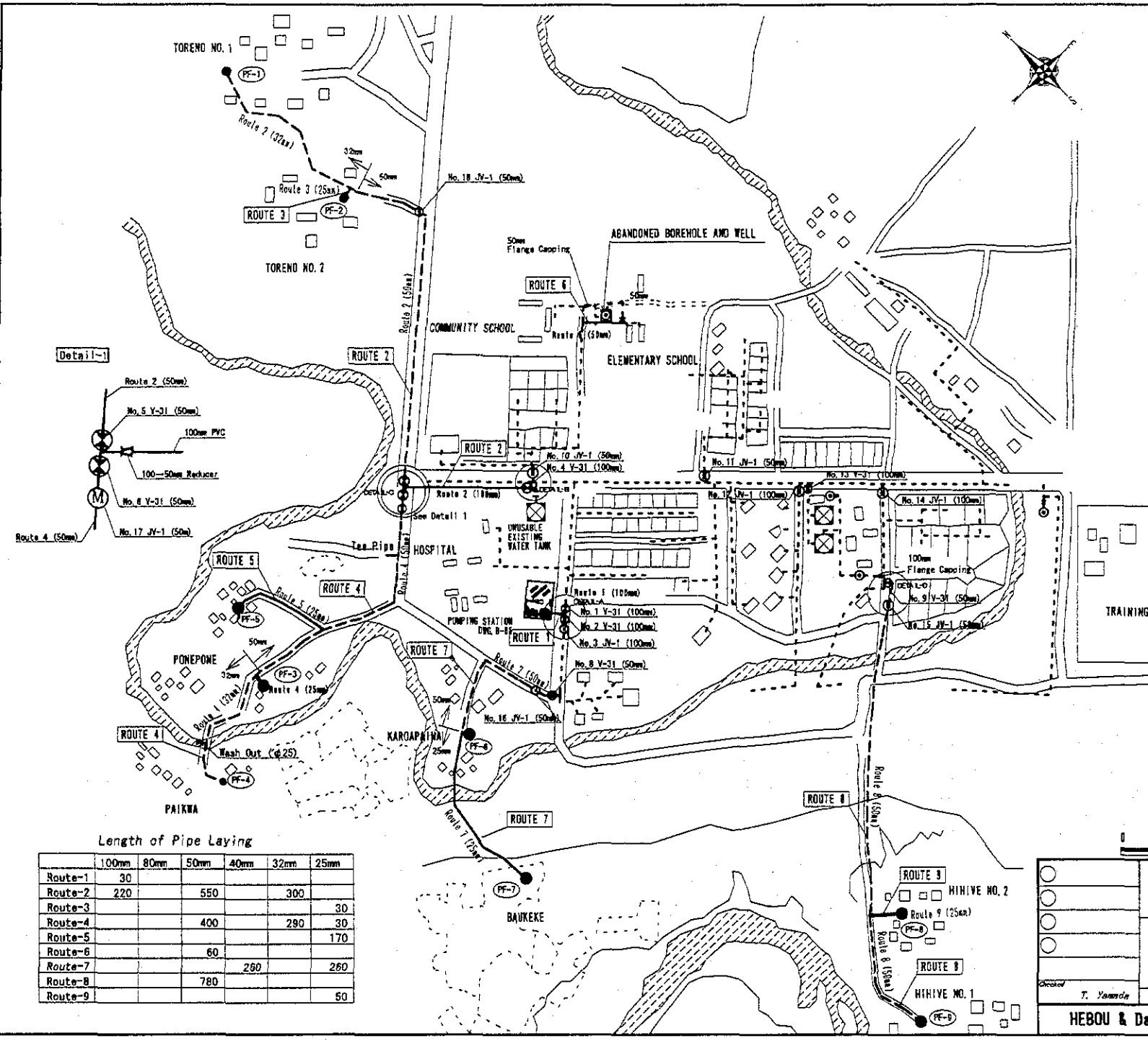


①	air valve	⑤	alarm light
②	pressure gauge	⑥	control panel
③	sand separator	⑦	control panel
④	water meter	⑧	check valve
⑤	pressure switch	⑨	distribution panel
⑥	safety valve	⑩	inverters
⑦	chlorinator	⑪	levelself control valve
⑧	alarm buzzer	⑫	ball tap

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	PILOT PROJECT	
	FLOW DIAGRAM	
Checked <i>T. Yamada</i>	AS BUILT DRAWINGS	JV-A-04
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LEGEND	
---	EXISTING PIPELINE
●	PUBLIC FAUCET
—	NEW PIPELINE 100mm
- - -	NEW PIPELINE 50mm
- - -	NEW PIPELINE 32mm
- - -	NEW PIPELINE 25mm

Valve Box Detail		
No. 1	100mm	V-31
No. 2	100mm	V-31
No. 3	100mm	JV-1
No. 4	50mm	V-31
No. 5	50mm	V-31
No. 6	50mm	V-31
No. 7	Canceled	
No. 8	50mm	V-31
No. 9	50mm	V-31
No. 10	50mm	JV-1
No. 11	50mm	JV-1
No. 12	100mm	JV-1
No. 13	100mm	V-31
No. 14	100mm	JV-1
No. 15	50mm	JV-1
No. 16	50mm	JV-1
No. 17	50mm	JV-1
No. 18	50mm	JV-1



Length of Pipe Laying

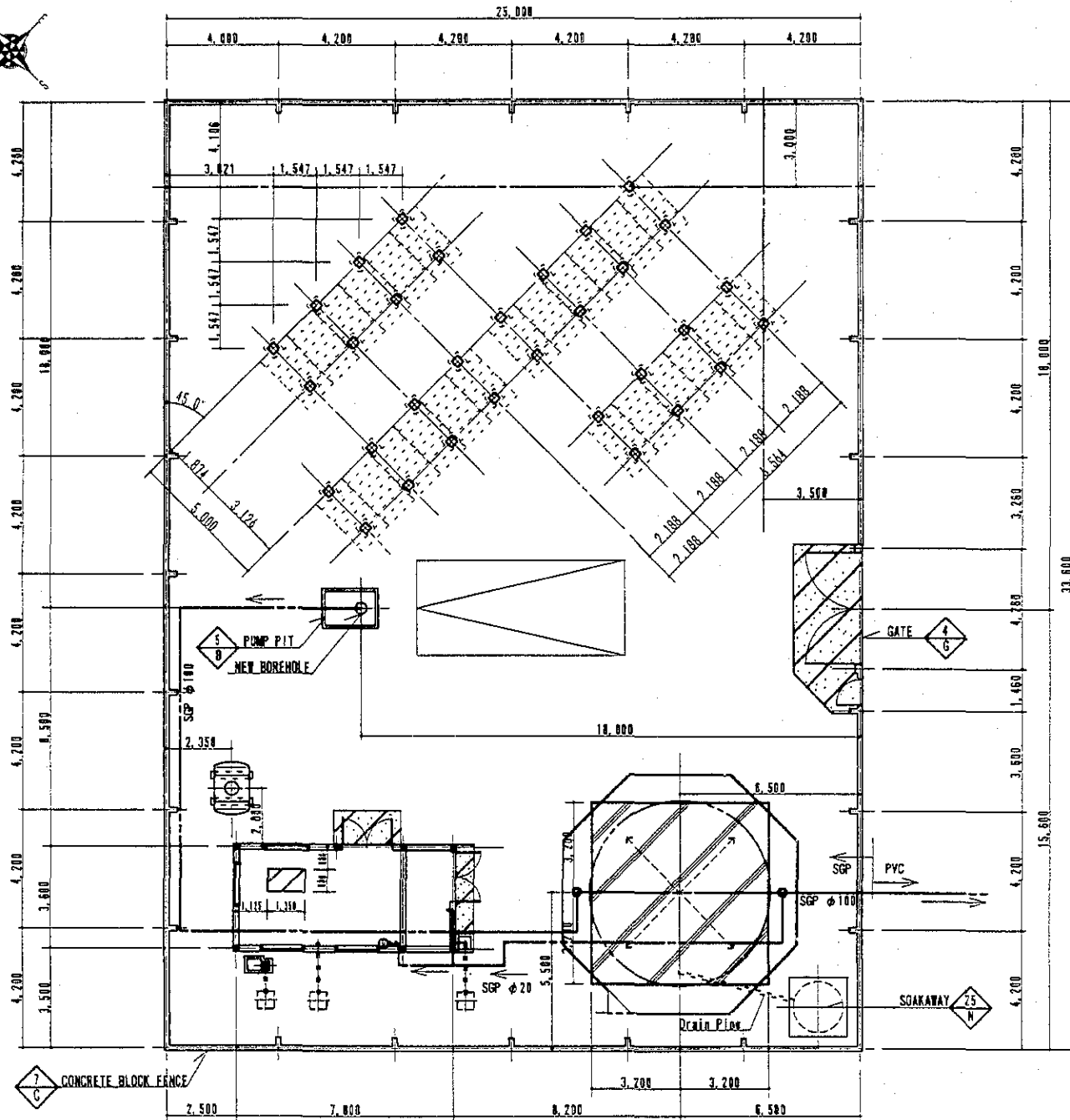
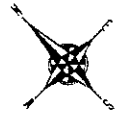
	100mm	80mm	50mm	40mm	32mm	25mm
Route-1	30					
Route-2	220		550		300	
Route-3						30
Route-4			400		290	30
Route-5						170
Route-6			60			
Route-7					290	260
Route-8			780			
Route-9						50



THE STUDY ON GROUNDWATER DEVELOPMENT FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA
PILOT PROJECT
SITE PLAN (BEREINA)

AS BUILT DRAWINGS JV-B-02

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LEGEND

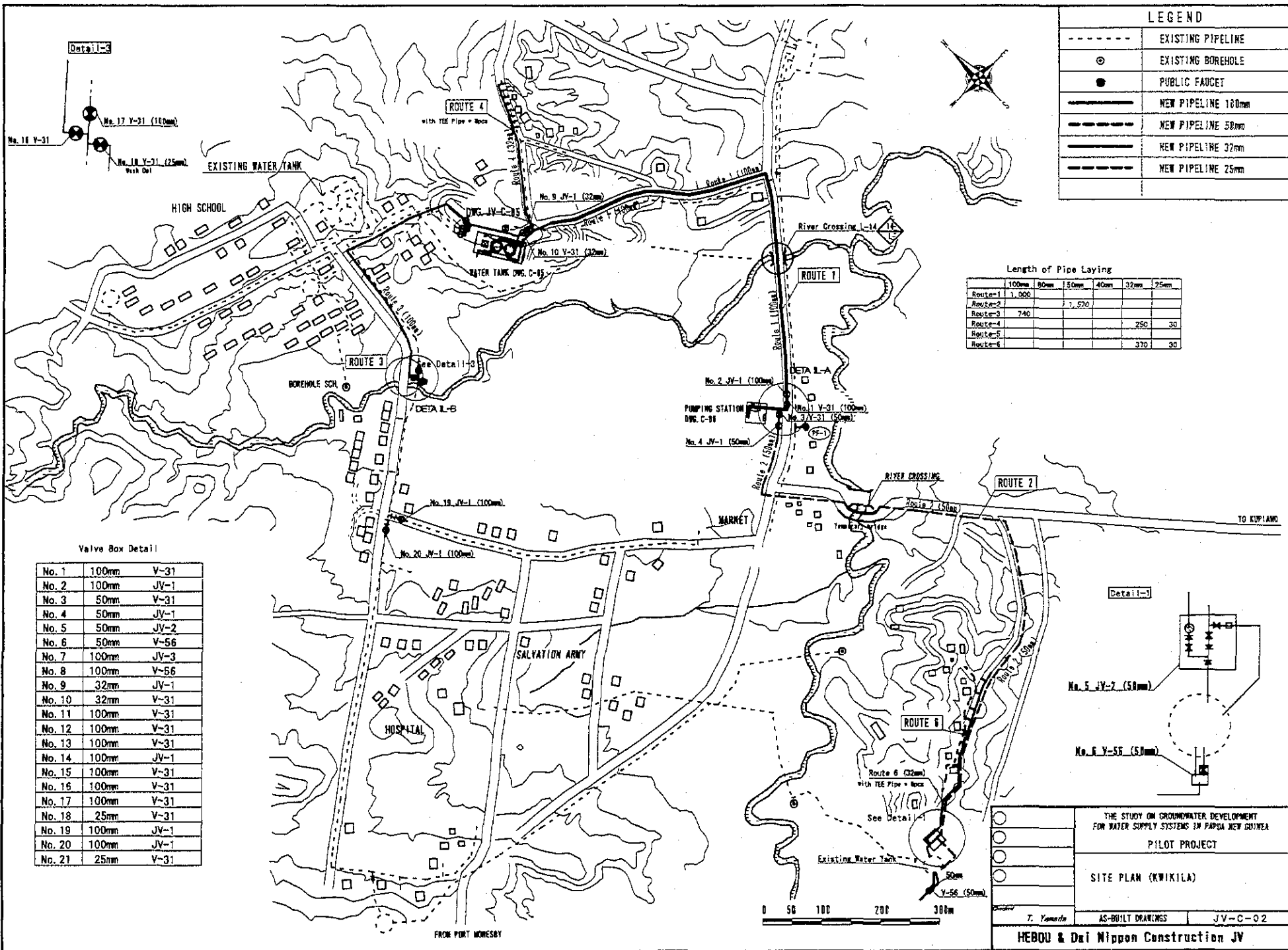
	PIPELINE
	DRAIN PIPELINE
	FENCE
	CONCRETE SLAB
	SOLAR PANEL
	GATE VALVE
	WATER METER
	PRESSURE GAUGE

NOTE

THE STUDY ON GROUNDWATER DEVELOPMENT FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA
 PILOT PROJECT
 LAYOUT PLAN FOR BEREINA

Drawn: T. Yamada AS BUILT DRAWINGS JV-B-05

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LEGEND

---	EXISTING PIPELINE
○	EXISTING BOREHOLE
●	PUBLIC FAUCET
—	NEW PIPELINE 100mm
- - -	NEW PIPELINE 50mm
—	NEW PIPELINE 32mm
- - -	NEW PIPELINE 25mm

Length of Pipe Laying

	100mm	80mm	50mm	40mm	32mm	25mm
Route-1	1,000					
Route-2			1,570			
Route-3	740					
Route-4					250	30
Route-5						
Route-6					370	30

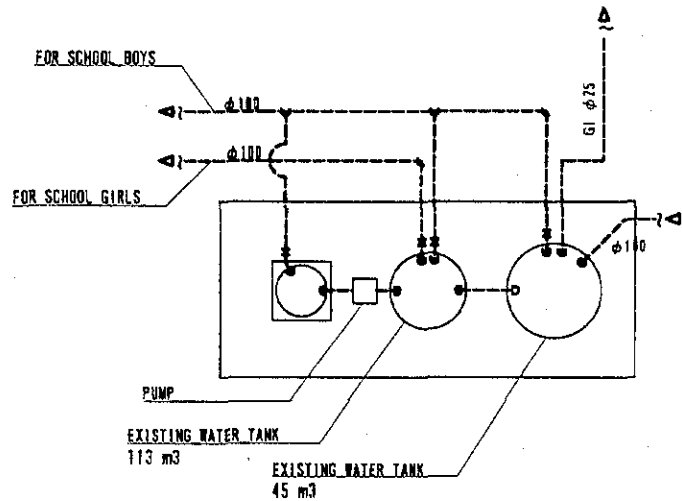
Valve Box Detail

No.	Diameter	Type
No. 1	100mm	V-31
No. 2	100mm	JV-1
No. 3	50mm	V-31
No. 4	50mm	JV-1
No. 5	50mm	JV-2
No. 6	50mm	V-56
No. 7	100mm	JV-3
No. 8	100mm	V-56
No. 9	32mm	JV-1
No. 10	32mm	V-31
No. 11	100mm	V-31
No. 12	100mm	V-31
No. 13	100mm	V-31
No. 14	100mm	JV-1
No. 15	100mm	V-31
No. 16	100mm	V-31
No. 17	100mm	V-31
No. 18	25mm	V-31
No. 19	100mm	JV-1
No. 20	100mm	JV-1
No. 21	25mm	V-31

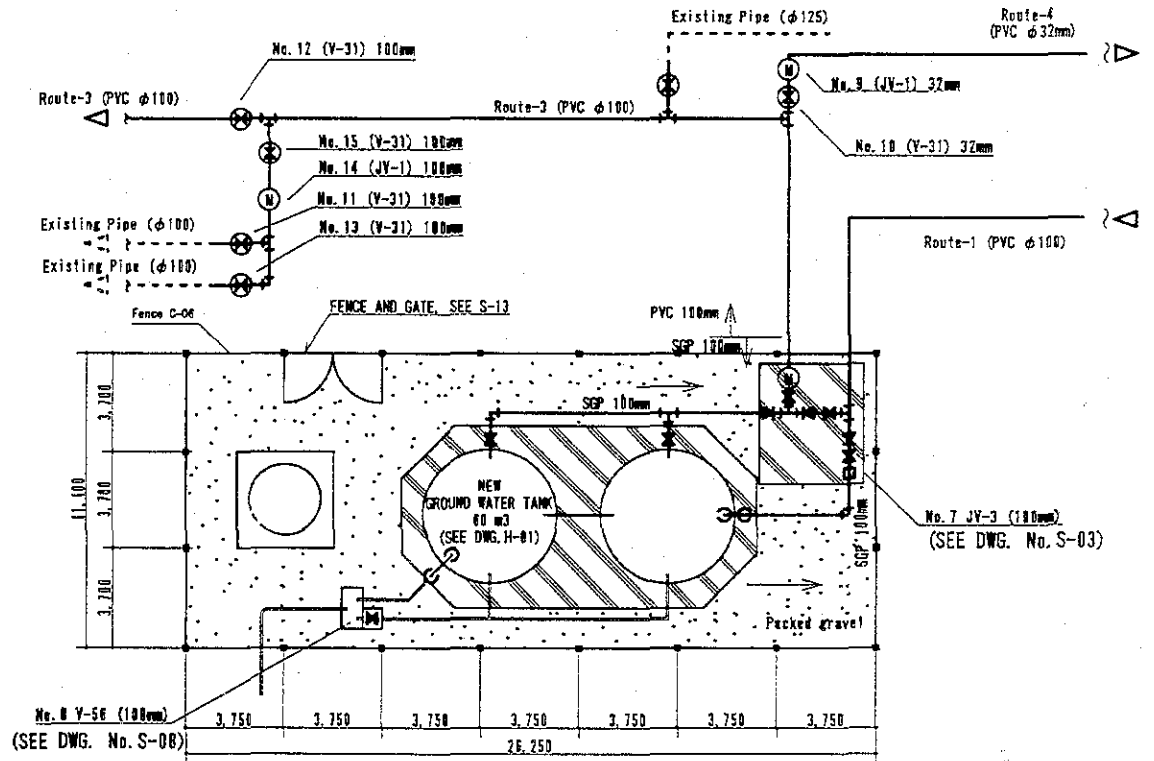
THE STUDY ON GROUNDWATER DEVELOPMENT
FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA
PILOT PROJECT
SITE PLAN (KWIKILA)

AS-BUILT DRAWINGS JV-C-02

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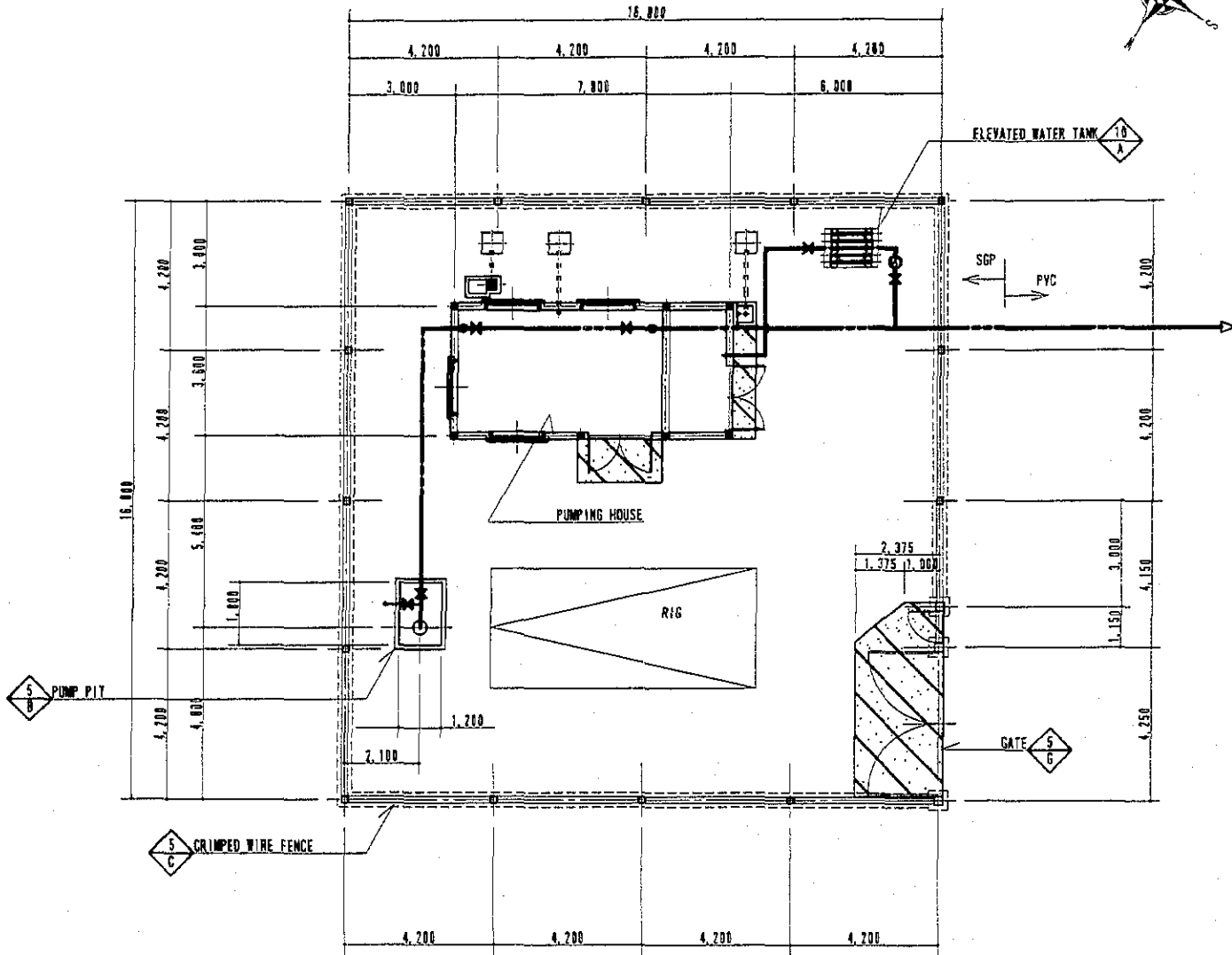
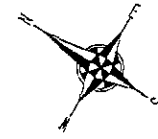
EXISTING PIPELINE



NEW PIPELINE

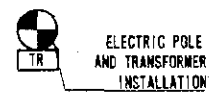
	EXISTING PIPELINE
	NEW PIPELINE
	DRAINAGE PIPELINE
	GRAVEL
	CONCRETE
	VALVE CASING
	FENCE

 	THE STUDY ON GROUNDWATER DEVELOPMENT FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA	
	PILOT PROJECT	
PIPE CONNECTION (KWIKILA)		
Drawn	T. Yamada	AS BUILT DRAWINGS
		JV-C-05
HEBOU & Dai Nippon Construction JV		



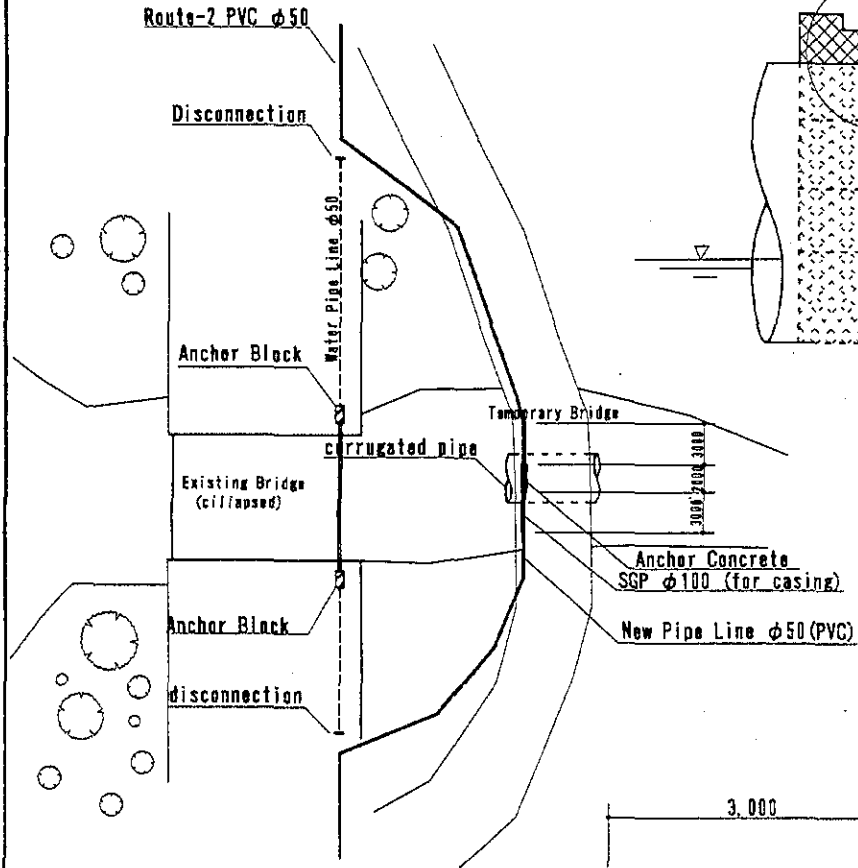
LEGEND	
	PIPELINE
	DRAIN PIPELINE
	FENCE
	CONCRETE SLUB
	SOLAR PANEL
	GATE VALVE
	WATER METER
	PRESSURE GAUGE

