

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

DEBARWA

VOLUME III DRAWINGS

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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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ON  
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OF  
ERITREA

**FINAL REPORT**

**DEBARWA**

**VOLUME III DRAWINGS**

JANUARY 1999

SANYU CONSULTANTS INC.



1148354 (2)

## List of Reports

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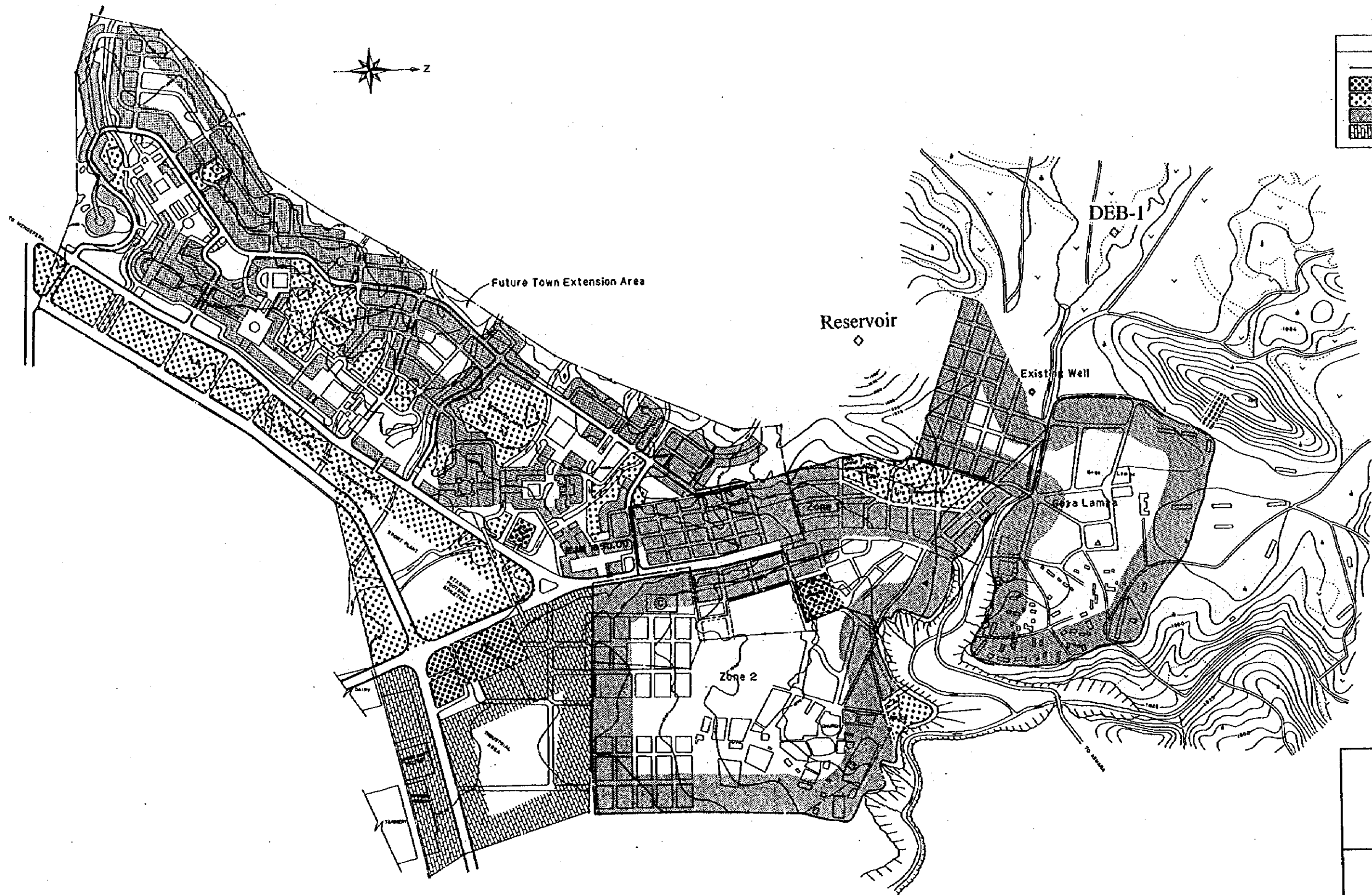
Operation and Maintenance Manual for Water Supply Facility

Hygiene Education Manual

Training Manual for Staff of WSA

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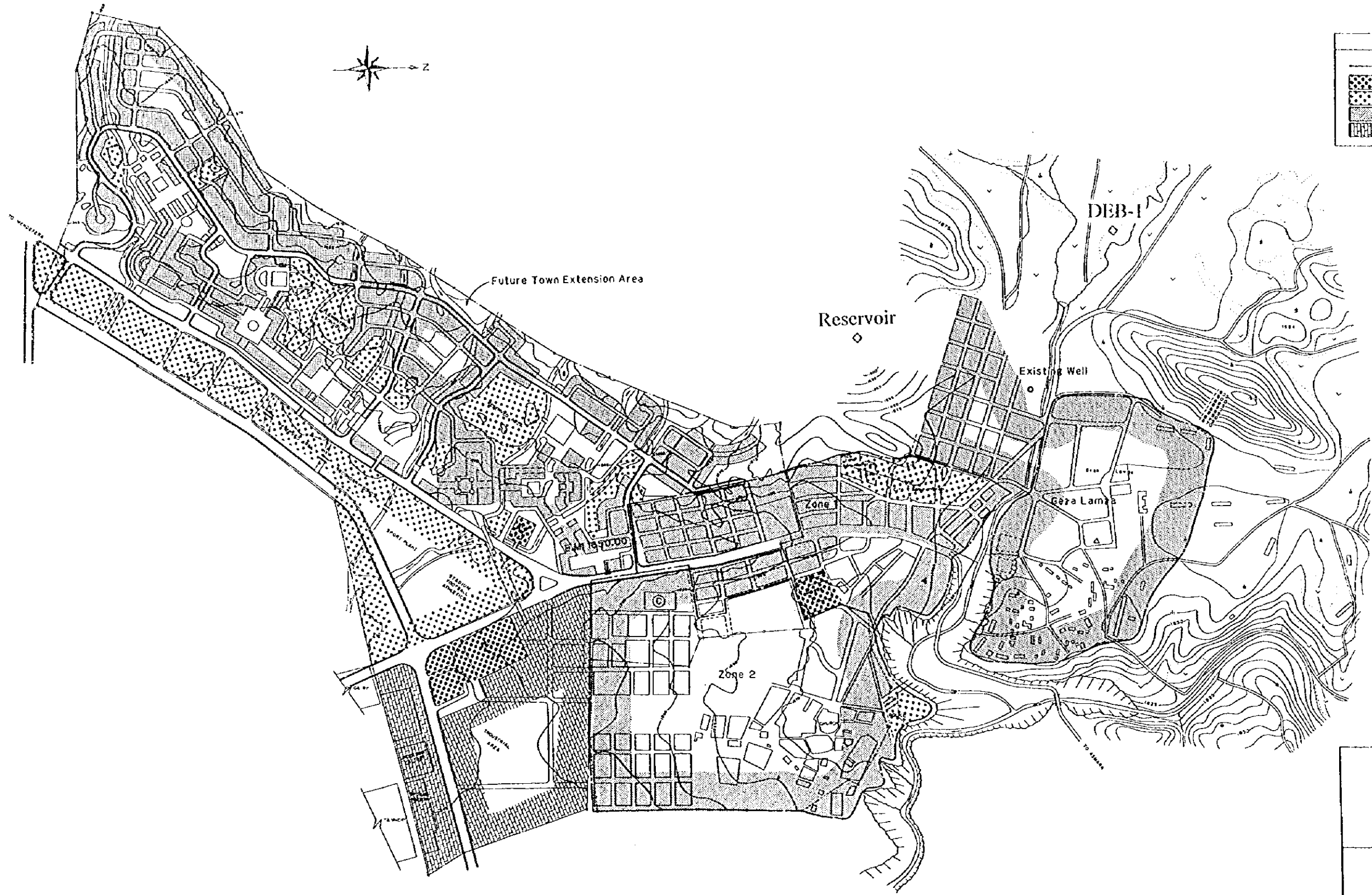


