

GOVERNMENT OF JAPAN
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
STATE OF ERITREA
MINISTRY OF LAND, WATER AND ENVIRONMENT

STUDY
ON
GROUNDWATER DEVELOPMENT AND WATER SUPPLY
FOR
SEVEN TOWNS IN SOUTHERN REGION
OF
ERITREA

FINAL REPORT

ADIQUALA

VOLUME III DRAWINGS

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JANUARY 1999

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GOVERNMENT OF JAPAN
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
STATE OF ERITREA
MINISTRY OF LAND, WATER AND ENVIRONMENT

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1148355 (9)

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Hygiene Education Manual

Training Manual for Staff of WSA

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LEGEND	
	Boundary
	Commercial Area
	Administration Area
	Residential Area
	Industrial Area

STATE OF ERITREA
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STUDY ON GROUNDWATER
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 FOR
 SEVEN TOWNS IN SOUTHERN REGION

Land Use and Zone Boundary
 ADIQUALA (2010)

WATER RESOURCES DEPARTMENT (ASBABA, ERITREA) BANTU CONSULTANTS INC. (JAPAN) 1999	Drawing No. 1/23
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LEGEND	
	Boundary
	Commercial Area
	Administration Area
	Residential Area
	Industrial Area

STATE OF ERITREA
 MINISTRY OF LAND, WATER &
 ENVIRONMENT

JAPAN INTERNATIONAL
 COOPERATION AGENCY

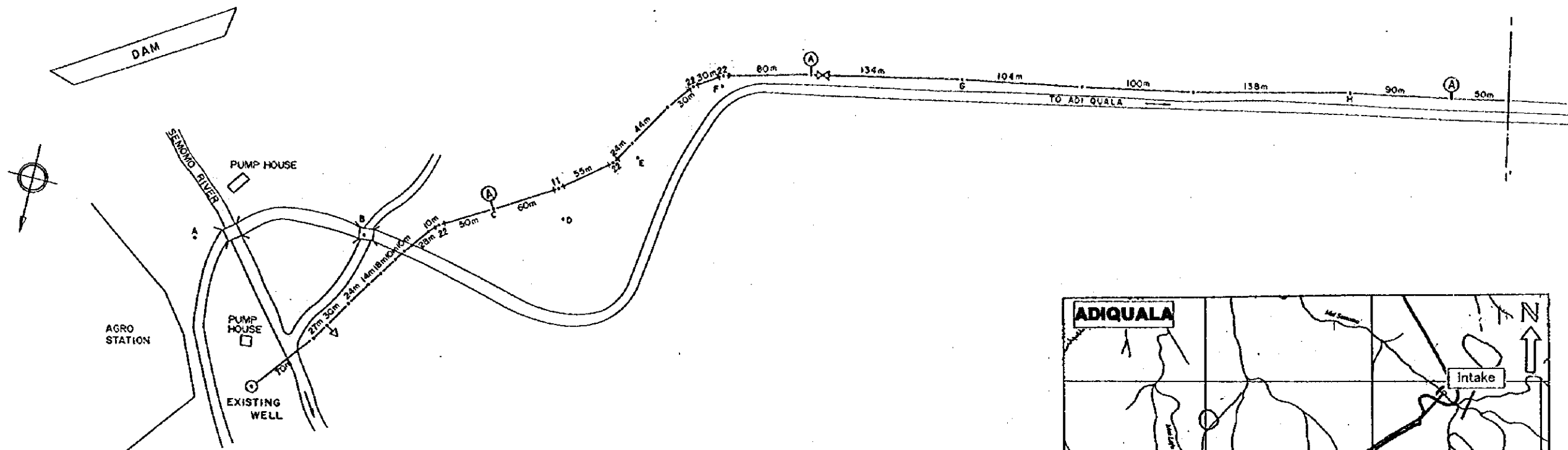
STUDY ON GROUNDWATER
 DEVELOPMENT & WATER SUPPLY
 FOR
 SEVEN TOWNS IN SOUTHERN REGION

Land Use and Zone Boundary
 ADIQUALA (2010)

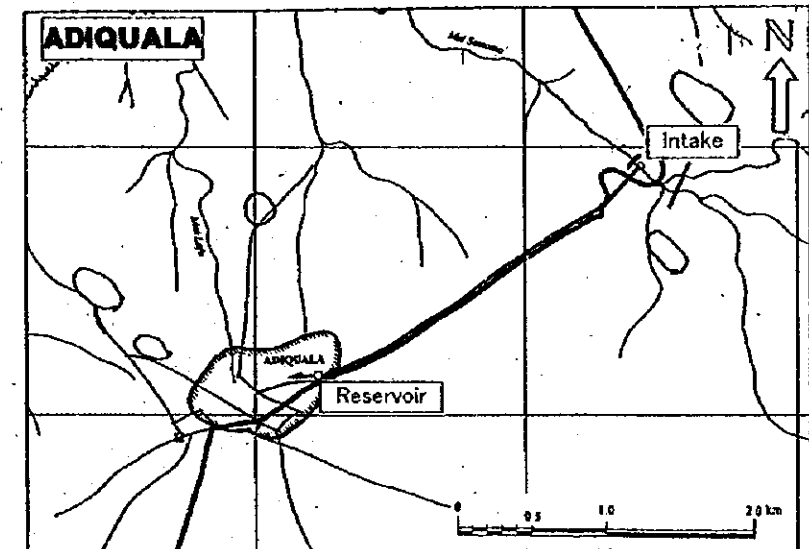
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No. 1/23
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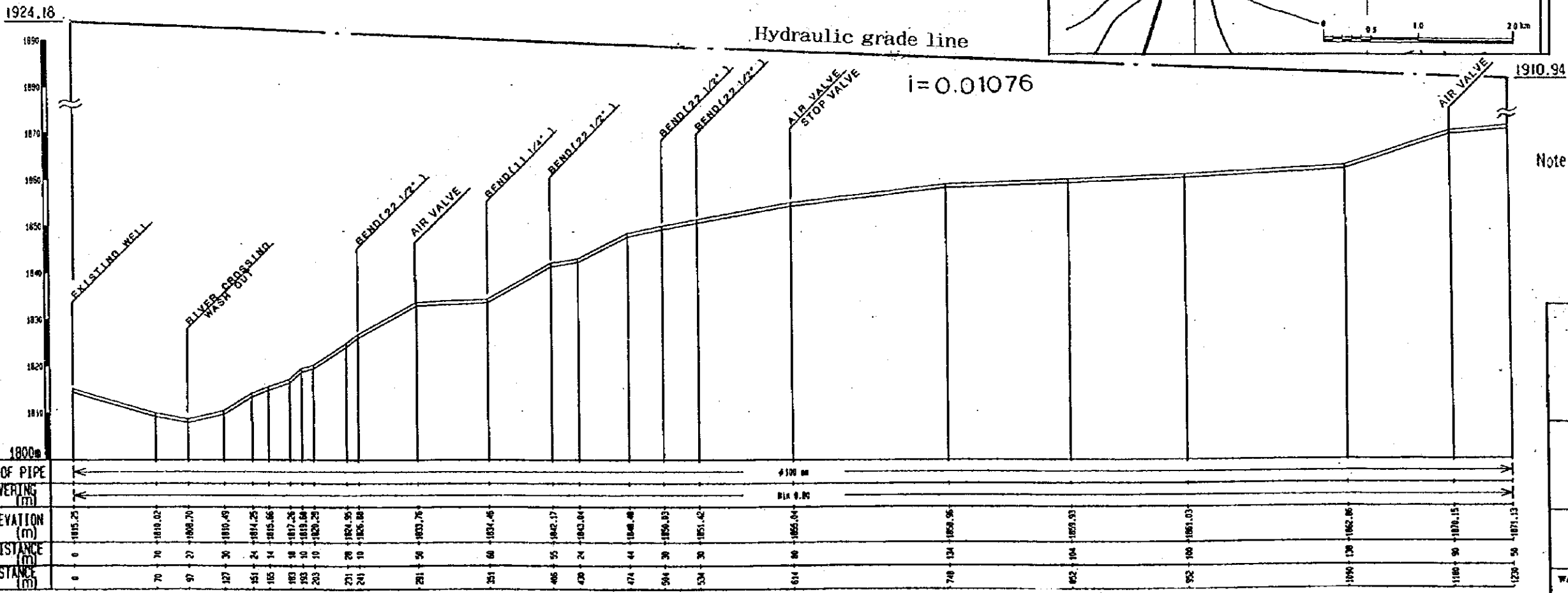
PLAN



PROFILE



LEGEND	
	BEND 90°
	BEND 45°
	BEND 22 1/2°
	BEND 11 1/4°
	TEE
	WASH OUT
	AIR VALVE
	STOP VALVE



Note: Water hammer analysis will be required and its countermeasure will be taken, if necessary

STATE OF ERITREA
 MINISTRY OF LAND, WATER & ENVIRONMENT

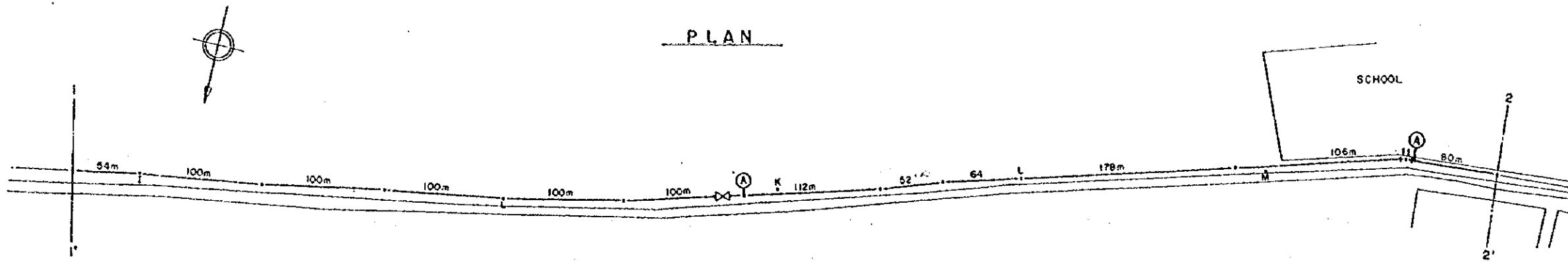
JAPAN INTERNATIONAL COOPERATION AGENCY

STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION

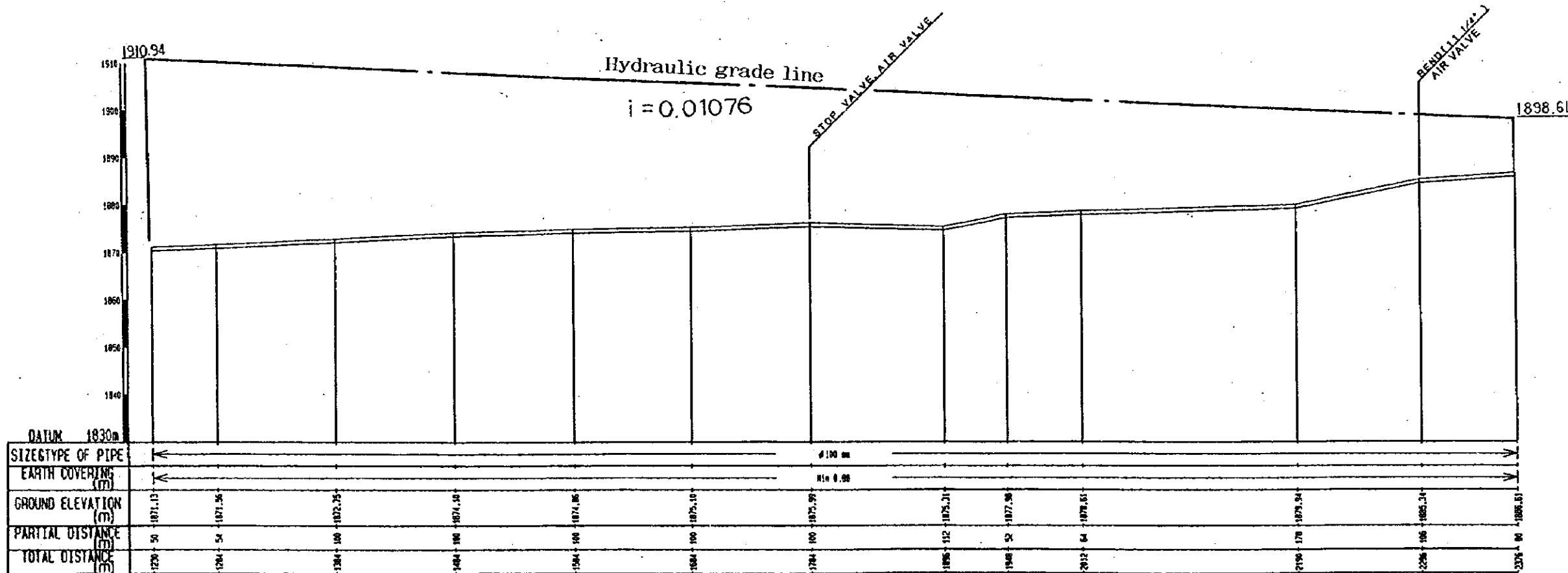
Plan & Profile for Transmission Pipeline (2005)
 ADIQUALA

WATER RESOURCES DEPARTMENT (ASMARA, ERITREA)
 SANTU CONSULTANTS INC. (JAPAN) 1999

Drawing No. 2 / 23



PROFILE



LEGEND	
	BEND 90°
	BEND 45°
	BEND 22 1/2°
	BEND 11 1/4°
	TEE
	WASH OUT
	AIR VALVE
	STOP VALVE

STATE OF ERITREA
 MINISTRY OF LAND, WATER & ENVIRONMENT

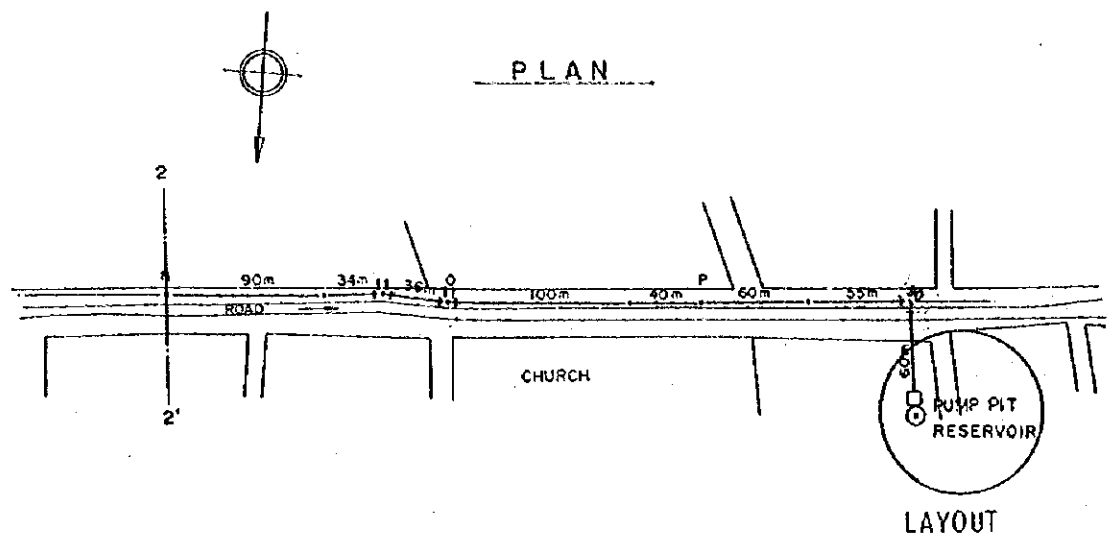
JAPAN INTERNATIONAL COOPERATION AGENCY

STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION

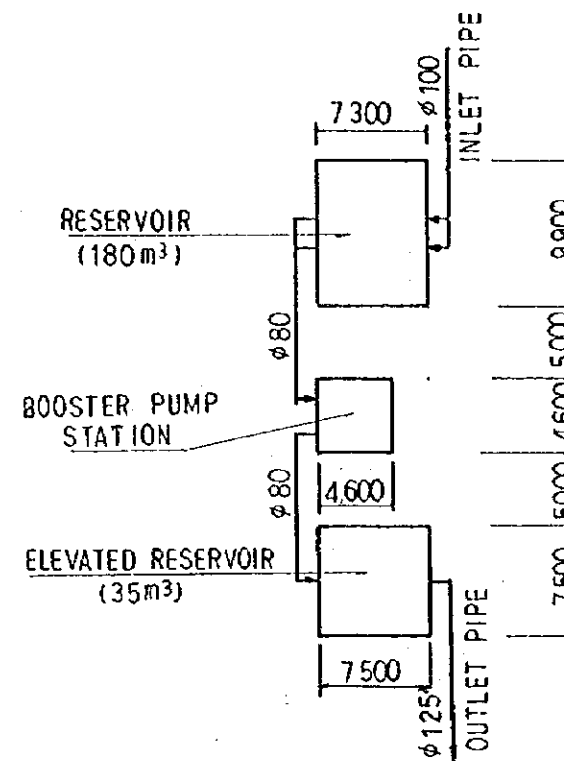
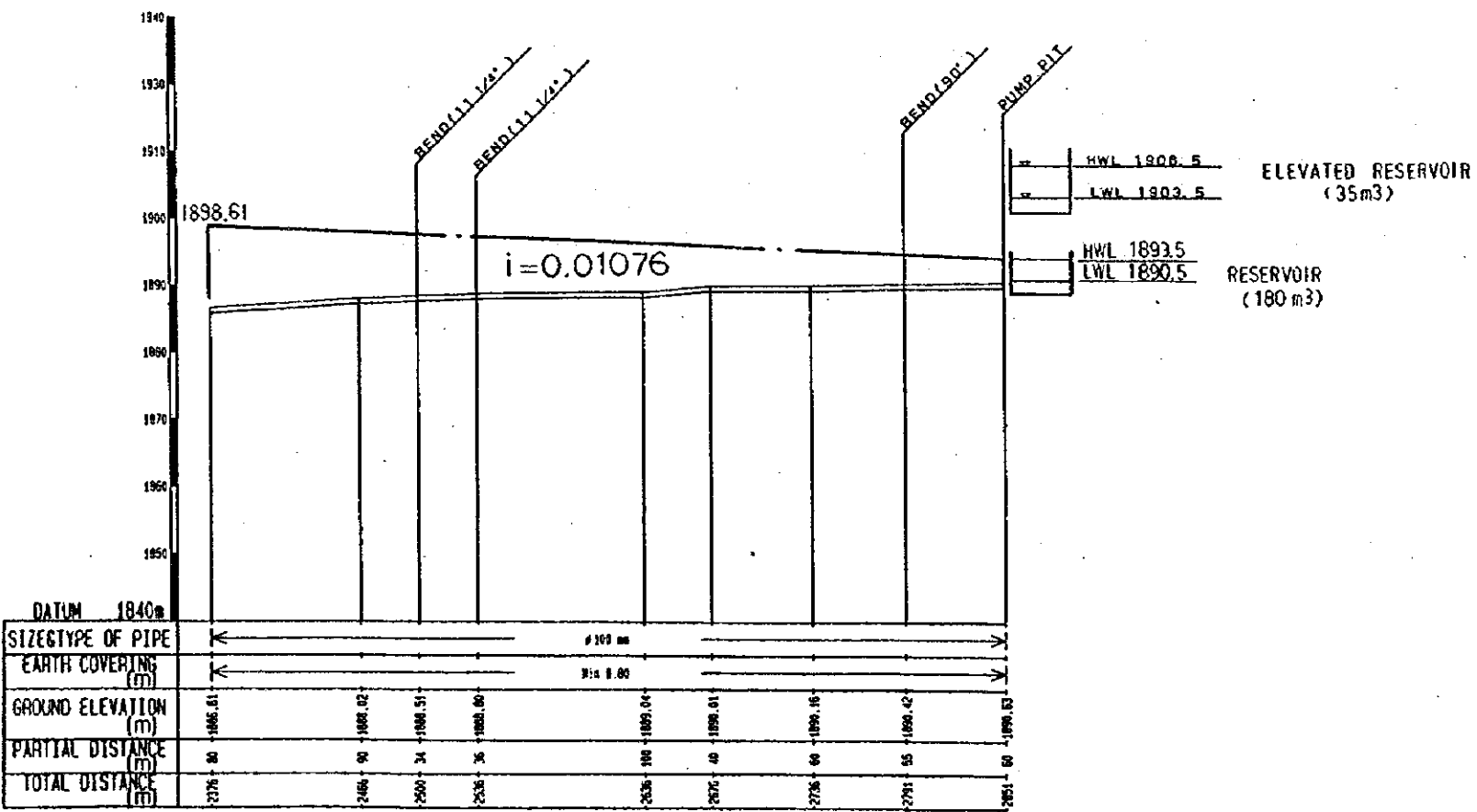
Plan & Profile for Transmission Pipeline (2005)
 ADIQUALA

WATER RESOURCES DEPARTMENT (ASMARA, ERITREA)
 SANTU CONSULTANTS INC. (JAPAN) 1999

Drawing No. 3 / 23



PROFILE



LAYOUT

LEGEND	
	BEND 90°
	BEND 45°
	BEND 22 1/2°
	BEND 11 1/4°
	TEE
	WASH OUT
	AIR VALVE
	STOP VALVE

STATE OF ERYTREA
MINISTRY OF LAND, WATER & ENVIRONMENT

JAPAN INTERNATIONAL COOPERATION AGENCY

STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION

Plan & Profile for Transmission Pipeline (2005)
ADIQUALA

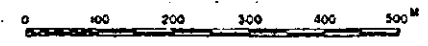
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SANTU CONSULTANTS INC. (JAPAN) 1999