NOTE

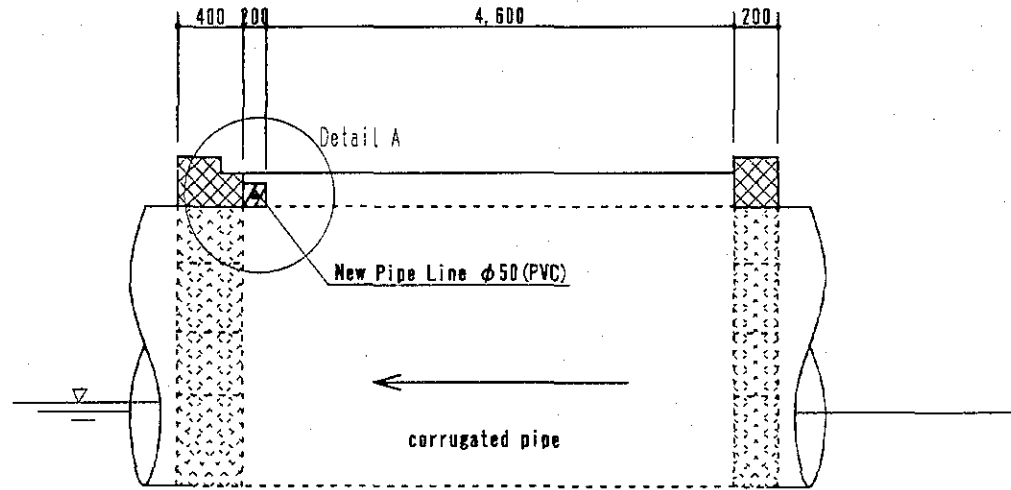


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	PILOT PROJECT	
	LAYOUT PLAN FOR KWIKILA	
Checked Y. Yasuda	AS BUILT DRAWINGS	JV-C-06
HEBOU & Dai Nippon Construction JV		

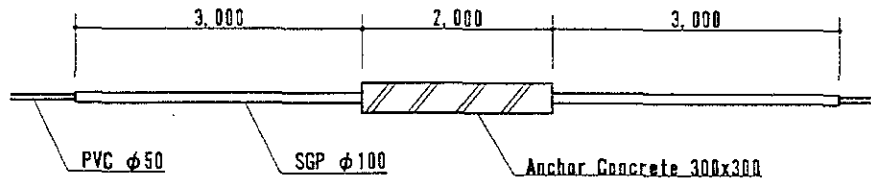
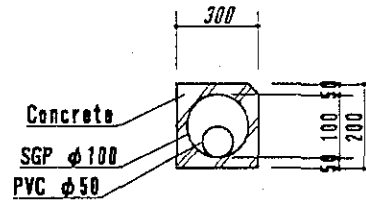
PLAN



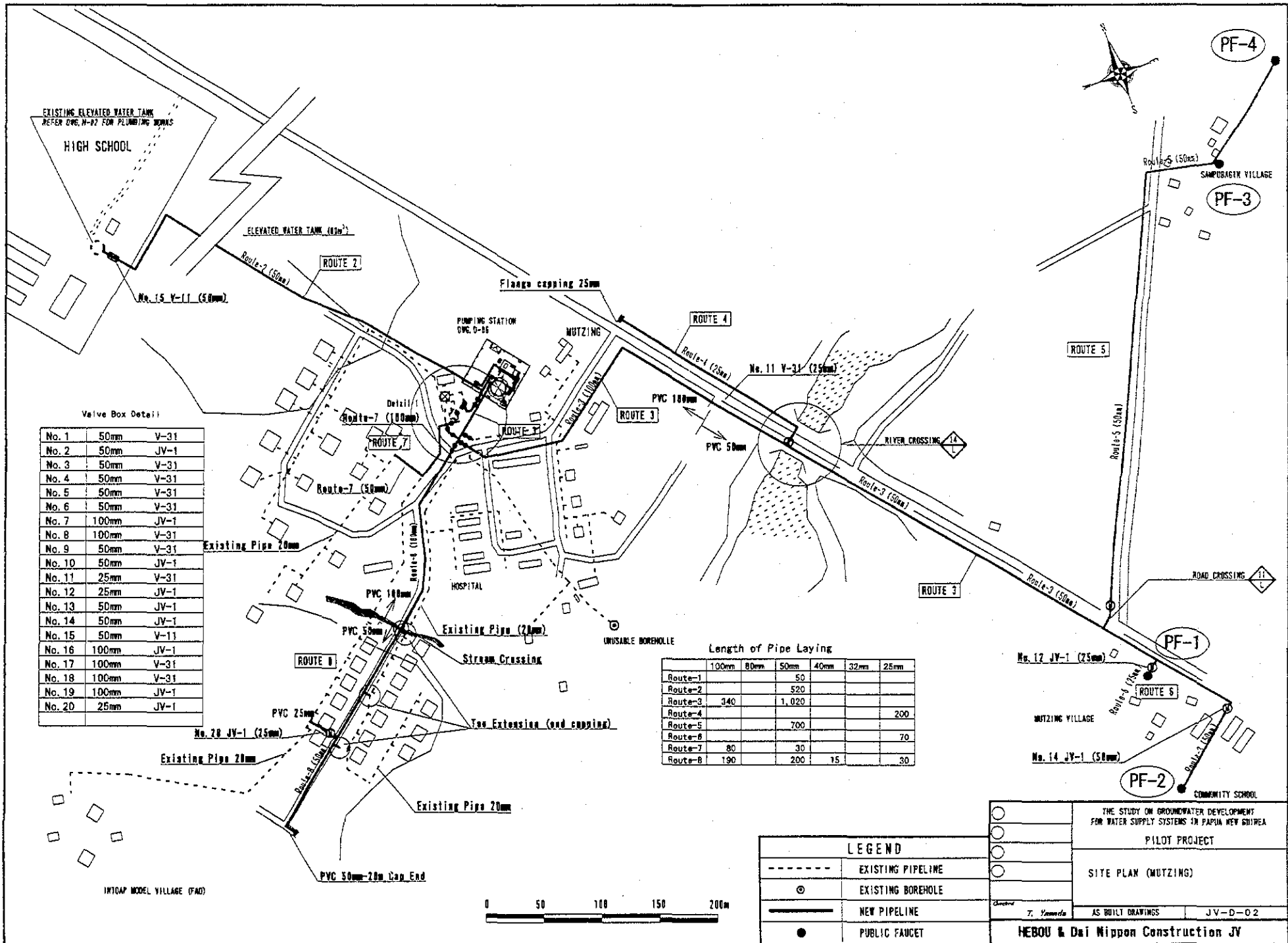
SECTION



DETAIL A



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	PILOT PROJECT	
	RIVER CROSSING (KWIKILA)	
Checked T. Yamada	AS-BUILT DRAWINGS	JV-C-07
HEBOU & Dai Nippon Construction JV		



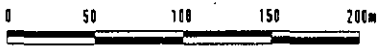
Valve Box Detail

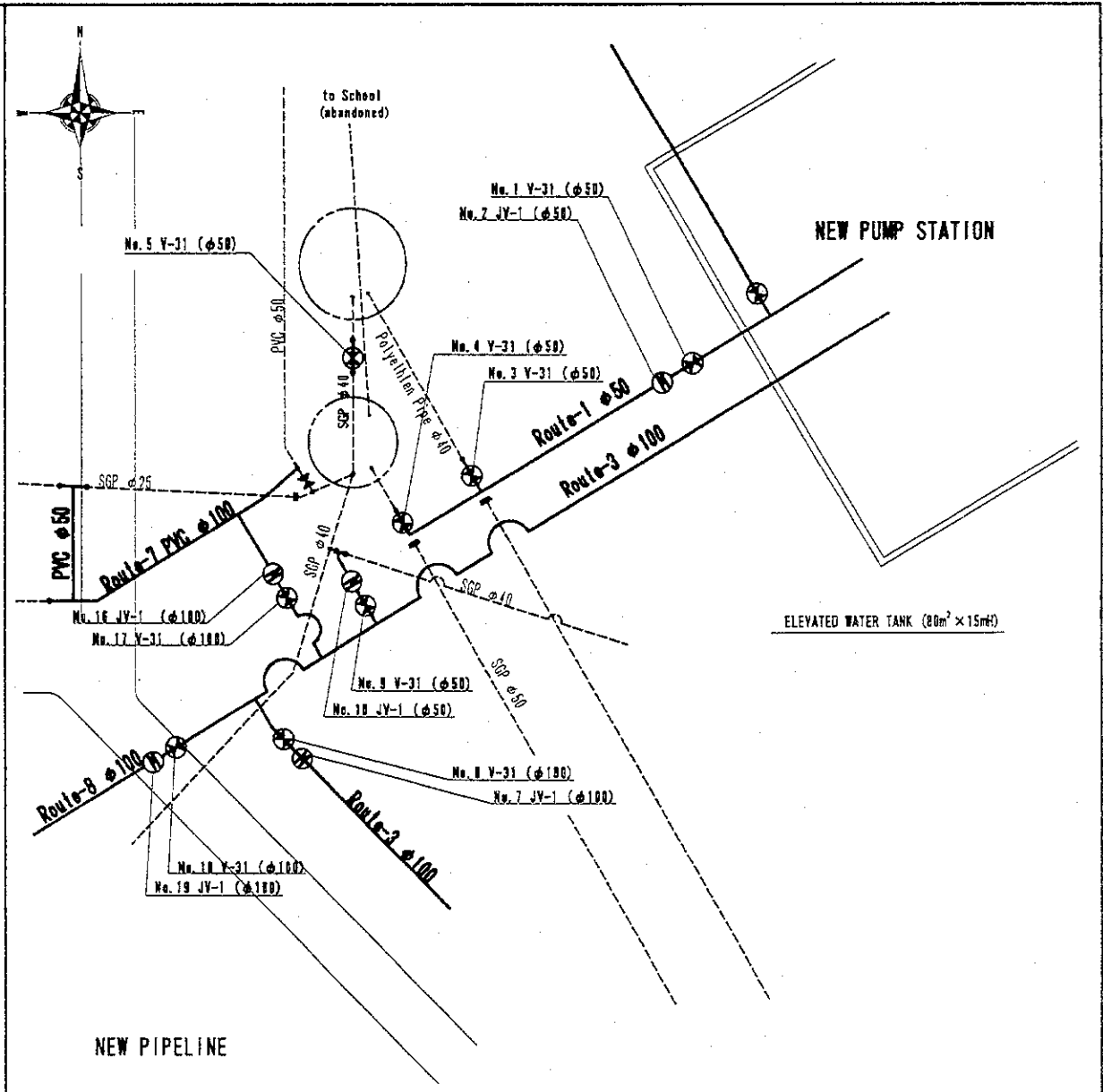
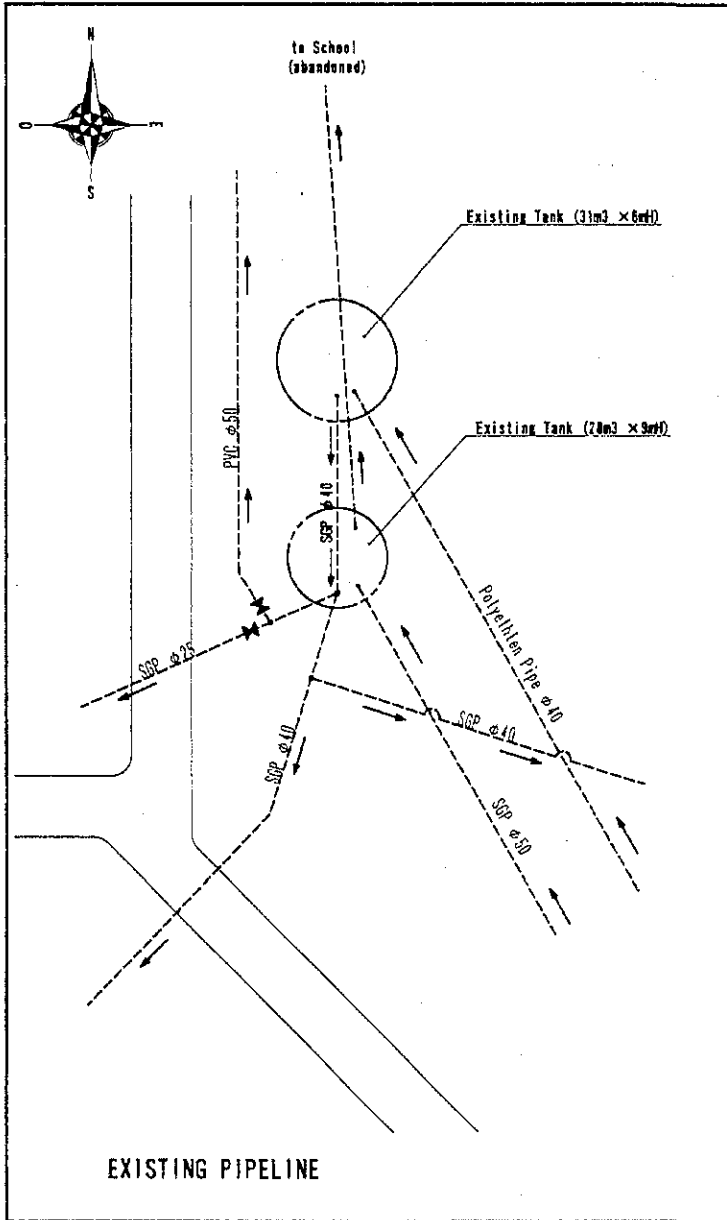
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No. 2	50mm	JV-1
No. 3	50mm	V-31
No. 4	50mm	V-31
No. 5	50mm	V-31
No. 6	50mm	V-31
No. 7	100mm	JV-1
No. 8	100mm	V-31
No. 9	50mm	V-31
No. 10	50mm	JV-1
No. 11	25mm	V-31
No. 12	25mm	JV-1
No. 13	50mm	JV-1
No. 14	50mm	JV-1
No. 15	50mm	V-11
No. 16	100mm	JV-1
No. 17	100mm	V-31
No. 18	100mm	V-31
No. 19	100mm	JV-1
No. 20	25mm	JV-1

Length of Pipe Laying

Route	100mm	80mm	50mm	40mm	32mm	25mm
Route-1			50			
Route-2			520			
Route-3	340		1,020			200
Route-4			700			
Route-5						70
Route-6						
Route-7	80		30			
Route-8	190	200	15			30

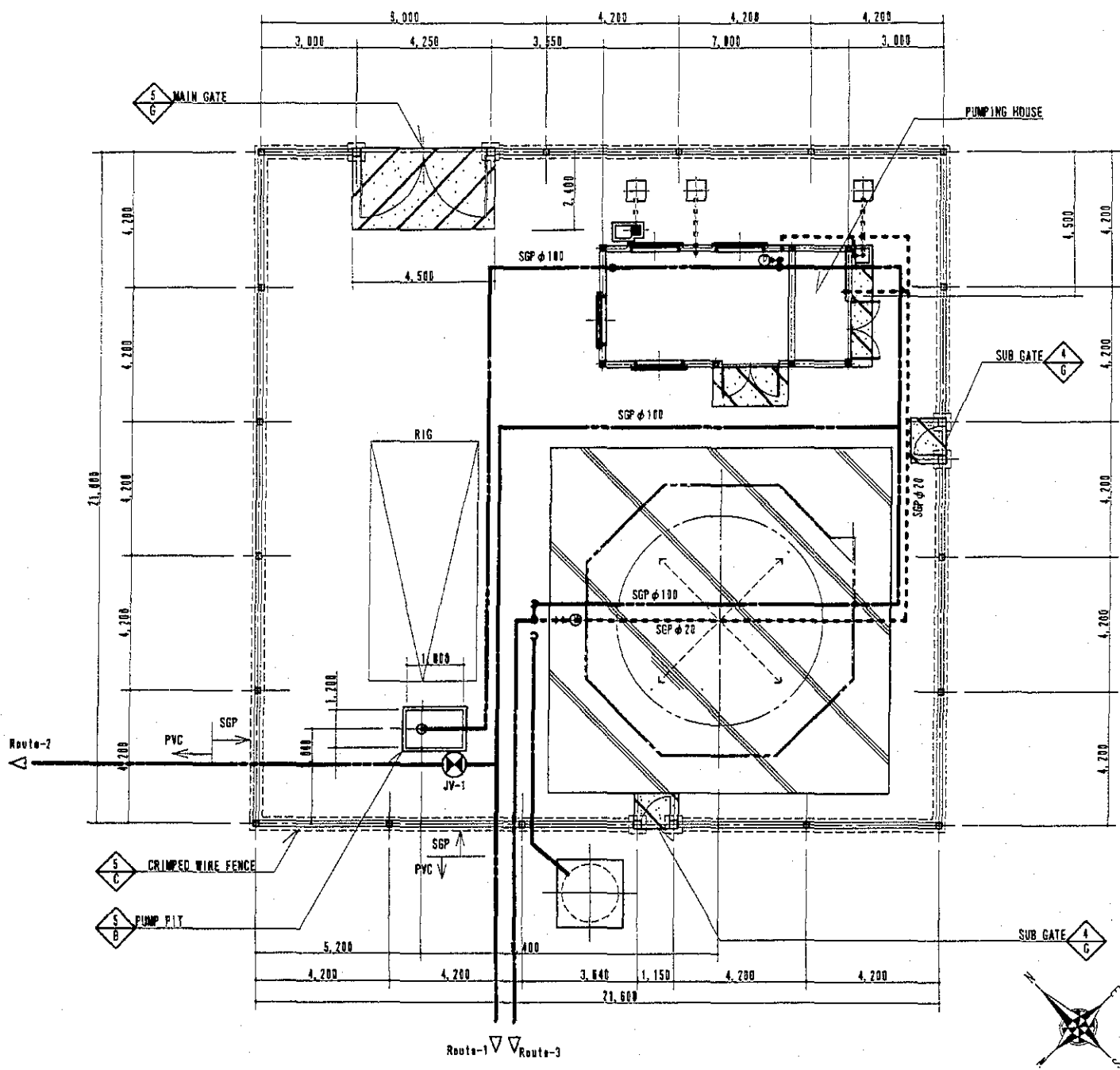
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	○	PILOT PROJECT
	○	SITE PLAN (MUTZING)
<p>7. Yonanda</p>		AS BUILT DRAWINGS
<p>HEBOU & Dai Nippon Construction JV</p>		JV-D-02





	PROJECT PIPELINE
	EXISTING PIPELINE
	GATE VALVE

	THE STUDY ON GROUNDWATER DEVELOPMENT FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA PILOT PROJECT PIPE CONNECTION OF MUTZING	
Director I. Yoneda	AS BUILT DRAWINGS	JV-D-04
HEBOU & Dai Nippon Construction JV		

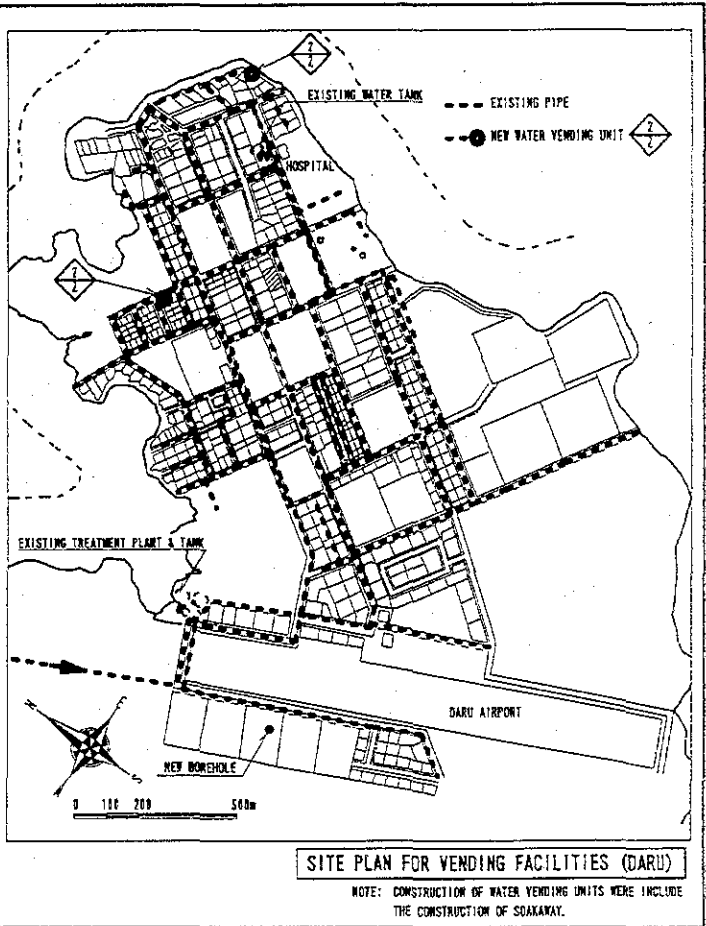
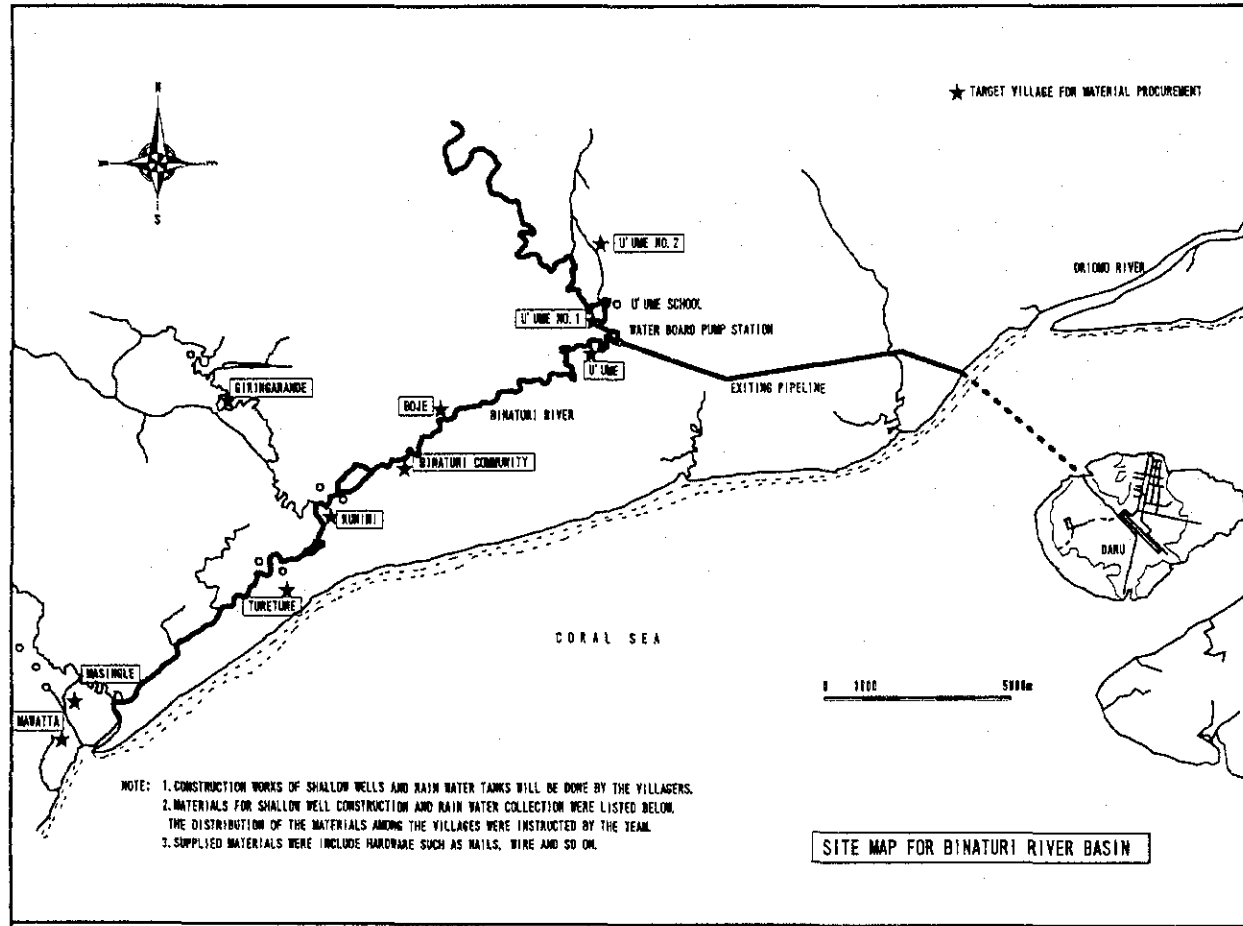