LEGEND	
—	Boundary
[Cross-hatched pattern]	Commercial Area
[Dotted pattern]	Administration Area
[Stippled pattern]	Residential Area
[Horizontal lines pattern]	Industrial Area

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 DEBARWA (2010)	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANTU CONSULTANTS INC. (JAPAN) 1999	Drawing No. 1/16

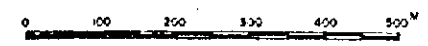




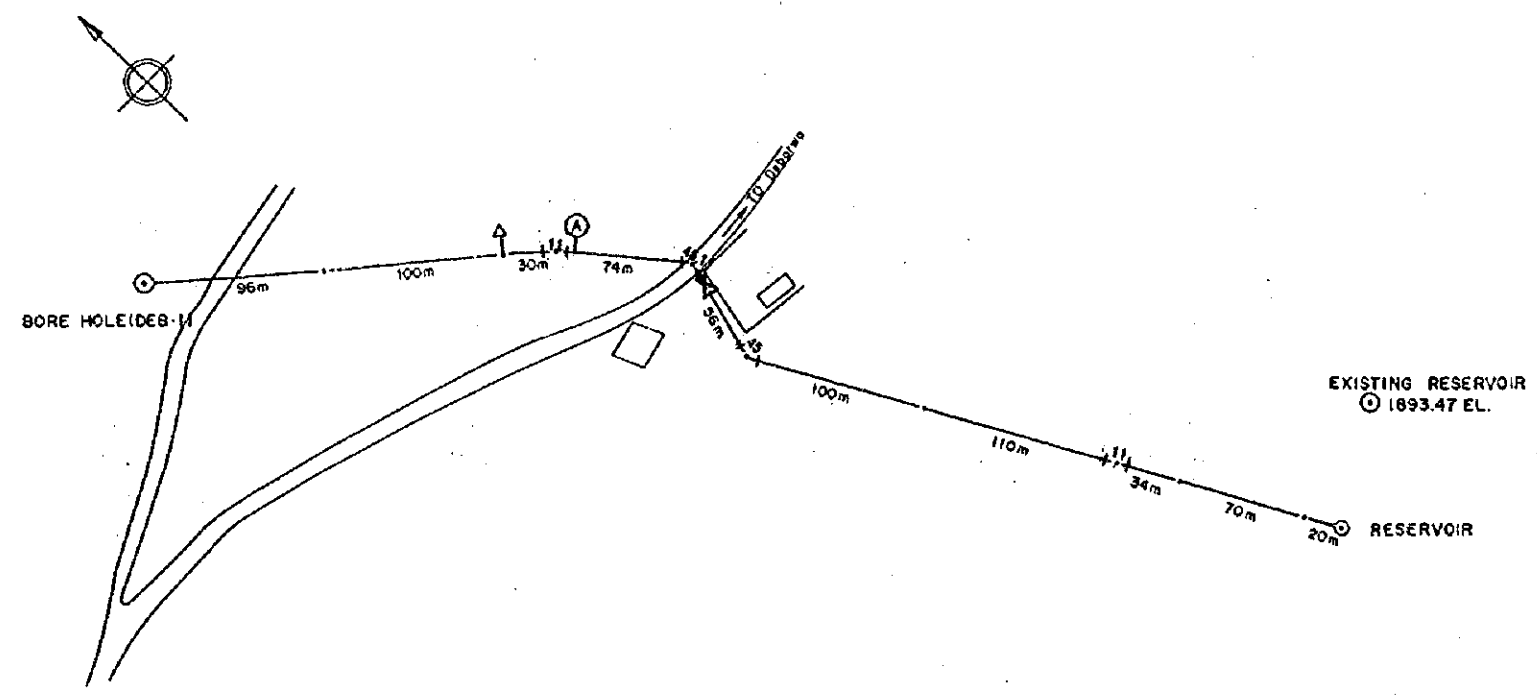


LEGEND	
	Boundary
	Commercial Area
	Administration Area
	Residential Area
	Industrial Area

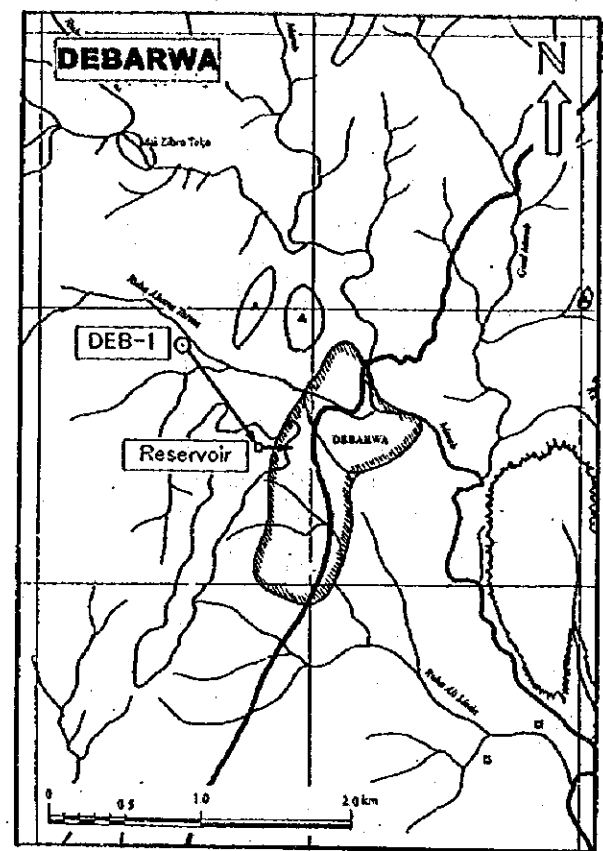
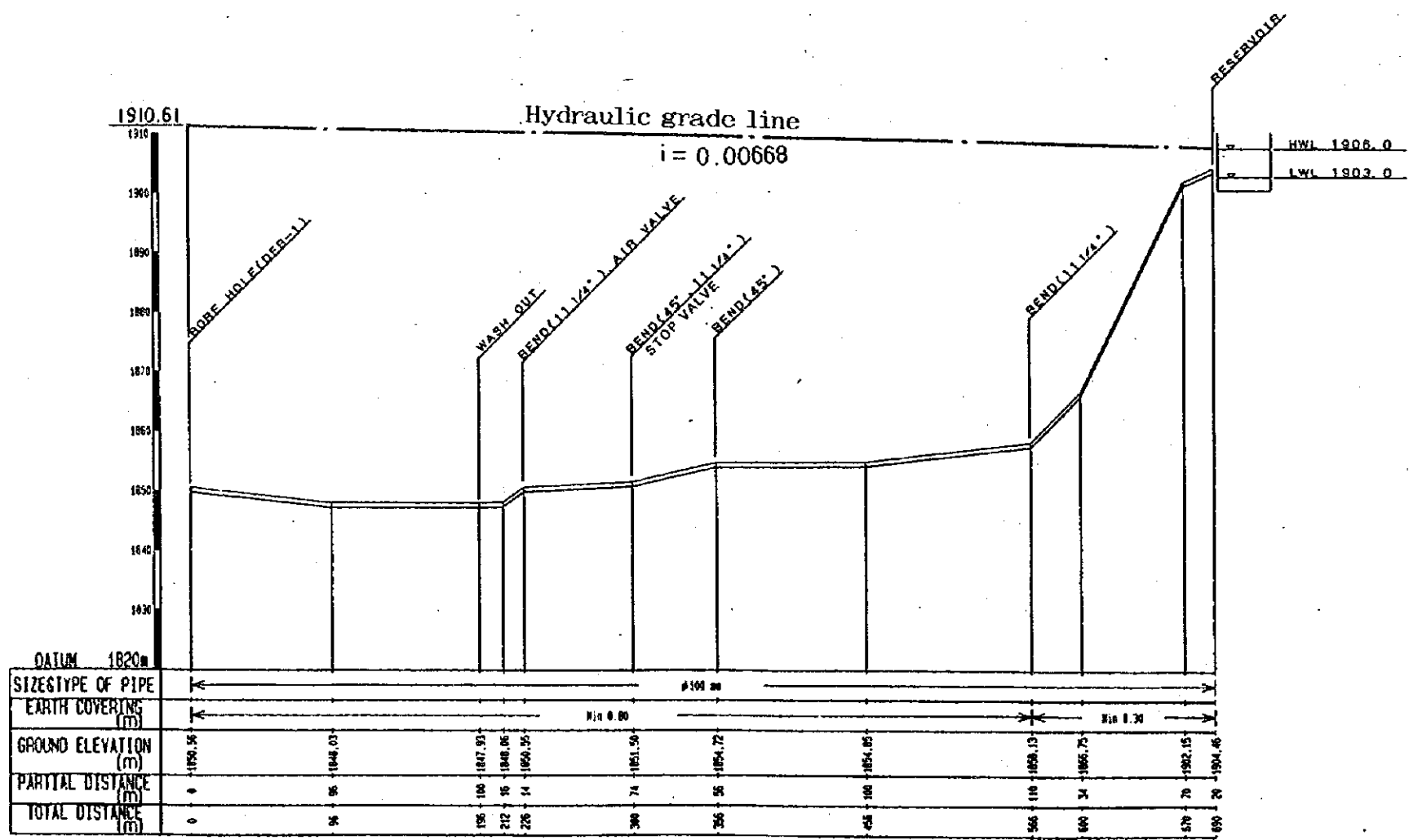
STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
Land Use and Zone Boundary DEBARWA (20:0)	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANTU CONSULTANTS INC. (JAPAN) 1999	Drawing No 1/16