Drawing No. 4/23

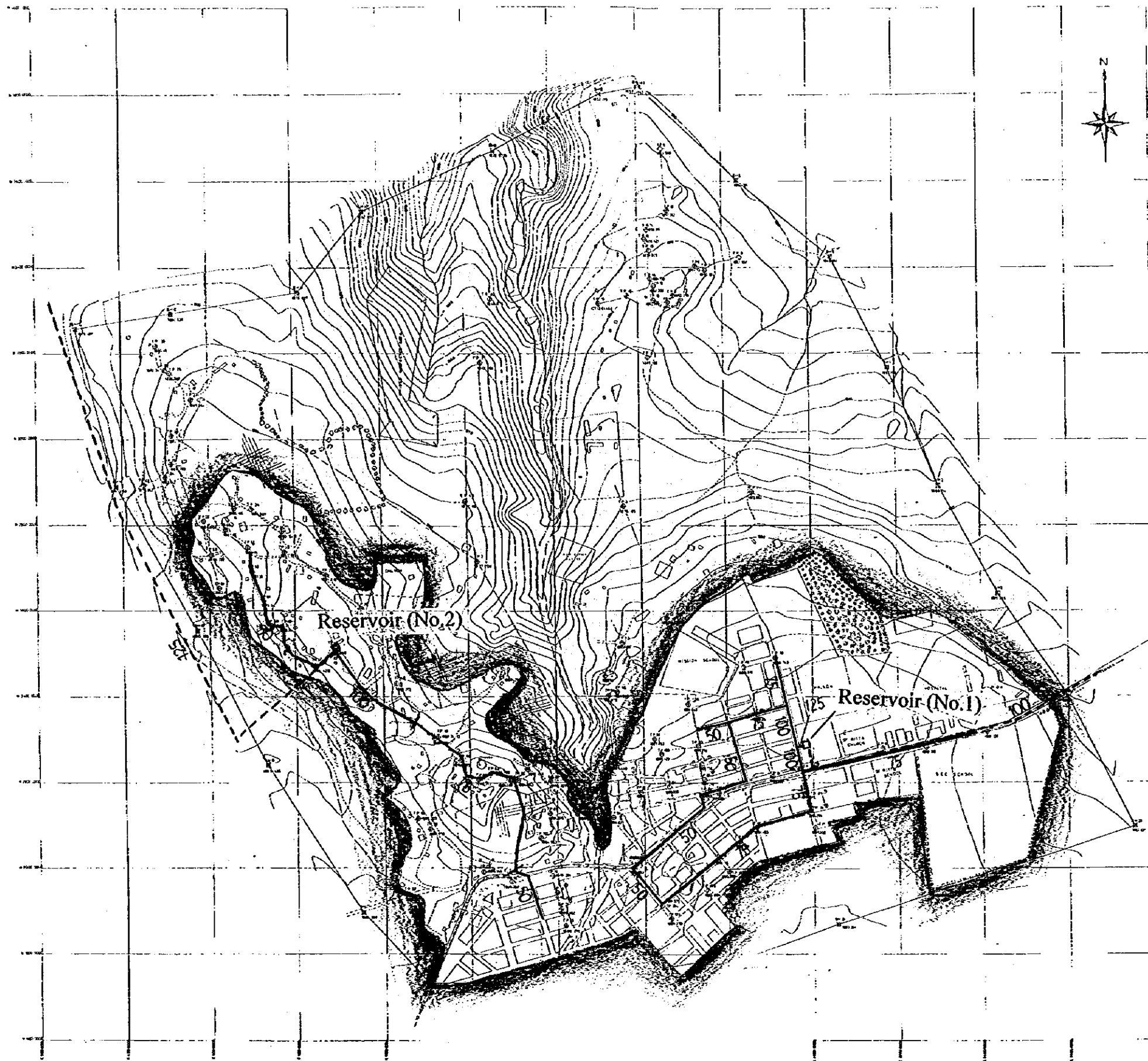


- Legend**
- 100 ——— Distribution pipeline
Pipe Diameter (mm)
 - - - - - Transmission pipeline
 - Well
 - Reservoir

Plan of Distribution Pipeline (2005)



STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
PLAN OF DISTRIBUTION PIPELINE (2005)	
ADIQUALA	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA)	Drawing No.
SANTYU CONSULTANTS INC. (JAPAN) 1999	5 / 23

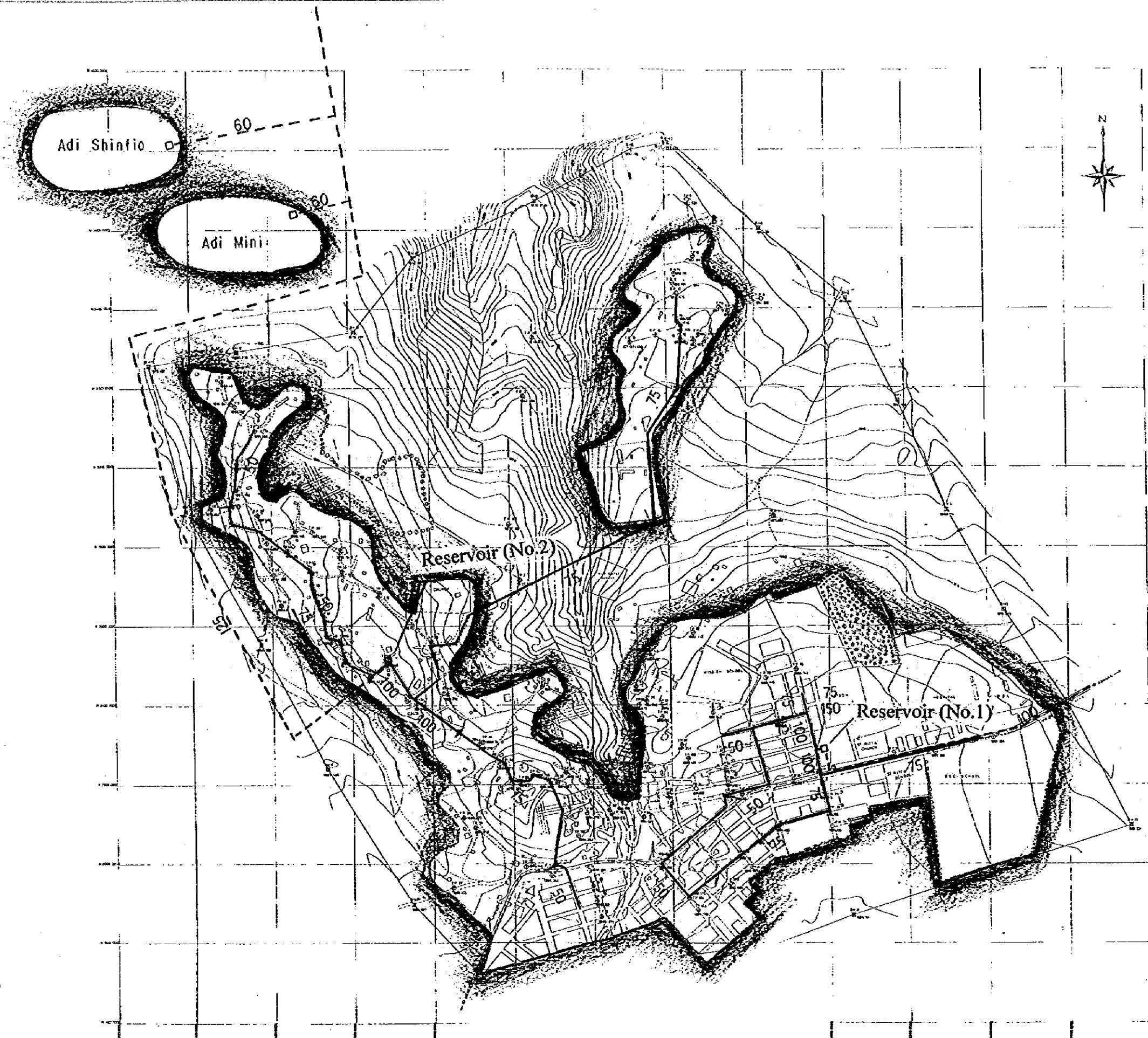


- Legend**
- 100 — Distribution pipeline
 - Pipe Diameter (mm)
 - - - - - Transmission pipeline
 - Well
 - Reservoir



Plan of Distribution Pipeline (2010)

STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
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PLAN OF DISTRIBUTION PIPELINE (2010) ADIQUALA	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANYU CONSULTANTS INC. JAPAN, 1999	Drawing No. 6 / 23

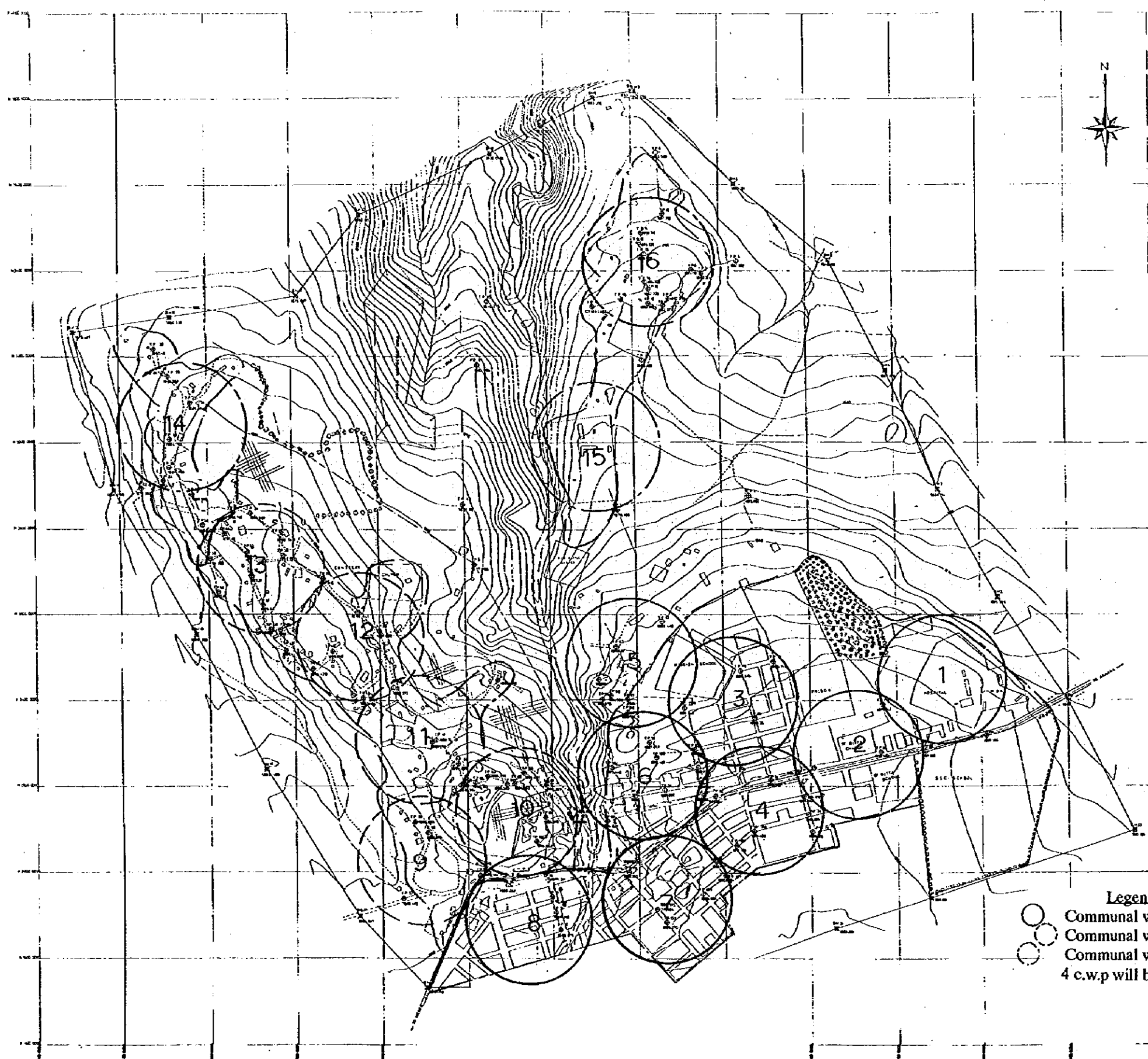


- Legend**
- 100 — Distribution pipeline
Pipe Diameter (mm)
 - - - - - Transmission pipeline
 - Well
 - Reservoir

Plan of Distribution Pipeline (2015)



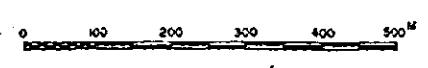
STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
PLAN OF DISTRIBUTION PIPELINE (2015) ADIQUALA	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANYU CONSULTANTS INC. (JAPAN) 1998	Drawing No. 7 / 23



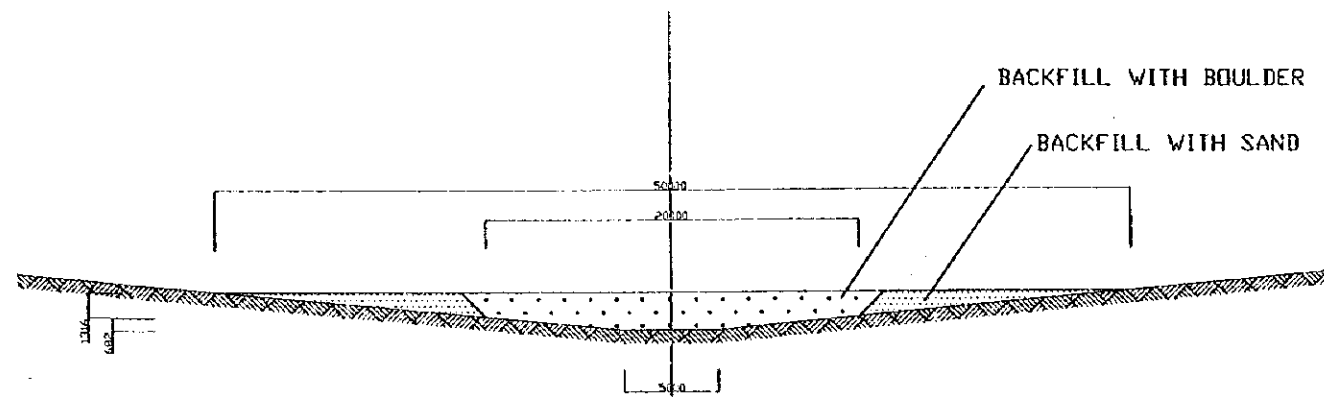
Legend

- Communal water points for 2005 (No. 1 - 8)
- Communal water points for 2010 (No. 9 - 13)
- Communal water points for 2015 (No. 14 - 16)
- 4 c.w.p will be added for 2 villages in 2015.

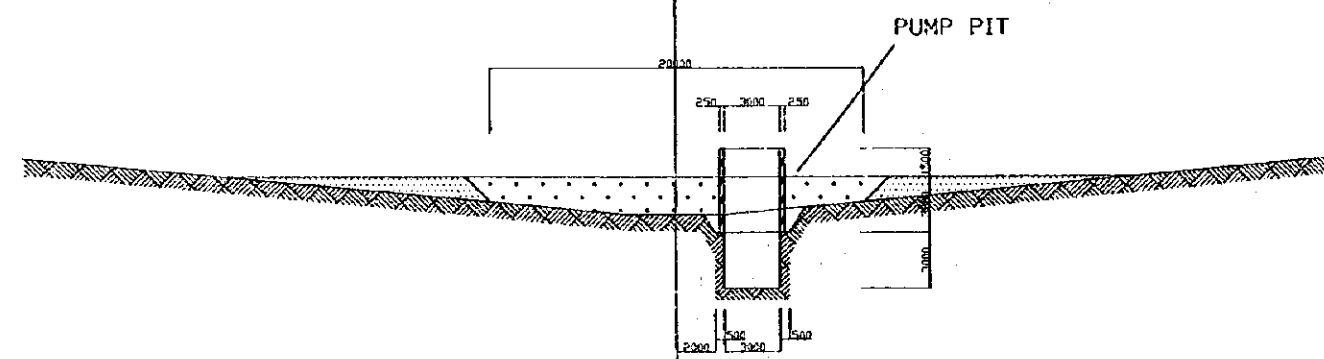
Location of Proposed Communal Water Point



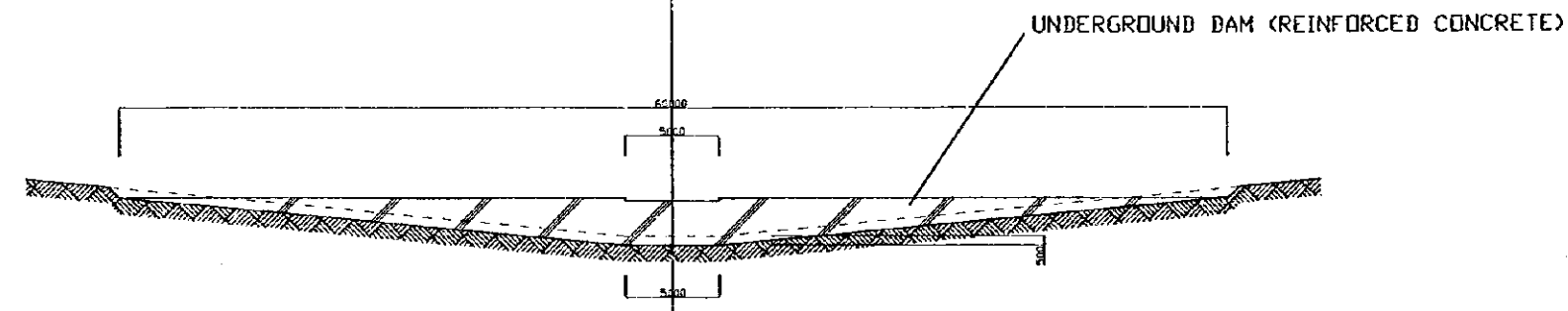
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JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
LOCATION OF PROPOSED COMMUNAL WATER POINT ADIQUALA	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANYU CONSULTANTS INC. (NAFAS) 1999	Drawing No. 8 / 23



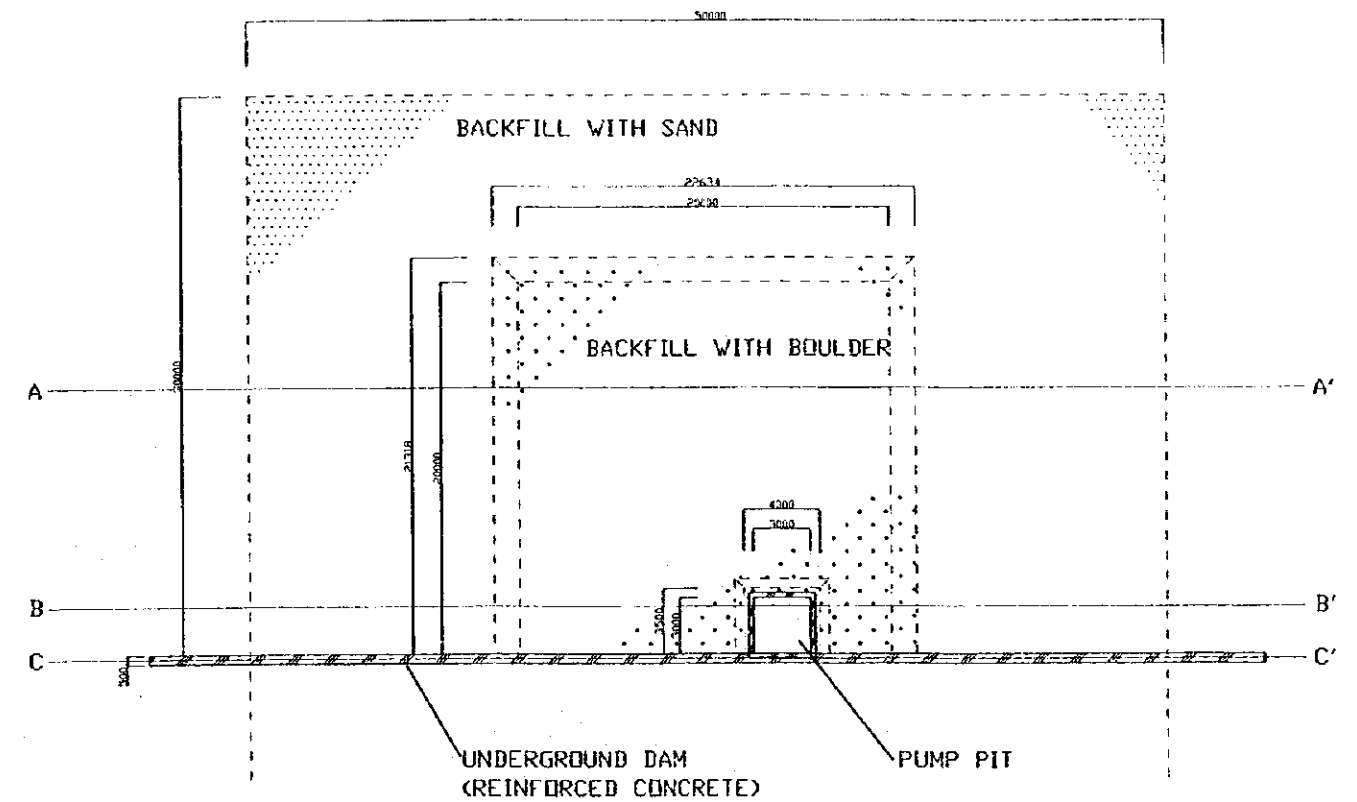
SECTION A-A'



SECTION B-B'