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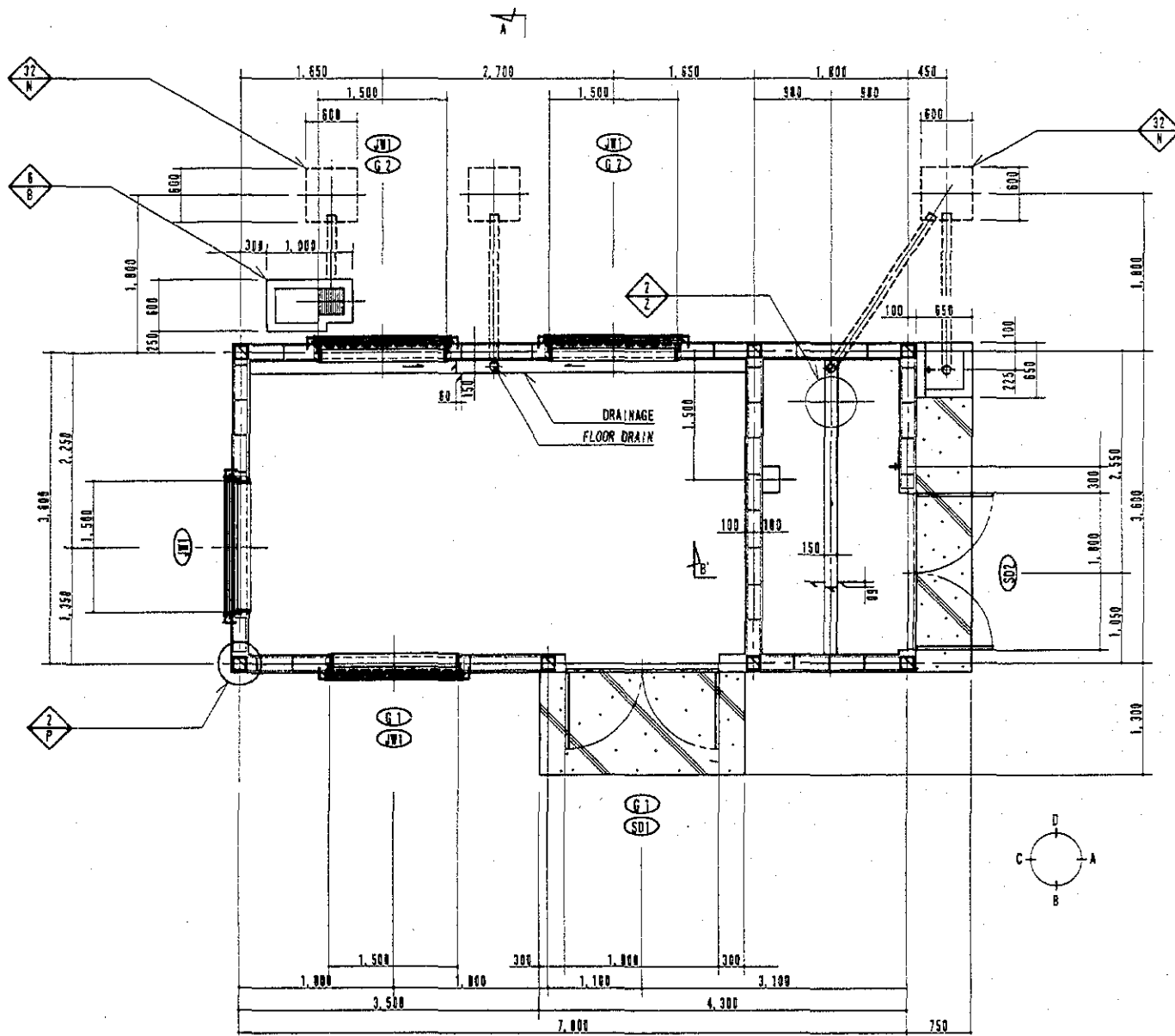
	PIPELINE
	DRAIN PIPELINE
	CONCRETE SLAB
	GATE VALVE
	WATER METER
	PRESSURE GAUGE

NOTE

	THE STUDY ON GROUNDWATER DEVELOPMENT FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA	
	PILOT PROJECT	
	LAYOUT PLAN FOR MUTZING	
Checked: <i>T. Yemochi</i>	AS BUILT DRAWINGS	JV-D-05
HEBOU & Dai Nippon Construction JV		



○	THE STUDY ON GROUNDWATER DEVELOPMENT FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA	
○	PILOT PROJECT	
○	SITE MAP FOR BINATURU RIVER BASIN	
○	SITE PLAN FOR WATER VENDING UNITS (DARU)	
○	Drawn F. Yasuda	JV-E-01
HEBOU & Dai Nippon Construction JV		



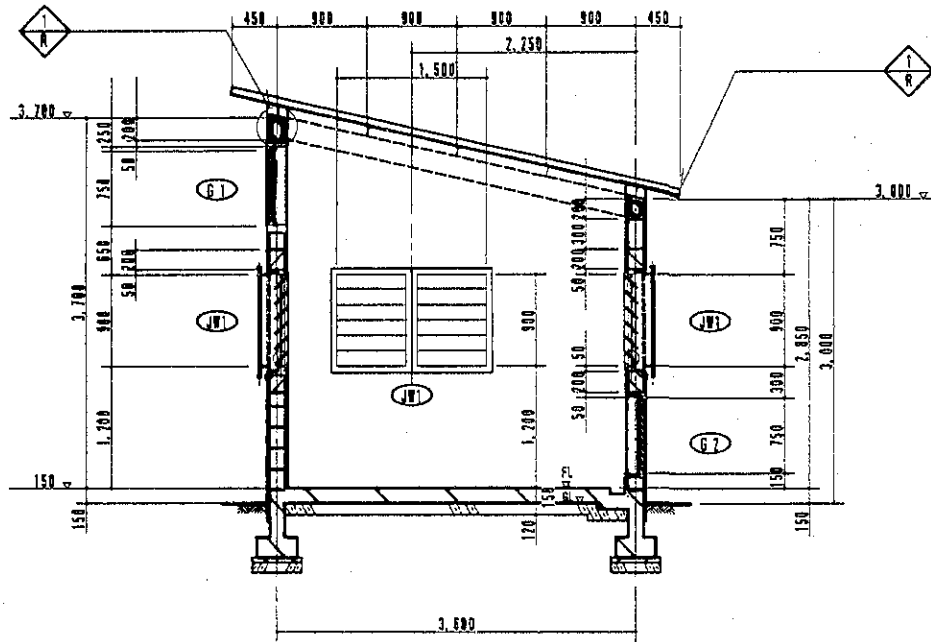
DOORS AND WINDOWS SCHEDULE

GLAZED DOOR	LATTICE DOOR
SD1	SD2
JALOUSIE	LOUVER
JW1	G1, G2

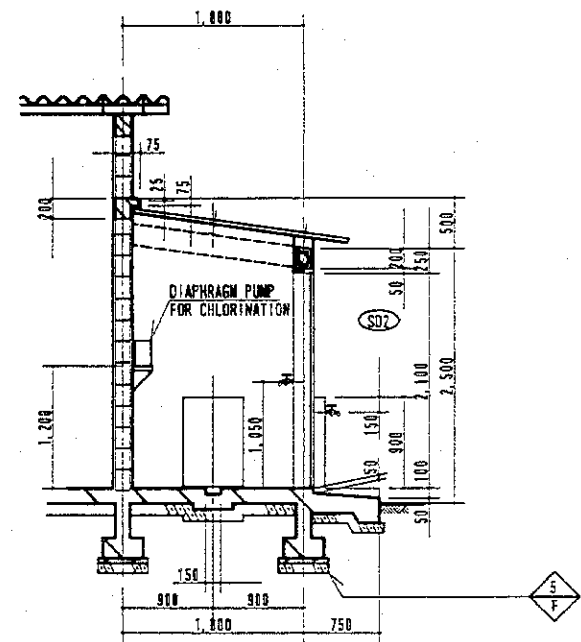
NOTE

THE STUDY ON GROUNDWATER DEVELOPMENT
FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA
PILOT PROJECT
PUMPING HOUSE (KWIKILA)
PLAN
T. Yamada AS BUILT DRAWINGS JV-F-01

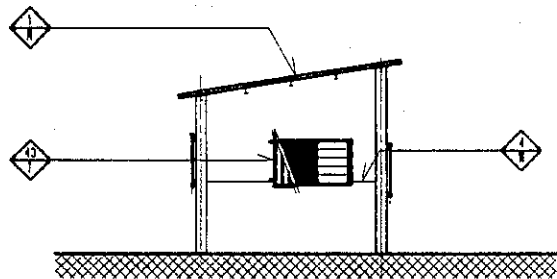
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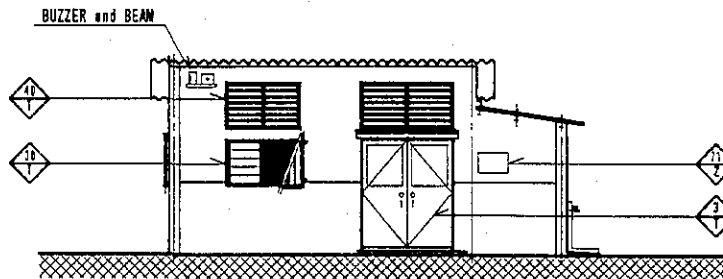
A-A' SECTION



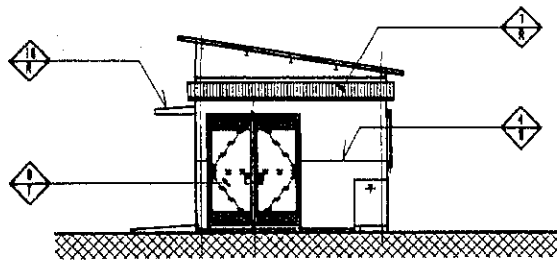
B-B' SECTION



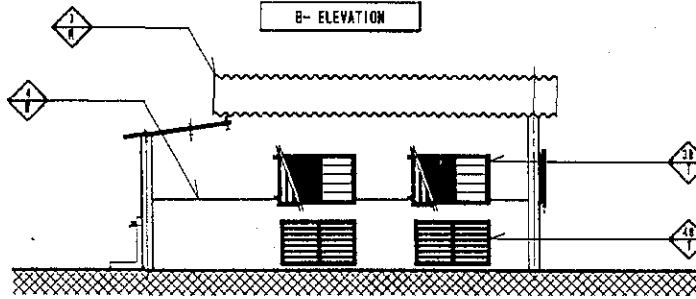
A- ELEVATION



B- ELEVATION

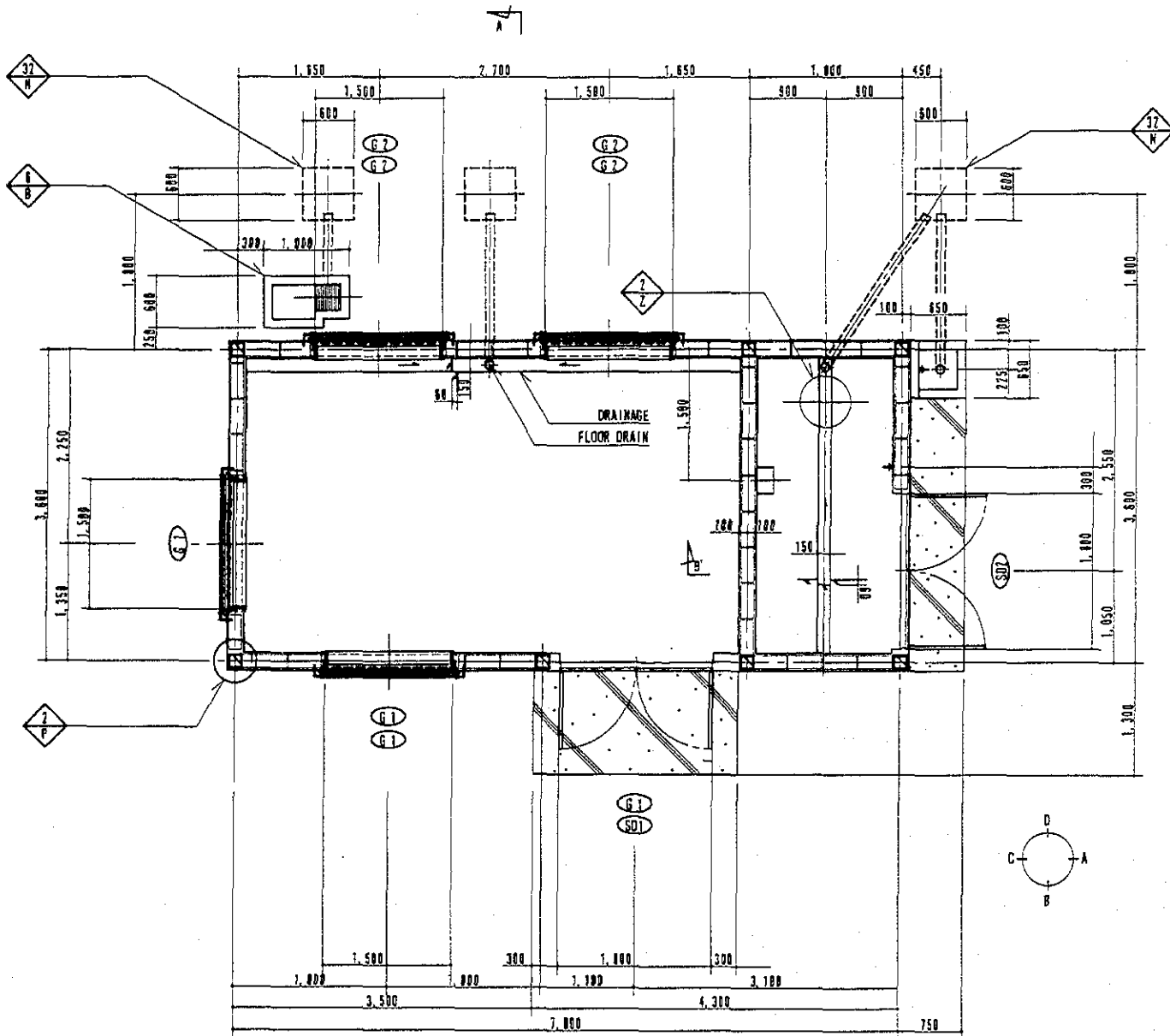


C- ELEVATION



D- ELEVATION

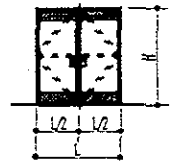
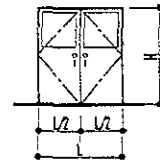
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	PILOT PROJECT	
	PUMPING HOUSE (KWIKILA)	
	SECTION, ELEVATION	
<i>T. Yamada</i>		AS BUILT DRAWINGS
HEBOU & Dai Nippon Construction JV		JV-F-02



DOORS AND WINDOWS SCHEDULE

GLAZED DOOR

LATTICE DOOR

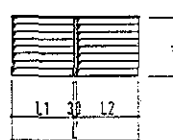
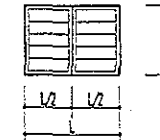


SD1

SD2

JALOUSIE

LOUVER



JW1

G1, G2

NOTE

-
-
-
-
-

THE STUDY ON GROUNDWATER DEVELOPMENT
FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA
PILOT PROJECT

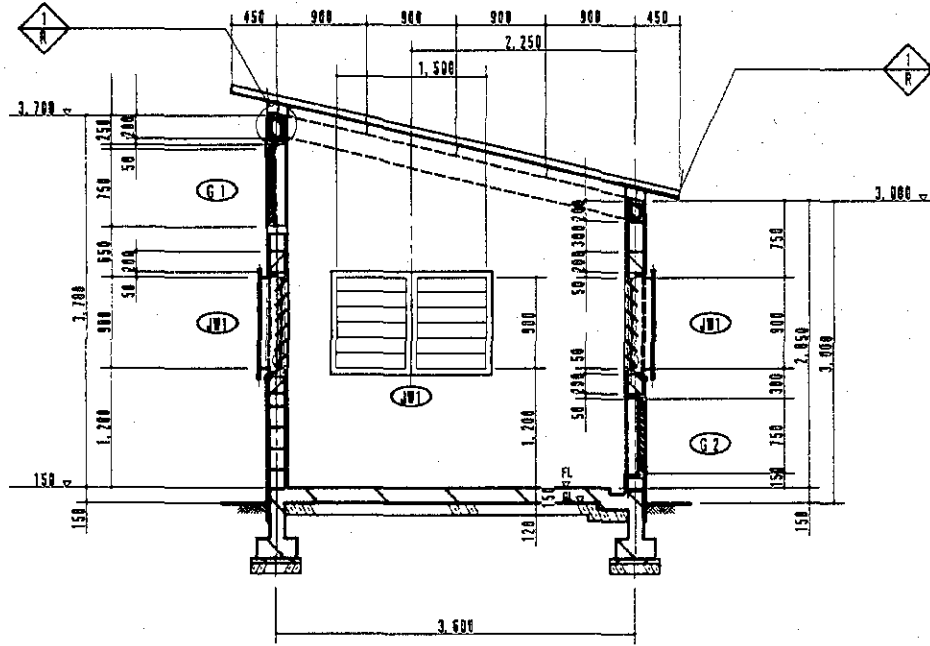
PUMPING HOUSE (MUTZING)
PLAN

T. Panada

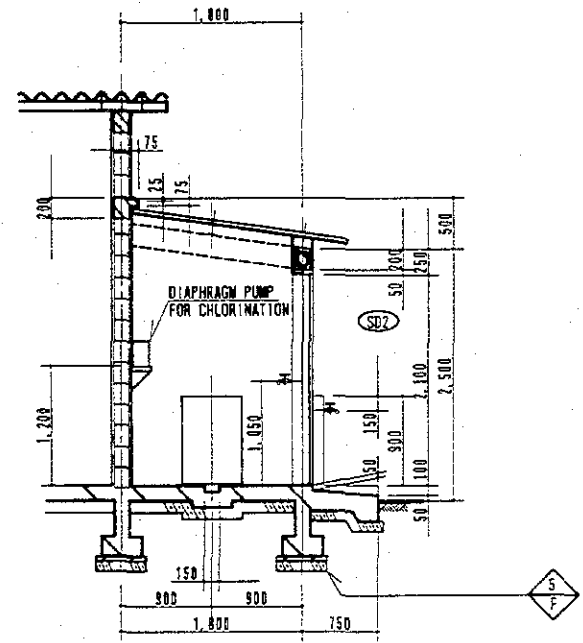
AS BUILT DRAWINGS

JV-F-03

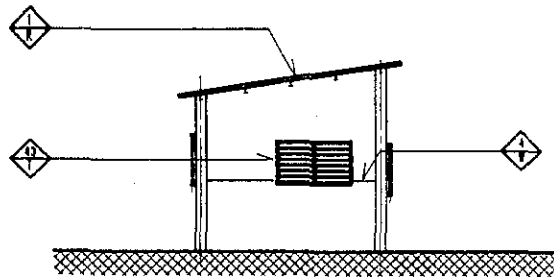
HEBOU & Dai Nippon Construction JV



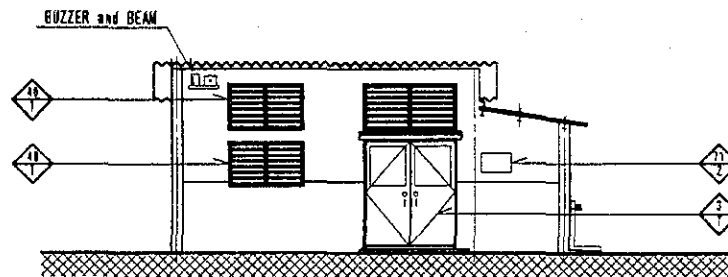
A-A' SECTION



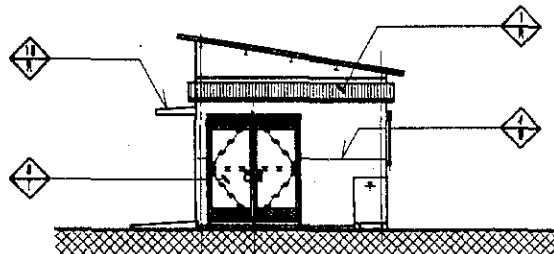
B-B' SECTION



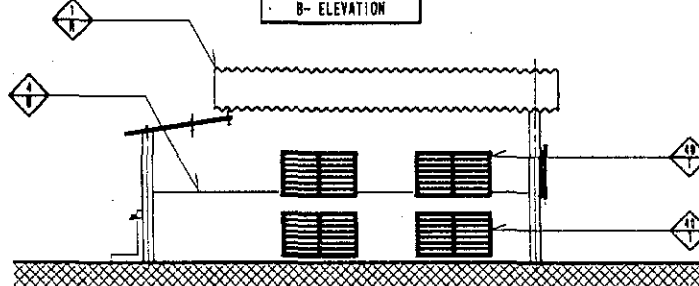
A- ELEVATION



B- ELEVATION

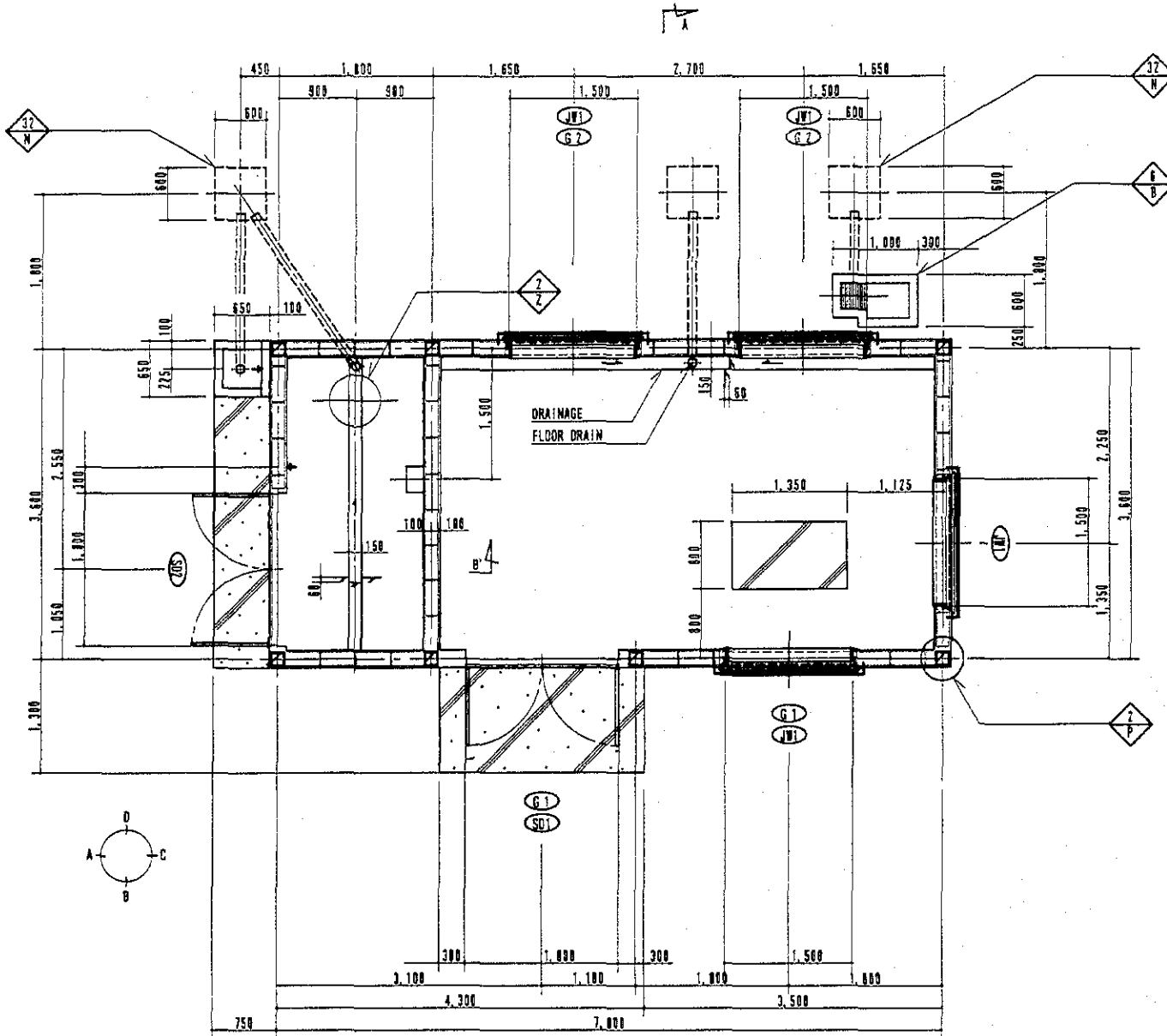


C- ELEVATION



D- ELEVATION

○	THE STUDY ON GROUNDWATER DEVELOPMENT FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA	
○	PILOT PROJECT	
○	PUMPING HOUSE (MUTZING)	
○	SECTION, ELEVATION	
○	Drawn T. Yamada	AS BUILT DRAWINGS
○		JV-F-04
HEBOU & Dai Nippon Construction JV		



DOORS AND WINDOWS SCHEDULE

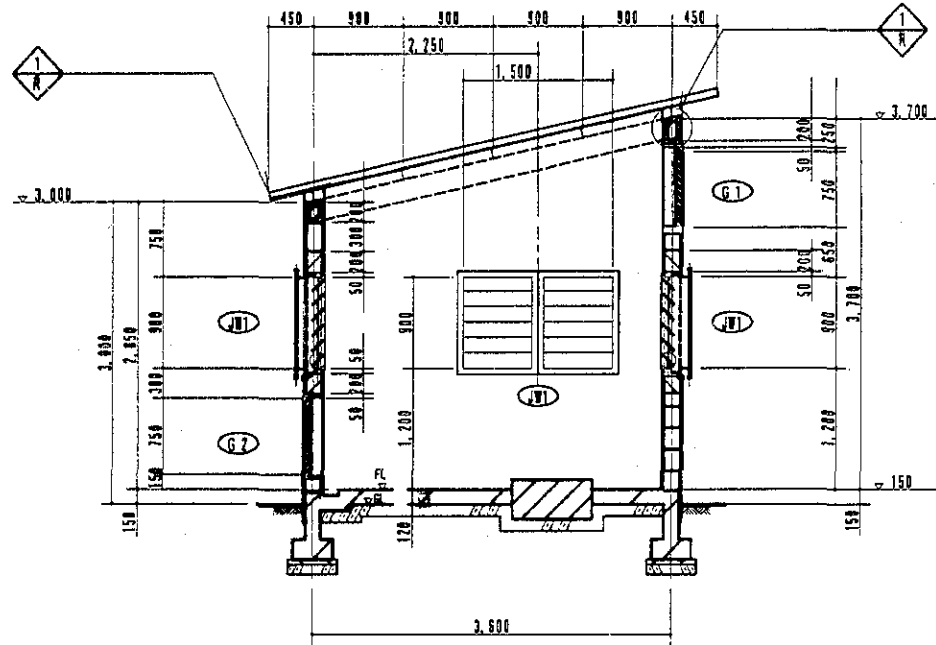
GLAZED DOOR	LATTICE DOOR
SD1	SDZ
JALOUSIE	LOUVER
JW1	G1, G2

NOTE

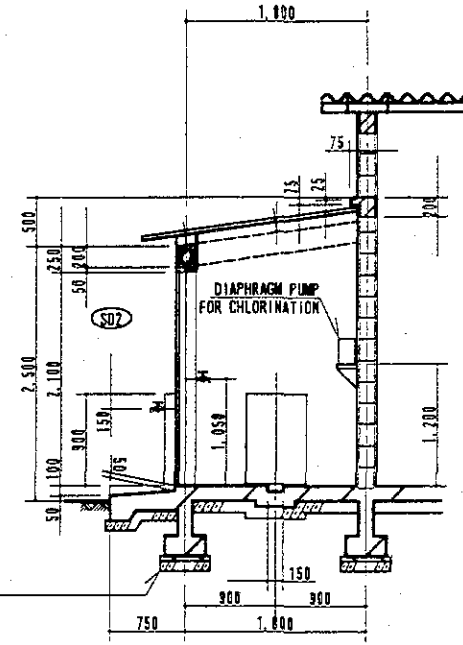
THE STUDY ON GROUNDWATER DEVELOPMENT
FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA
PILOT PROJECT
PUMPING HOUSE (BEREINA)
PLAN