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

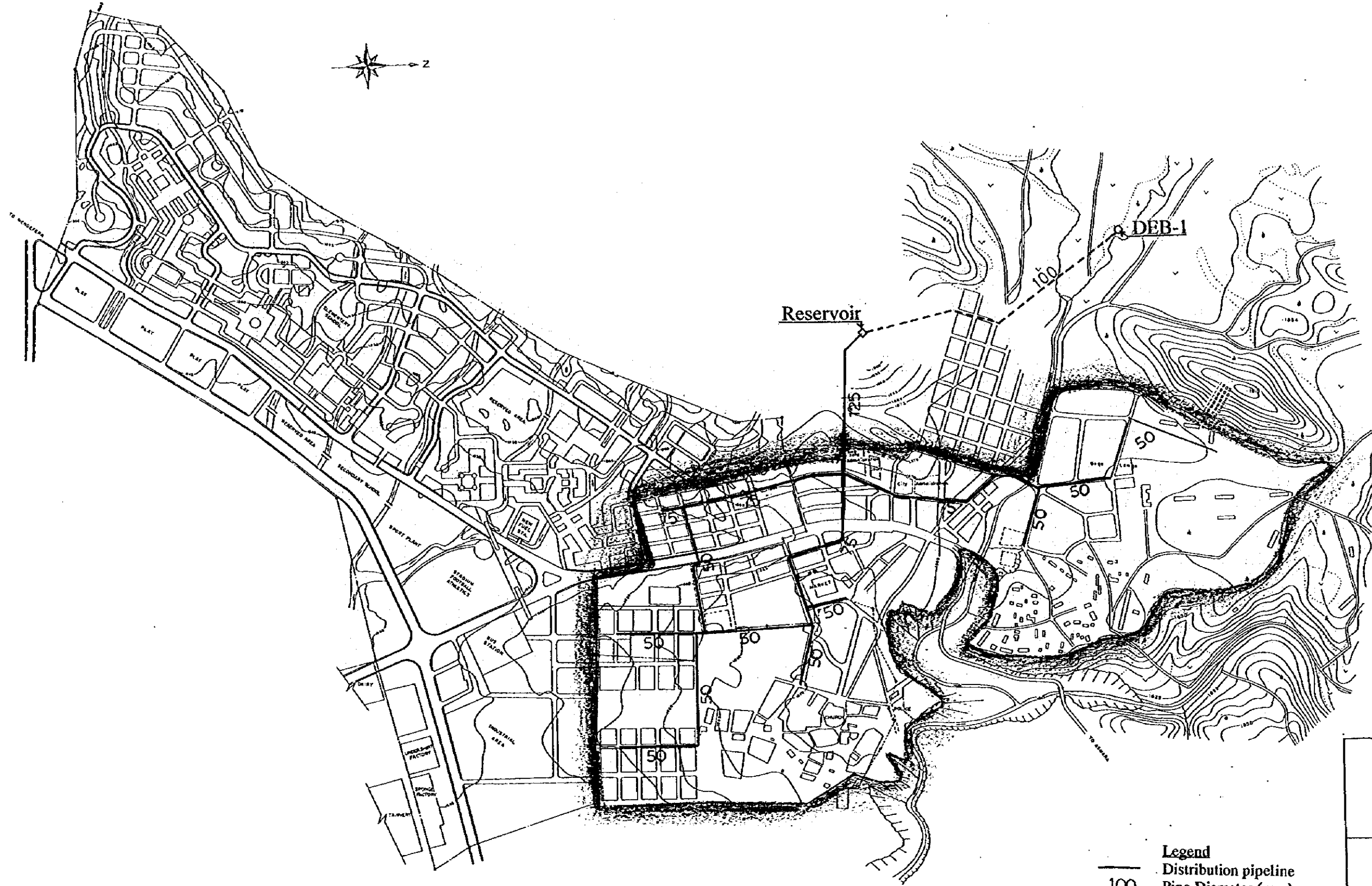
JAPAN INTERNATIONAL COOPERATION AGENCY

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

Plan & Profile for Transmission Pipeline (2005)  
DEBARWA

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

Drawing No. 2 / 16



Plan of Distribution Pipeline (2005)

**Legend**

— 100 Distribution pipeline  
Pipe Diameter (mm)