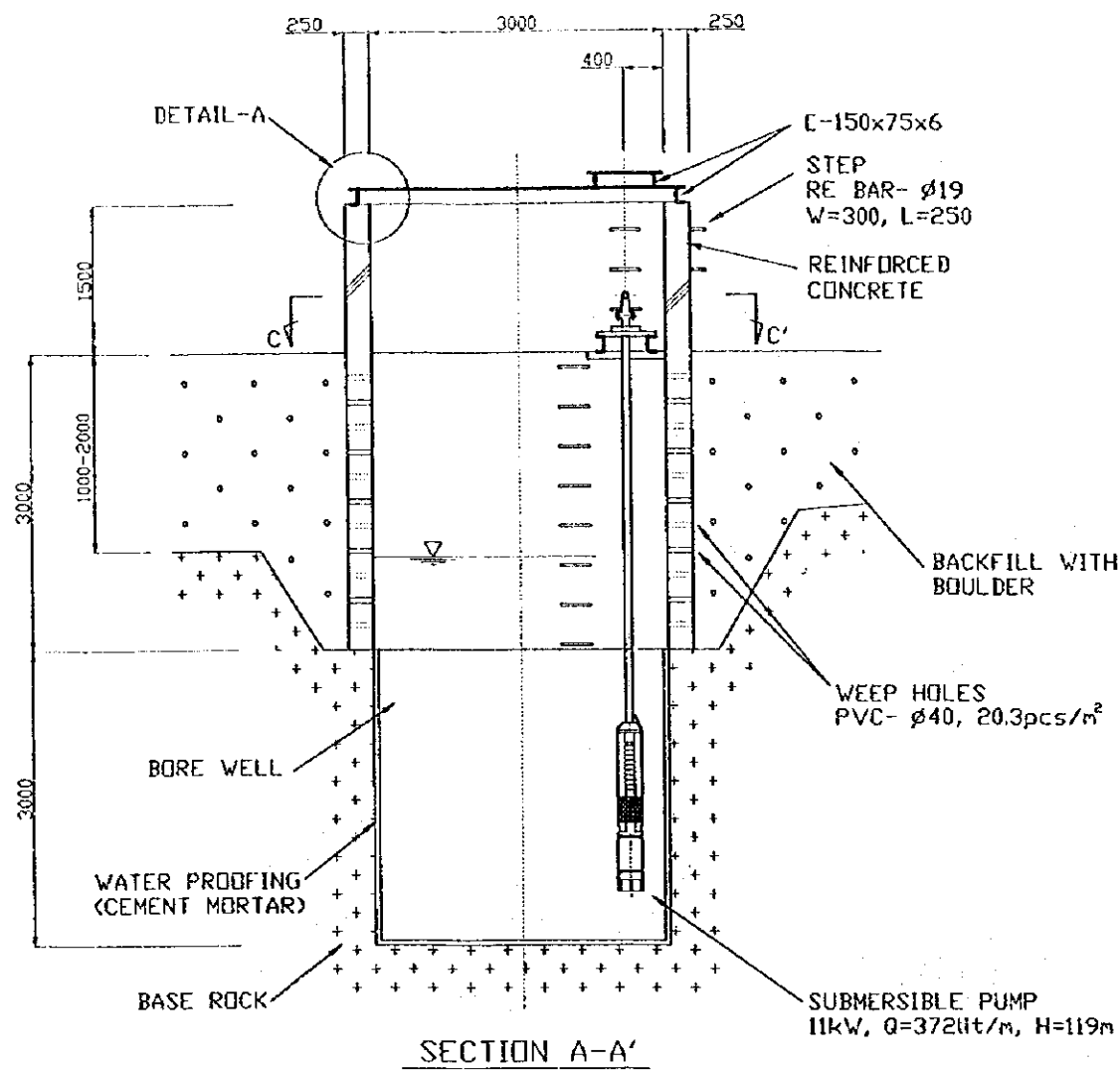


SECTION C-C'

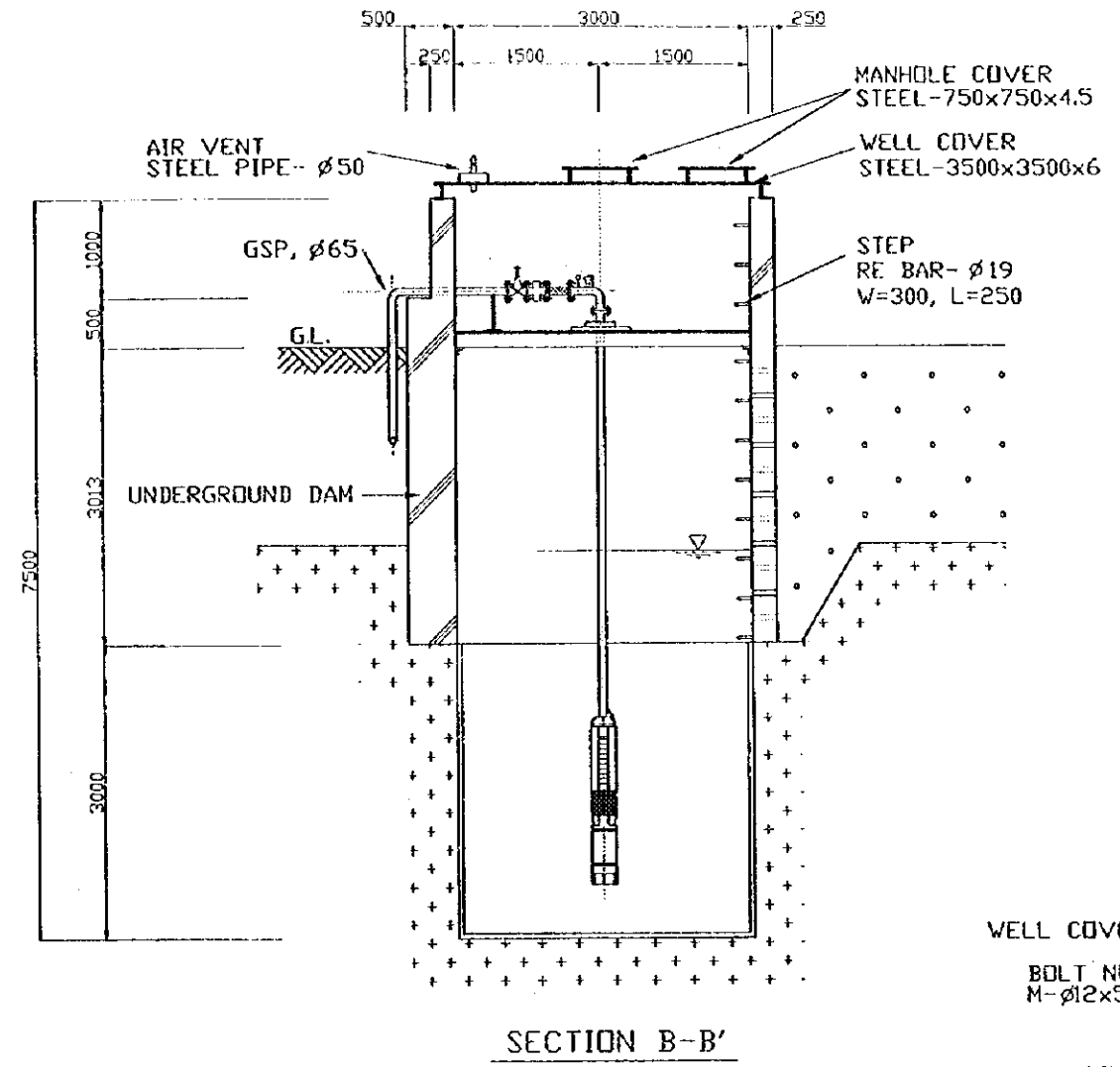


PLAN

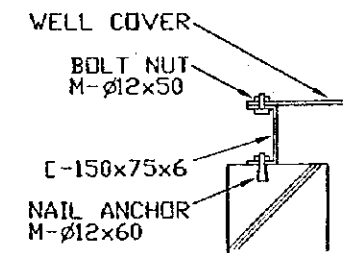
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STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
INTAKE FACILITY ADIQUALA	
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No. 9/23



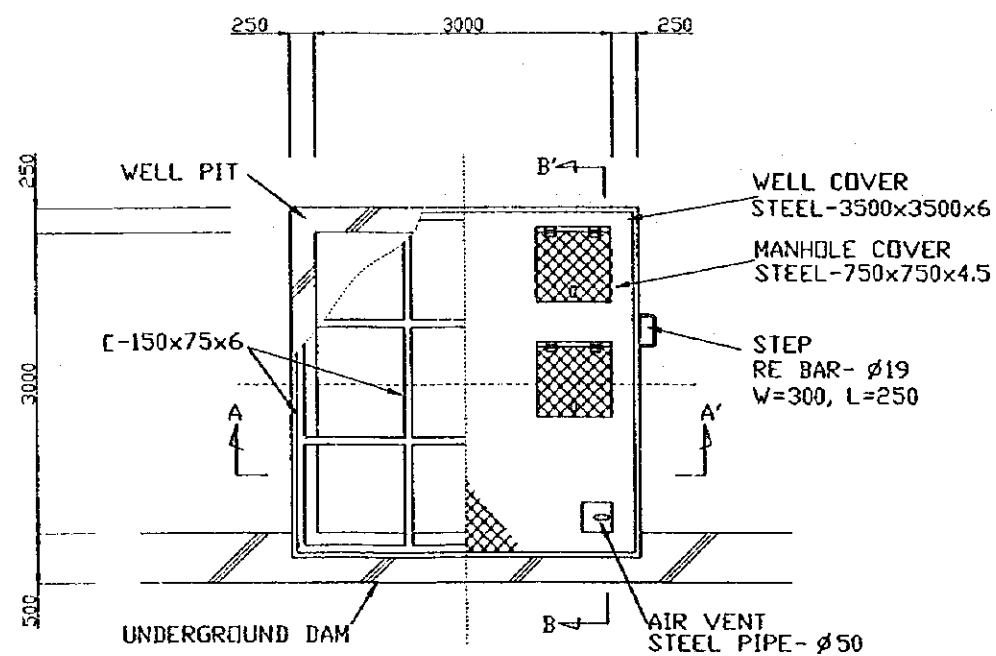
SECTION A-A'



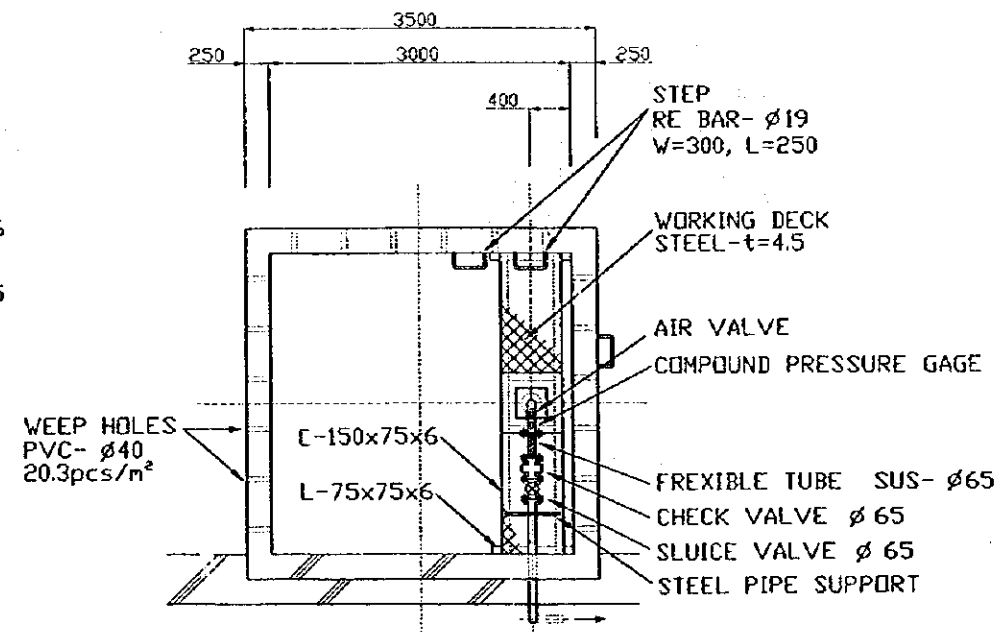
SECTION B-B'



DETAIL-A

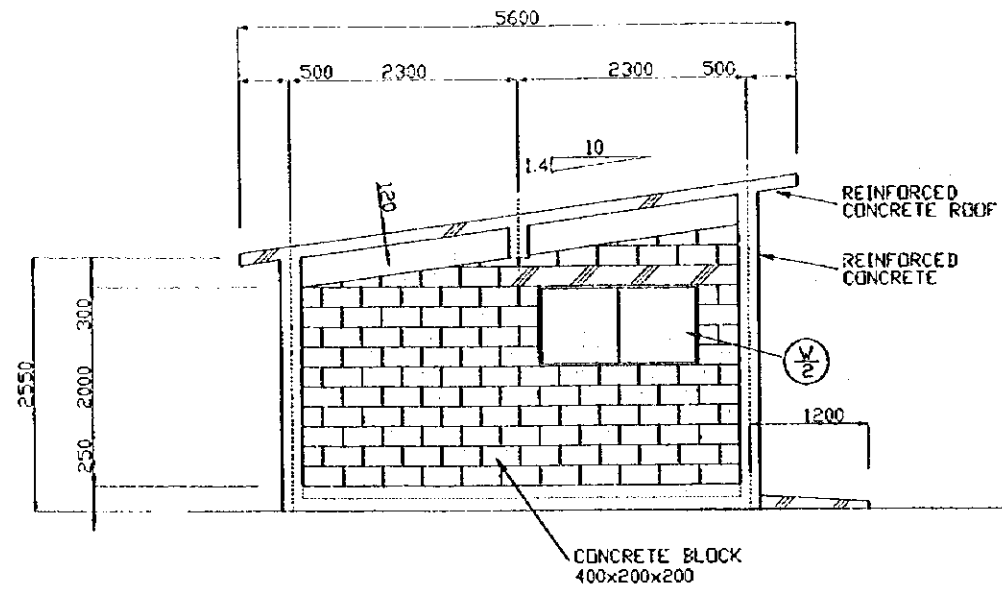


PLAN

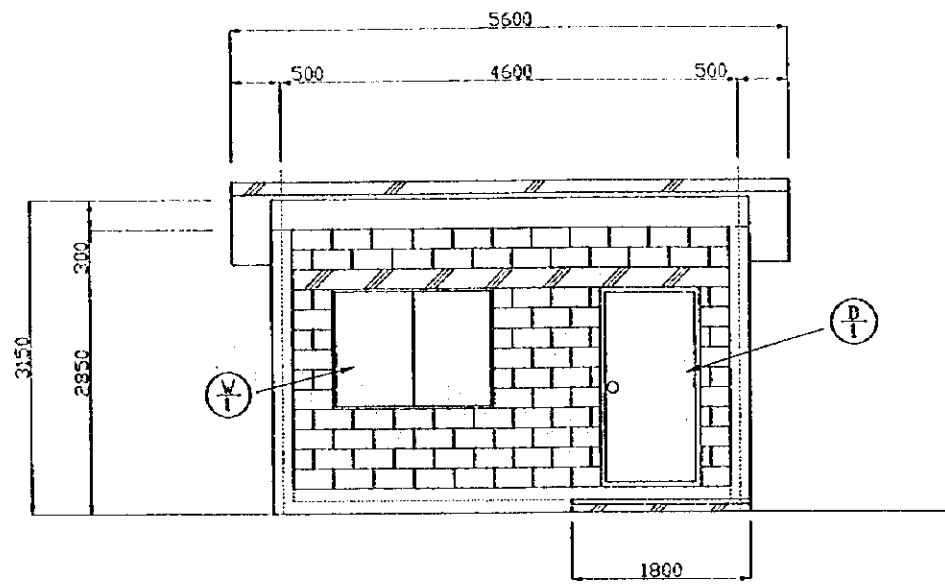


SECTION C-C'

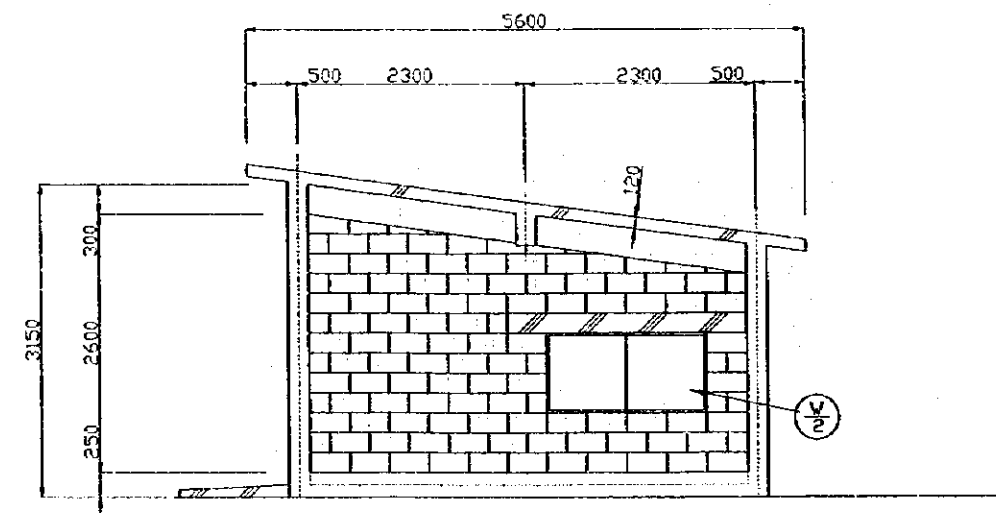
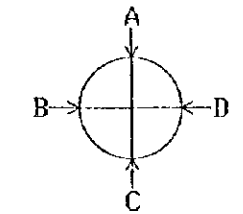
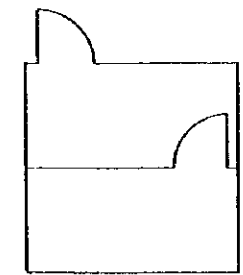
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STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
DETAIL OF INTAKE FACILITY ADIQUALA	
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No. 10/23