T. Yamada AS BUILT DRAWINGS JV-G-01

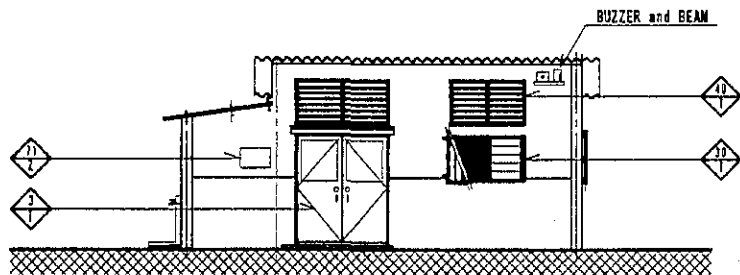
HEBOU & Dai Nippon Construction JV



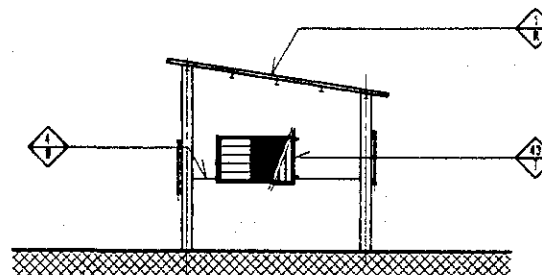
A-A' SECTION



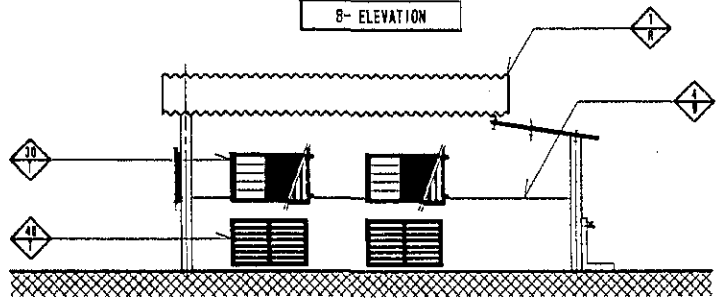
B-B' SECTION



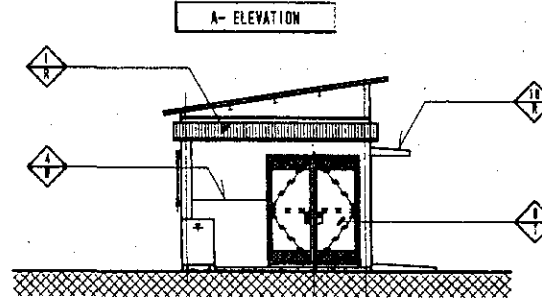
B- ELEVATION



A- ELEVATION

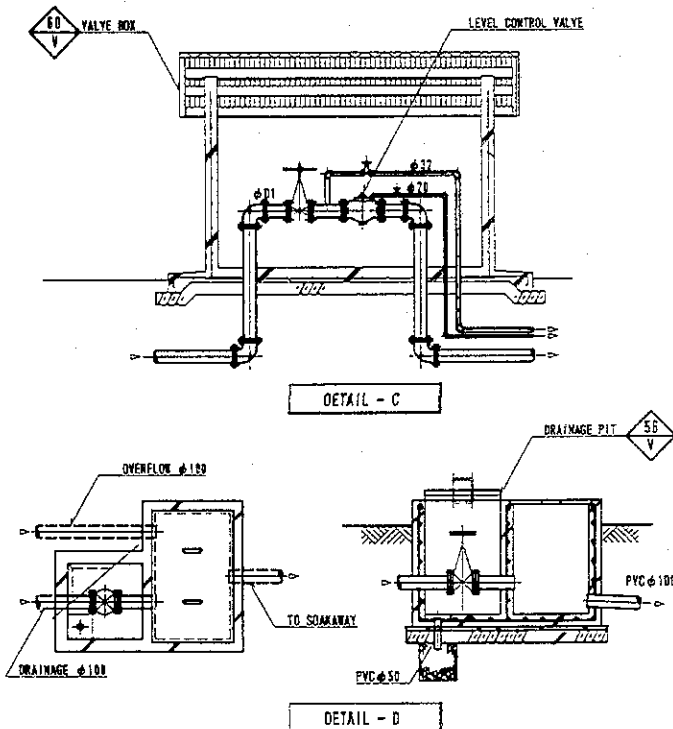
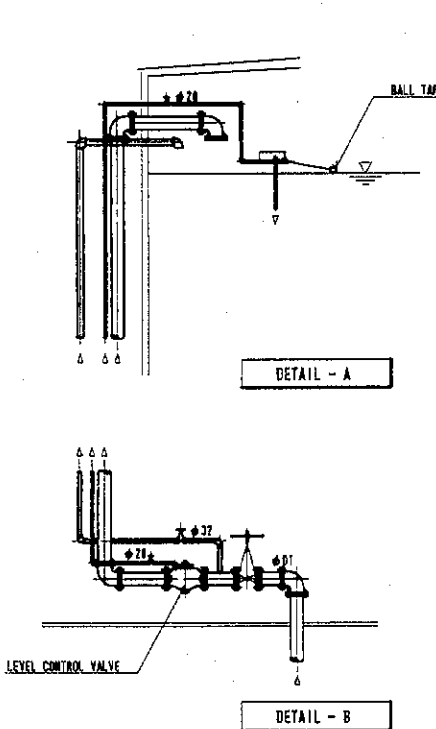
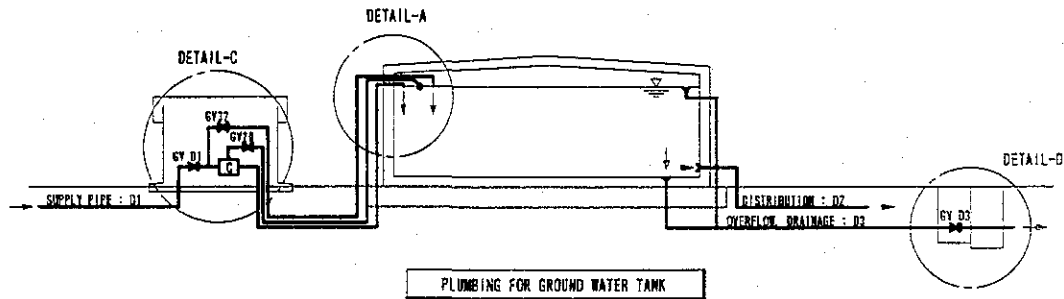
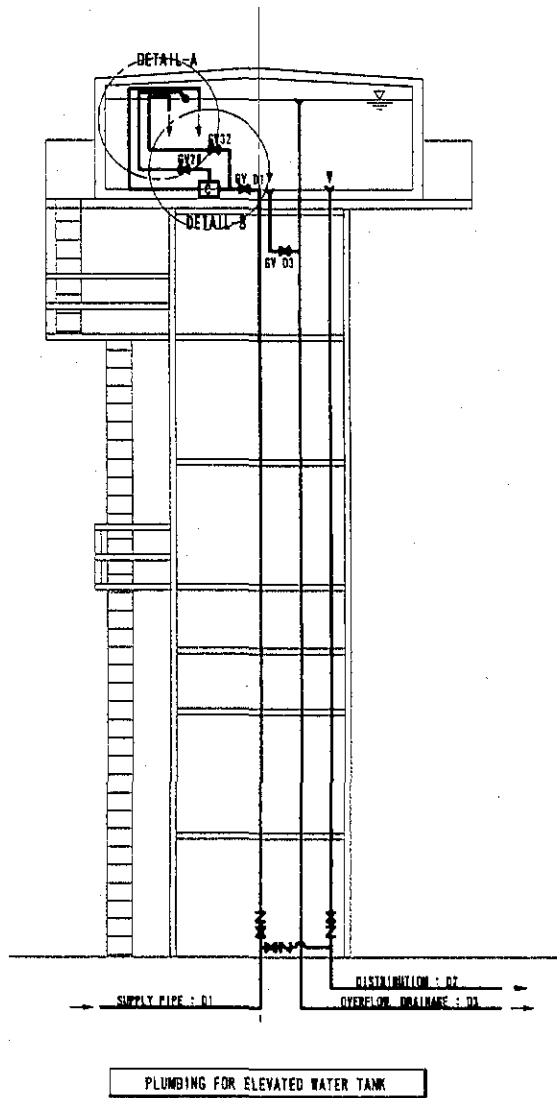


D- ELEVATION



C- ELEVATION

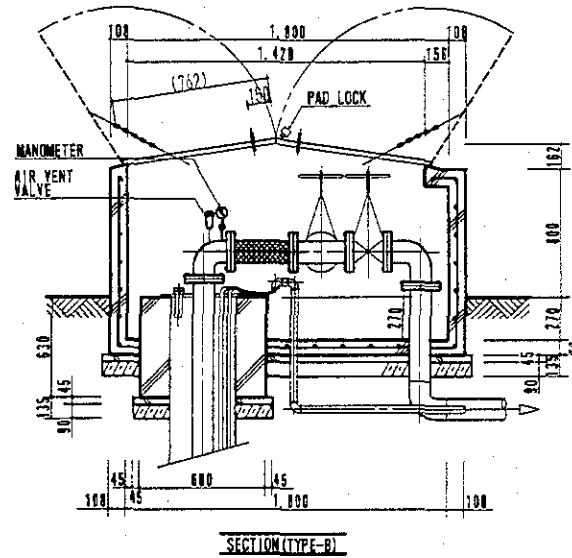
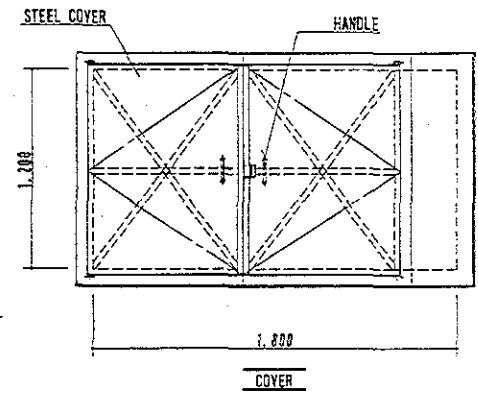
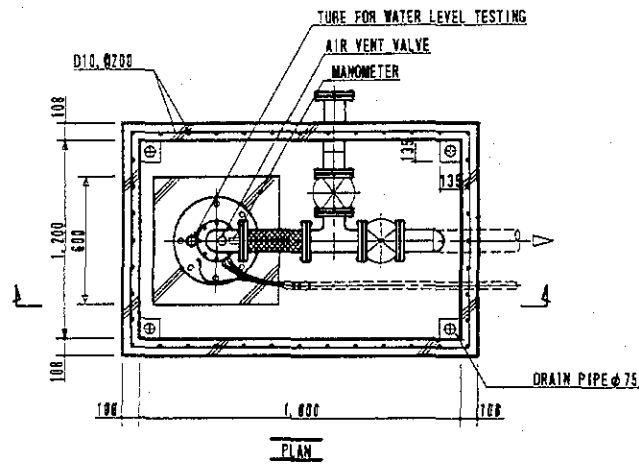
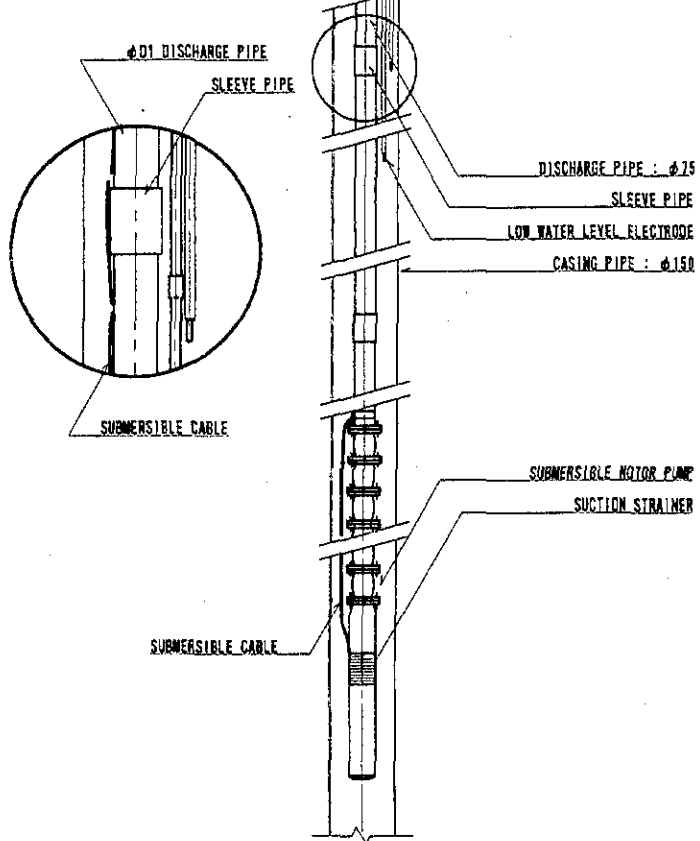
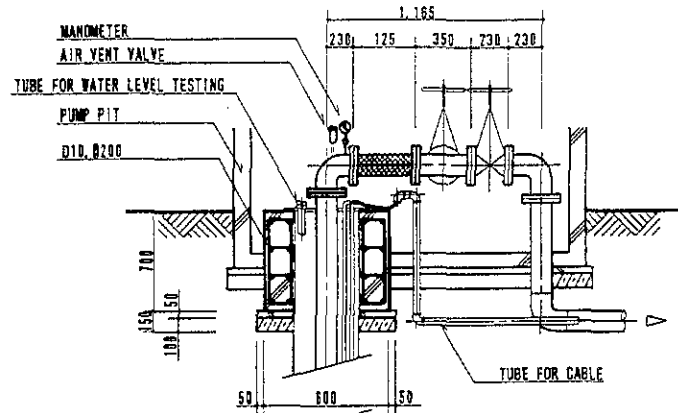
THE STUDY ON GROUNDWATER DEVELOPMENT FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA	
PILOT PROJECT	
PUMPING HOUSE (BEREINA)	
SECTION, ELEVATION	
T. Pando	AS BUILT DRAWINGS
JV-G-02	
HEBOU & Dai Nippon Construction JV	



TYPE OF WATER TANK	SITE NAME	TANK VOLUME (m ³)	D1	D2	D3
ELEVATED WATER TANK	BEREINA	80	φ100	φ100	φ100
ELEVATED WATER TANK	MUTZING	80	φ100	φ100	φ100
GROUND WATER TANK	KWIKILA	50 × 2	φ100	φ100	φ100

NOTE:

○	THE STUDY ON GROUNDWATER DEVELOPMENT FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA
○	PILOT PROJECT
○	WATER TANK
○	DETAILS OF PLUMBING WORKS
○	AS BUILT DRAWINGS
○	JV-H-02
HEBOU & Dai Nippon Construction JV	



INSTALLATION OF SUBMERSIBLE MOTOR PUMP

NOTE 1:
2:
3:

B-1



PUMP PIT

Checked T. Yamada

AS BUILT DRAWINGS

NOTE 1:
2:
3:

B-5



HEBOU & Dai Nippon Construction JV

JV-S-01

JAPAN INTERNATIONAL COOPERATION AGENCY
THE PAPUA NEW GUINEA WATERBOARD

THE STUDY ON GROUNDWATER DEVELOPMENT
FOR WATER SUPPLY SYSTEMS
IN PAPUA NEW GUINEA

OPERATION & MAINTENANCE MANUAL
FOR
WATER SUPPLY SYSTEM

— BEREINA —

July 2001

JAPAN TECHNO Co.,Ltd.
TOKYO JAPAN

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6. Management.....	8
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3) Drawing of Pump Station	
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1 . Introduction

This "Operation and Maintenance Manual for Water Supply System" describes for the Facility Operators how to operate and maintain water supply facilities continuously in Bereina.

The Facility Operator has several important roles with regard to the water supply service. The main tasks of the Facility Operator are as follows;

1. To operate the facilities properly.
2. To patrol and inspect the facilities daily and weekly.
3. To write the operation dairy, which consists of operation data, etc.
4. To report to the Regional Office, weekly and/or monthly.
5. To correspond with Regional Office in case of trouble.

The sustainability of the water supply facilities depends on the Facility Operator's tasks as listed above. Therefore it is expected that this manual be referred to by Facility Operators at all times.

THE STUDY ON GRANDWATER DEVEROPMENT
FOR WATER SUPPLY SYSTEMS
IN PAPUA NEW GUINEA

JAPAN INTERNATIONAL COOPERATION AGENCY
JICA STUDY TEAM
JAPAN TECHNO Co., Ltd.

2. Outline of the Water Supply System

The Water Supply System constructed in this pilot project is comprises of five facilities as follows.

(1)	Pump Station.....	1 Station
(2)	Rising Main Pipeline.....	1 System
(3)	Water Storage Tank.....	Elevated Tank 80 m ³
(4)	Distribution Pipeline.....	1 System
(5)	Public Faucet.....	9 Units

In addition to these new facilities mentioned above, there is an existing pipeline reticulation and water storage tanks in Bereina.

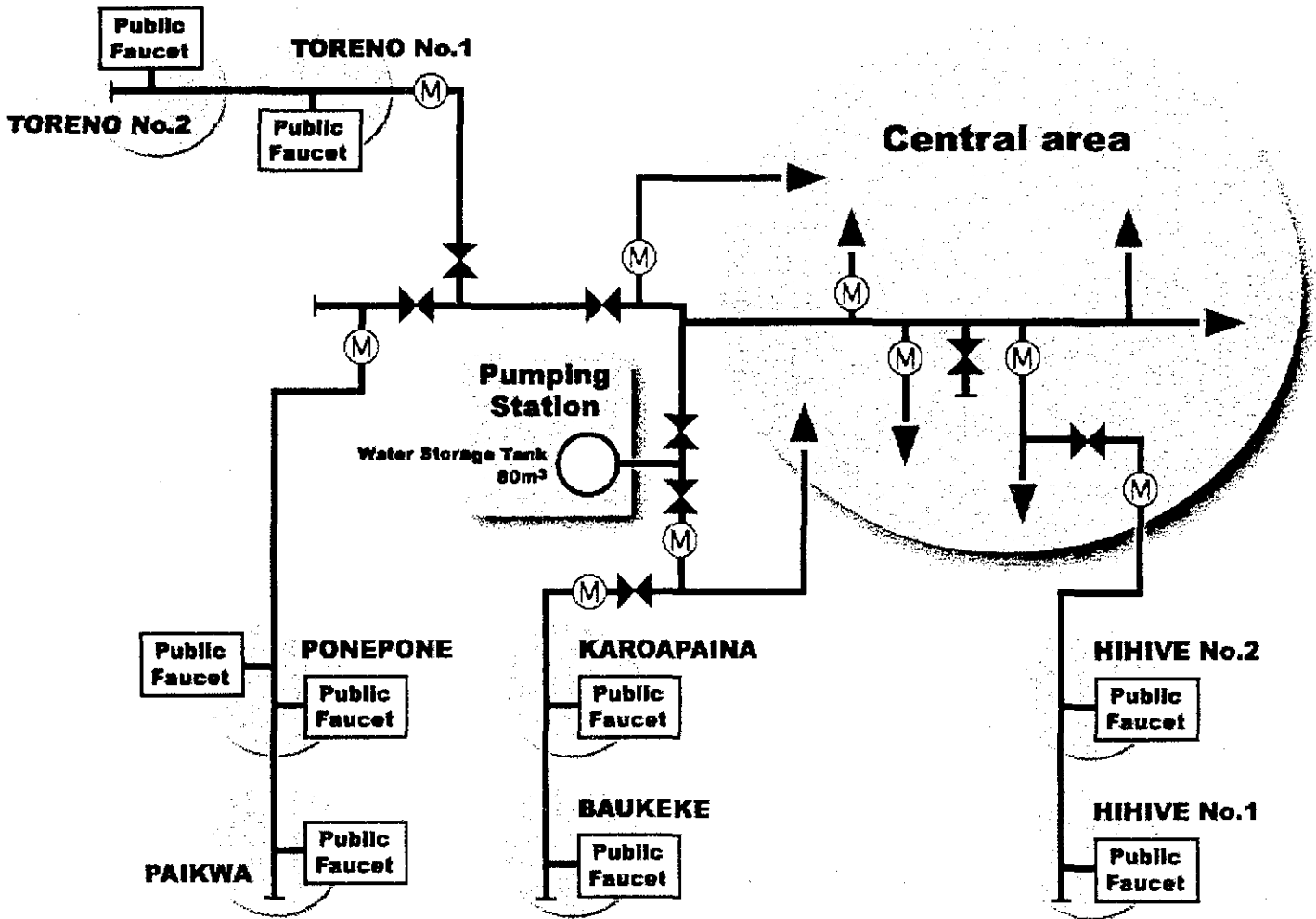
The pump station consists of four portions (Well facility, Pump house and Elevated Water Tank and Power souses which is Solar System and Generator). Water storage tank is located in water supply areas as follows.

3. Water Supply Area

There are water supply areas, one of (A)Central, another is (B)Eight villages. Both areas are supplied from new elevated water tank.

Water Supply Area		Water Storage Tank
Area-A	Central	Elevated Tank 80m ³
Area-B	Eight Villages	

A gate valve is located on a distribution pipeline for each water supply area. These gate valves will enable the control of distribution to these areas.



THE STUDY ON GRANDWATER DEVELOPMENT
FOR WATER SUPPLY SYSTEMS
IN PAPUA NEW GUINEA

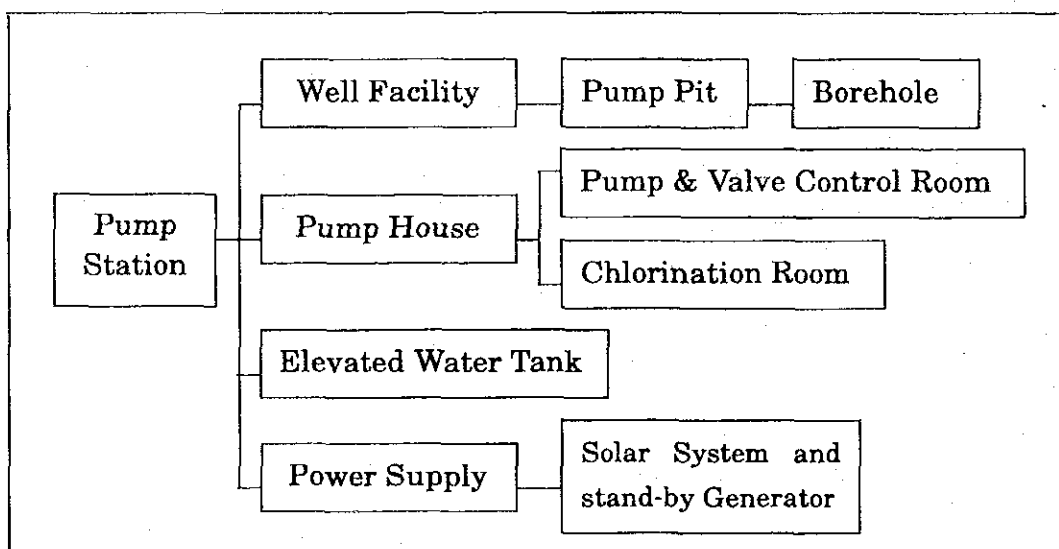
SITE : BERENA

Figure - 1

Water Supply Areas

4 . Pump Station

The pump station in Bereina consists of four portions (a) Well facility, (b) Pump house, (c) Elevated Water Tank, (d) Power supply as follows.