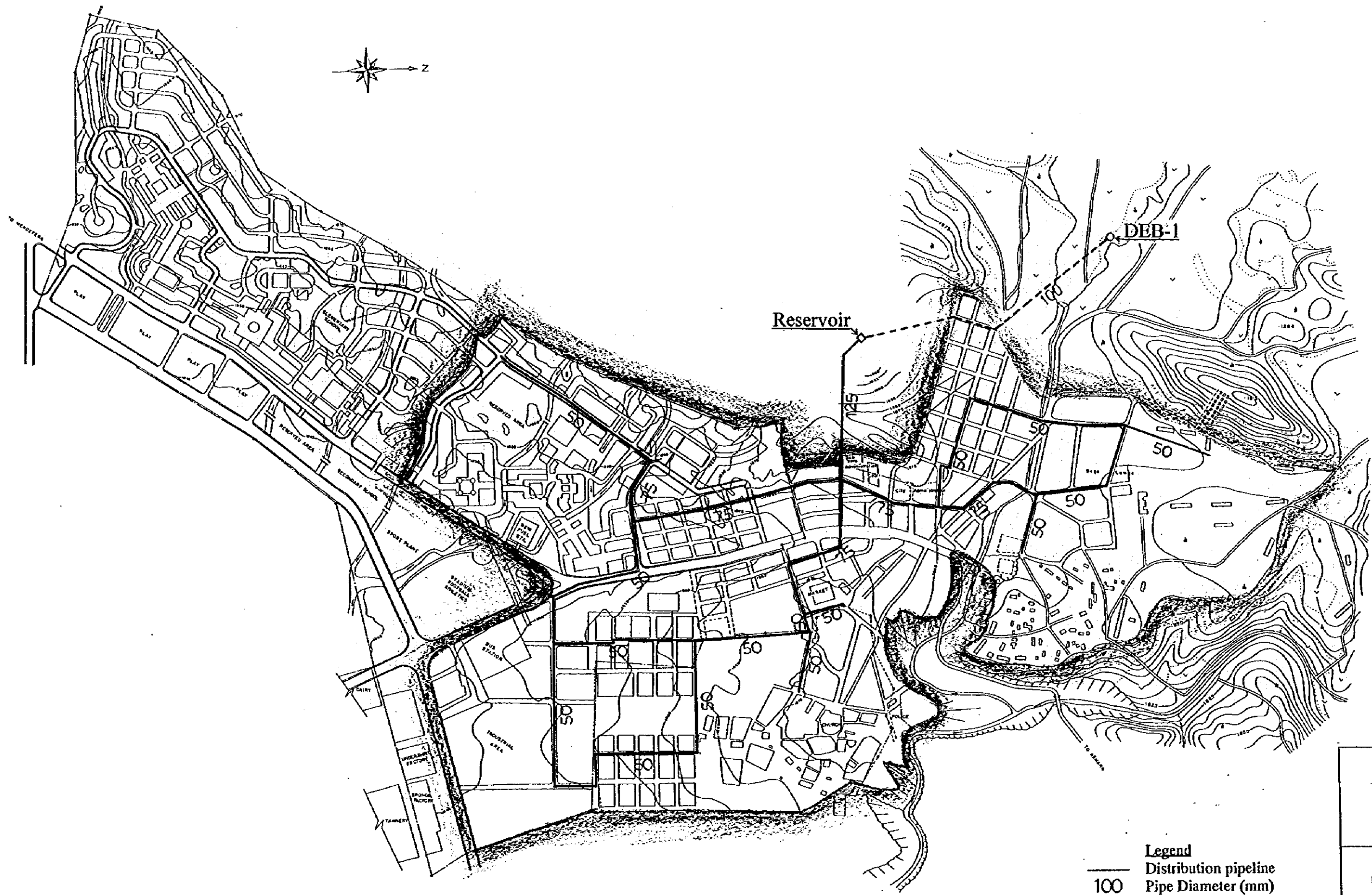
- - - Transmission pipeline

○ Well

□ Reservoir

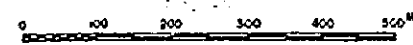
0 100 200 300 400 500<sup>m</sup>

STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
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PLAN OF DISTRIBUTION PIPELINE (2005) DEBARWA	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANYU CONSULTANTS INC. JAPAN 1999	Drawing No 3 / 16

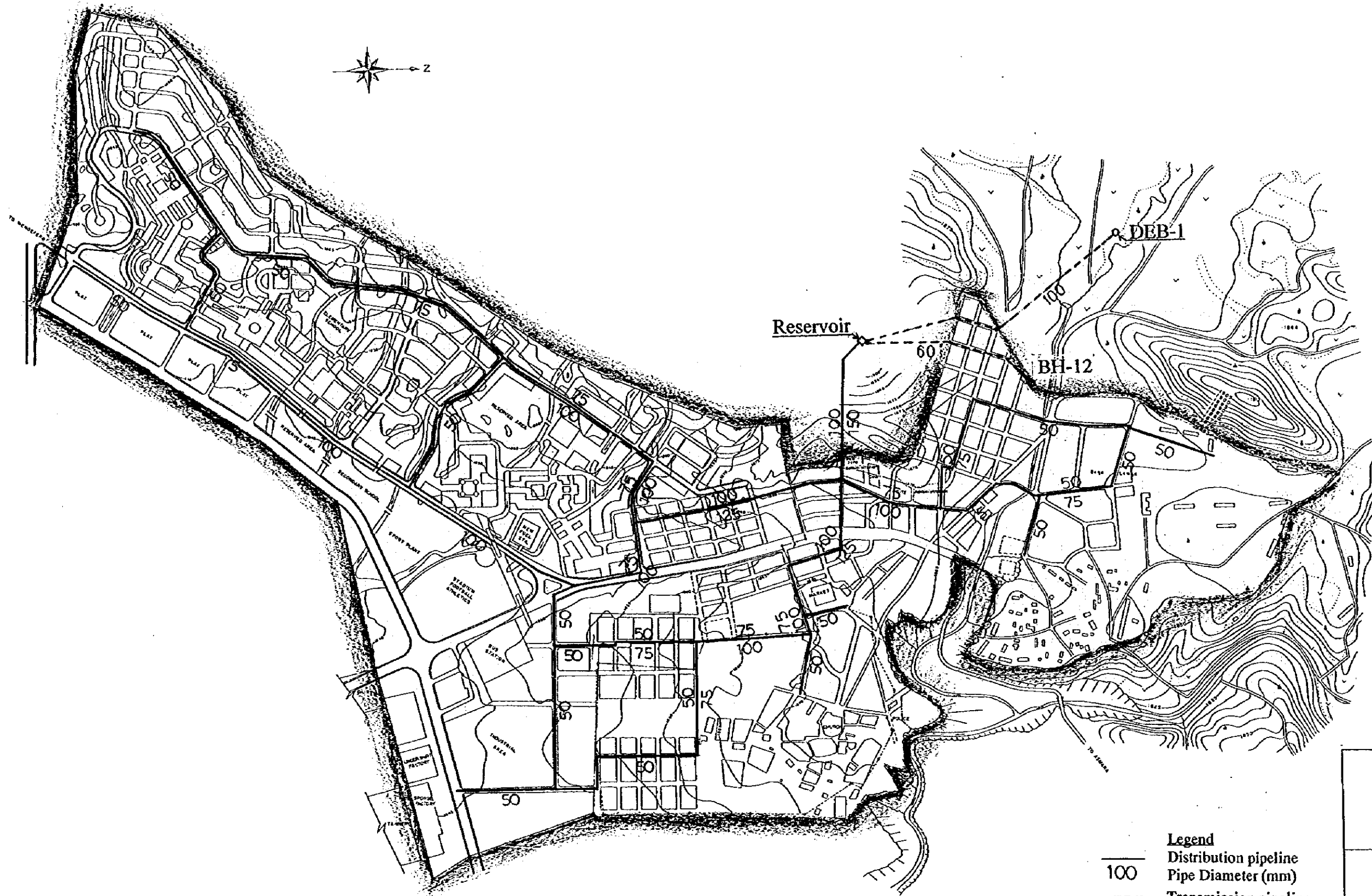


Plan of Distribution Pipeline (2010)

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



STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
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PLAN OF DISTRIBUTION PIPELINE (2010) DEBARWA	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANYU CONSULTANTS INC. (JAPAN) 1993	Drawing No. 4 / 16