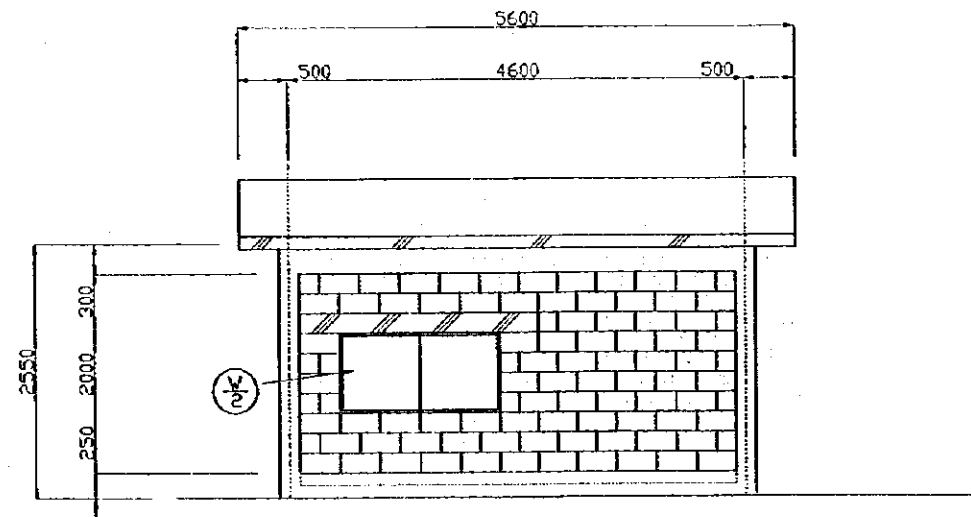
D-ELEVATION



A-ELEVATION



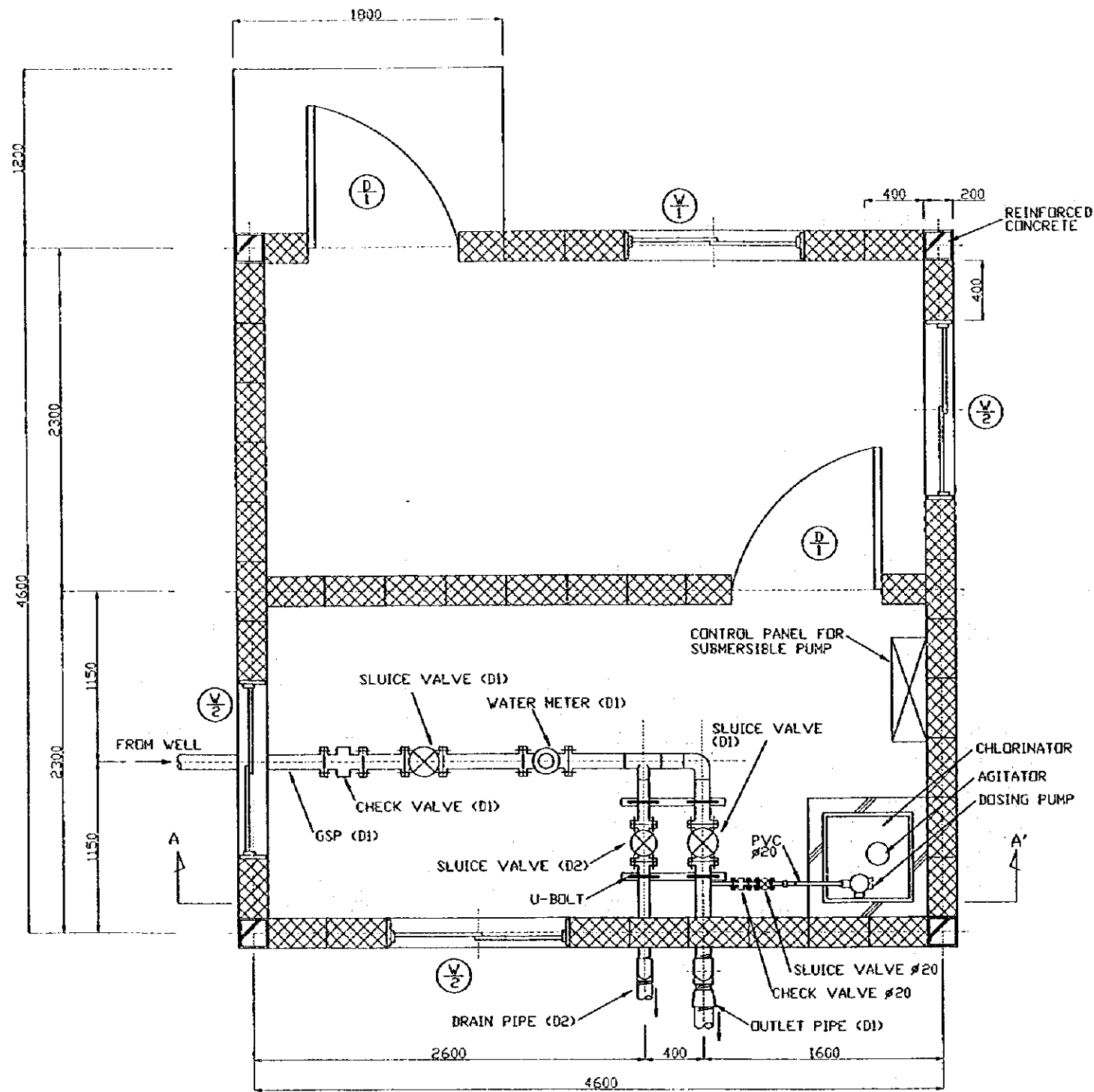
B-ELEVATION



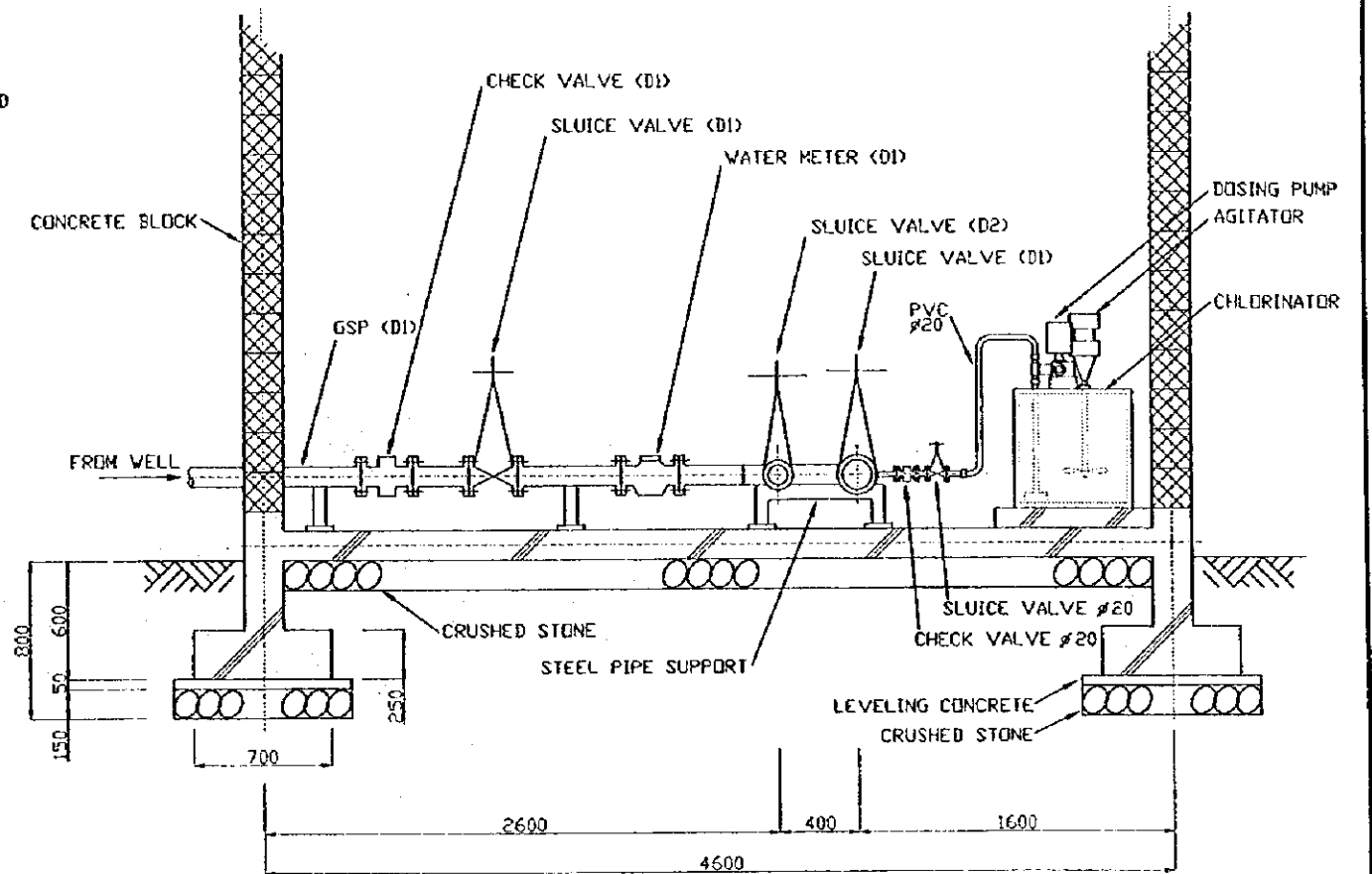
C-ELEVATION

	V	H	ea
	STEEL DOOR	800 X 1,900	X 2
	WINDOW WITH WIRED GLASS	900 X 900	X 1
	WINDOW WITH WIRED GLASS	900 X 600	X 3

STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
STRUCTURE OF BOREHOLE PUMP STATION ADIQUALA	
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No 11/23



PLAN



SECTION A-A'

- | | | | |
|--|-----|-------|-----|
| | V | H | ea |
| | 800 | 1,900 | X 2 |
| | 900 | 900 | X 1 |
| | 900 | 600 | X 3 |

Water Source	D1	D2
N-INTAKE	80	50

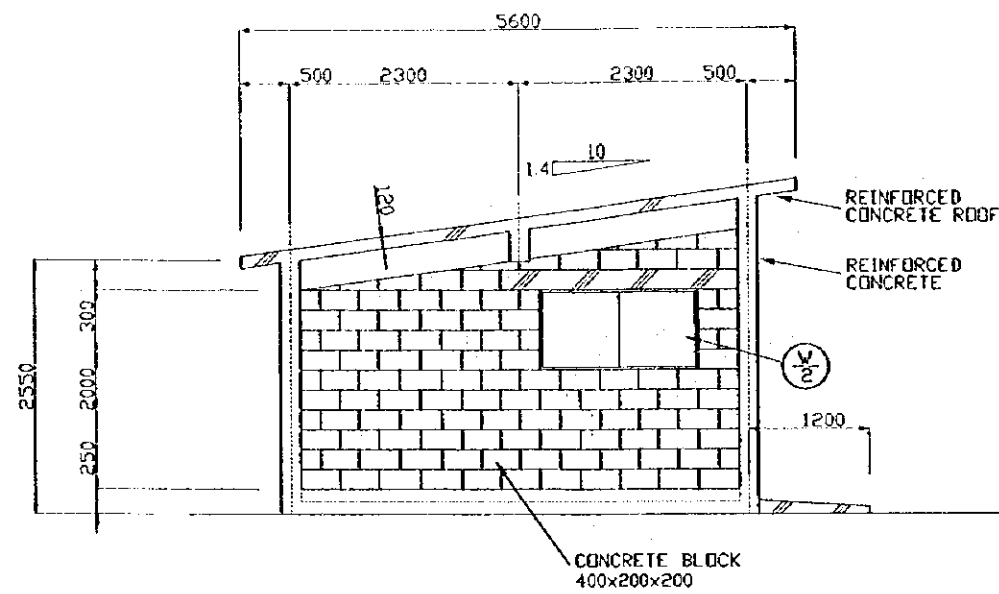
STATE OF ERITREA
MINISTRY OF LAND, WATER & ENVIRONMENT

JAPAN INTERNATIONAL COOPERATION AGENCY

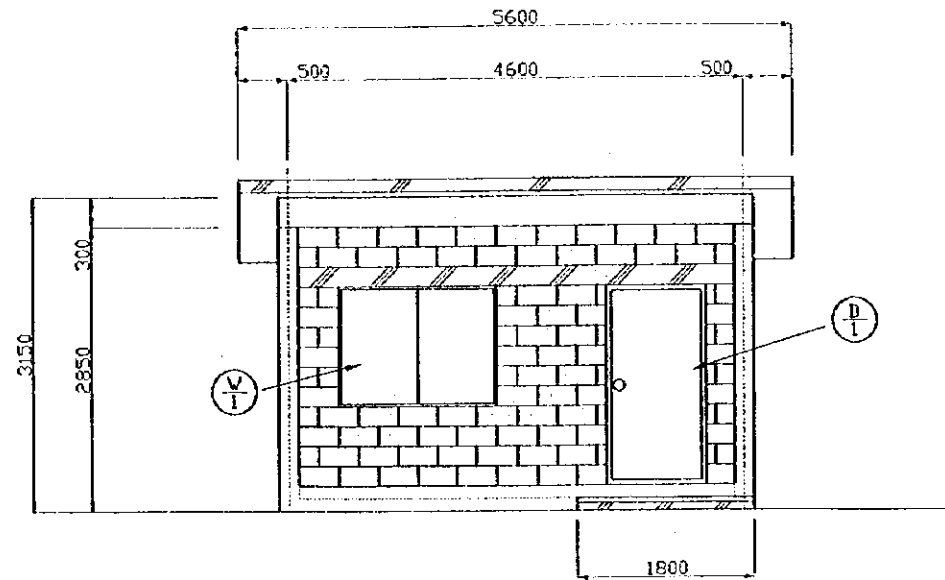
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION

BOREHOLE PUMP STATION
ADIQUALA

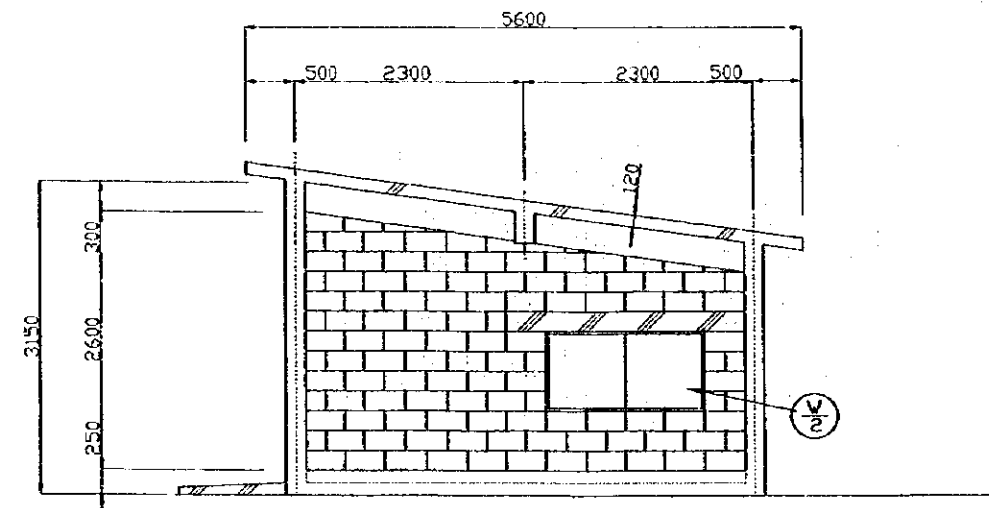
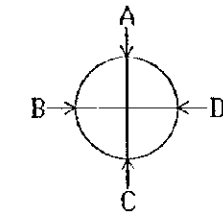
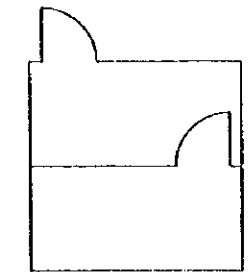
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No. 12/23
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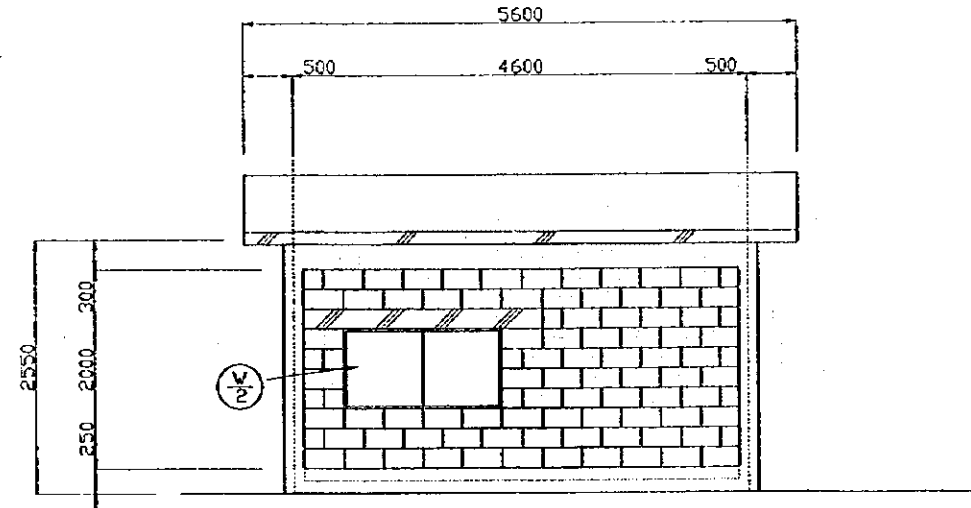
D-ELEVATION



A-ELEVATION



B-ELEVATION



C-ELEVATION

	W	H	ea
⊕	800	1,900	2
⊕ V	900	900	1
⊕ V	900	600	3

STATE OF ERITREA
MINISTRY OF LAND, WATER &
ENVIRONMENT

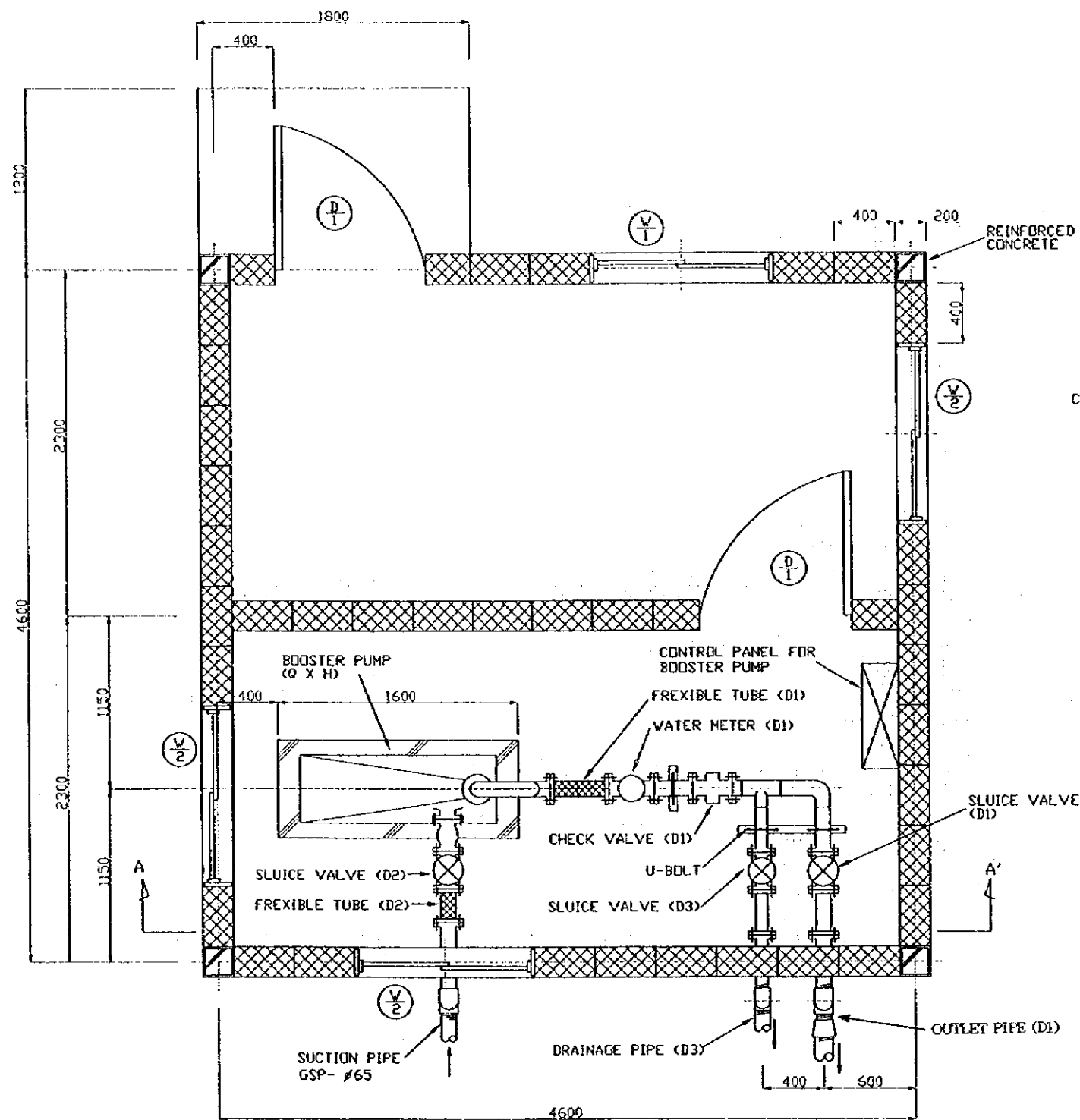
JAPAN INTERNATIONAL
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STUDY ON GROUNDWATER
DEVELOPMENT & WATER SUPPLY
FOR
SEVEN TOWNS IN SOUTHERN REGION

STRUCTURE OF BOOSTER PUMP STATION
ADIQUALA

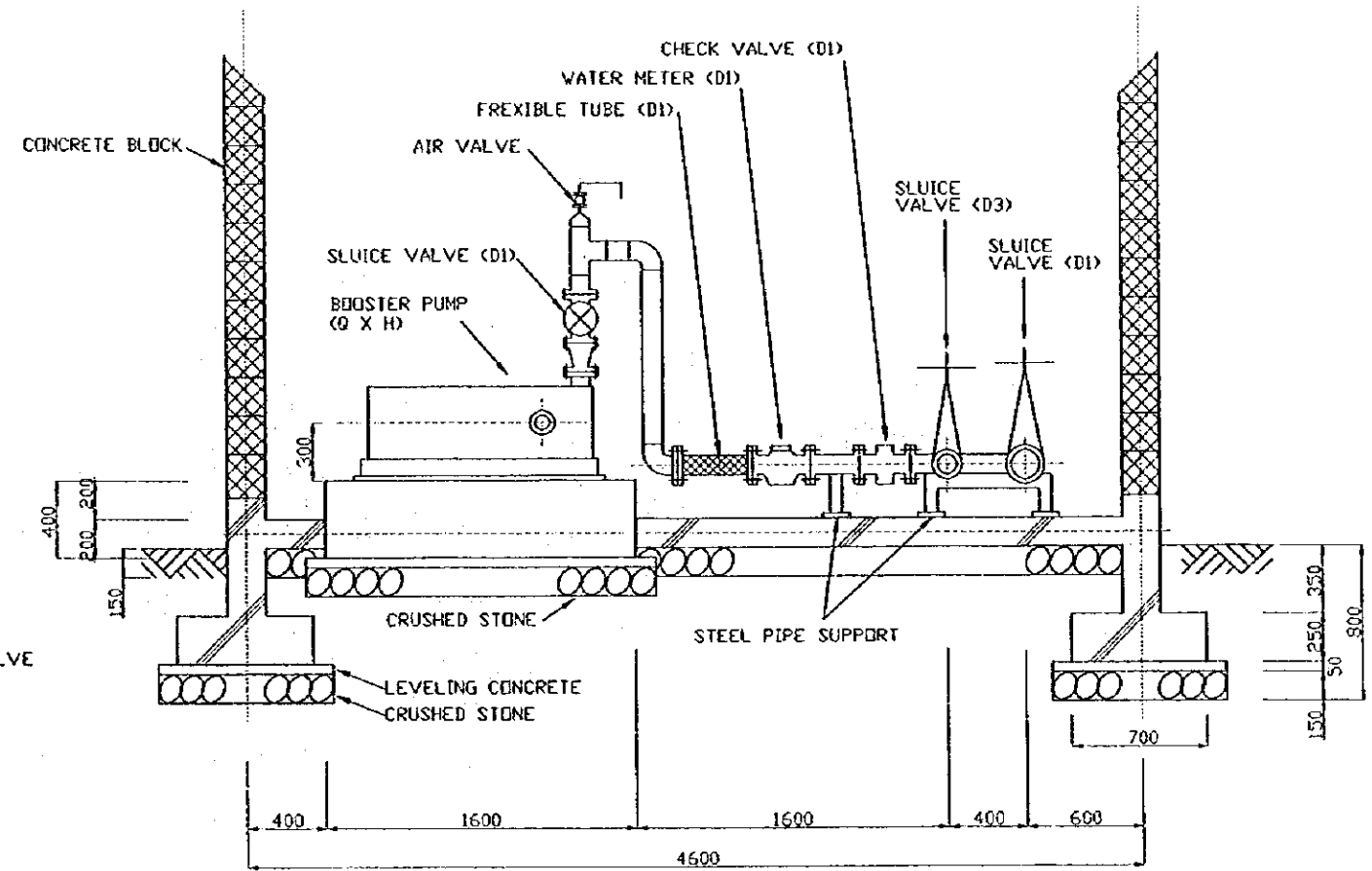
WATER RESOURCES DEPARTMENT
SANYU CONSULTANTS INC.
(JAPAN) 1999

Drawing No
13/23



PLAN

- | | | | |
|---|-------------------------|-----------------|----|
| | V | H | ea |
| ⊕ | STEEL DOOR | 800 X 1,900 X 2 | |
| ⊕ | WINDOW WITH WIRED GLASS | 900 X 900 X 1 | |
| ⊕ | WINDOW WITH WIRED GLASS | 900 X 600 X 3 | |



SECTION A-A'