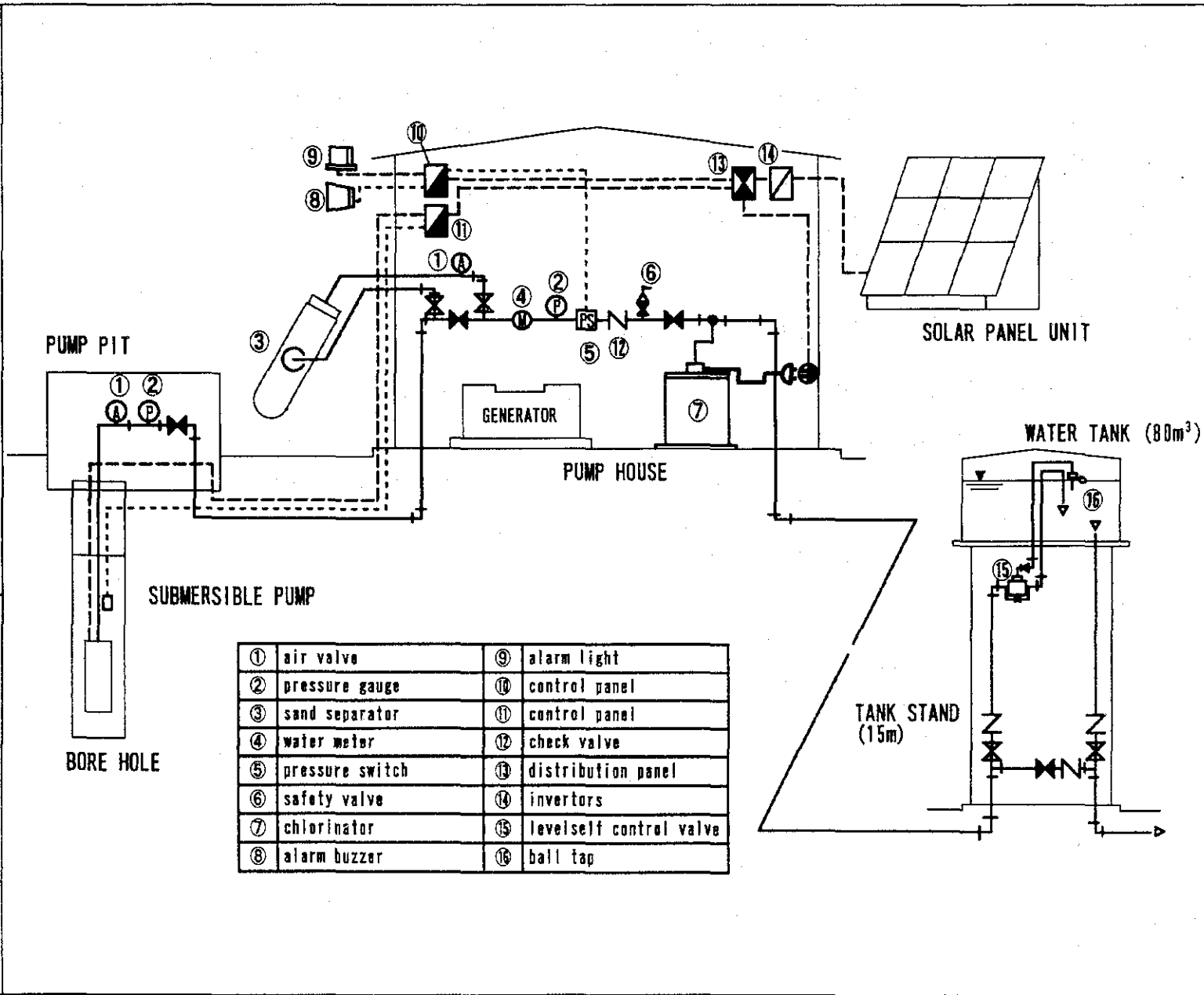
The Specification of Well Facility

Borehole	Dia. = 150 mm (inside 143 mm), Depth = 28m
Screen	Depth = 11.0~17.0 m & 23.0~26.0 m
Pump	Submersible Pump ; AC3 ϕ 240V, 300L/min \times 45m Riser Pipe ; GSP 3" (outside 89mm) Pump installation depth ; 20 m

5 . Pump House

The pump house separated into two rooms "Pump control room" and the "Chlorination room". The pump control panel has been installed in the pump control room. The gate valves, sand separator, safety valve, check valve and water meter have been installed along the pipe in this room.

The chlorination room is for the chlorinator. The pipeline from the borehole reaches this room through the pump control room. Solution chlorine injection will be done by the injection pump in this room before the water goes up to water storage tank.



THE STUDY ON GRANDWATER DEVELOPMENT
FOR WATER SUPPLY SYSTEMS
IN PAPUA NEW GUINEA

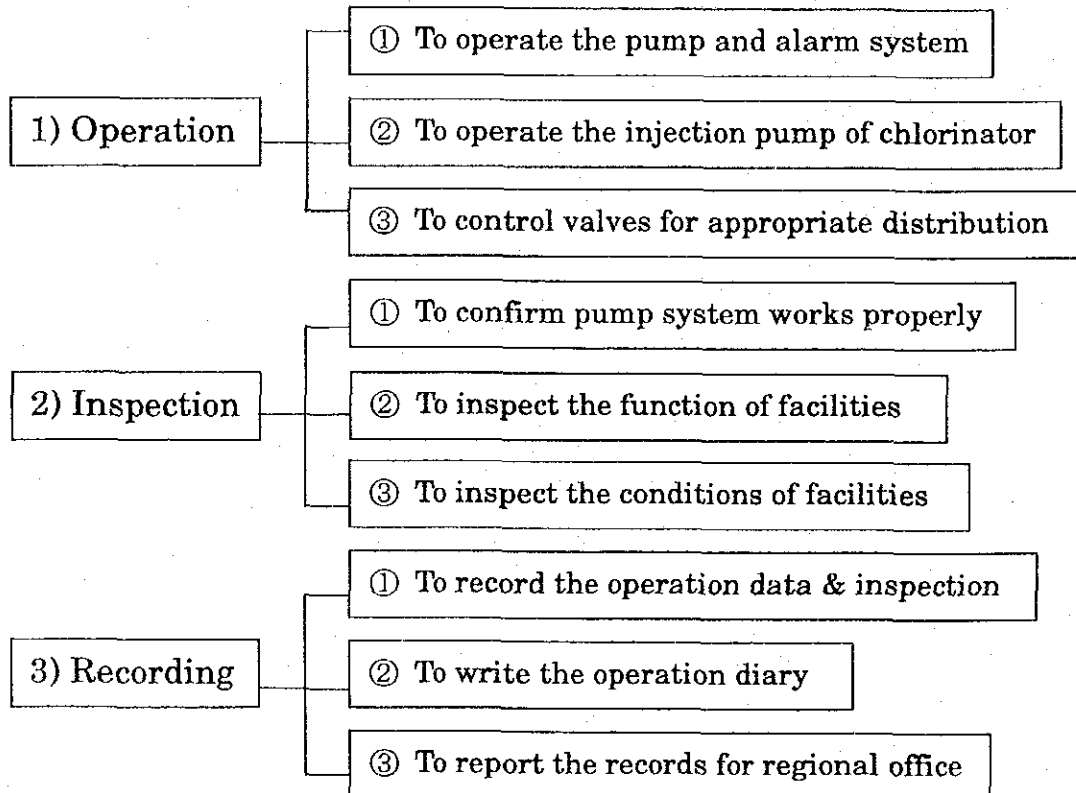
SITE : BERENA

Figure - 2

Flow Diagram

6. Management

The management role to be done by the Facility Operator is categorized into three categories and each one is divided into three items.

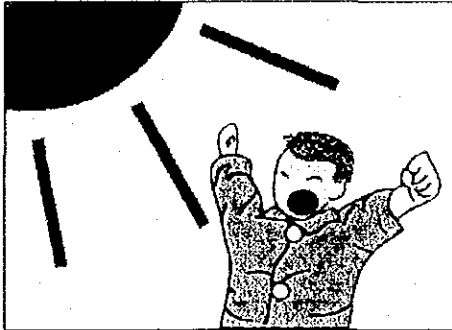


7. Daily Operation

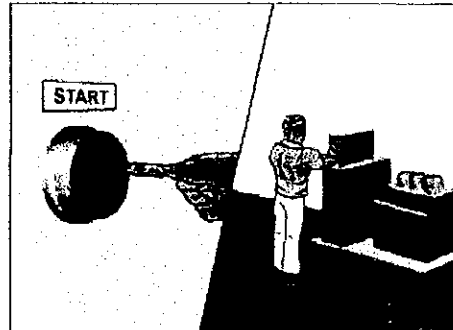
The Facility Operator's daily work begins by switching on the pump, and his work continues from morning to evening as follows;

1. Switch on the pump and alarm system
2. Check & confirm the system if it is working properly
3. Adjust the chlorinator and valves where necessary.
4. Write the operation dates on record.
5. Inspect the function and conditions of facilities.
6. Switch off the pump and alarm system
7. Write the operation diary.

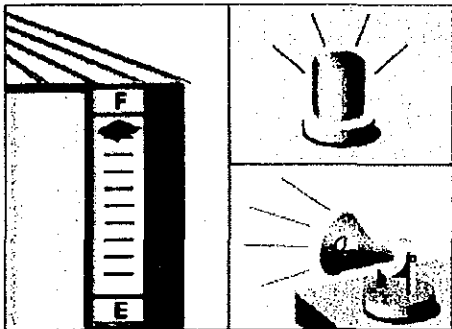
8. One Working day for the Facility Operator



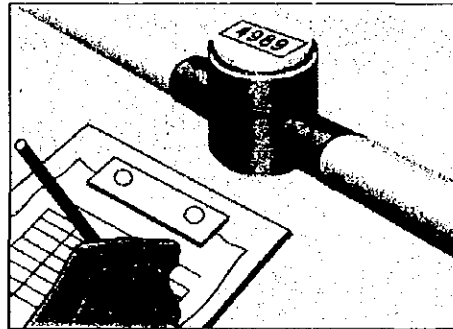
Good Morning !



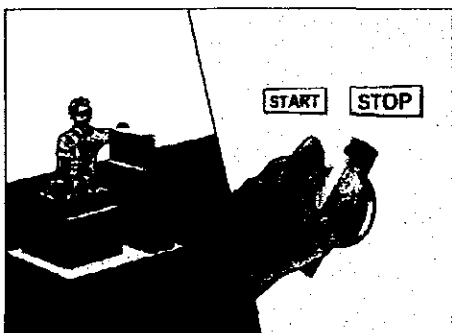
Switch on
the Pump & Alarm system



A full tank makes
the Alarm buzz and light blink



Inspects the facilities
& Records



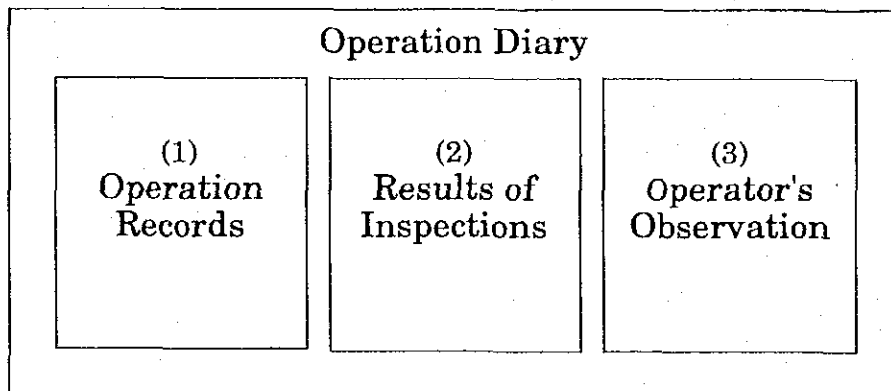
Switches off
the Pump & Alarm system



Good Night !

9. Operation Diary

The Facility Operator has an obligation to write the operation diary everyday. The operation diary includes operation records, result of inspections and the operator's observation.



The main items of operation records which operator has to pay attention are listed below. The operation record should be attached to monthly reports for the regional office.

1. Date / Operator's Name and Signature
2. Operation time
3. Water discharge and Pressure
4. Water flow in each water supply area
5. Information of trouble and/or accident if it happen

The form of the operation record will be instructed for facility operator by the regional office but there is an example, which is comprises of the recommendable items in the appendix of this Operation and Maintenance Manual.

OPERATION & MAINTENANCE MANUAL FOR WATER SUPPLY FACILITY

10. Check List Items

Daily inspection and confirmation will be done by the Facility Operator. The main check list items are listed below. Weekly and/or monthly inspection will be held based on this list also.

Date: / /	Time: _____	Name: _____	Signature: _____	Y	N
(1) Pump House	1-1	Is the pump operating correctly ?	<input type="checkbox"/>	<input type="checkbox"/>	
	1-2	Is the alarm system working correctly ?	<input type="checkbox"/>	<input type="checkbox"/>	
	1-3	Is the chlorinator working correctly ?	<input type="checkbox"/>	<input type="checkbox"/>	
	1-4	Is the pressure and flow sufficient ?	<input type="checkbox"/>	<input type="checkbox"/>	
	1-5	Is the pipeline in the control room free from leakage ?	<input type="checkbox"/>	<input type="checkbox"/>	
	1-6	Is the pump house being kept clean ?	<input type="checkbox"/>	<input type="checkbox"/>	
	1-7	Are the doors and gate locked for security ?	<input type="checkbox"/>	<input type="checkbox"/>	
(2) Water Storage Tanks	2-1	Is the level control valve working correctly ?	<input type="checkbox"/>	<input type="checkbox"/>	
	2-2	Is the ball tap working correctly ?	<input type="checkbox"/>	<input type="checkbox"/>	
	2-3	Does the water level indicator work correctly ?	<input type="checkbox"/>	<input type="checkbox"/>	
	2-4	Are the tank and valves free from leakage ?	<input type="checkbox"/>	<input type="checkbox"/>	
	2-5	Is the drain clear from sand or rubbish ?	<input type="checkbox"/>	<input type="checkbox"/>	
(3) Pipeline and Valves	3-1	Is there any water leakage along the pipeline ?	<input type="checkbox"/>	<input type="checkbox"/>	
	3-2	Are the water mater and valves working properly ?	<input type="checkbox"/>	<input type="checkbox"/>	
	3-3	Is there any portion damaged by accident ?	<input type="checkbox"/>	<input type="checkbox"/>	
(4) Public Faucet	4-1	Are the taps in good working order ?	<input type="checkbox"/>	<input type="checkbox"/>	
	4-2	Are the water mater and valves working properly ?	<input type="checkbox"/>	<input type="checkbox"/>	
	4-3	Is the meter box free from leakage ?	<input type="checkbox"/>	<input type="checkbox"/>	
	4-4	Is the drain clear from sand or rubbish ?	<input type="checkbox"/>	<input type="checkbox"/>	
	4-5	Is the Public faucet kept clean by the people ?	<input type="checkbox"/>	<input type="checkbox"/>	
(5) Others	5-1	Is the facility environment in a satisfactory sanitary condition?	<input type="checkbox"/>	<input type="checkbox"/>	
	5-2	Is the pipeline free from illegal connection ?	<input type="checkbox"/>	<input type="checkbox"/>	

11. Maintenance

Maintenance of the facilities forms the basis for the long term sustainability of the water supply system. Therefore it is important that the Facility Operator pays special attention to each facility and maintains the system. Important items of maintenance are listed below.

1. Submersible Pump

The submersible pump shall be maintained according to the methods by which the manufacturer and/or supplier recommends. If there is a technical problem, the Operator should report to the Regional office after the confirmation of the actual condition.

2. Chlorination Pump

The chlorination pump shall be maintained according to the methods by which the manufacturer and/or supplier recommends. The cleaning of the Chlorination Pump and surrounding shall be done once a week.

3. Water Storage Tank

The cleaning of the Water Storage Tank and surrounding shall be done once a month.

4. Meter Box and Valve Box

There are meters and valve boxes in the reticulation of the system. These facilities must be maintained properly also. The cleaning of these facilities and surrounding shall be done once a month.

5. Power Source

The power source which are solar system and generator shall be maintained according to the methods by which the manufacturer and/or supplier recommends. If there is a technical problem, the Operator should report to the Regional office after the confirmation of the actual

condition.

5. Emergency Case

In emergency cases where an accident or trouble occurs, the Facility Operator has to report to the Regional office immediately.

12. Data of Equipments

The following data of Equipment, which contain catalogues, is distributed for the Facility Operator. The Facility Operator should inspect this material when it is necessary, and keep them in a safe location.

- 1) Data of Borehole
- 2) Catalogue of Submersible Pump
- 3) Catalogue of Level self Control Valve
- 4) Catalogue of Chlorination Pump
- 5) Completion Drawings of the Water supply System

13. Reporting

Monthly report shall be submitted by the Facility Operator to the Regional office. The operation record in the monthly report is essential information for the management of water supply service. It is very important for the Regional office to get the trend of water consumption and the conditions of facilities in order to understand the actual situation of water supply in the District. Therefore the Facility Operator should keep reporting periodically to the office without delay.

14. Sampling

The Facility Operator has to send water samples to the Regional office periodically (once in a half year). The Regional office will bring the sample to a certified laboratory to confirm the water quality. To supply safe clean water is an important mission in water management.

Therefore the sampling has to be done carefully by the Facility Operator based on the sampling method instructed by the Regional office and/or PNG Waterboard.

15. Appendix

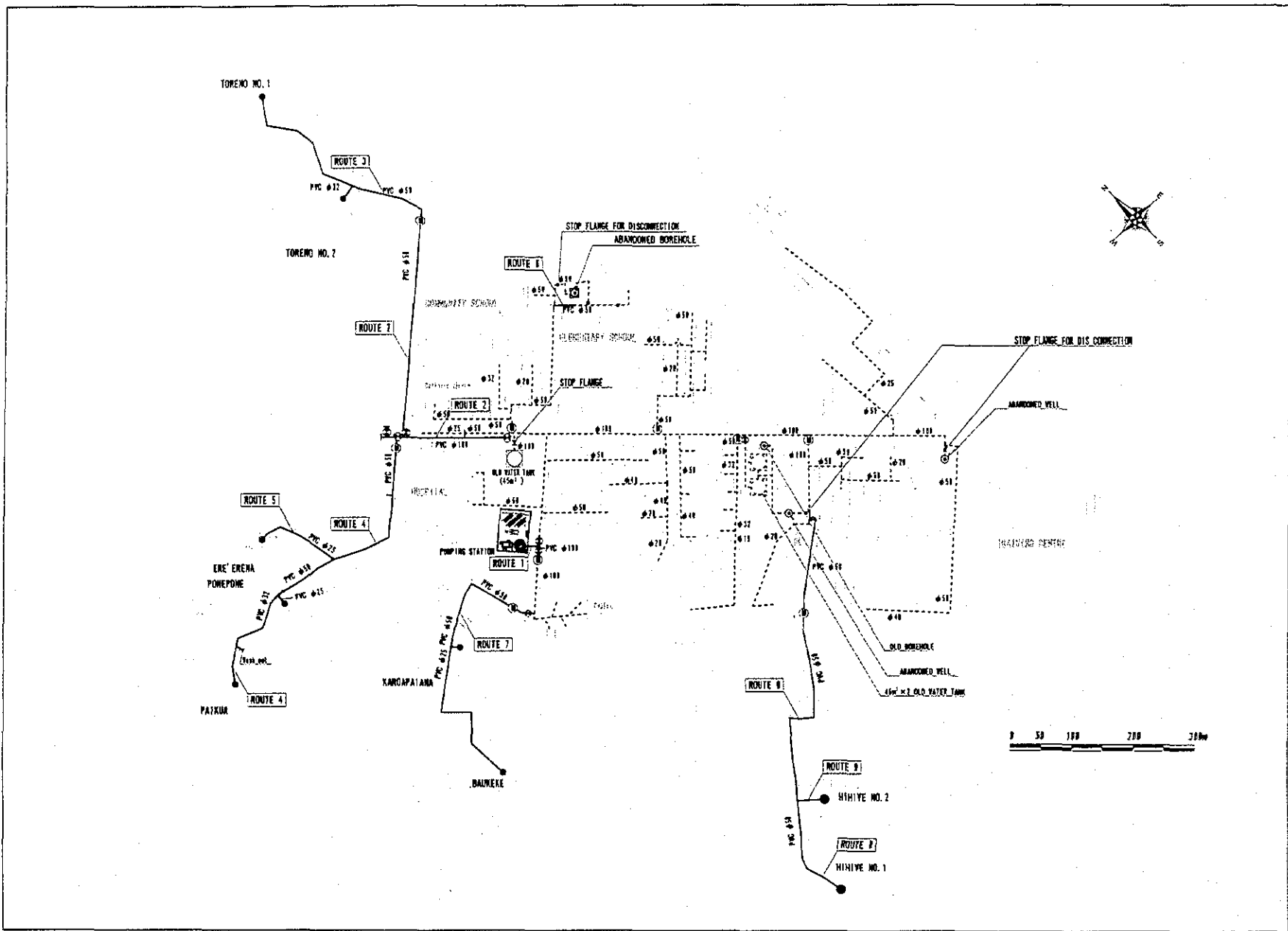
- 1) Form of Operation Records (Example)
- 2) Drawing of Reticulation
- 3) Drawing of Pump Station
- 4) Drawing of Pump Pit
- 5) Drawing of Pump House

APPENDIX : 1) Form of Operation Records (Example)

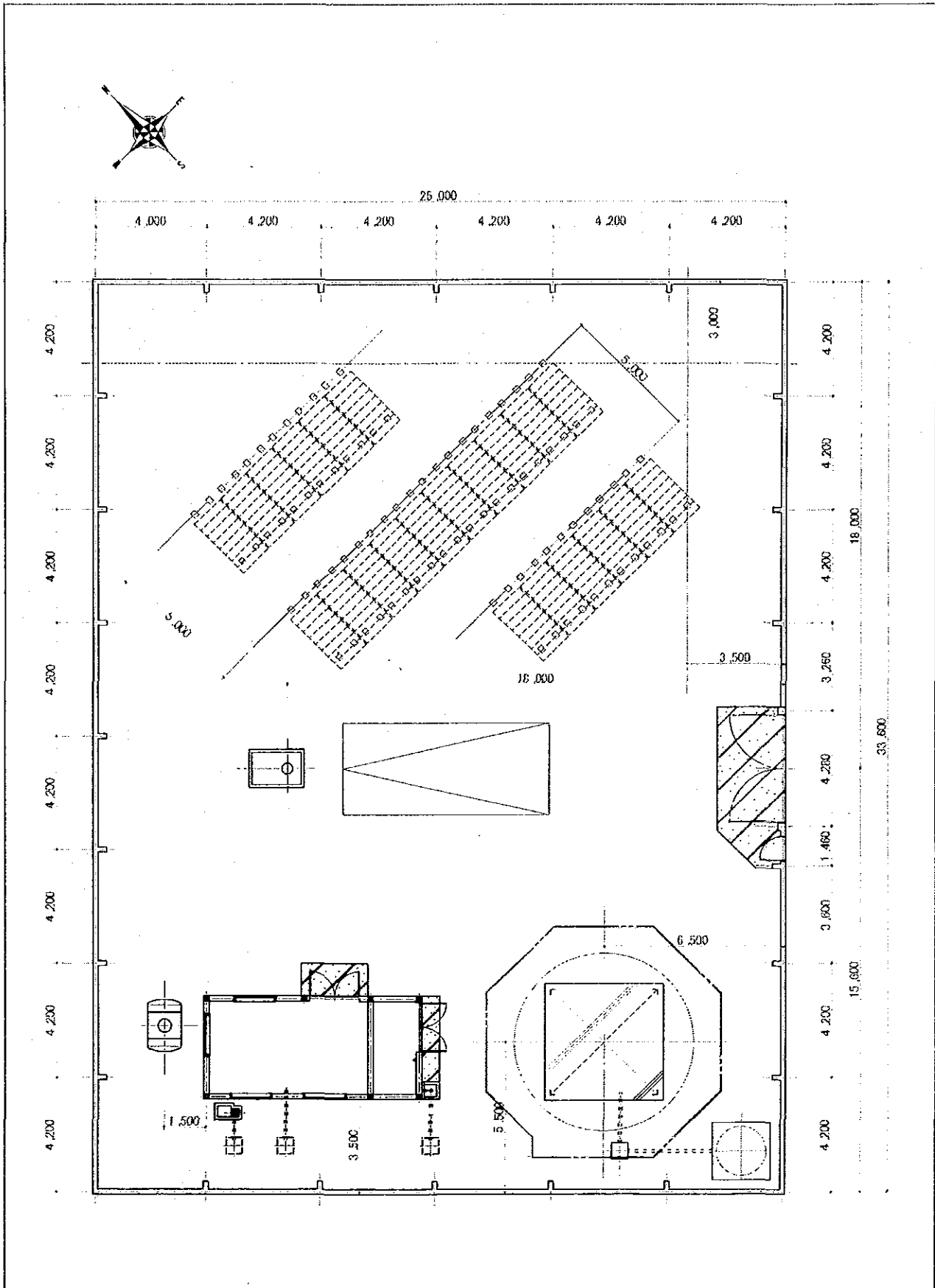
Monthly Log Sheet				Year 2001	Month August	Name		
Date	Operation time	Pump House			Water Meter (lit/min)			Signature
		Meter (lit/min)	Pressure (MPa)	Time	Meter-1 / Time	Meter-2 / Time	Meter-3 / Time	
1	8:00~22:00	250	2.0	8:30	120/9:00	45/9:30	85/9:45	
2					/	/	/	
3					/	/	/	
4					/	/	/	
5					/	/	/	
6					/	/	/	
7					/	/	/	
8					/	/	/	
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31					/	/	/	