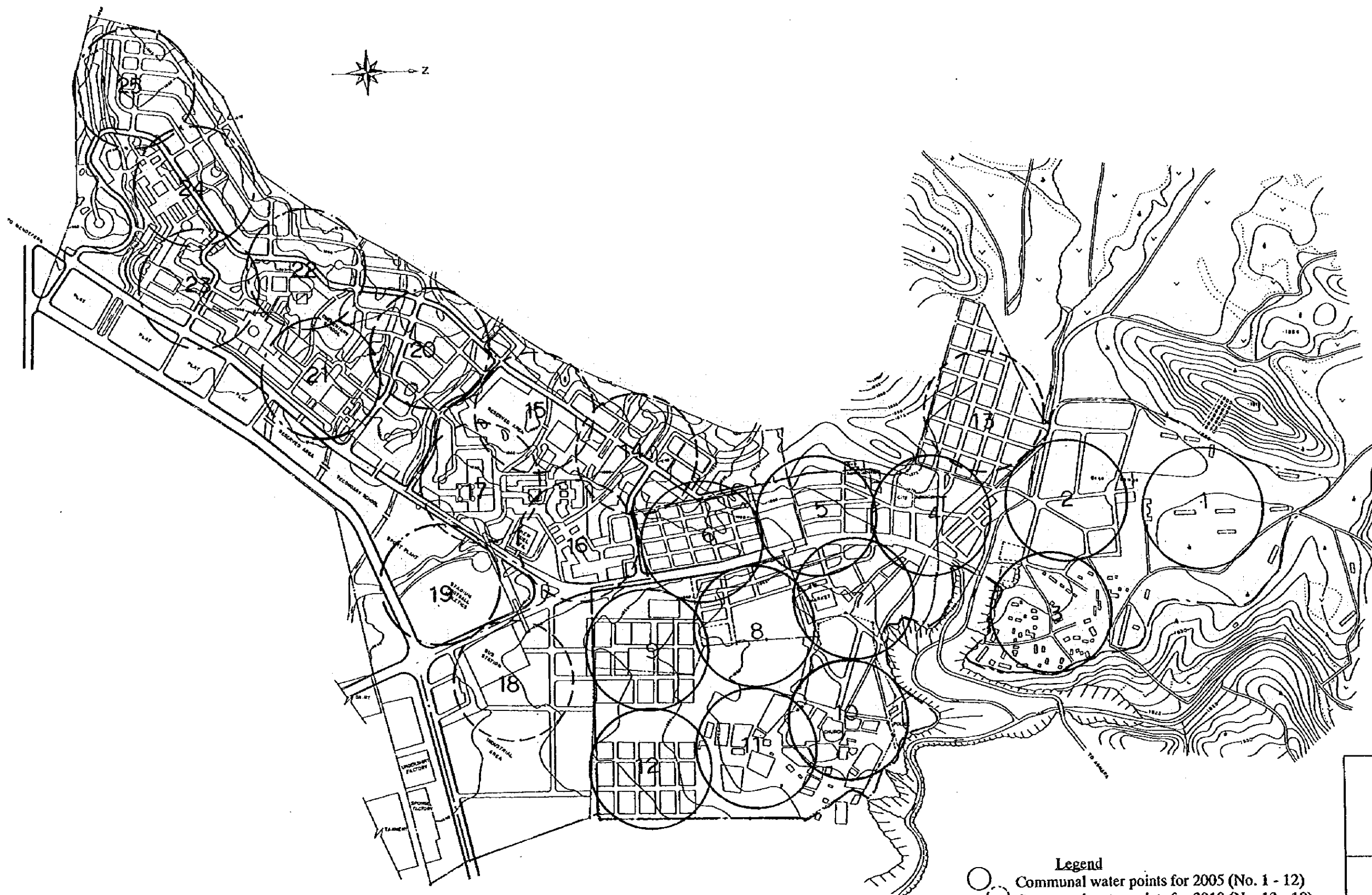


- Legend**
- Distribution pipeline
  - 100 Pipe Diameter (mm)
  - - - Transmission pipeline
  - o Well
  - Reservoir

Plan of Distribution Pipeline (2015)

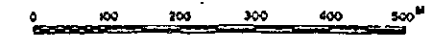


STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
PLAN OF DISTRIBUTION PIPELINE (2015) DEBARWA	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANTU CONSULTANTS INC. (JAPAN) 1999	Drawing No. 5 / 16

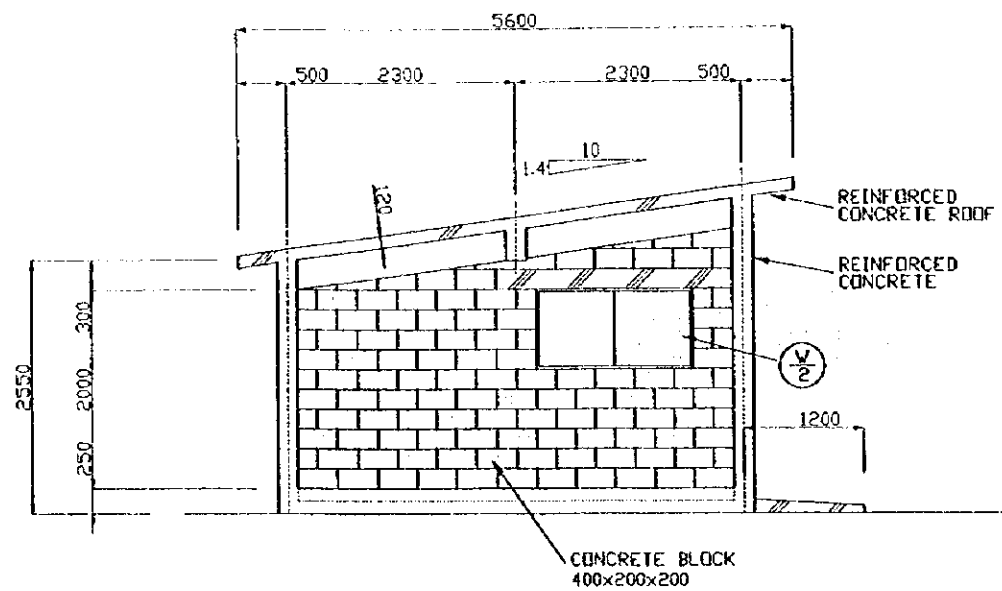


- Legend**
- Communal water points for 2005 (No. 1 - 12)
  - Communal water points for 2010 (No. 13 - 18)
  - Communal water points for 2015 (No. 19 - 25)

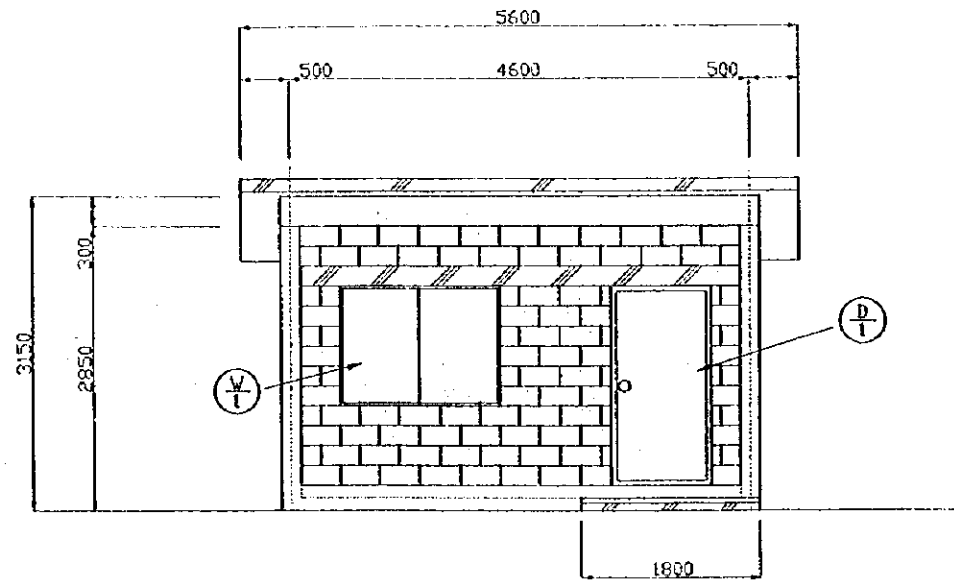
Location of Proposed Communal Water Point