Water Source	D1	D2	D3	Q (lit/m)	H (m)
BOOSTER-31	80	65	50	372	16

STATE OF ERITREA
 MINISTRY OF LAND, WATER &
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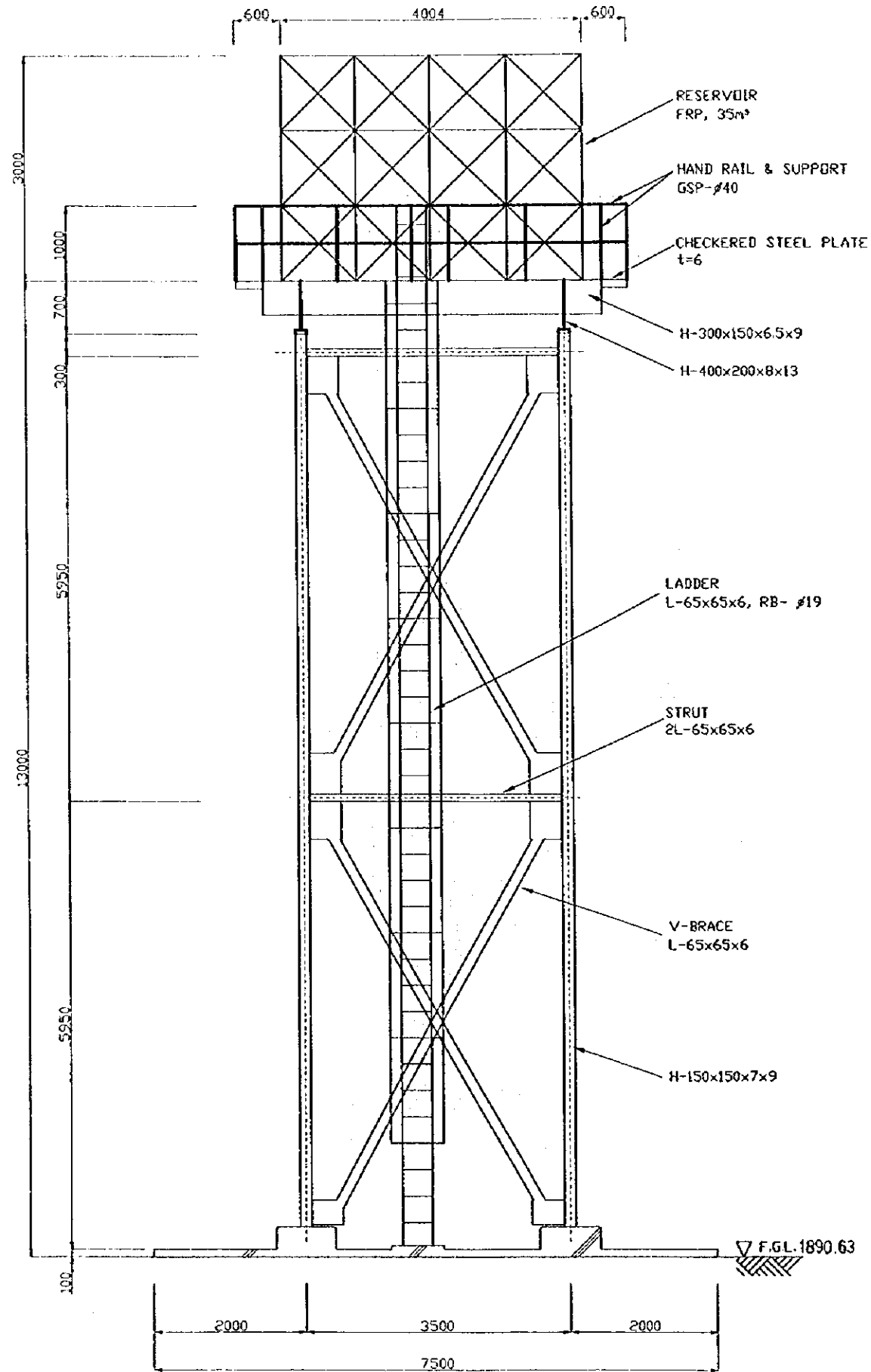
JAPAN INTERNATIONAL
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STUDY ON GROUNDWATER
 DEVELOPMENT & WATER SUPPLY
 FOR
 SEVEN TOWNS IN SOUTHERN REGION

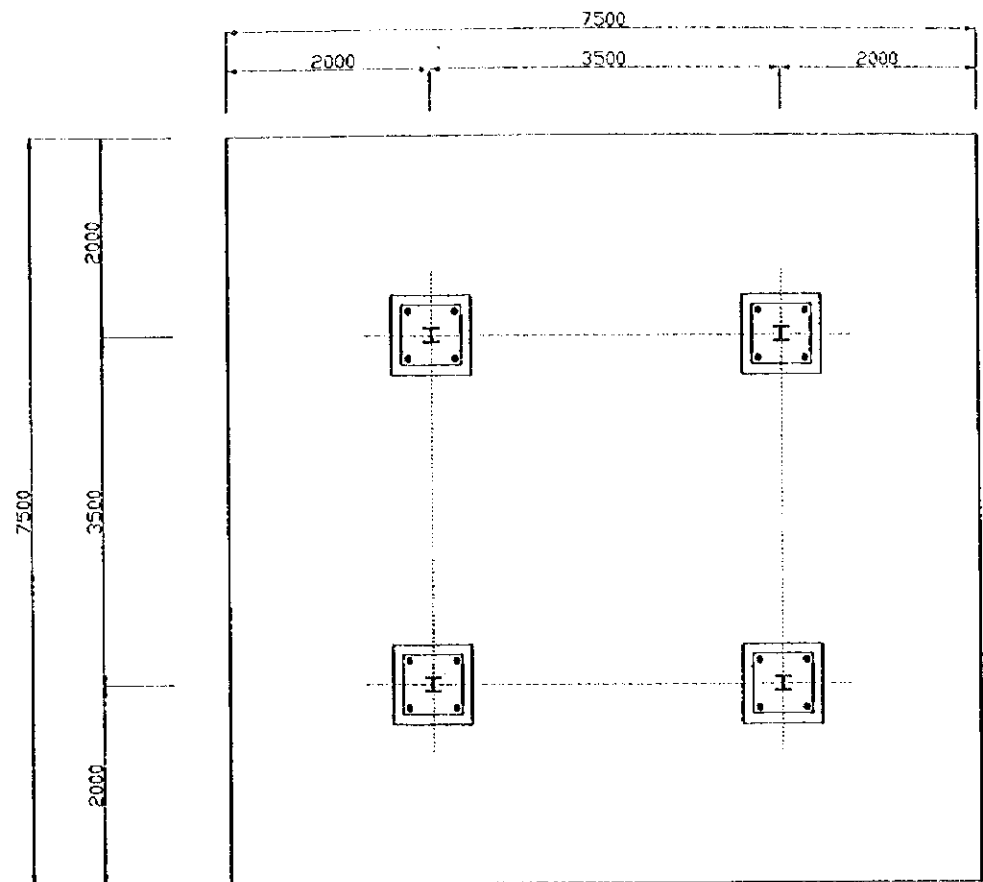
**BOOSTER PUMP STATION
 ADIQUALA**

WATER RESOURCES DEPARTMENT
 SANYU CONSULTANTS INC.
 (JAPAN) 1999

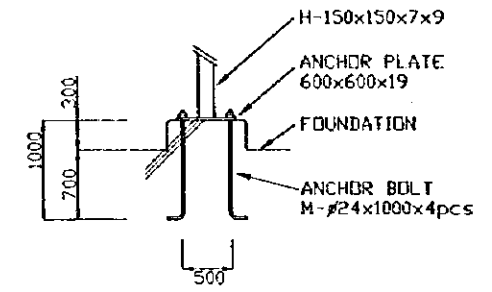
Drawing No
14/23



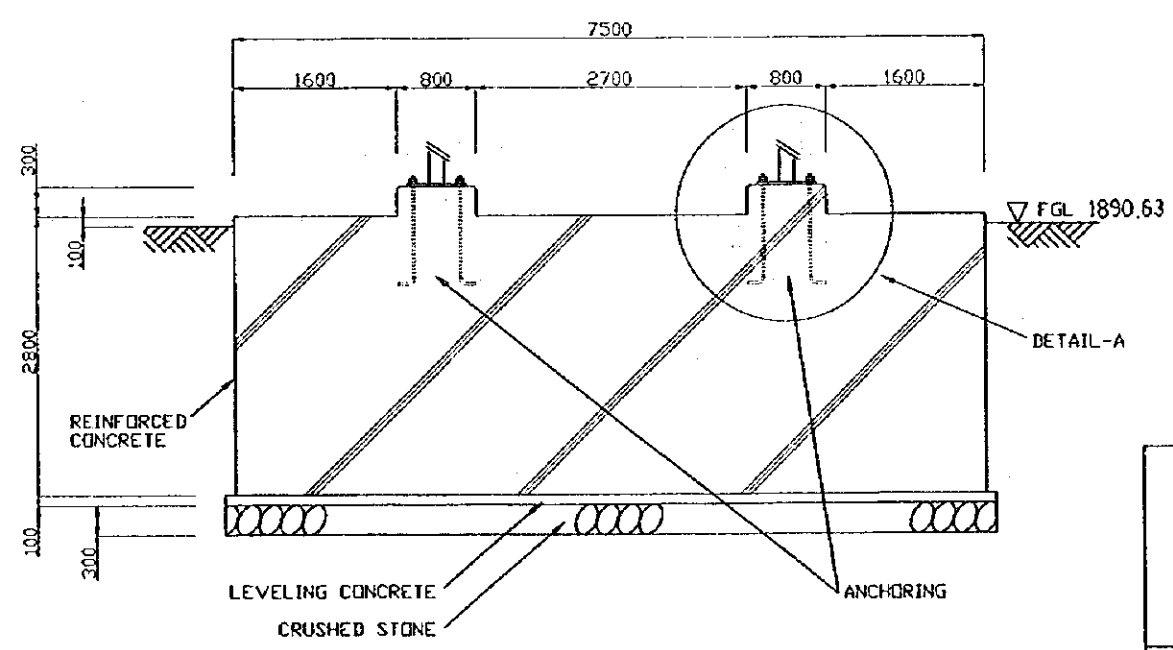
ELEVATION



PLAN OF FOUNDATION

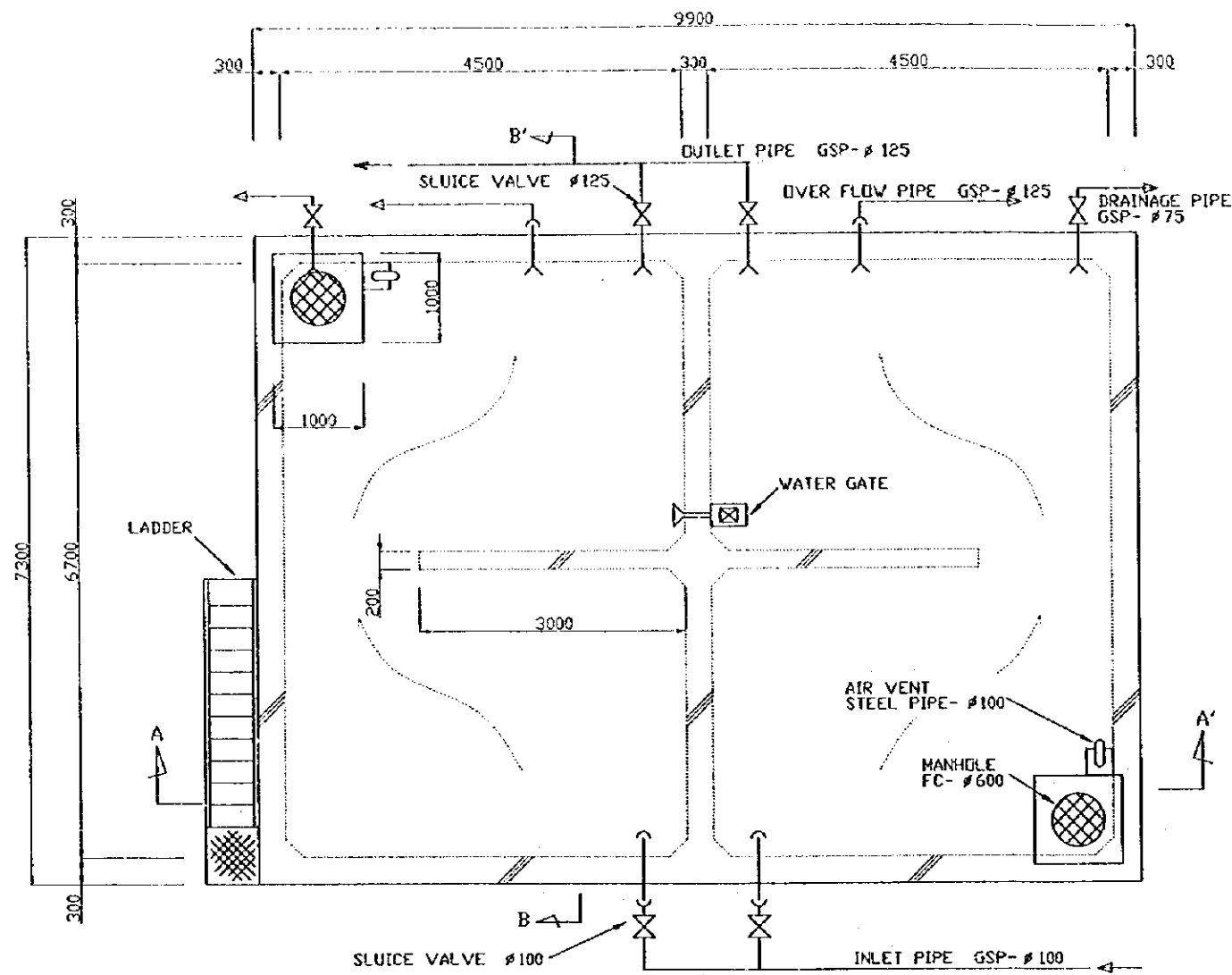


DETAIL -A

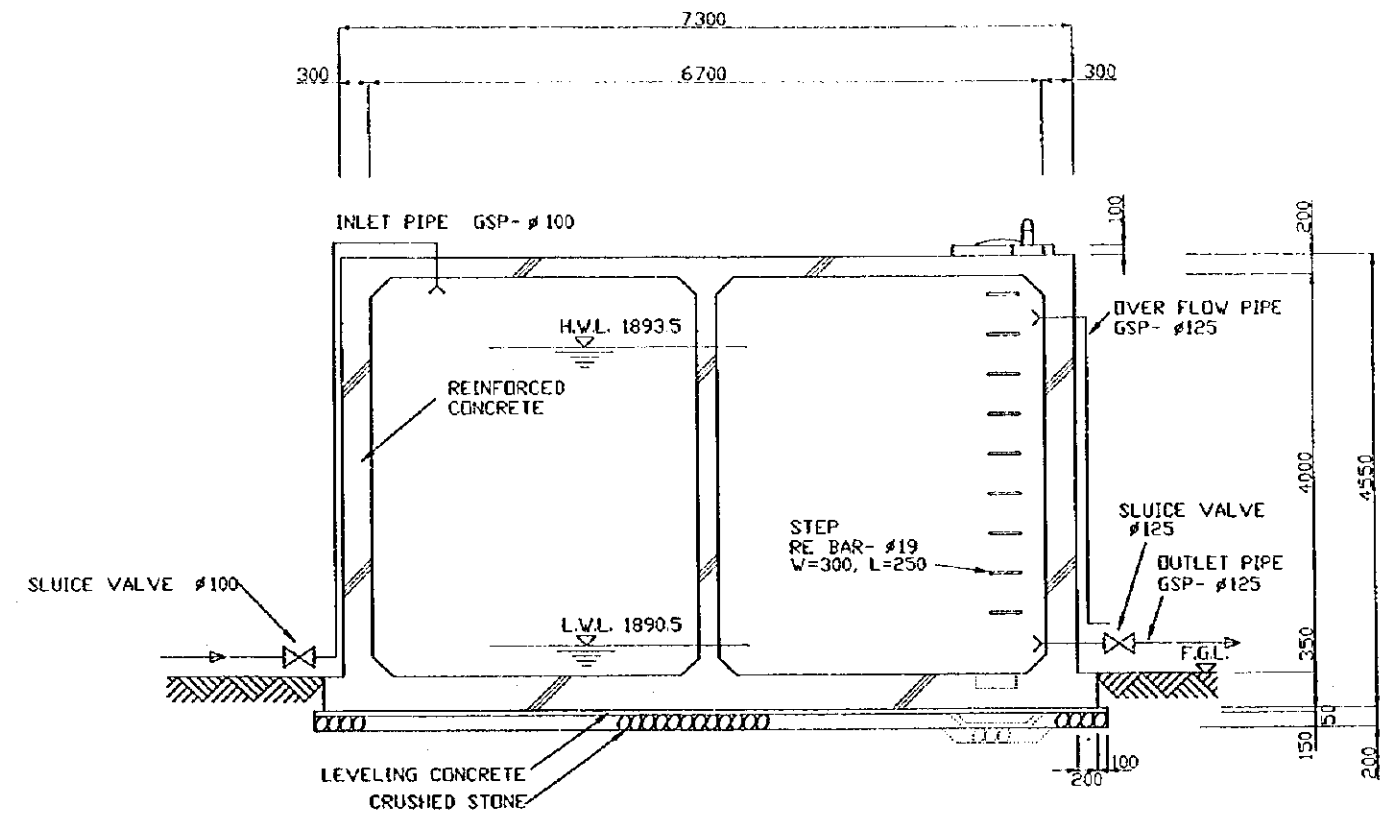


FOUNDATION

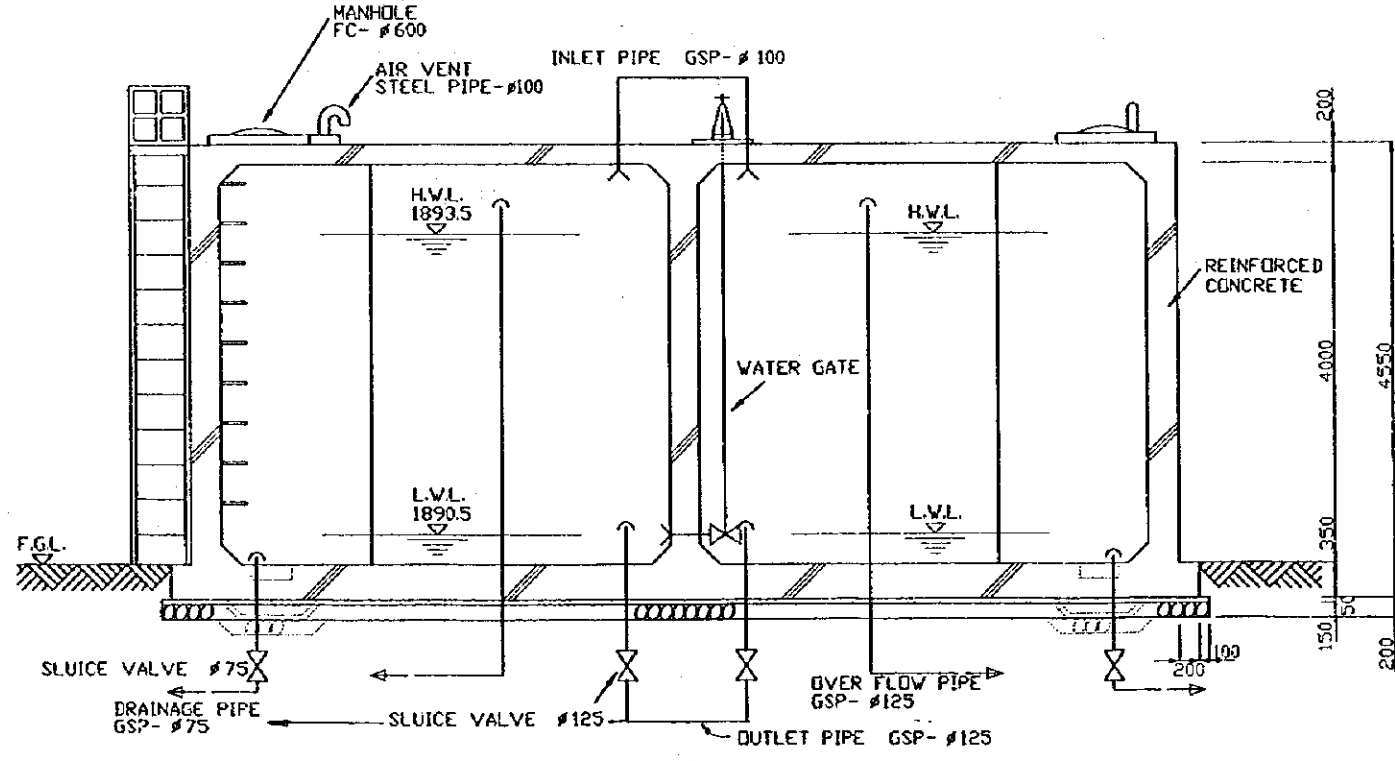
STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
35m ³ ELEVATED RESERVOIR ADIQUALA	
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No 15/23



PLAN

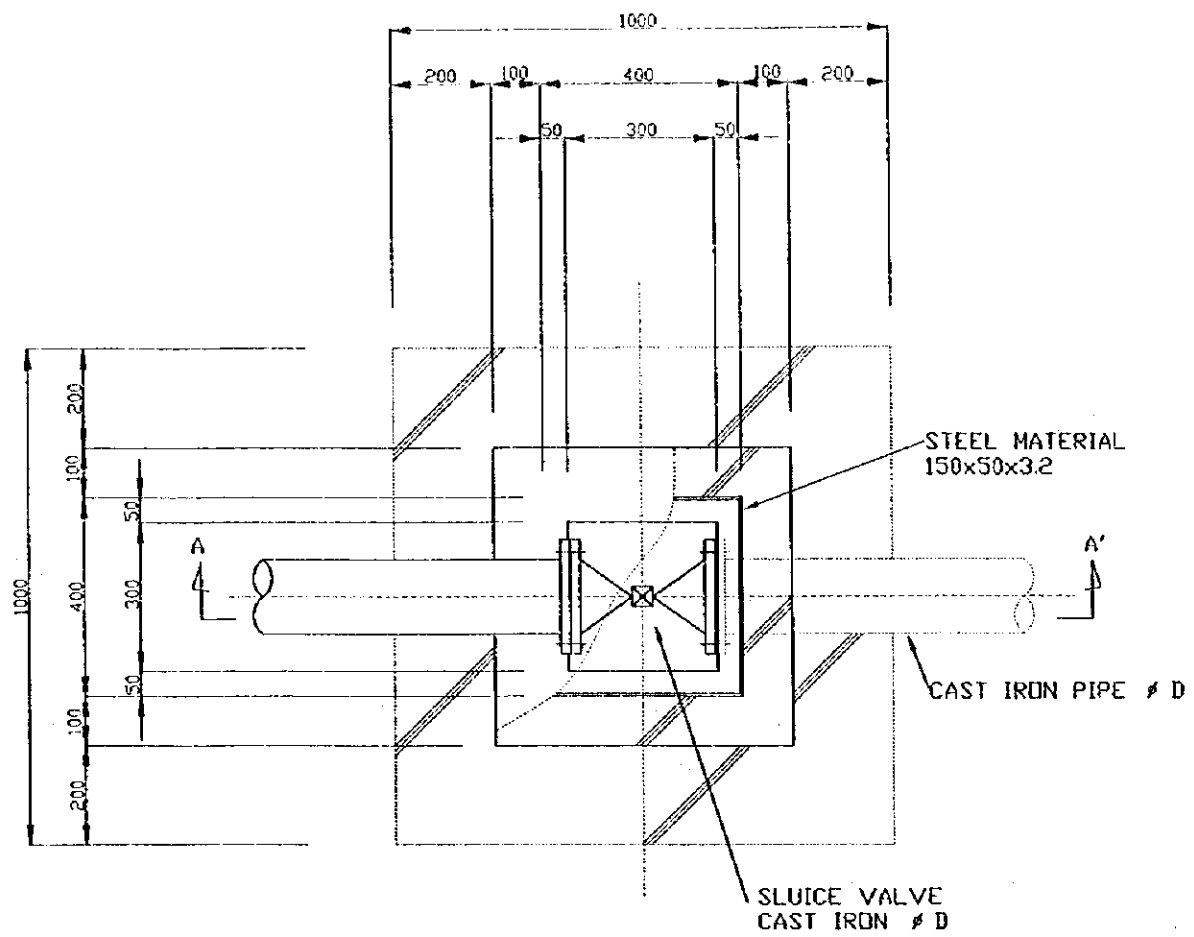


SECTION B-B'