Observations

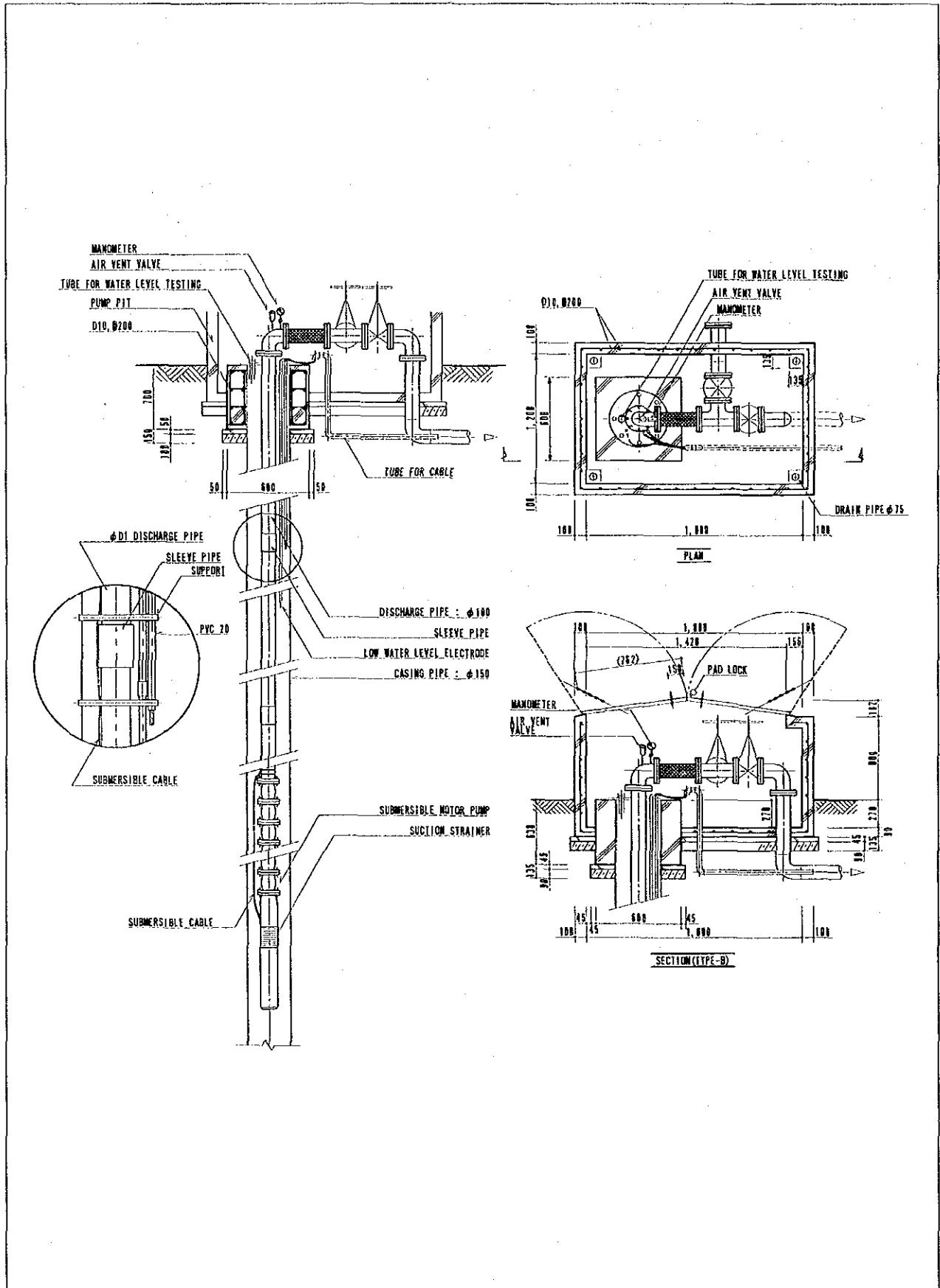
APPENDIX : 2) Drawing of Retiulation



APPENDIX : 3) Drawing of Pump Station

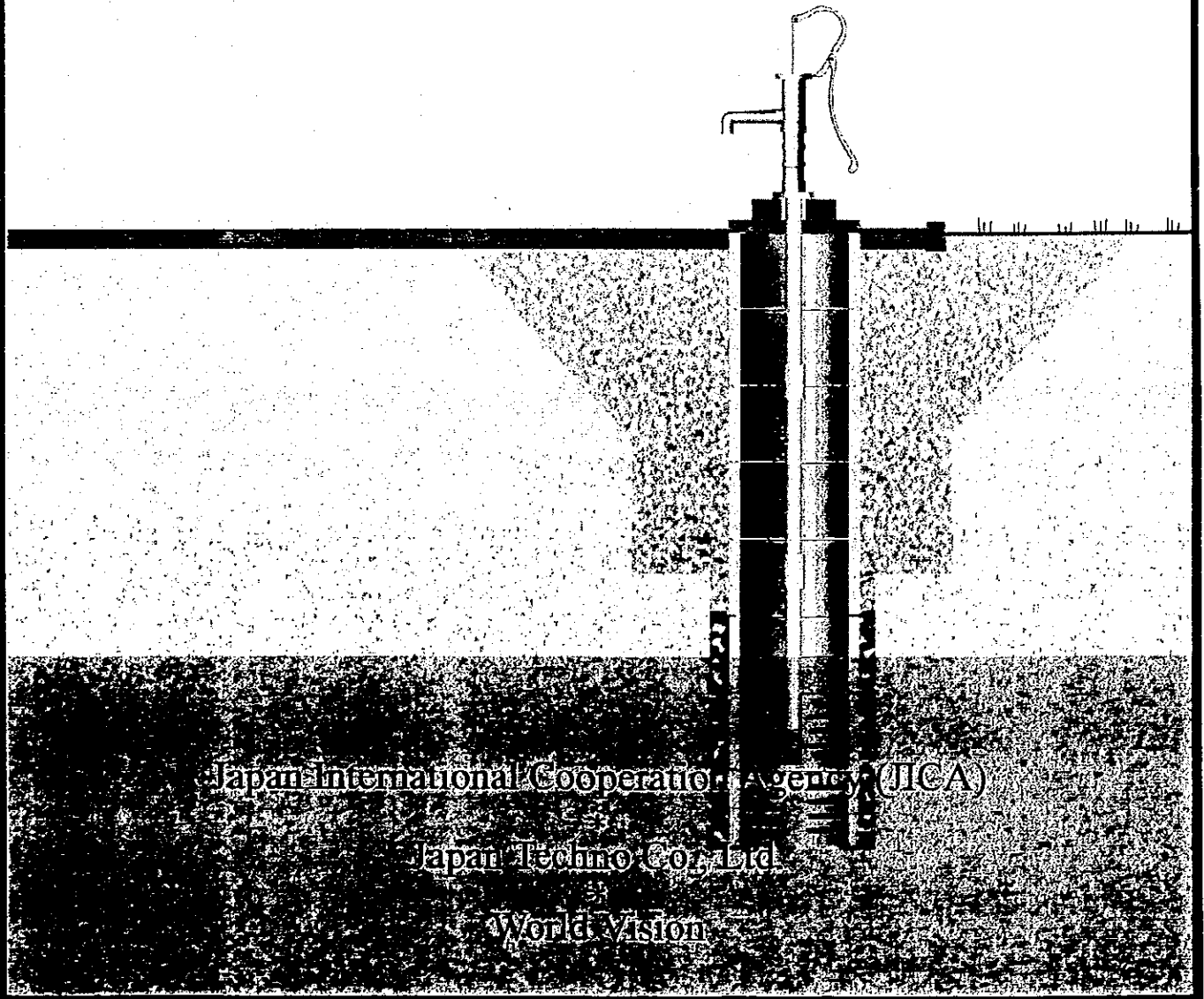


APPENDIX : 4) Drawing of Pump Pit



The Study on Groundwater Development
for
Water Supply Systems
in
Papua New Guinea

Guide for
Hand-dug Well Construction
&
Handpump Installation



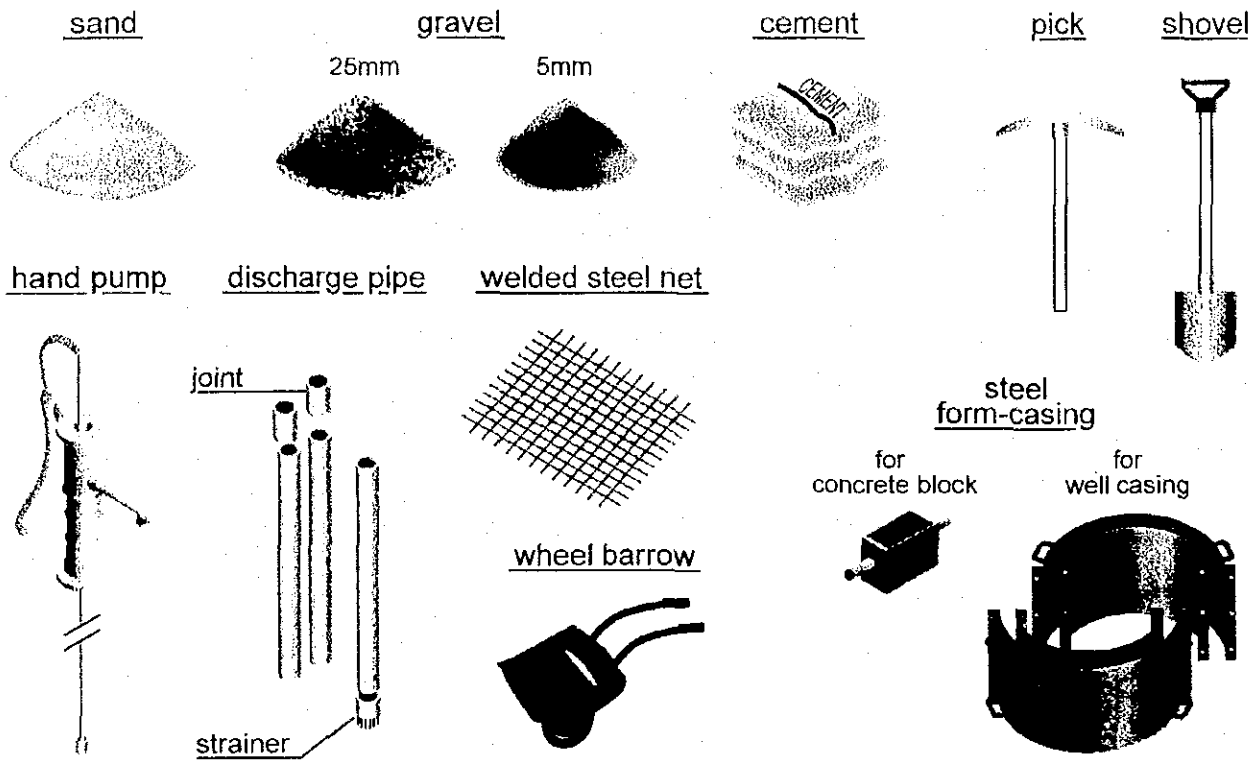
Japan International Cooperation Agency (JICA)

Japan Techno Co., Ltd.

World Vision

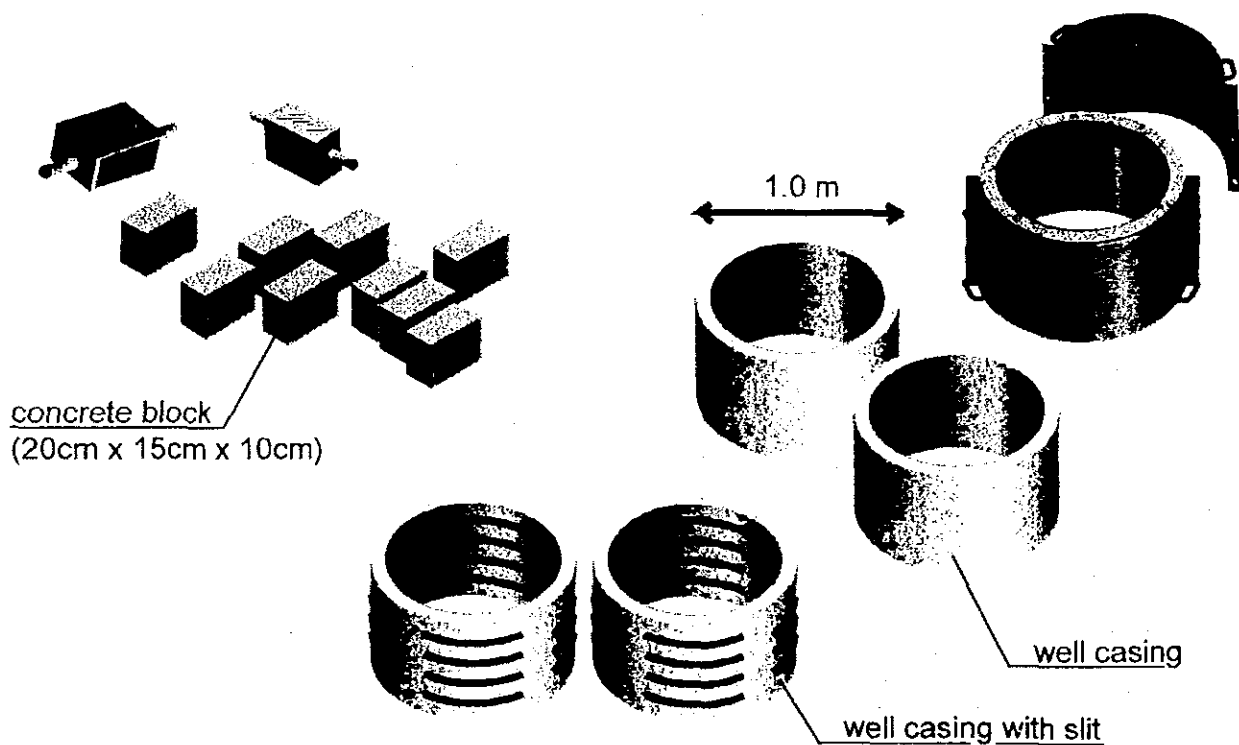
1. MATERIALS & TOOLS

- Prepare the following.

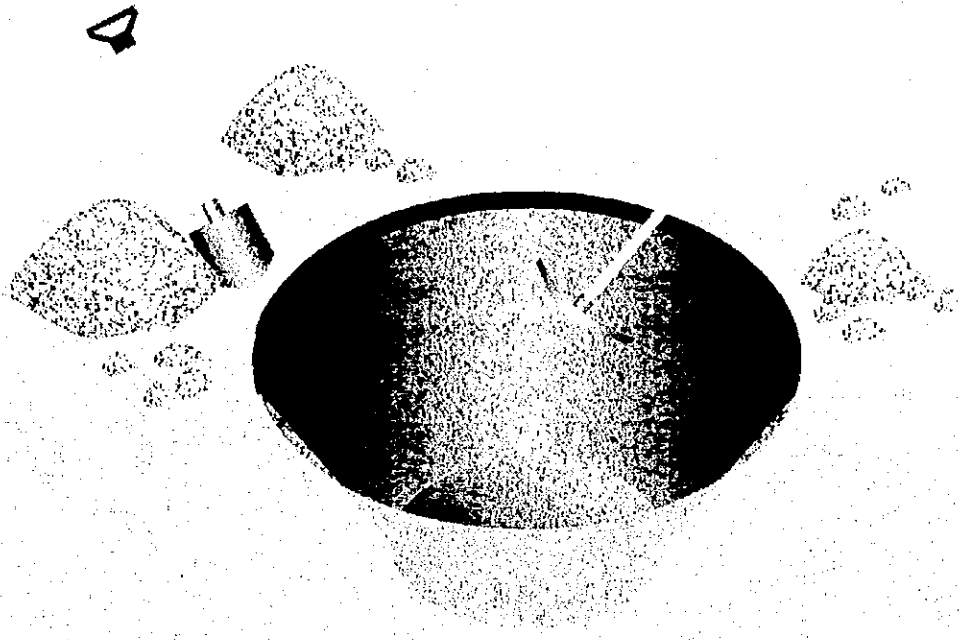


2. CONCRETE BLOCKS and WELL CASINGS

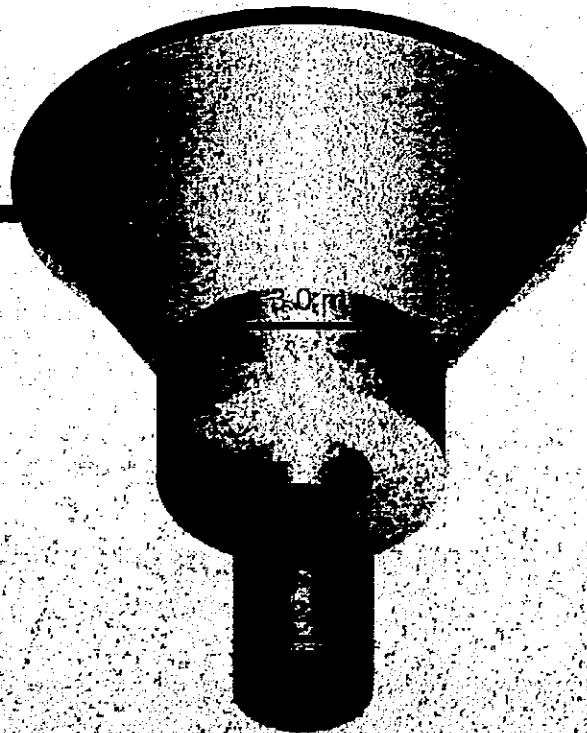
- Make concrete blocks and well casing using a steel-form casing.



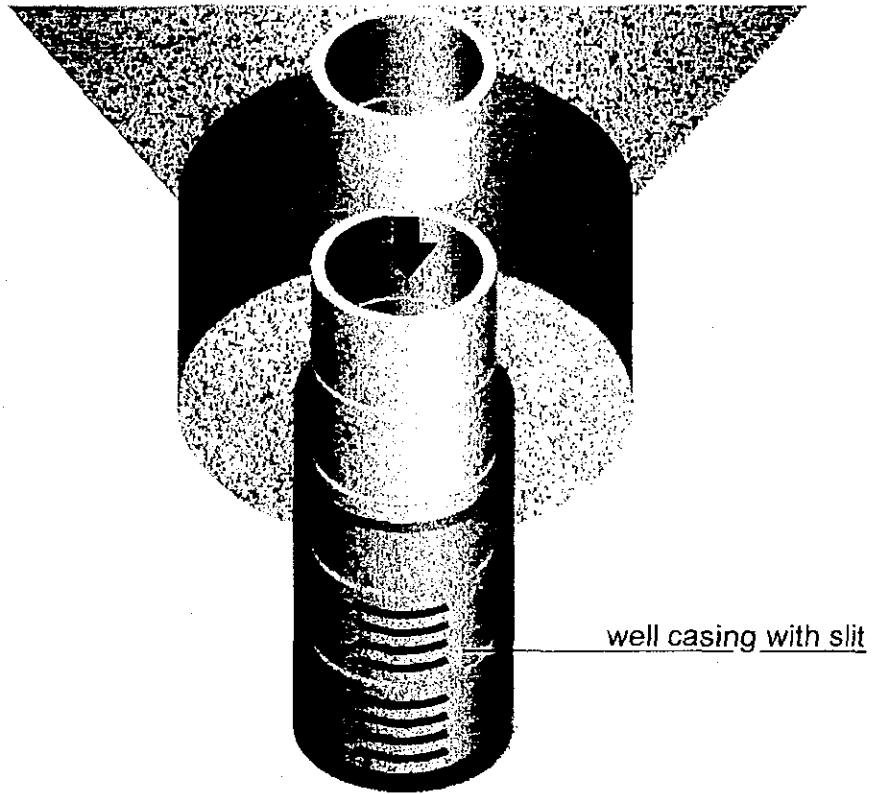
3. DIGGING (1) - Dig the plot for the well (Dia. 5.0m ,Depth 3.0m).



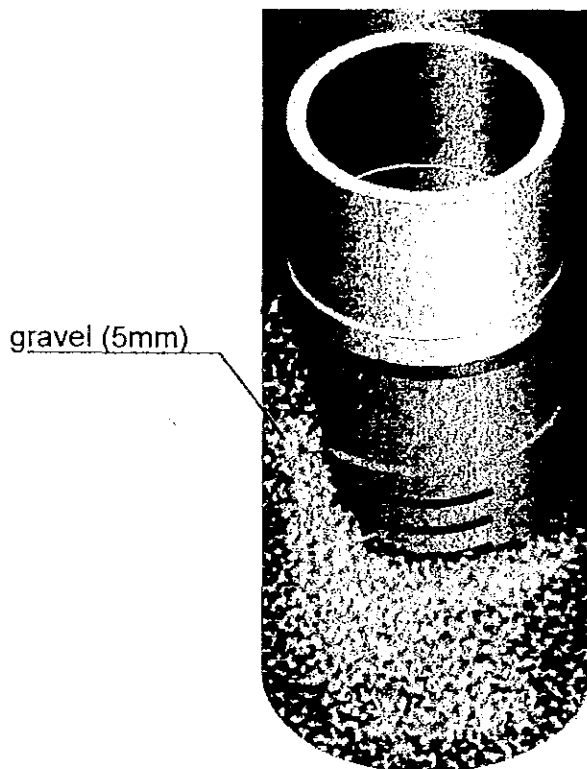
4. DIGGING (2) - Continue to dig to approximately 8.0m depth (see the drawing).



5. CASING - Pile the well casings (see the drawing).

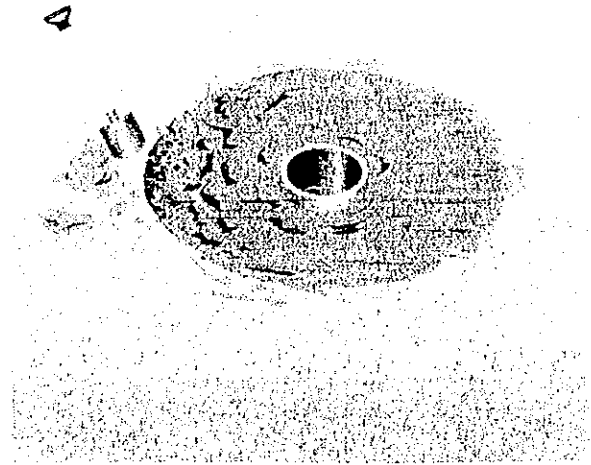
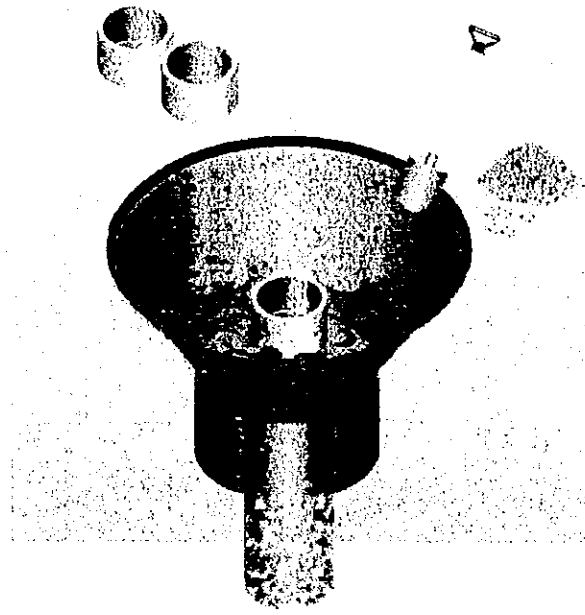


6. GRAVEL PACKING - Fill the gravel (dia. 5mm).



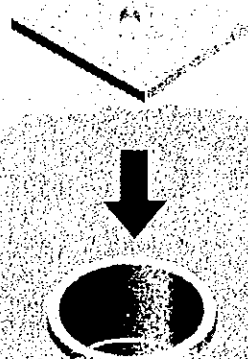
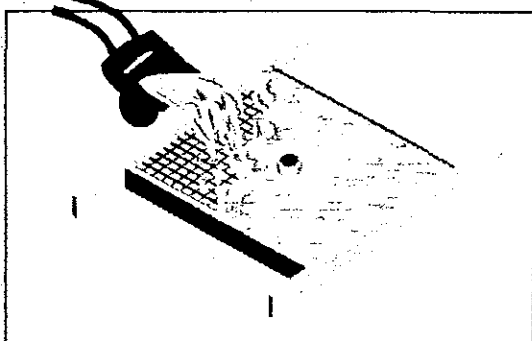
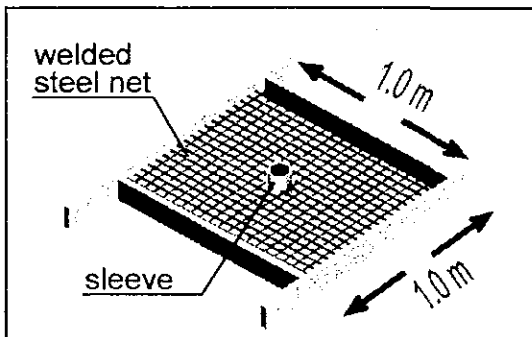
7. CASING and FILLING BACK

- Pile the well casings to ground level and fill back soil around the casings.

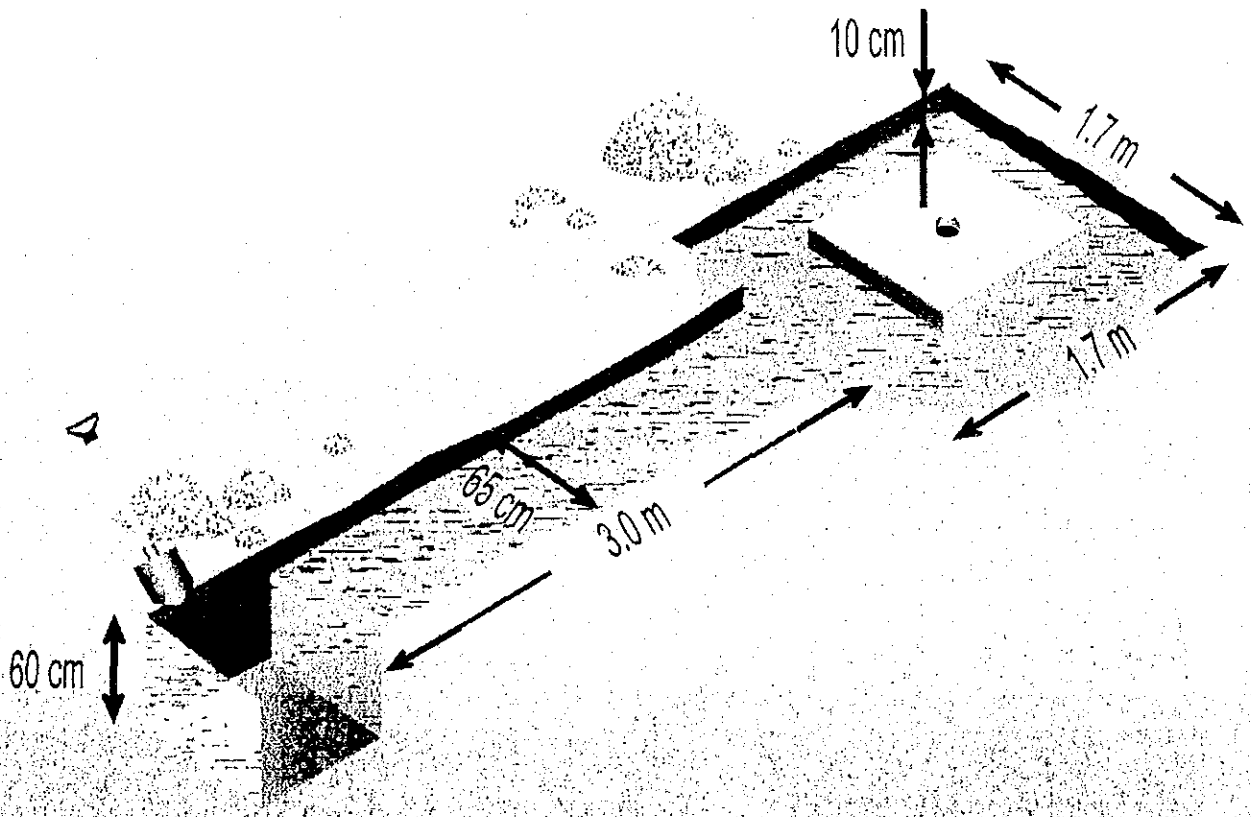


8. CONCRETE FLOOR

- Make concrete floor reinforced by welded steel net.
- Put the concrete floor on the well casing.