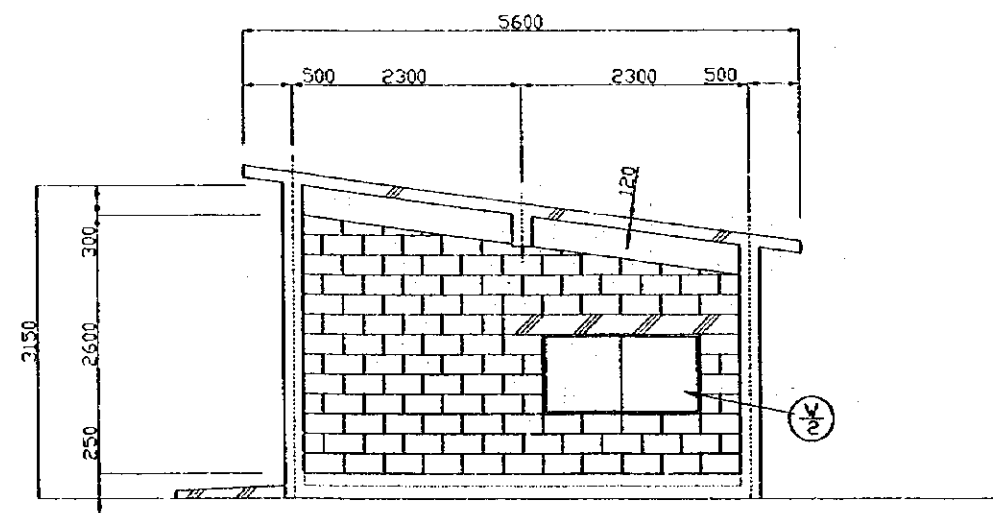
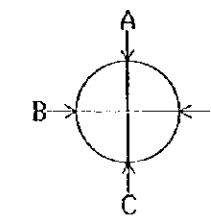
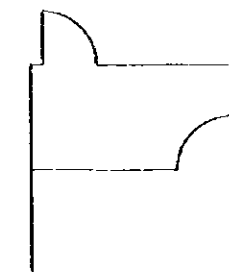
STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
LOCATION OF PROPOSED COMMUNAL WATER POINT DEBARWA	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANTU CONSULTANTS INC. (JAPAN) 1999	Drawing No. 6 / 16