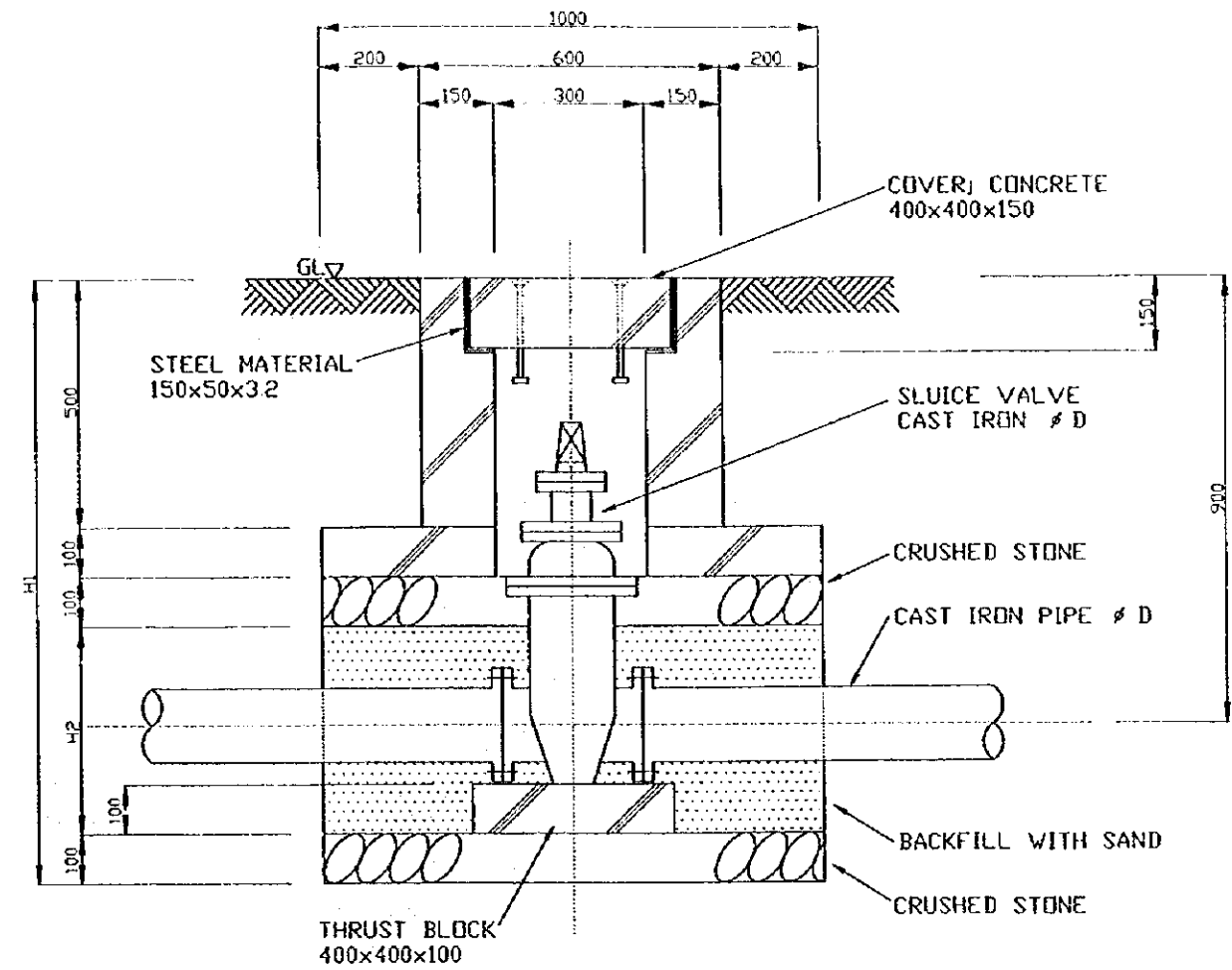


SECTION A-A

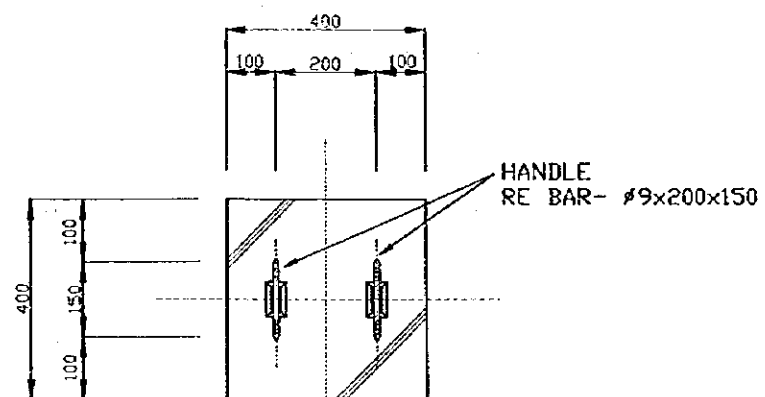
STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
180 ^m RESERVOIR ADIQUALA	
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No 16/23



PLAN



SECTION A-A'



COVER

øD	H1	H2
50	1180	380
80	1200	400
100	1220	420
125	1250	450
150	1280	480
200	1330	530

STATE OF ERITREA
MINISTRY OF LAND, WATER &
ENVIRONMENT

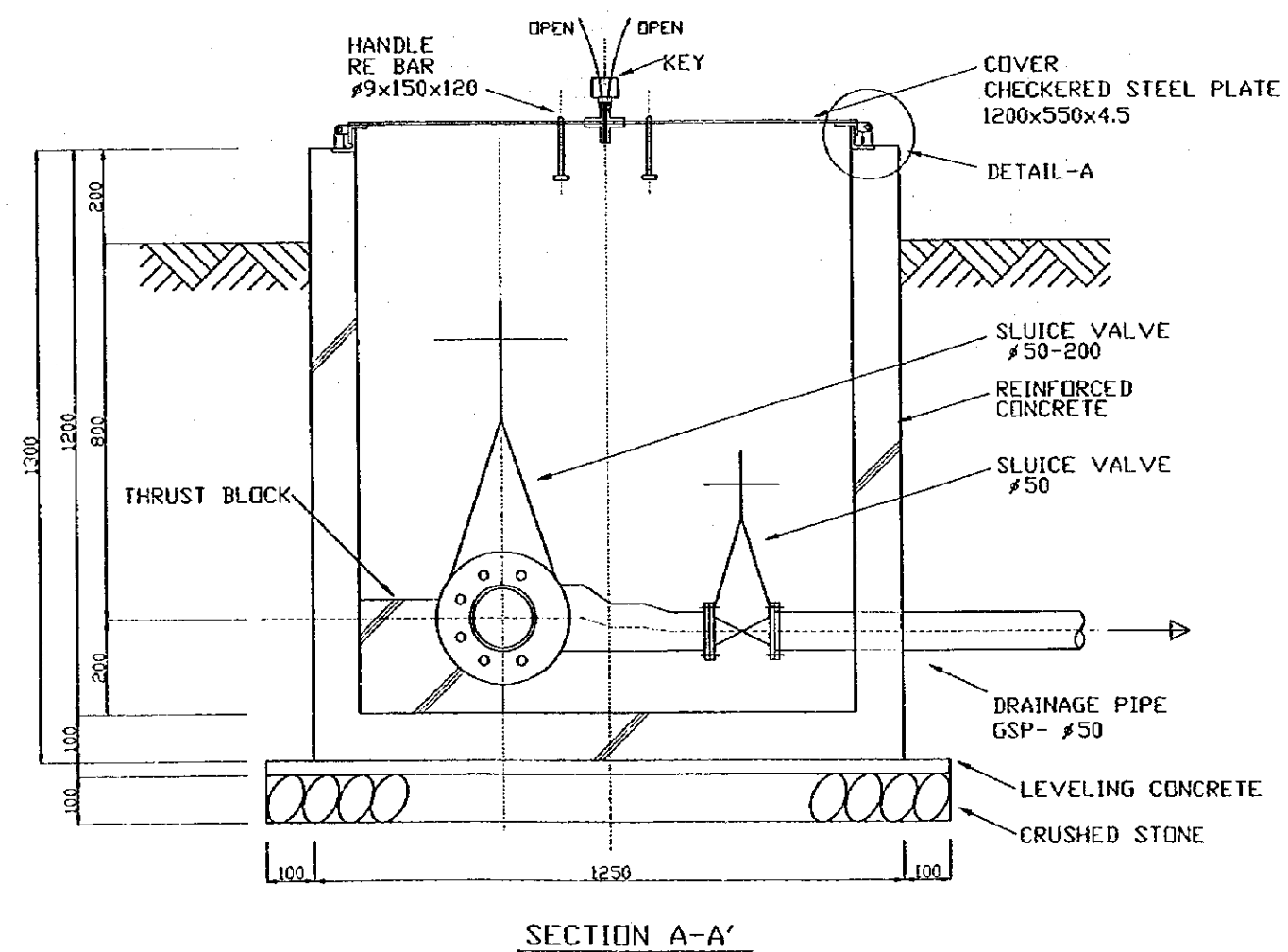
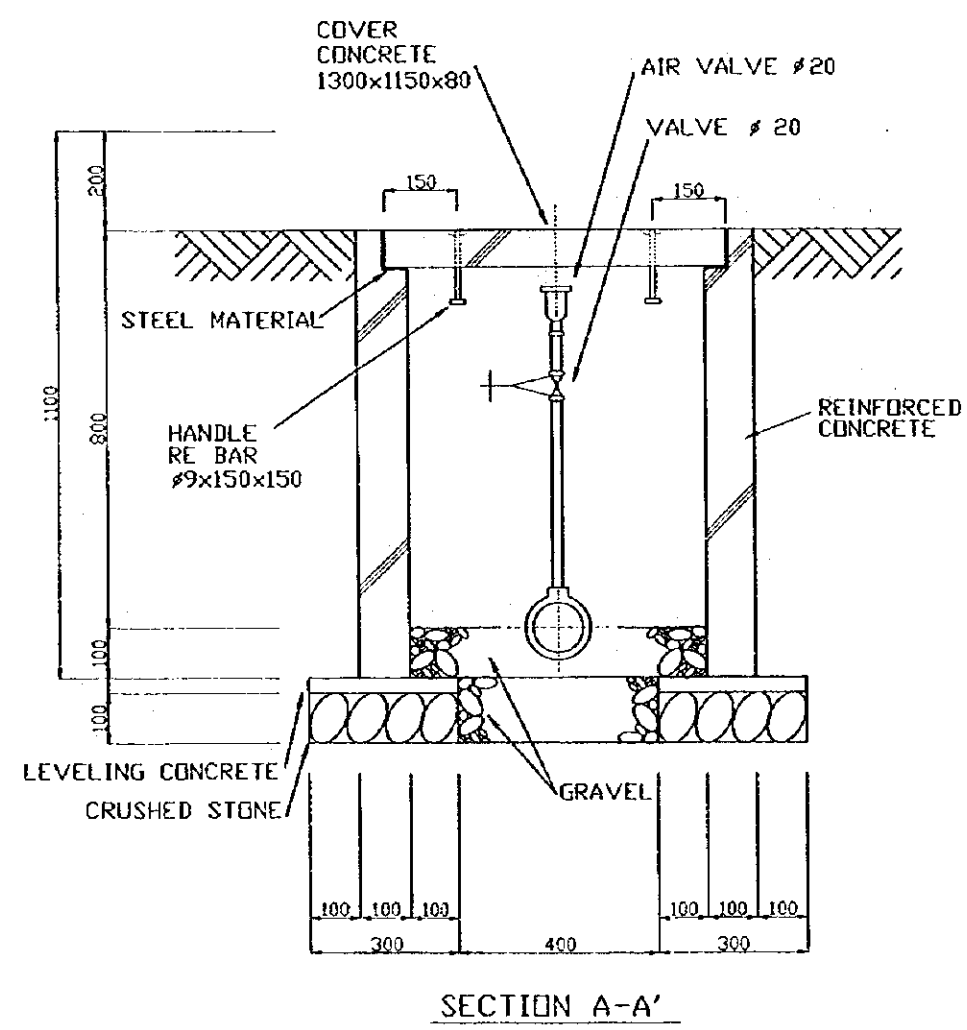
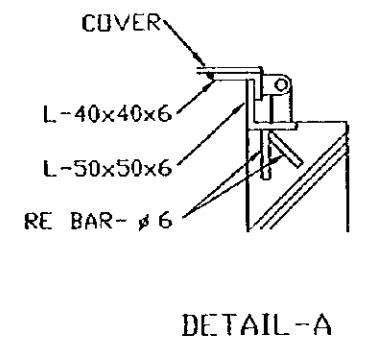
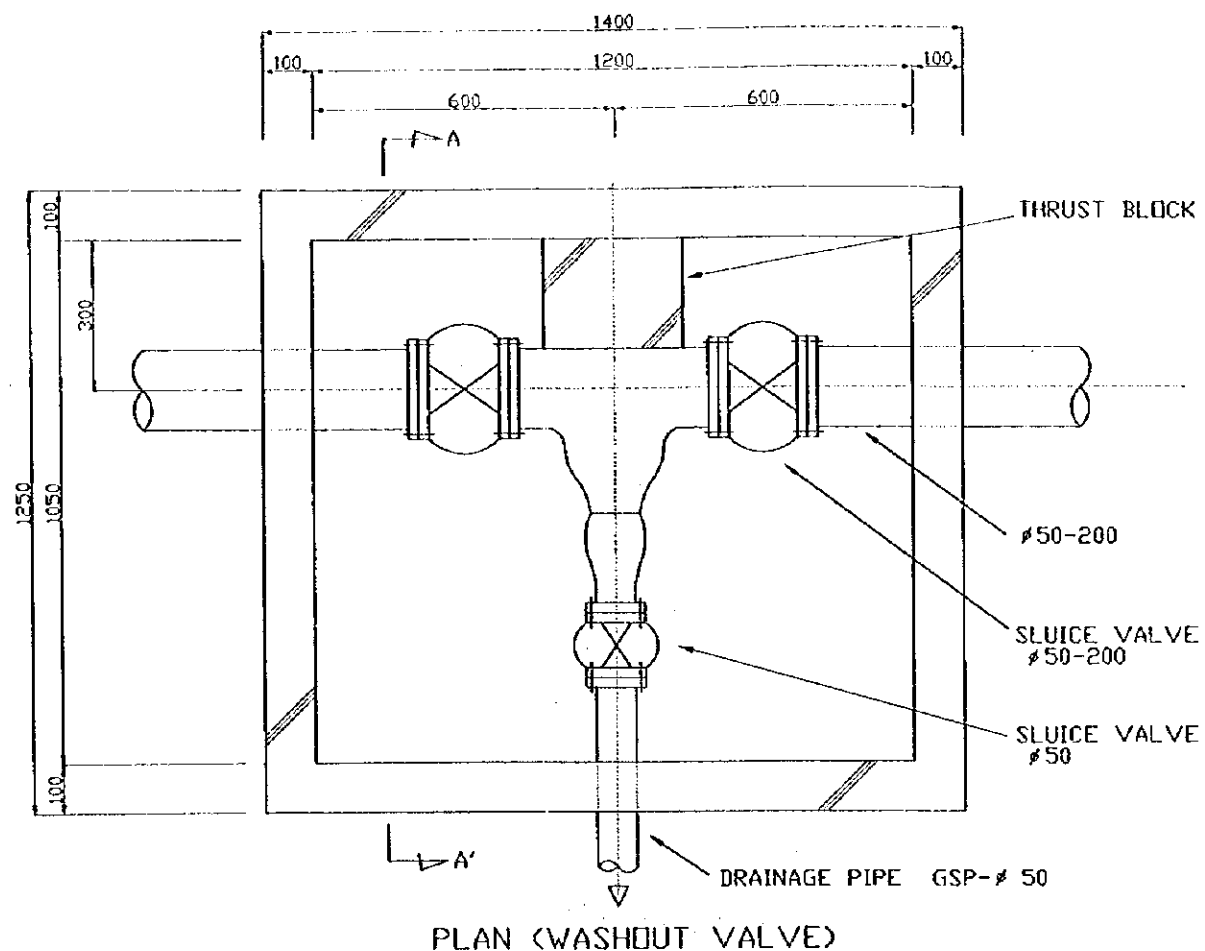
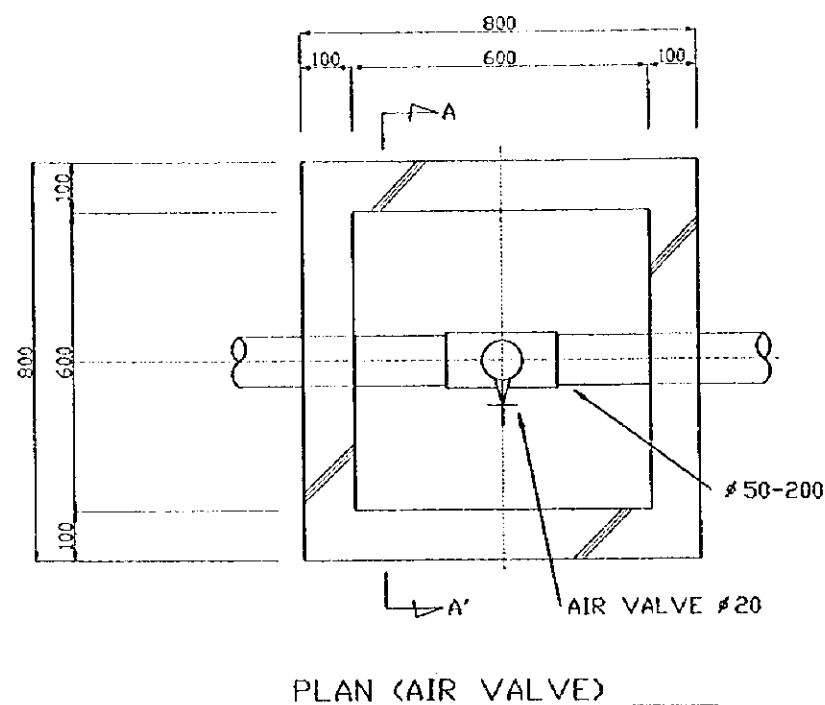
JAPAN INTERNATIONAL
COOPERATION AGENCY

STUDY ON GROUNDWATER
DEVELOPMENT & WATER SUPPLY
FOR
SEVEN TOWNS IN SOUTHERN REGION

TYPICAL VALVE BOX

WATER RESOURCES DEPARTMENT
SANYU CONSULTANTS INC.
(JAPAN) 1999

Drawing No
17/23



STATE OF ERITREA
 MINISTRY OF LAND, WATER &
 ENVIRONMENT

JAPAN INTERNATIONAL
 COOPERATION AGENCY

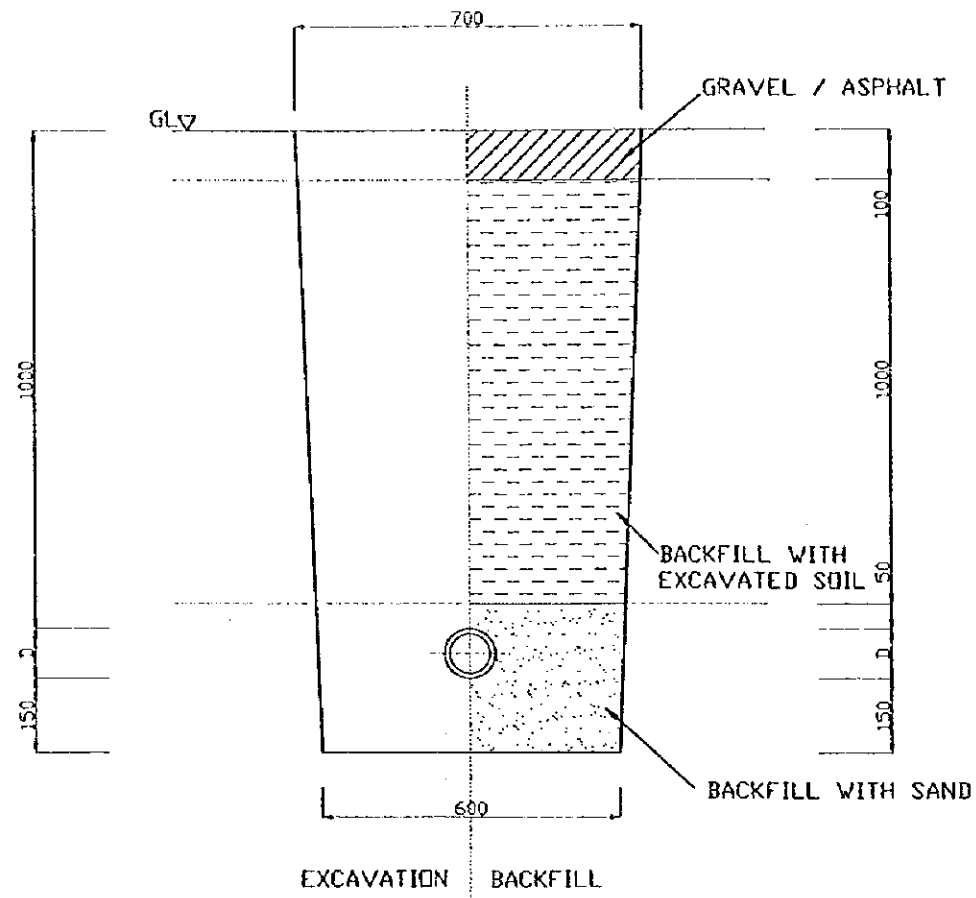
STUDY ON GROUNDWATER
 DEVELOPMENT & WATER SUPPLY
 FOR
 SEVEN TOWNS IN SOUTHERN REGION