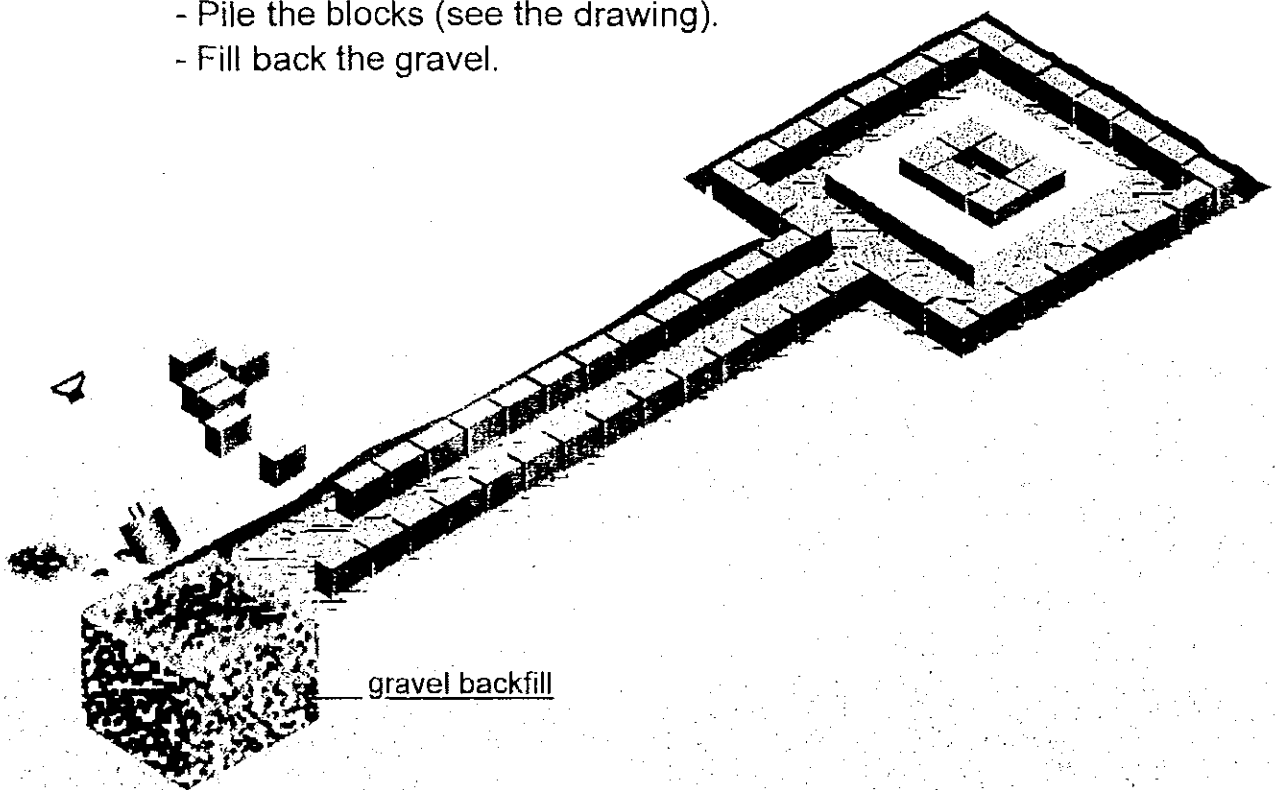


9. EXCAVATION - Excavate as drawing.



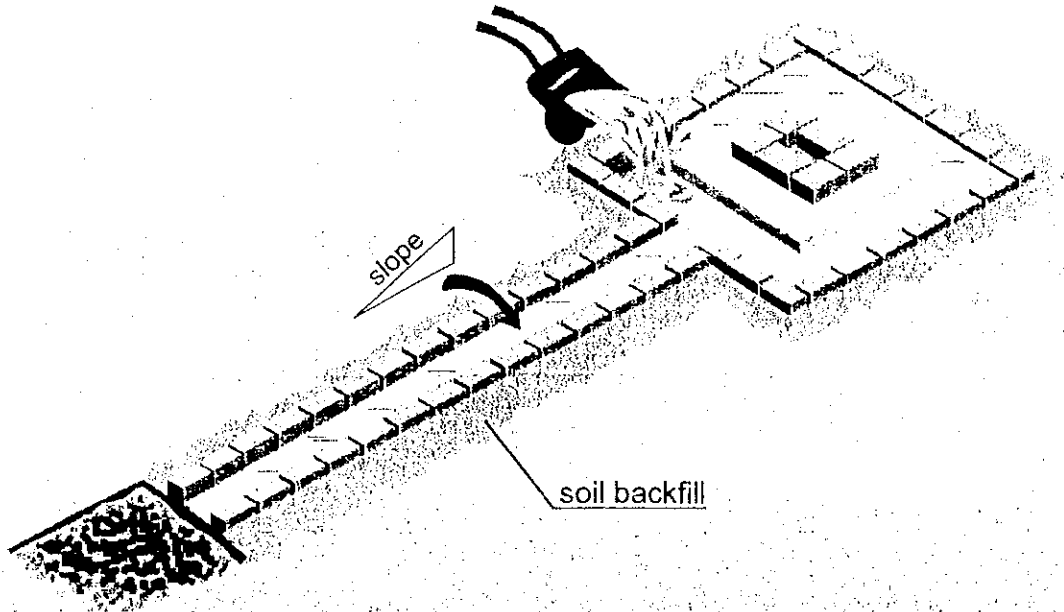
10. MASONRY

- Pile the blocks (see the drawing).
- Fill back the gravel.



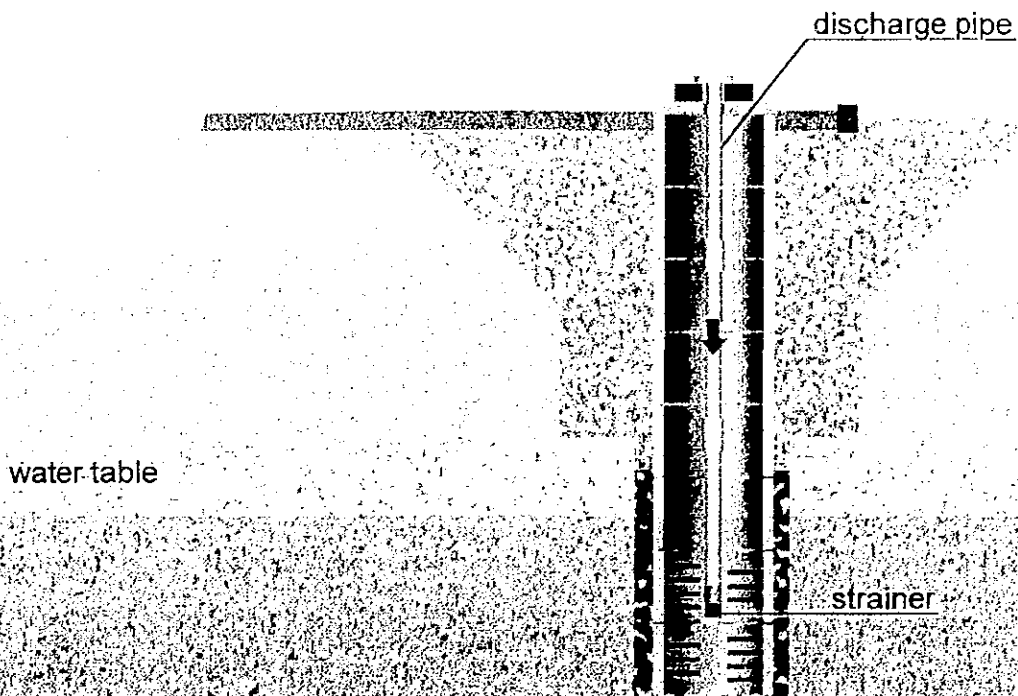
11. DRAINAGE APRON

- Fill inside of the piled blocks with concrete (see the drawing).
- Fill back the soil around the blocks.



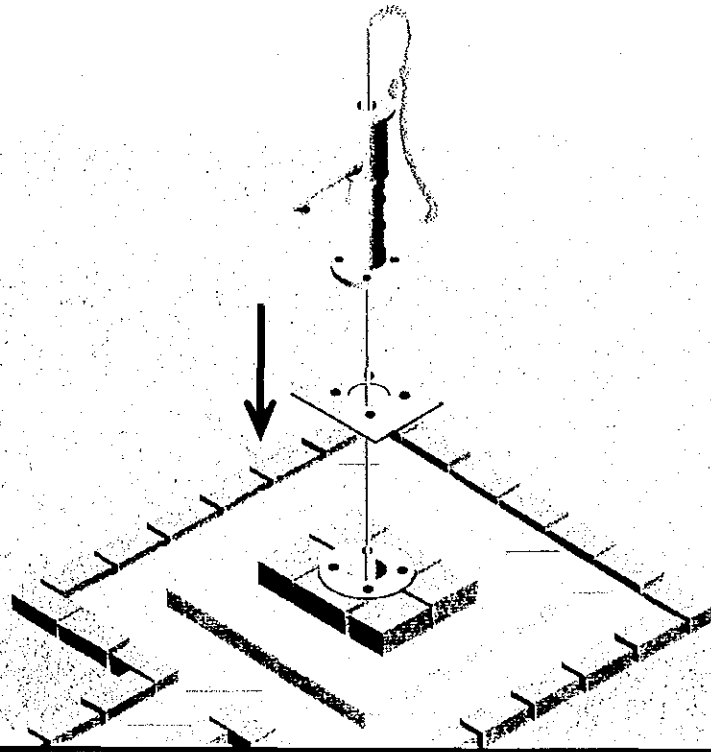
12. DISCHARGE PIPE INSTALLATION

- Install the discharge pipe.

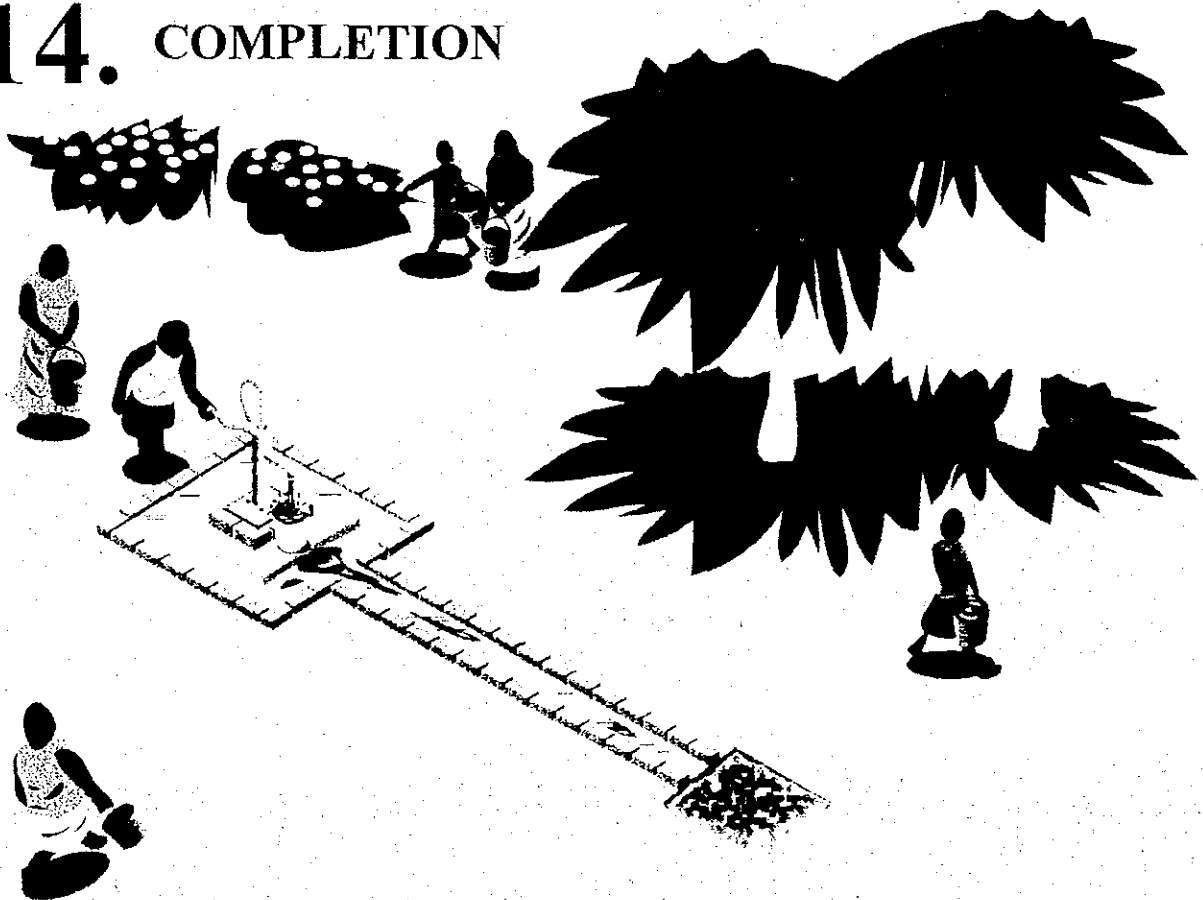


13. HAND-PUMP INSTALLATION

- Install the hand-pump in accordance with install manual.

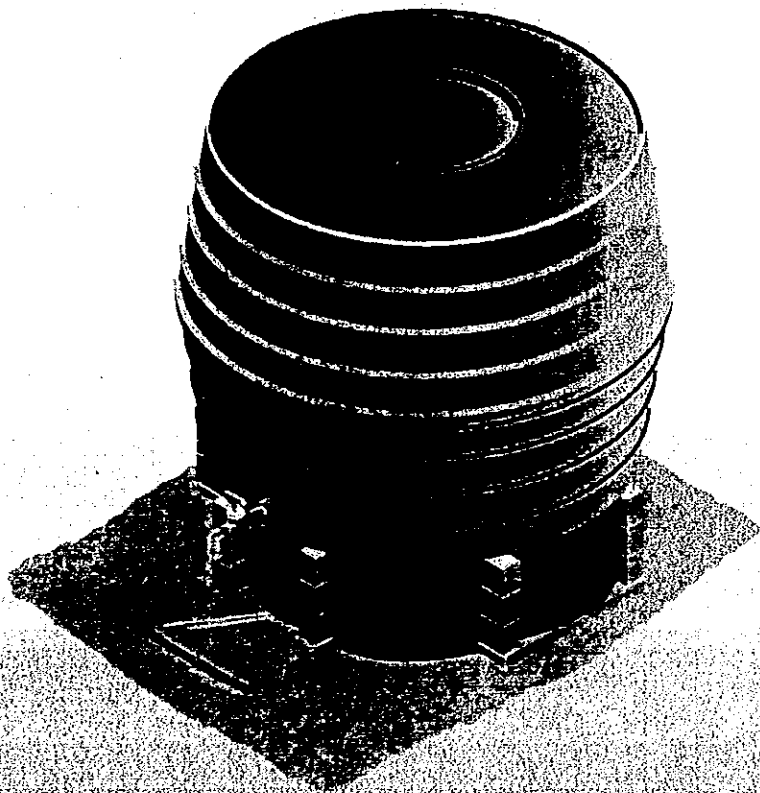


14. COMPLETION



The Study on Groundwater Development
for
Water Supply Systems
in
Papua New Guinea

Installation Guide for Rainwater Tank



Japan International Cooperation Agency (JICA)

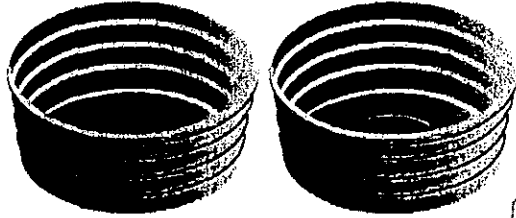
Japan Techno Co., Ltd.

World Vision

1. MATERIALS & TOOLS

- Prepare the following.

rainwater tank



sand



gravel



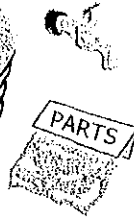
shovel



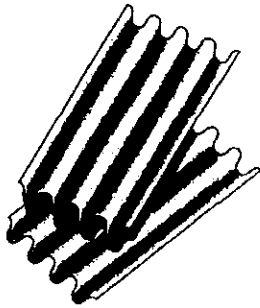
cement



steel form-casing



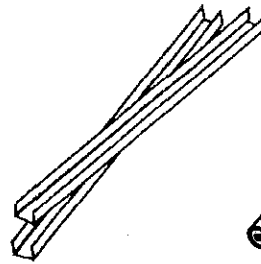
metal roof sheet



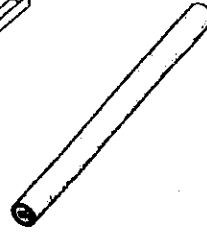
metal sheet cutter



gutter



water pipe



wheel barrow

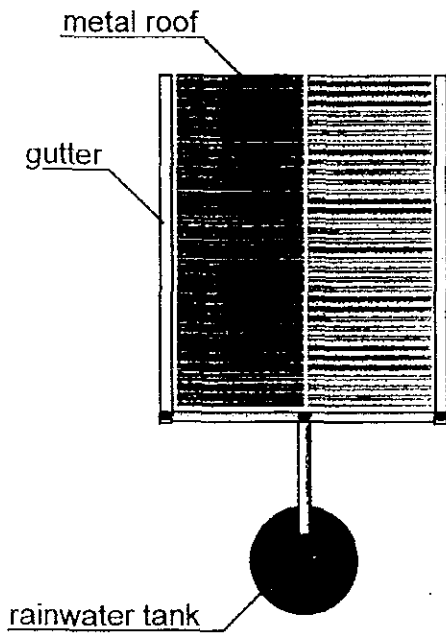


wire

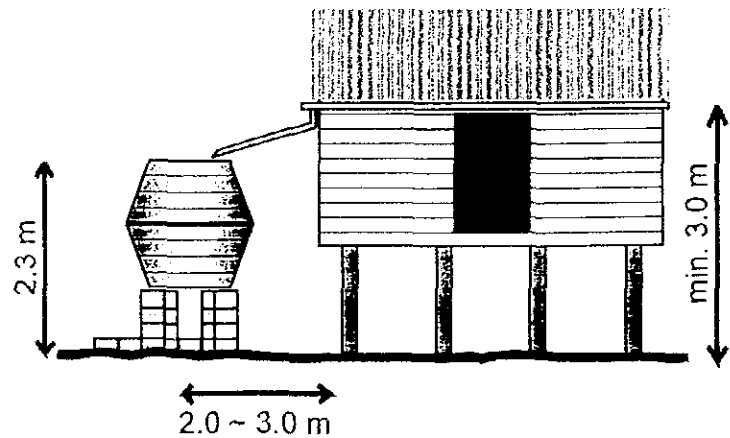


2. SITING

- Select the house to collect rainwater.
- Decide the location to install a rainwater tank.



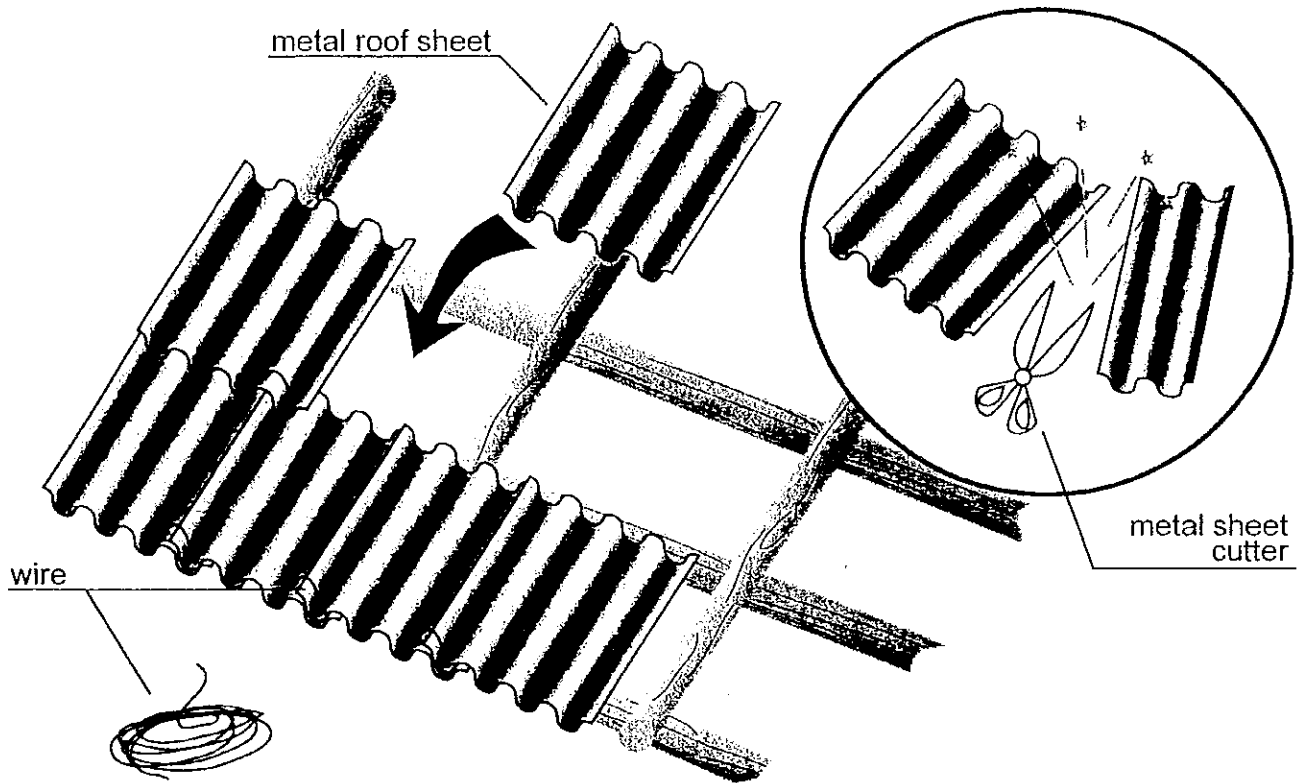
PLAN



ELEVATION

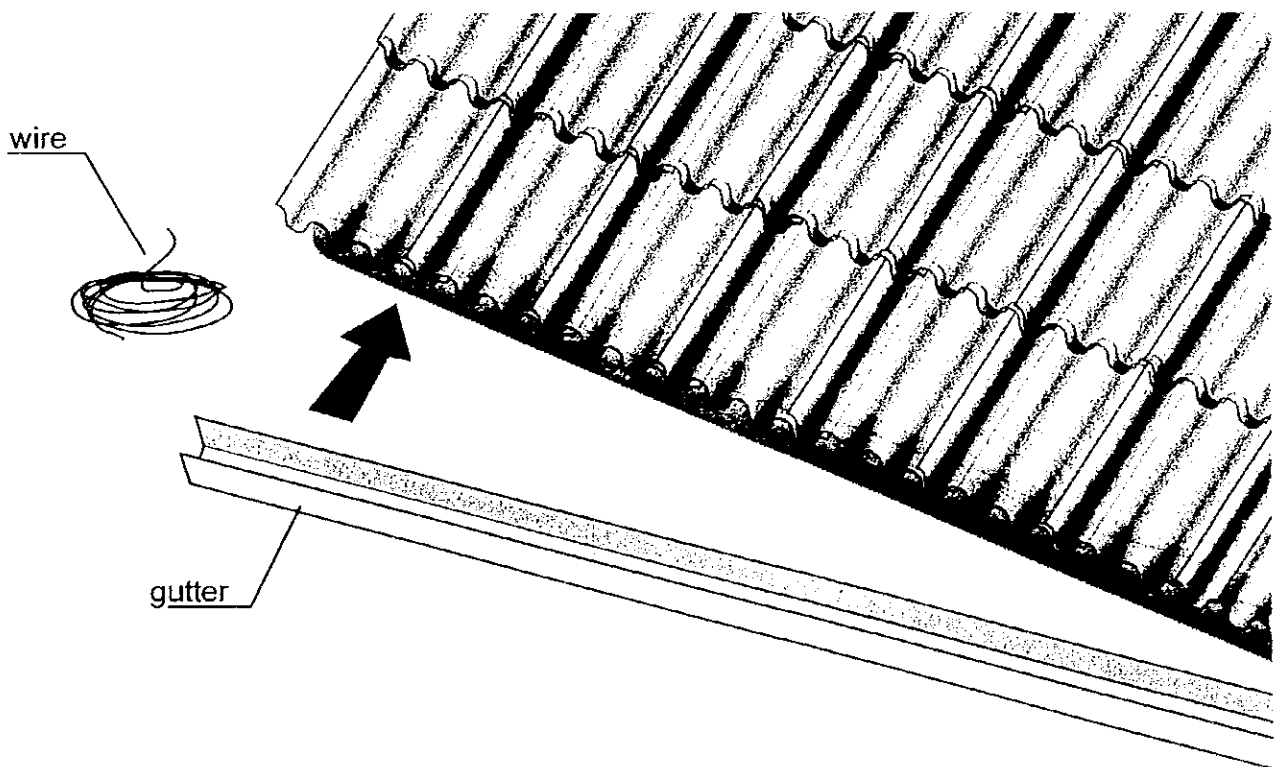
3. ROOFING

- Cut metal roof sheets to proper sizes.
- Attach the sheets with wire on the beams/walls of the house.