TYPICAL AIR VALVE AND
 WASHOUT VALVE

WATER RESOURCES DEPARTMENT
 SANYU CONSULTANTS INC.
 (JAPAN) 1999

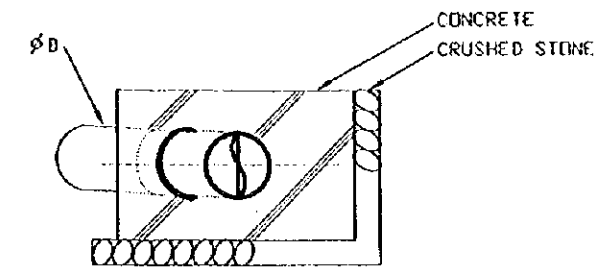
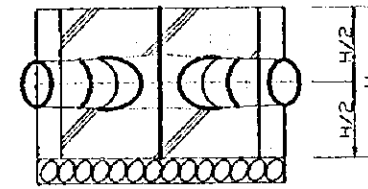
Drawing No
 18/23

EXCAVATION FOR PIPE LINE

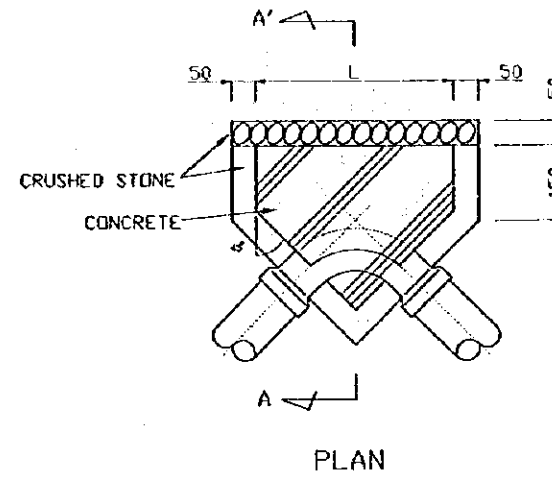


EXCAVATION BACKFILL

JOINT PROTECTION



SECTION A-A'

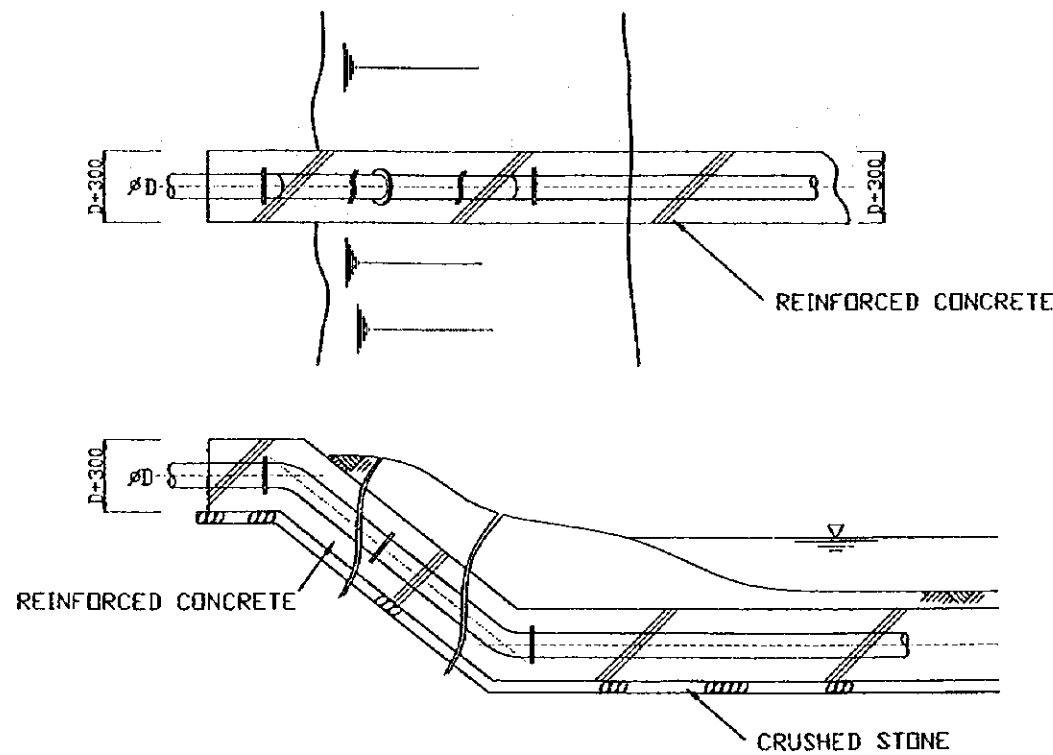


PLAN

ϕD	H	L
50	150	250
75	240	250
100	300	300
125	350	350
150	400	450
200	500	600
250	650	700
300	700	800

REMARKS : THRUST CONCRETE SHALL BE CASTED AT THE HORIZONTAL BENDS, VERTICAL BENDS, TEES, END POINTS OF PIPE.

TYPICAL RIVER CROSSING WORK



STATE OF ERITREA
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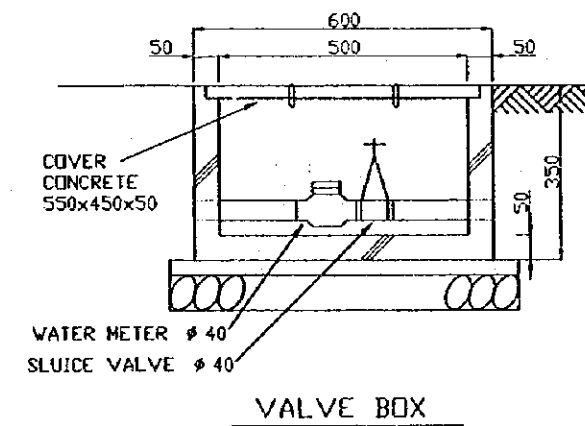
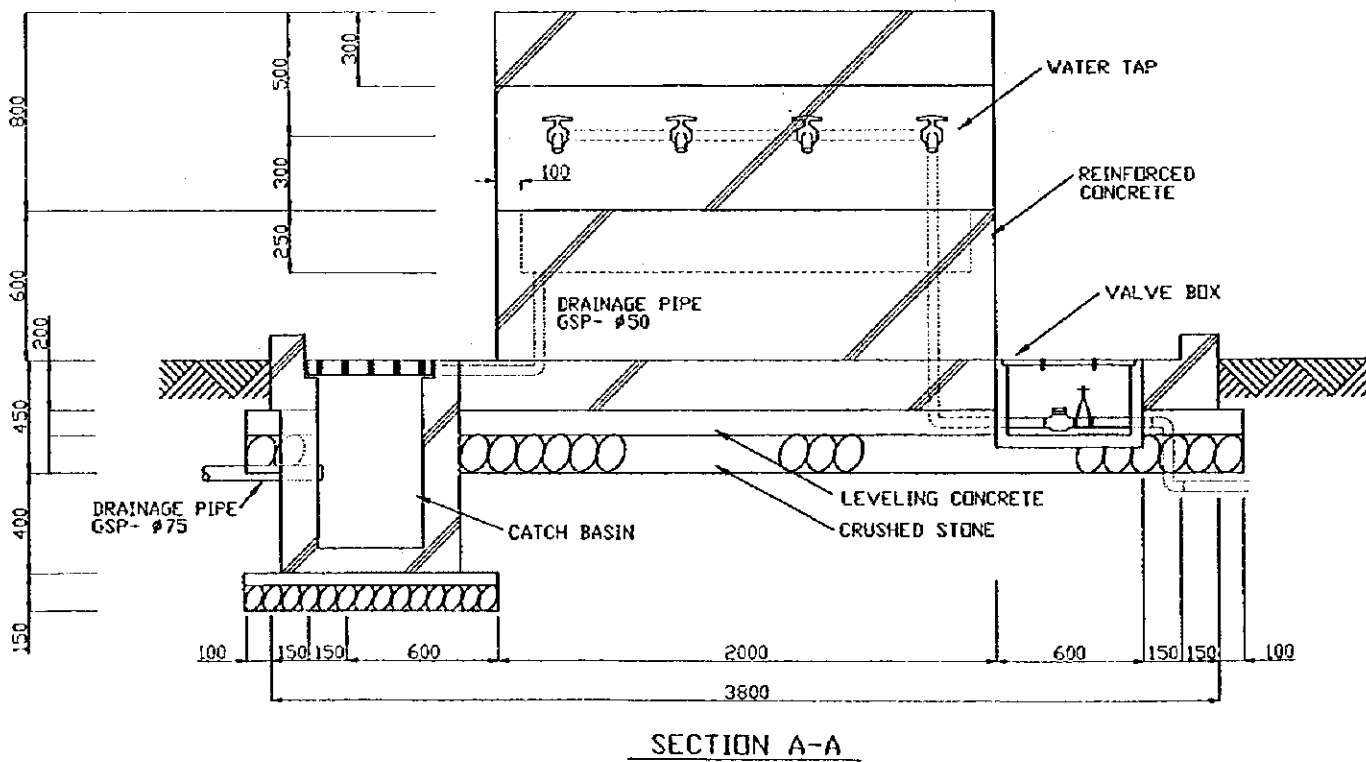
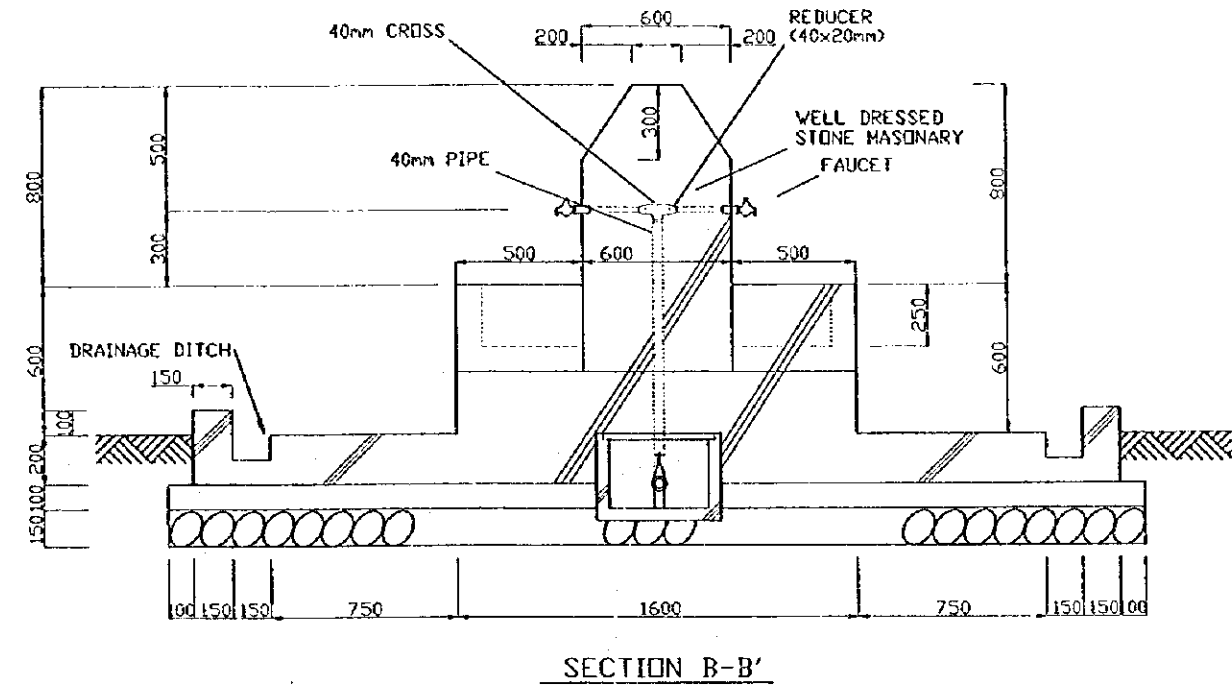
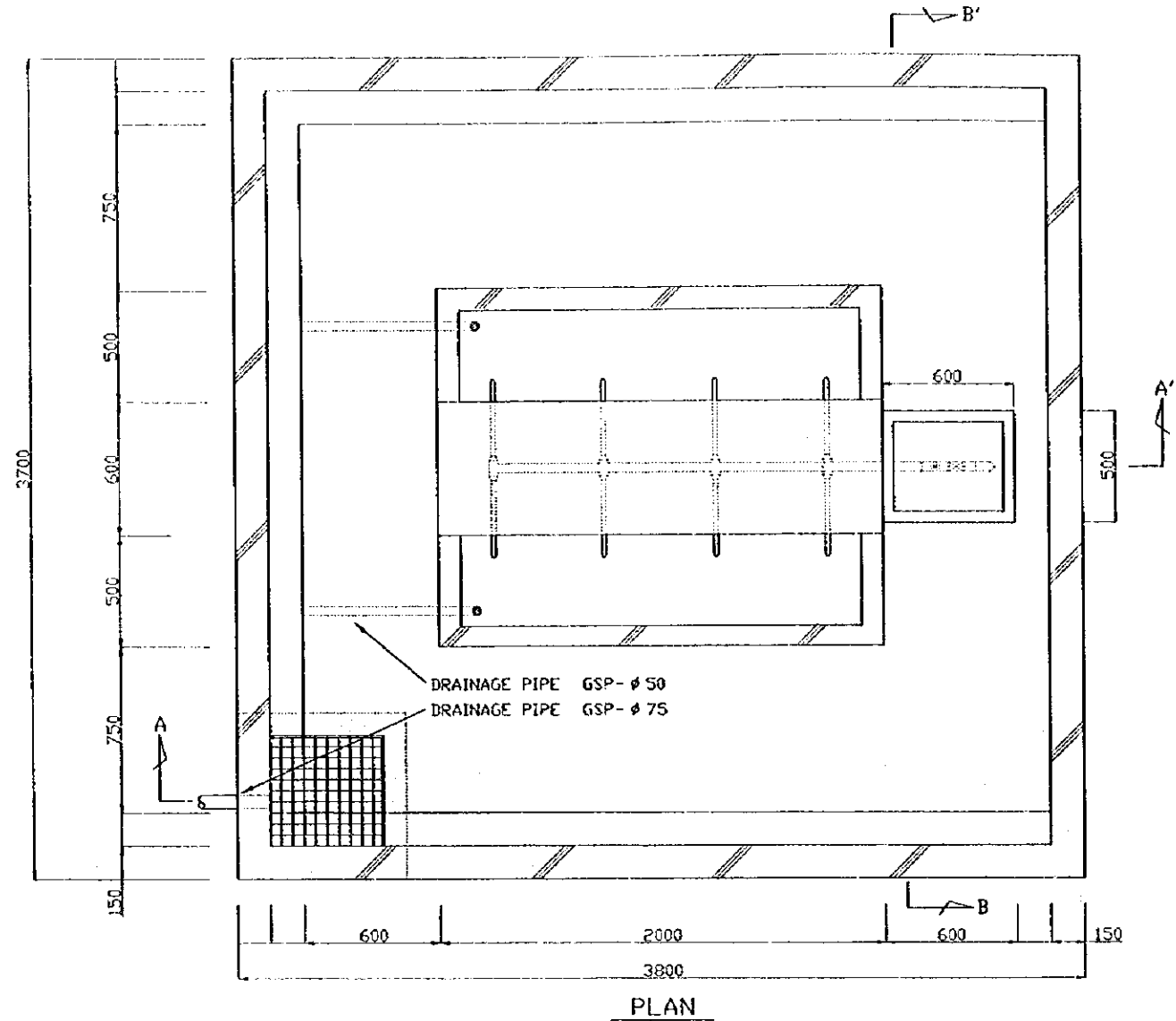
JAPAN INTERNATIONAL
COOPERATION AGENCY

STUDY ON GROUNDWATER
DEVELOPMENT & WATER SUPPLY
FOR
SEVEN TOWNS IN SOUTHERN REGION

TYPICAL EXCAVATION,
JOINT PROTECTION & CROSSING RIVER

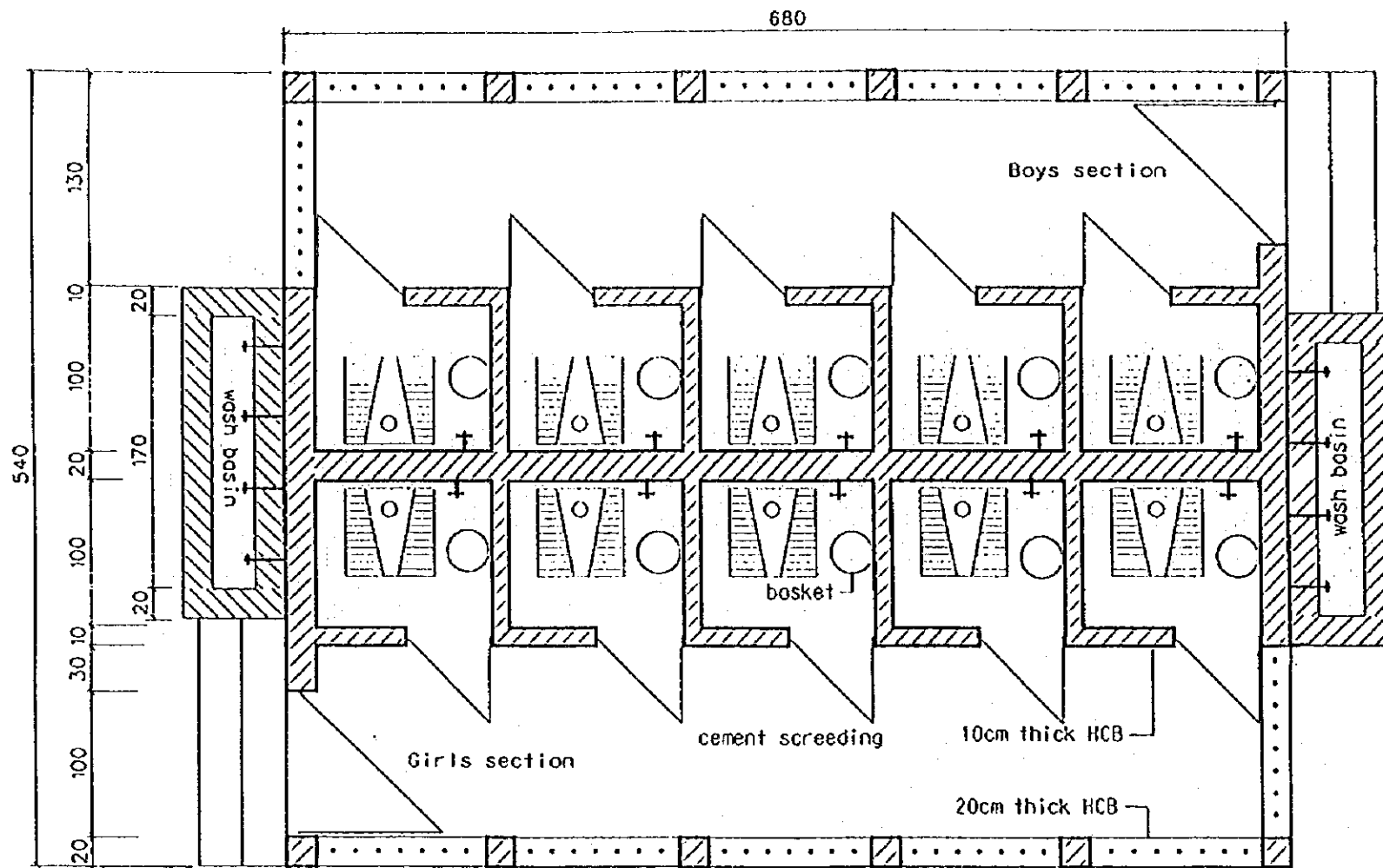
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SANYU CONSULTANTS INC.
(JAPAN) 1999

Drawing No
19/23



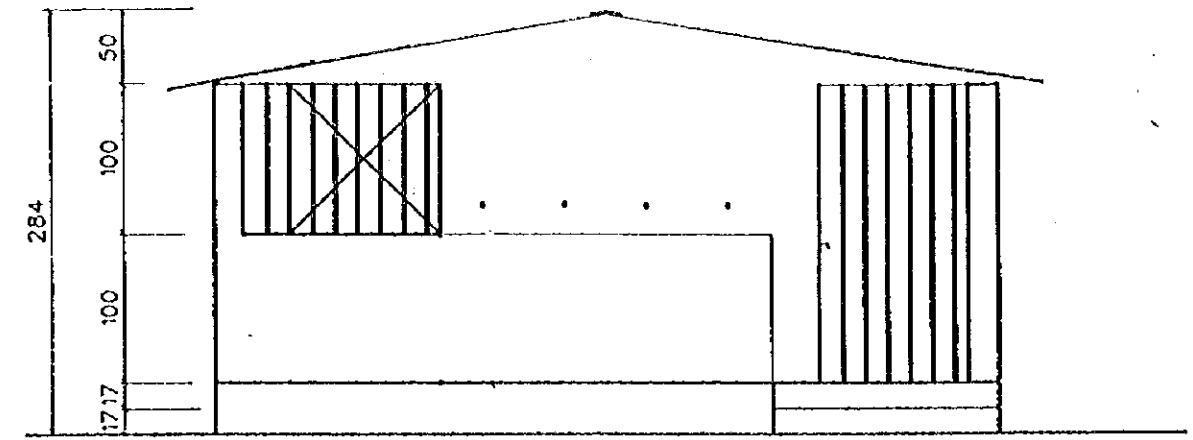
STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
PUBLIC FAUCET	
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No. 20/23

School latrine



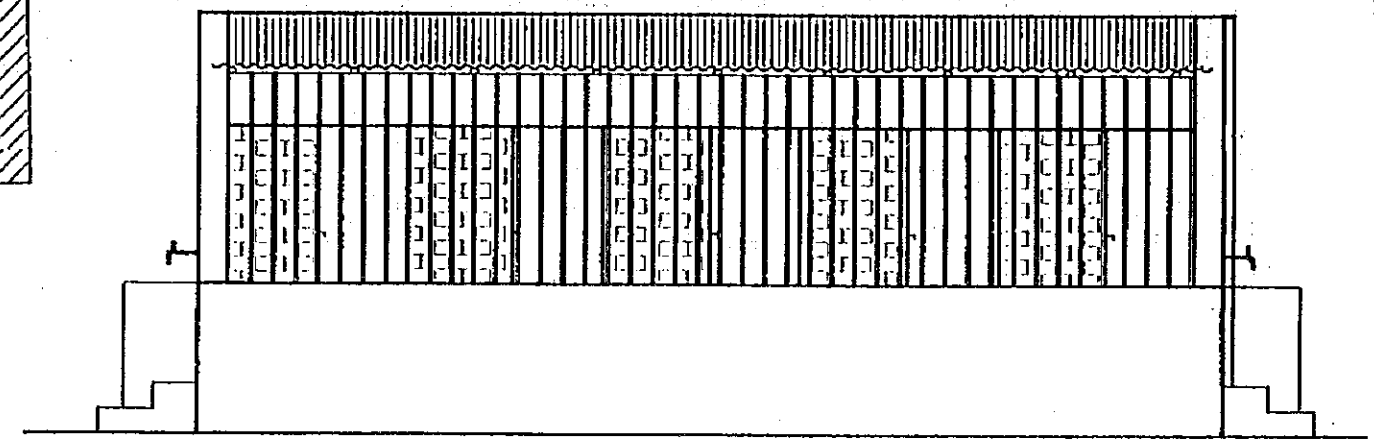
Plan

Scale 1:50



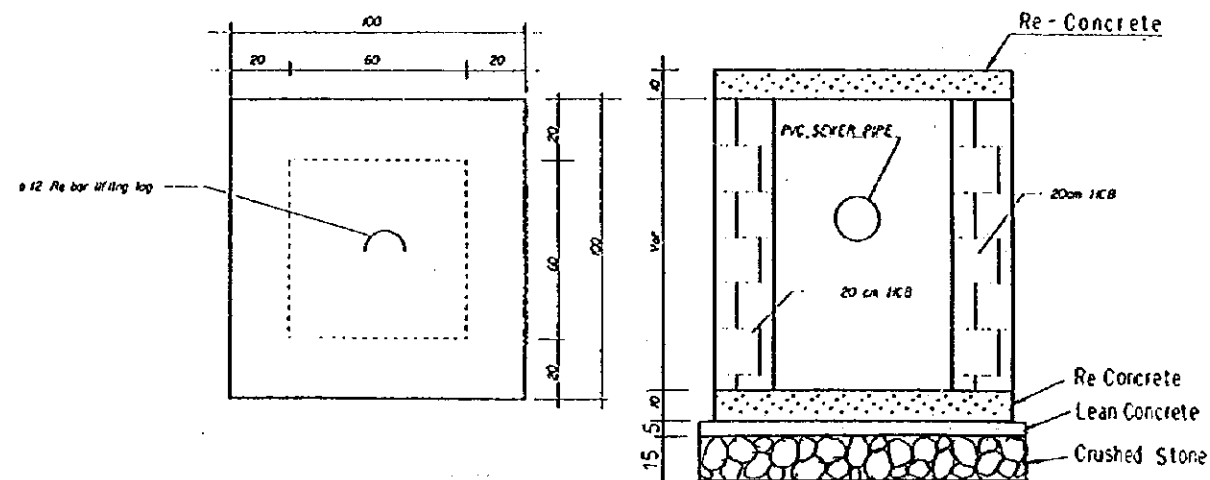
Front elevation

Scale 1:50



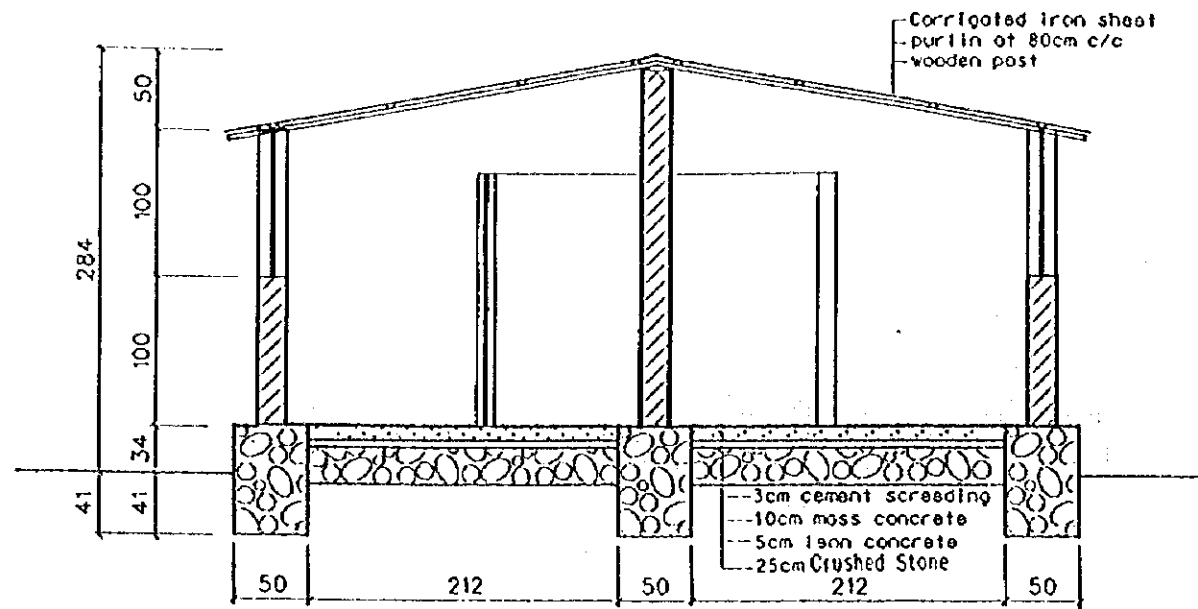
Side elevation

Scale 1:50

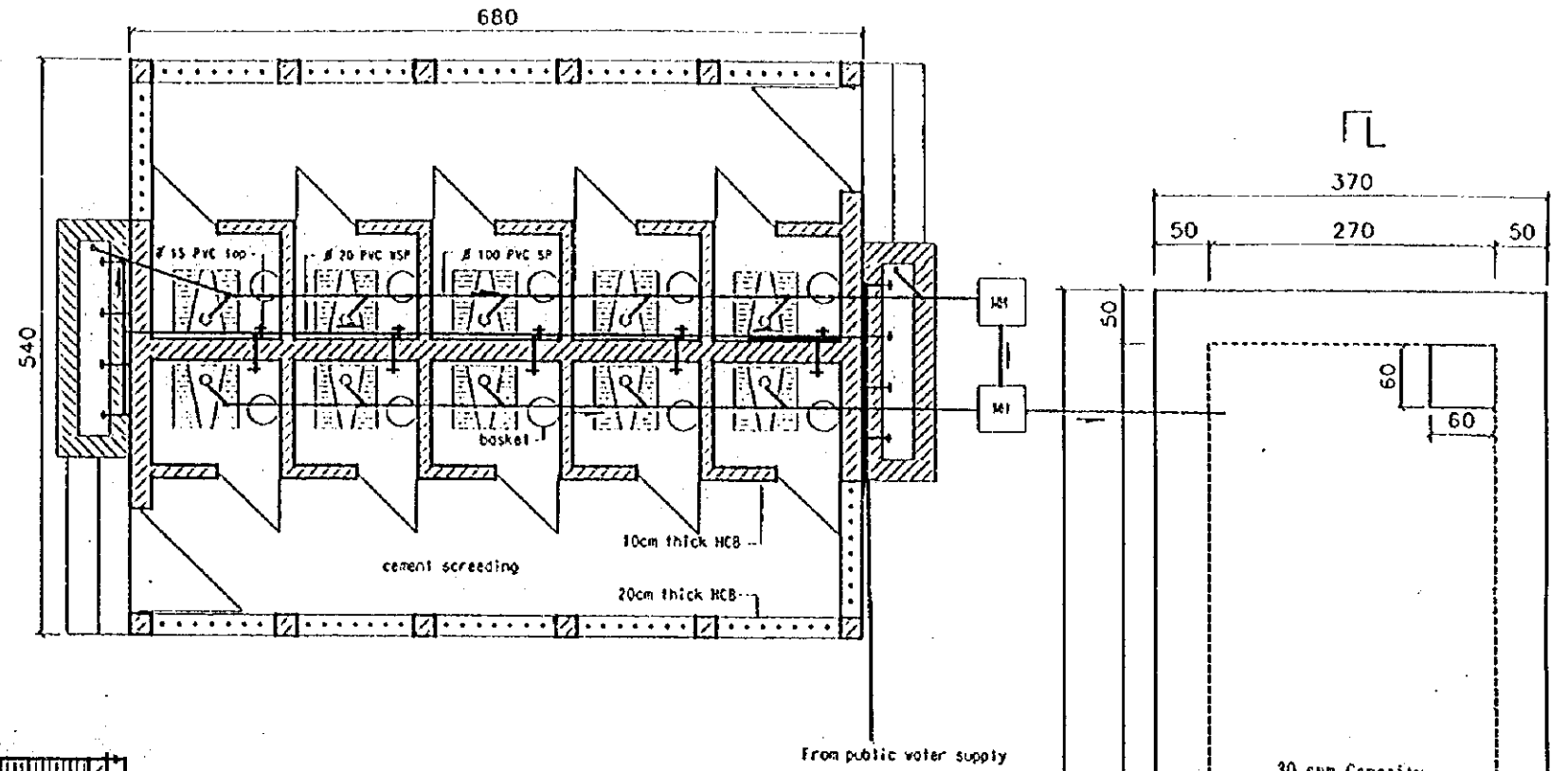


Typical manhole detail

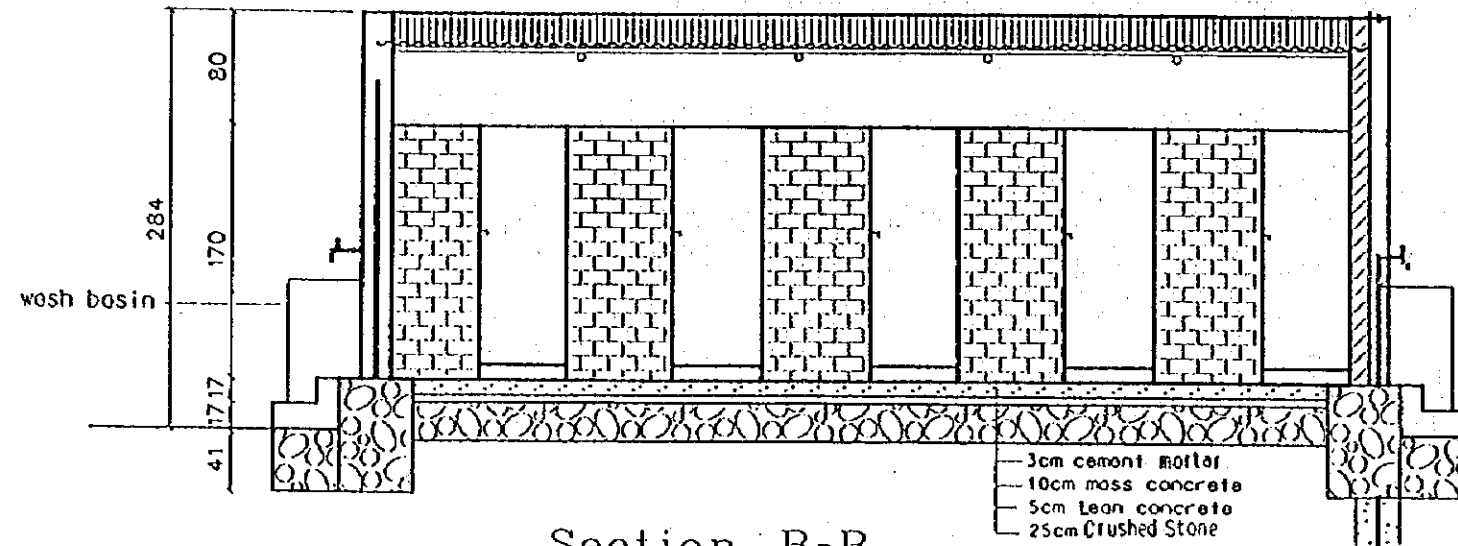
STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
School Latrine (1/2)	
WATER RESOURCES DEPARTMENT (ASMARARA, ERITREA) BANYU CONSULTANTS INC. JAPAN, 1999	Drawing No. 21/23



Section A-A
Scale 1:50

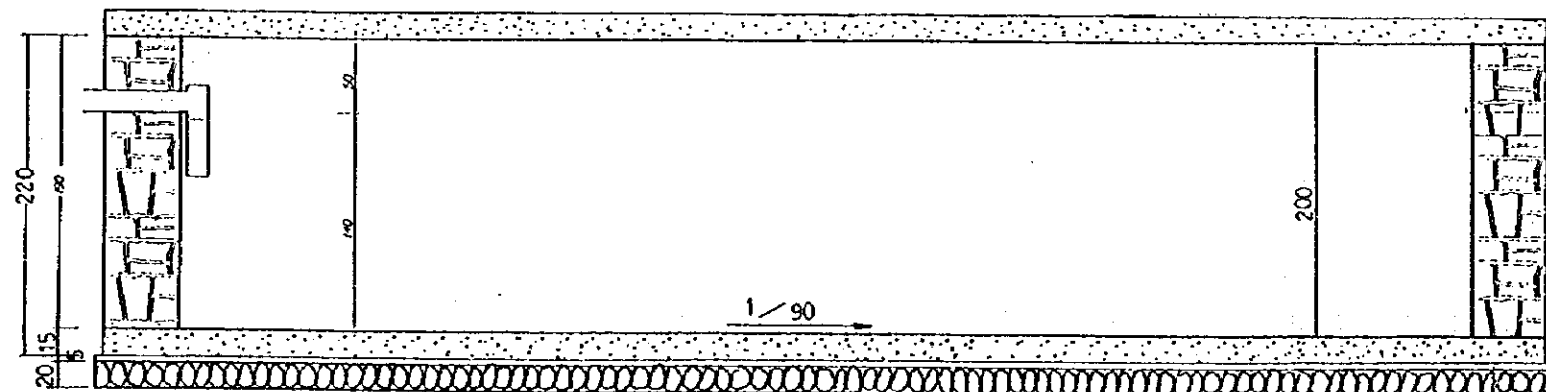


Pipe line layout
Scale 1:75

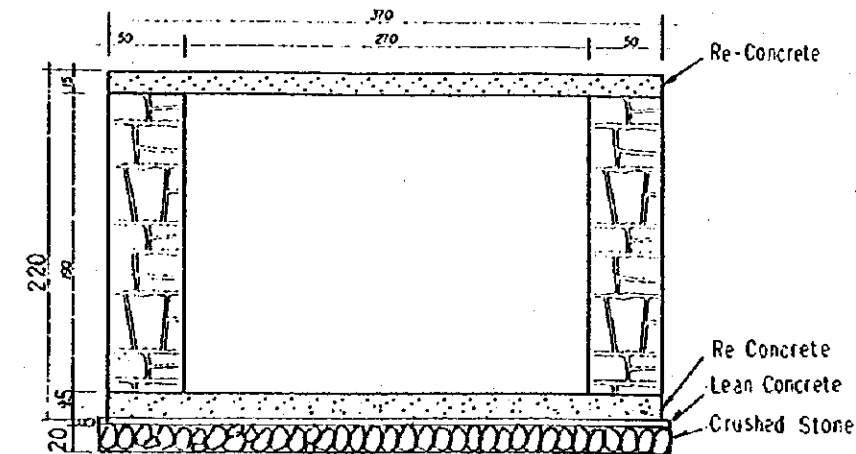


Section B-B
Scale 1:50

30 cum Capacity Excreta Storage Tank



Section L-L



Section X-X

STATE OF ERITREA
MINISTRY OF LAND, WATER &
ENVIRONMENT

JAPAN INTERNATIONAL
COOPERATION AGENCY

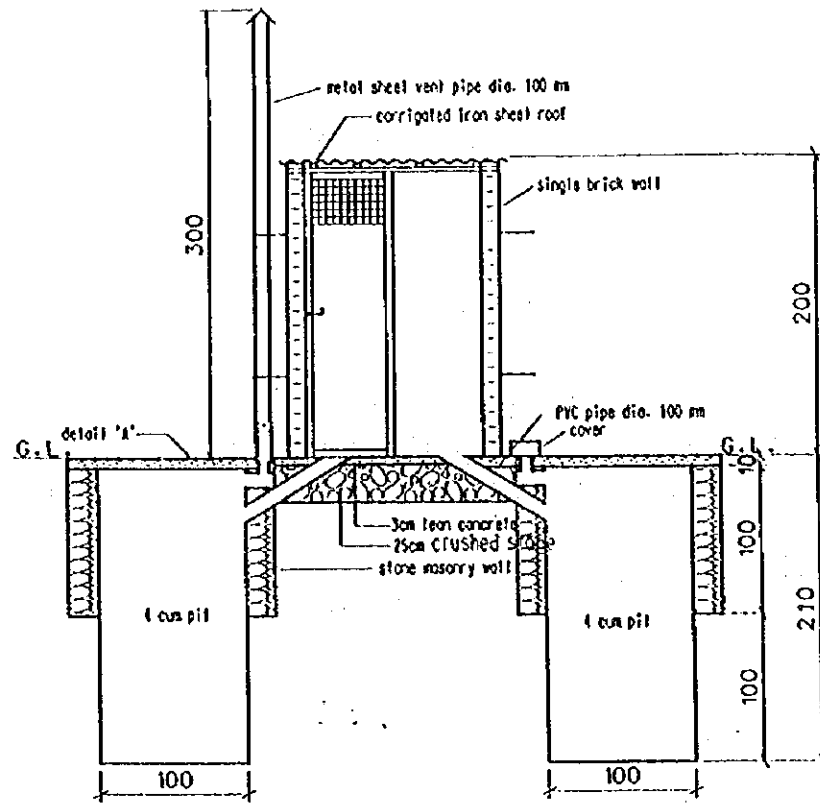
STUDY ON GROUND WATER
DEVELOPMENT & WATER SUPPLY
FOR
SEVEN TOWNS IN SOUTHERN REGION

School Latrine (2/2)

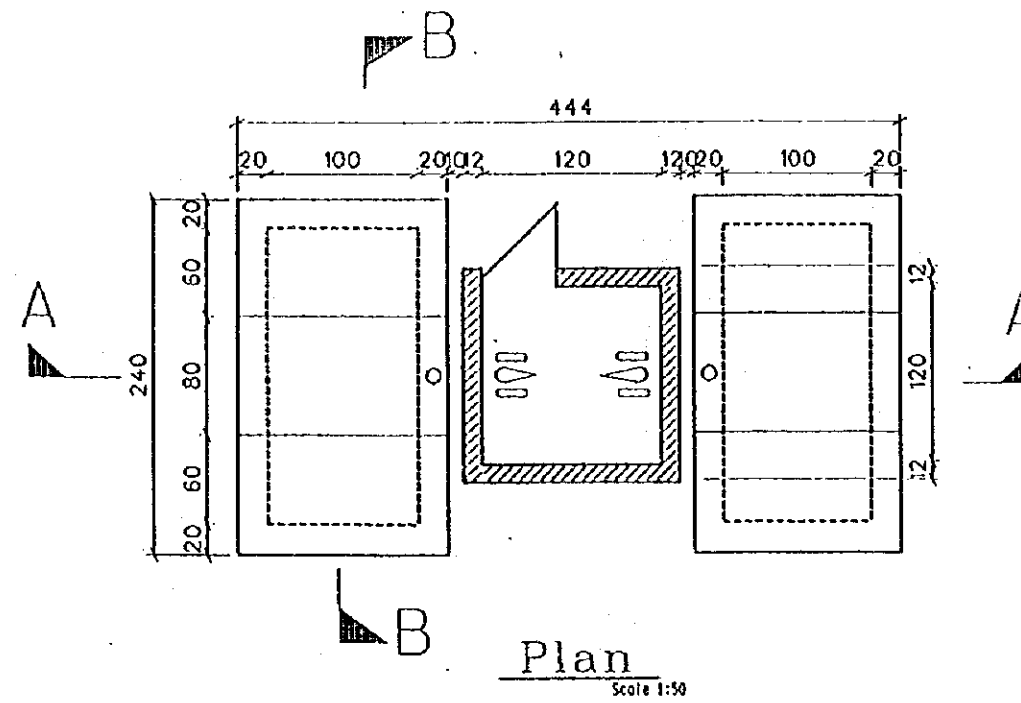
WATER RESOURCES DEPARTMENT
(ASMARA, ERITREA)
BANTU CONSULTANTS ENG.
(JAPAN, 1999)

Drawings No.
22/23

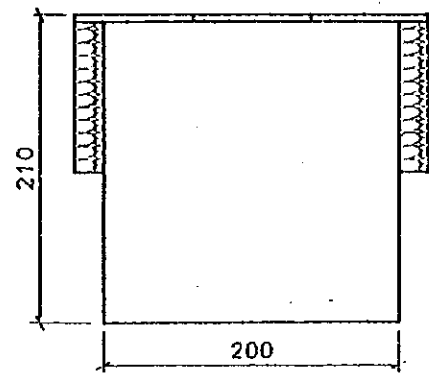
DOUBLE PIT VIP LATRINE



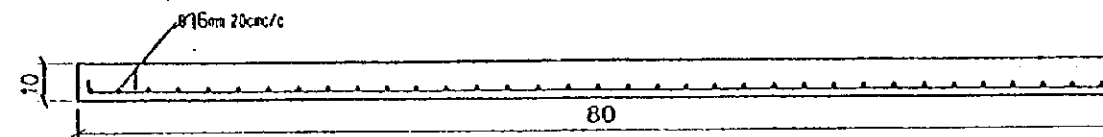
Section 'A-A'
Scale 1:50



Plan
Scale 1:50



Section 'B-B'
Scale 1:50



Pit roof slab (140x80)
Detail 'A'
Scale 1:20

STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
DOUBLE PIT VIP LATRINE	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) BANTU CONSULTANTS INC. (JAPAN, 1999)	Drawing No. 23/23

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