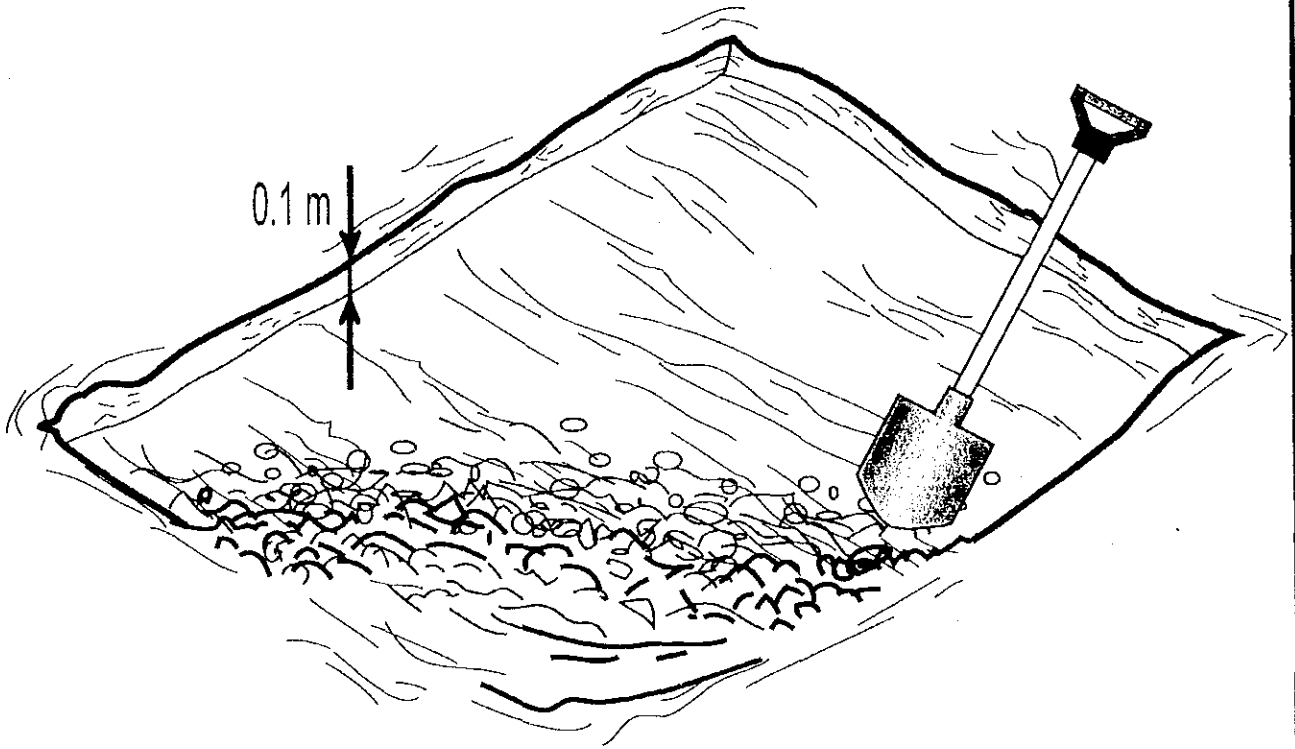
4. GUTTERING

- Cut gutters to proper lengths.
- Attach the gutters with wire on the beams/roofs of the house.



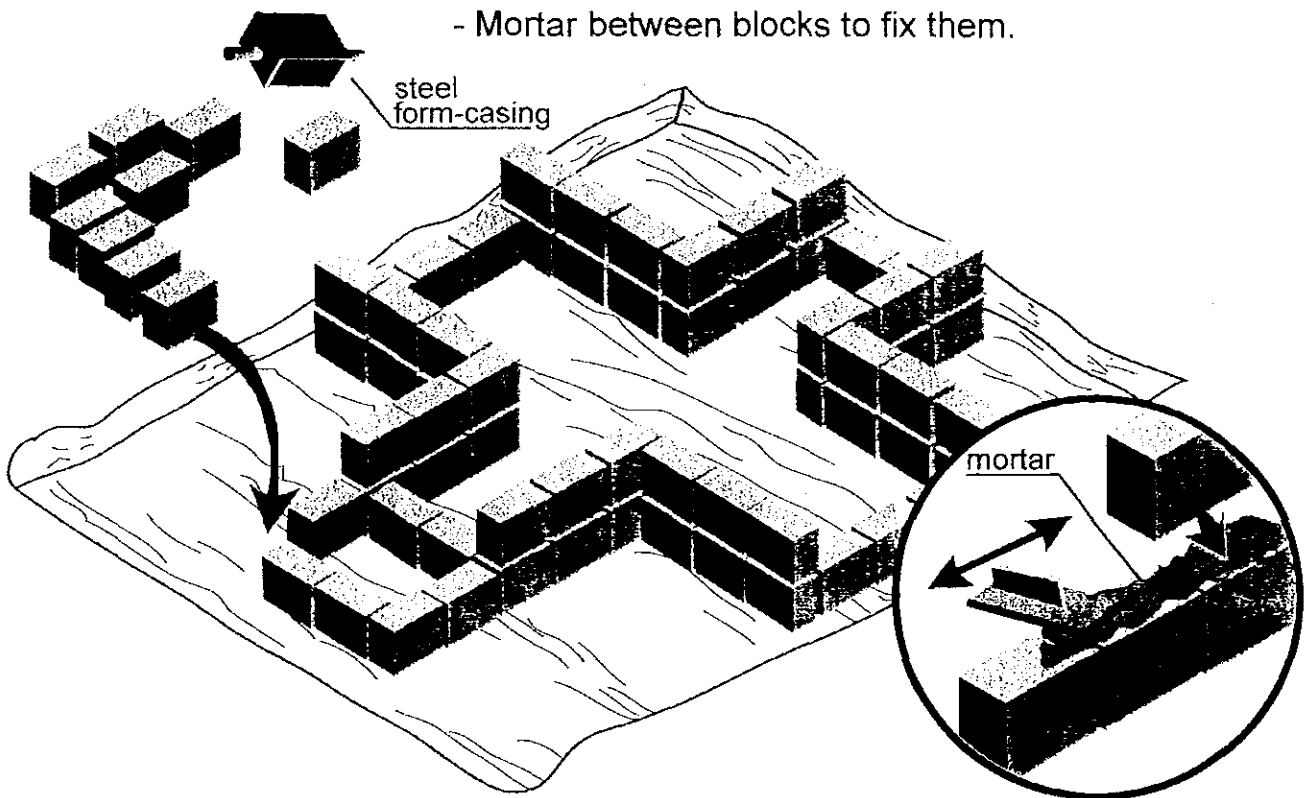
5. EXCAVATION

- Excavate the plot for a rainwater tank
(Length 2.5m x Width 2.5m x Depth 0.1m)

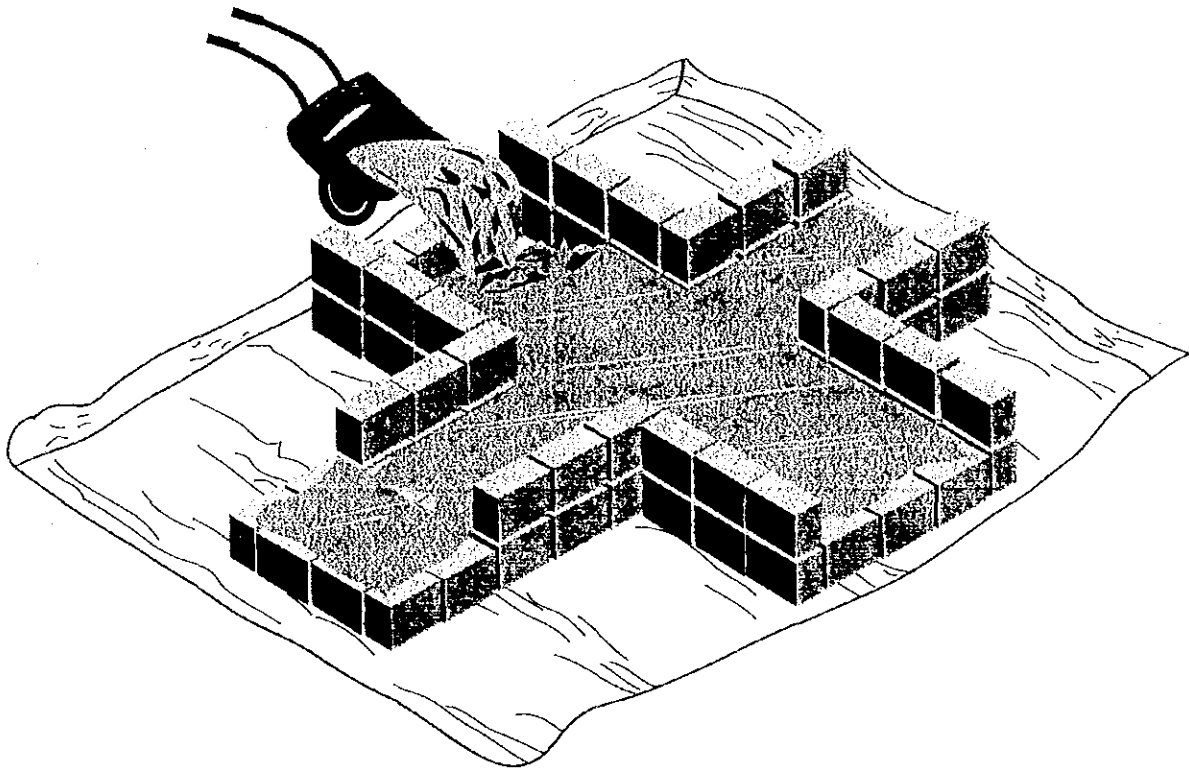


6. MASONRY (1)

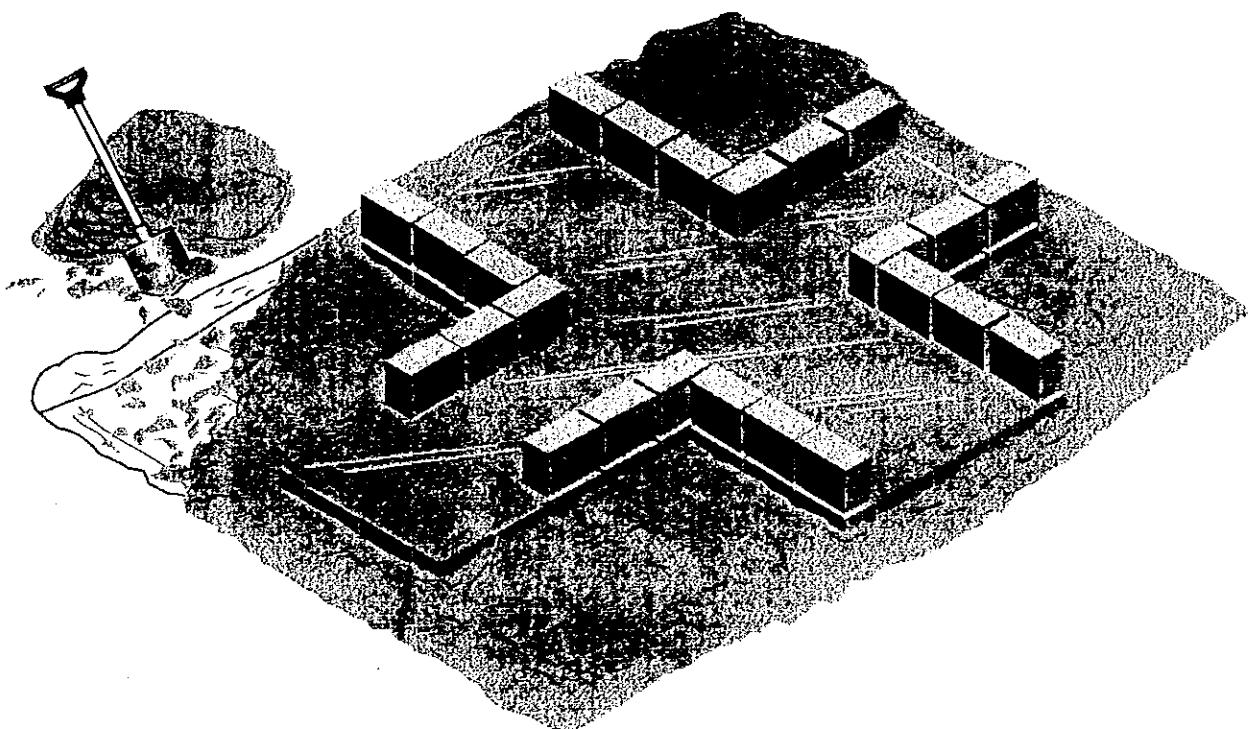
- Make approximately 120 concrete blocks (20cm x 15cm x 10cm) using a steel-form casing.
- Pile the blocks up to the 2nd layer (see the drawing).
- Mortar between blocks to fix them.



7. CONCRETE FLOOR - Fill inside of the piled blocks with concrete up to the 1st layer (see the drawing).

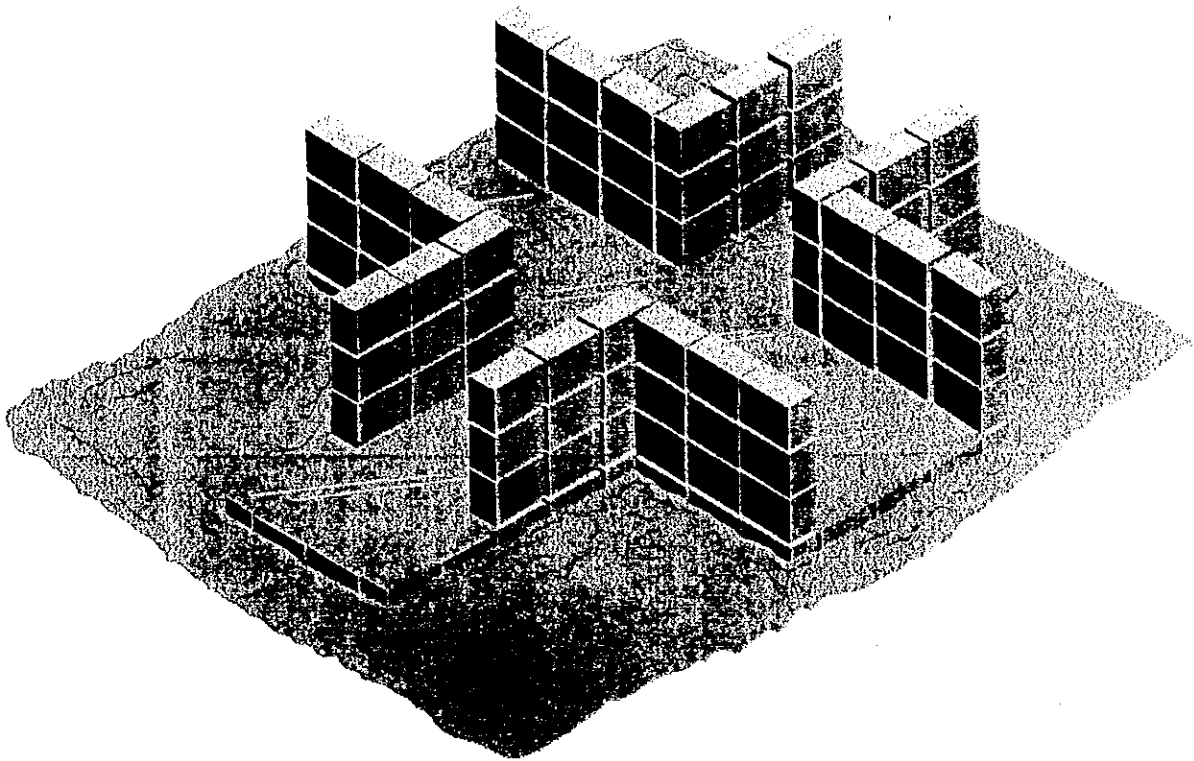


8. FILLING BACK - Fill back the soil around the base.



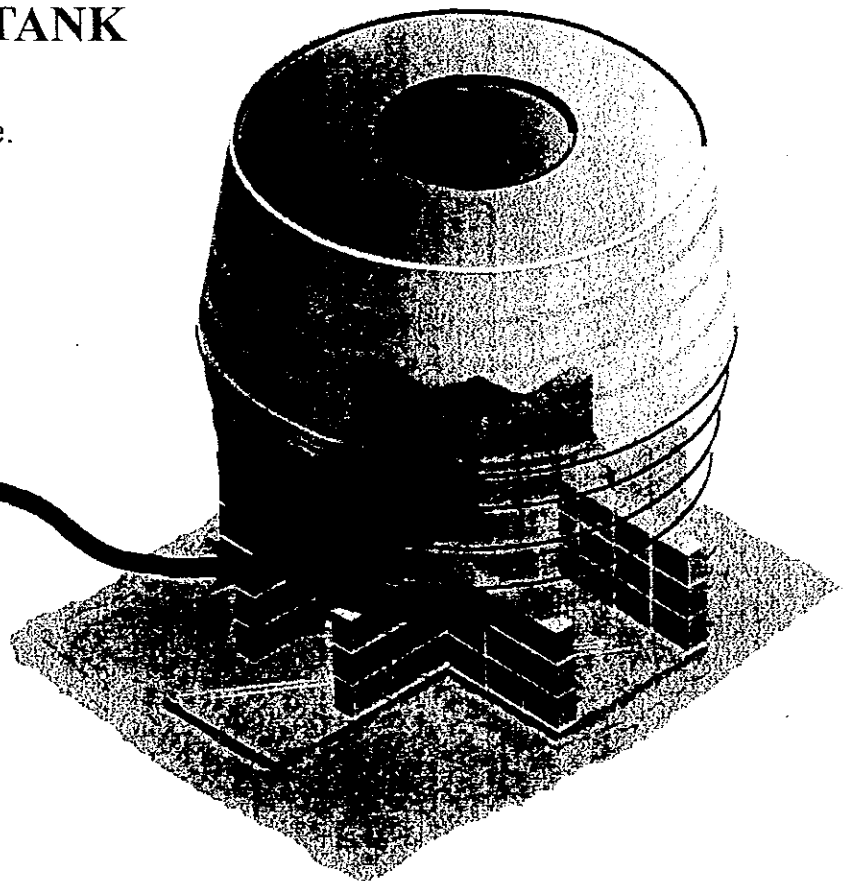
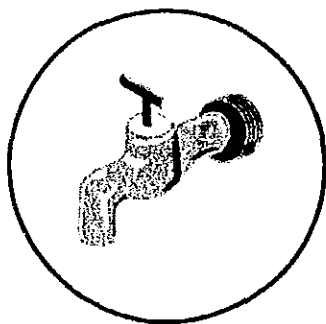
9. MASONRY (2)

- Pile the blocks (see the drawing).



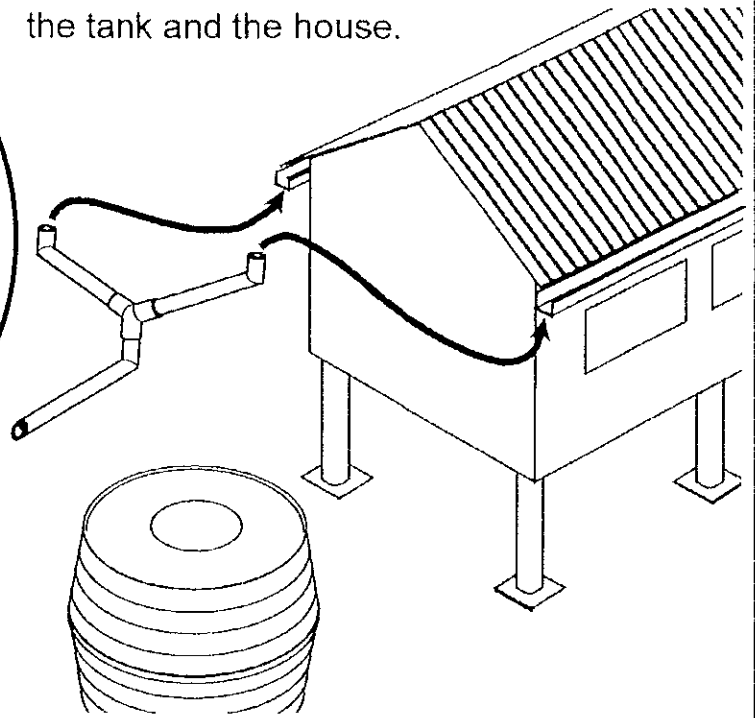
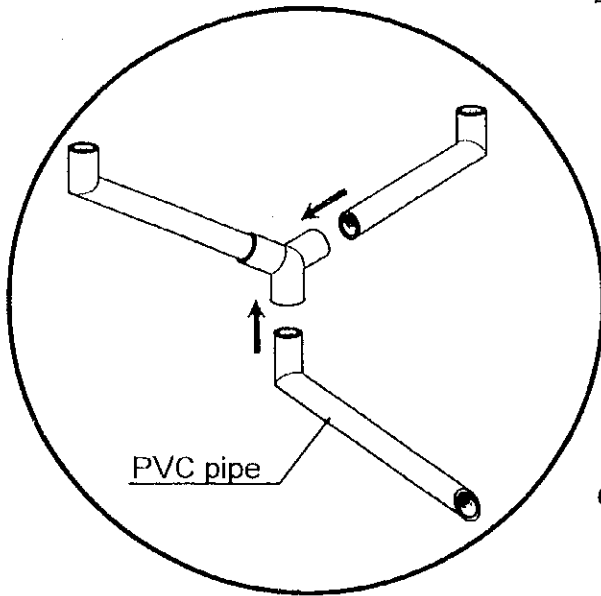
10. SETTING TANK

- Set the tank on the base.

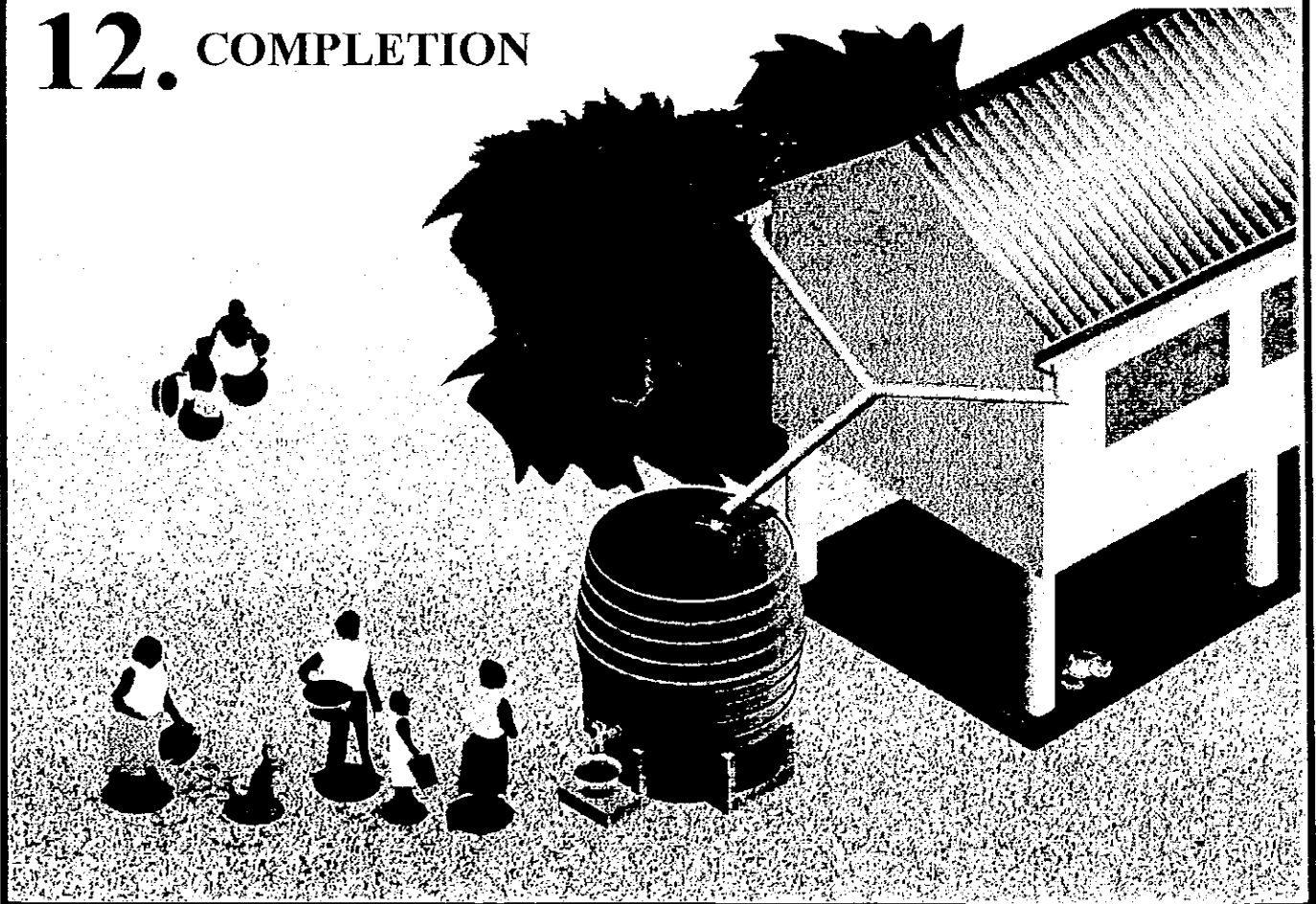


11. CONNECTION

- Connect the rainwater tank and the gutters by PVC pipes
- The way of connection should be flexible in accordance with the location of the tank and the house.



12. COMPLETION



JICA