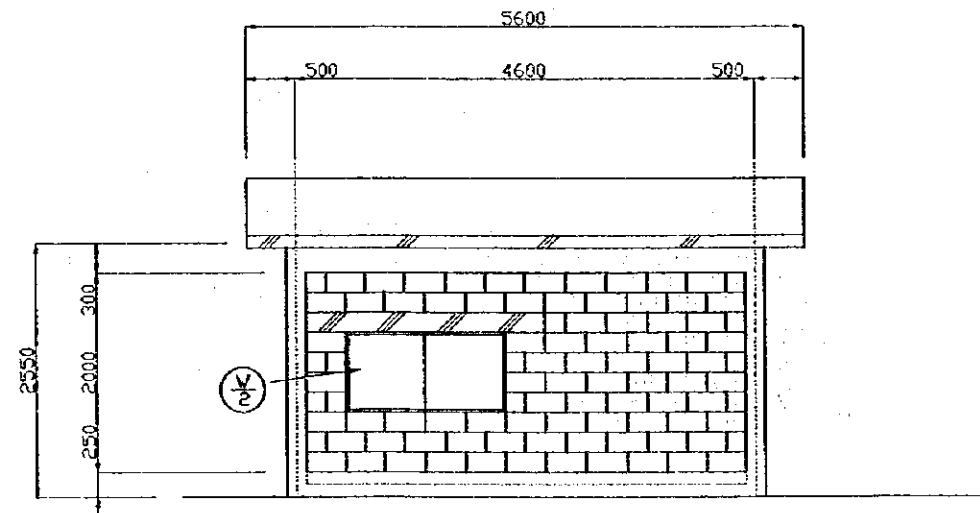
D-ELEVATION



A-ELEVATION



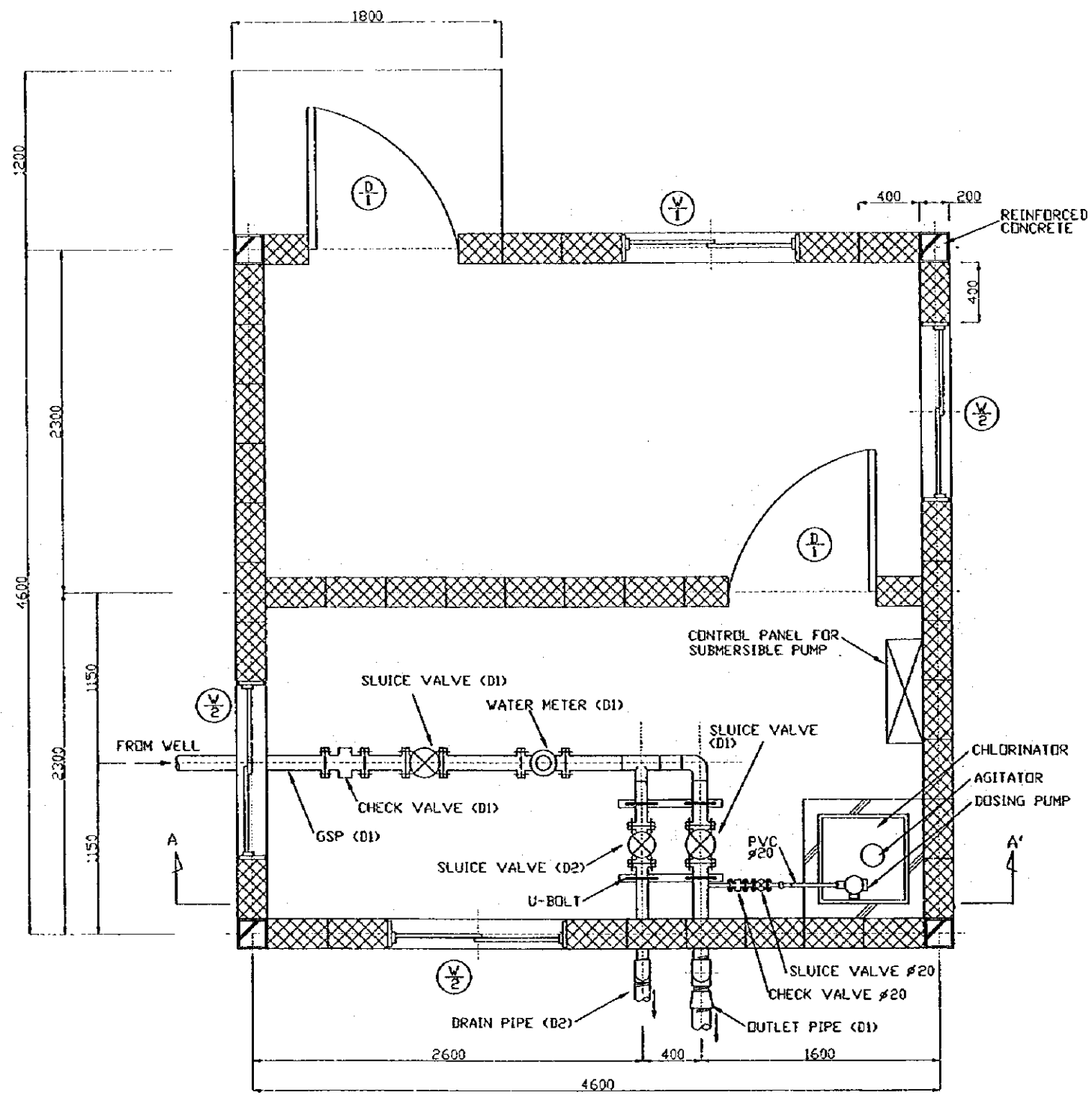
B-ELEVATION



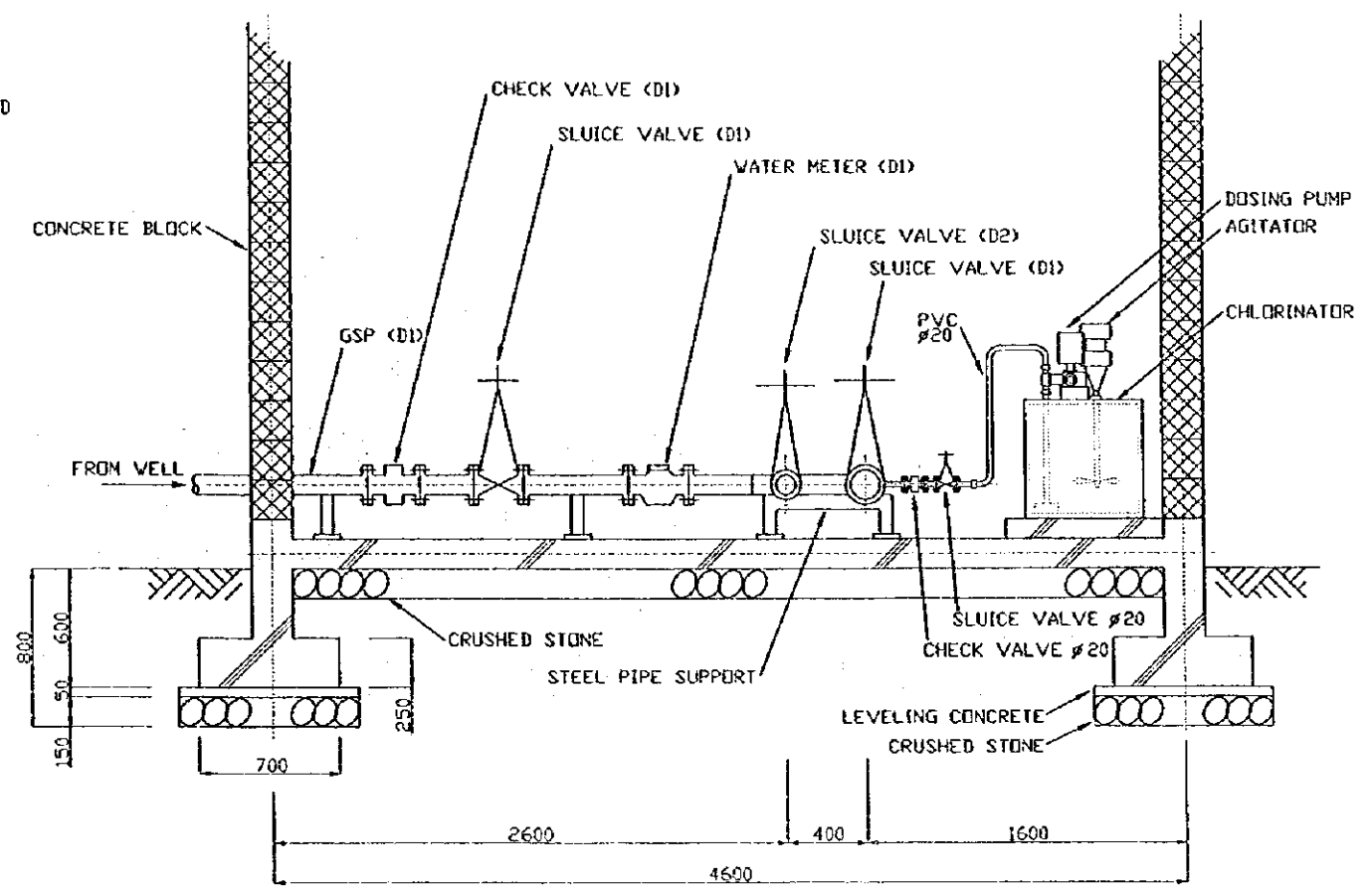
C-ELEVATION

	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 DEBARWA	
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No 7/16



PLAN



SECTION A-A'

- |   |                         |                 |    |
|---|-------------------------|-----------------|----|
|   | 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   |    |

Water Souce	D1	D2
DBE-1	80	50

STATE OF ERITREA  
 MINISTRY OF LAND, WATER & ENVIRONMENT

JAPAN INTERNATIONAL COOPERATION AGENCY

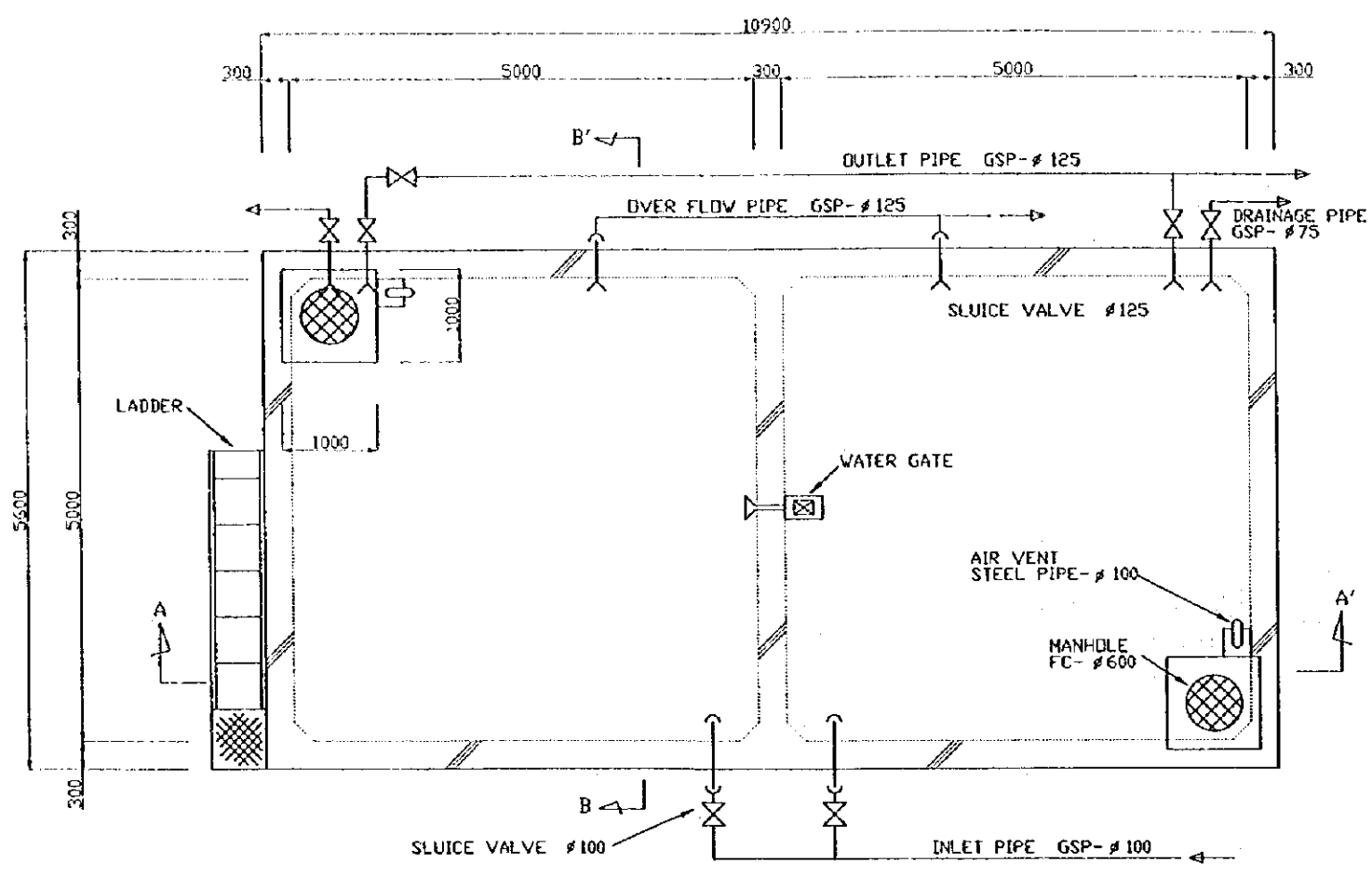
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION

BOREHOLE PUMP STATION  
 DEBARWA

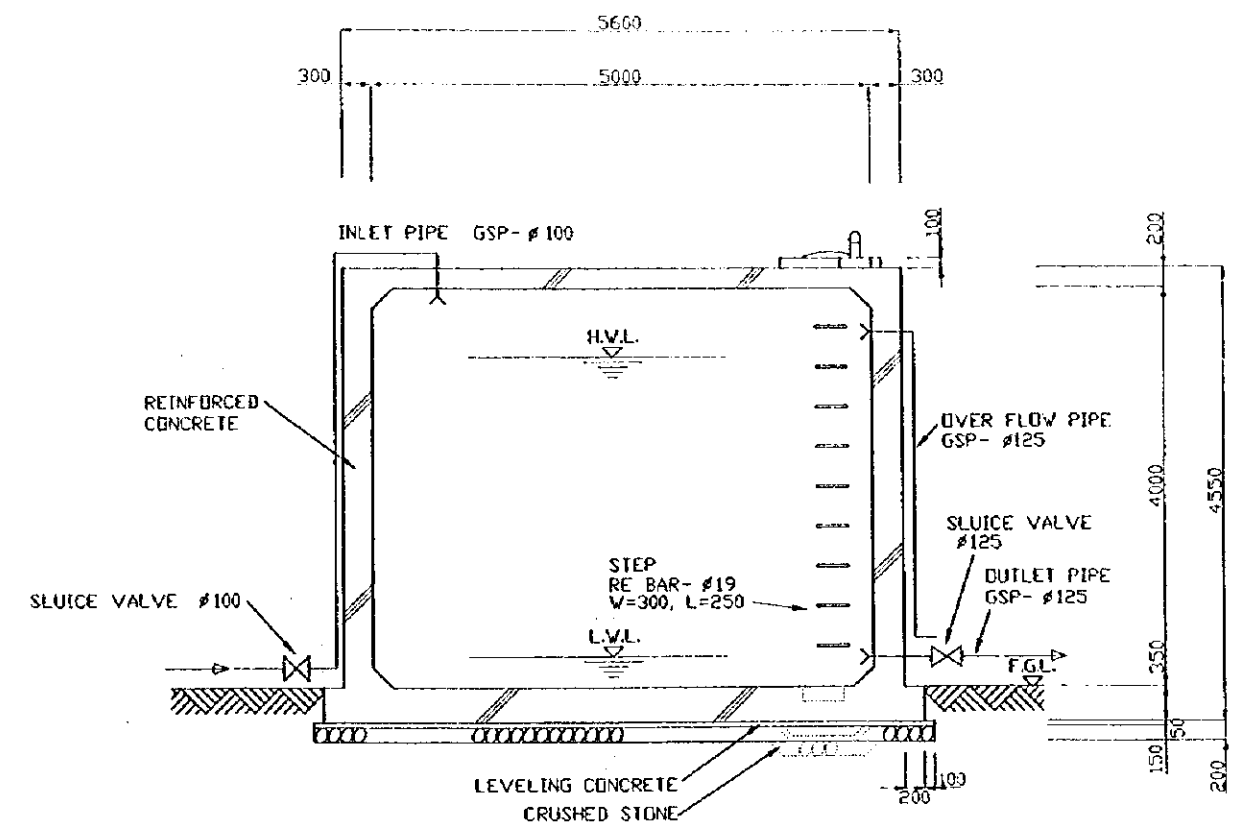
WATER RESOURCES DEPARTMENT  
 SANYU CONSULTANTS INC.  
 (JAPAN) 1999

Drawing No  
 8/16

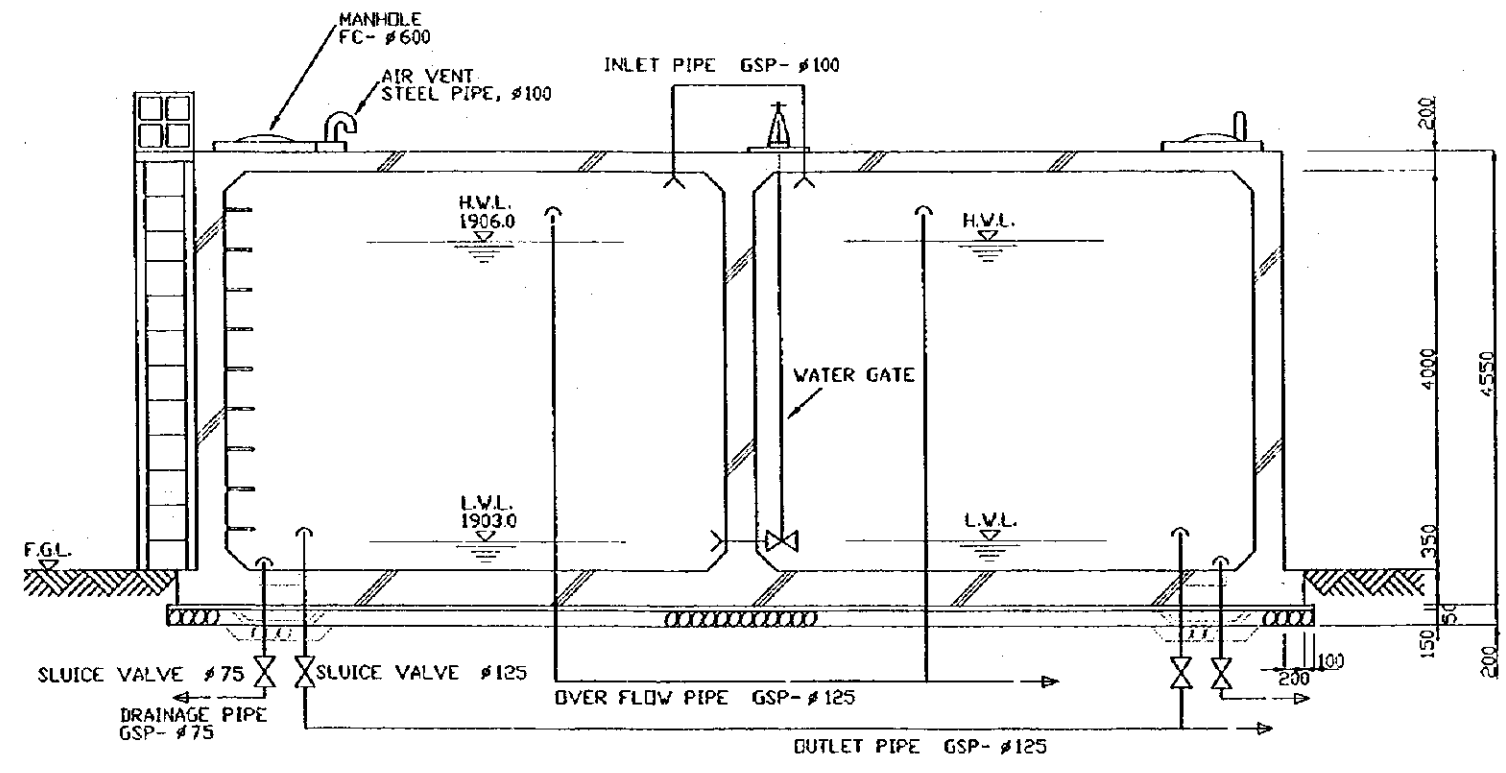




PLAN

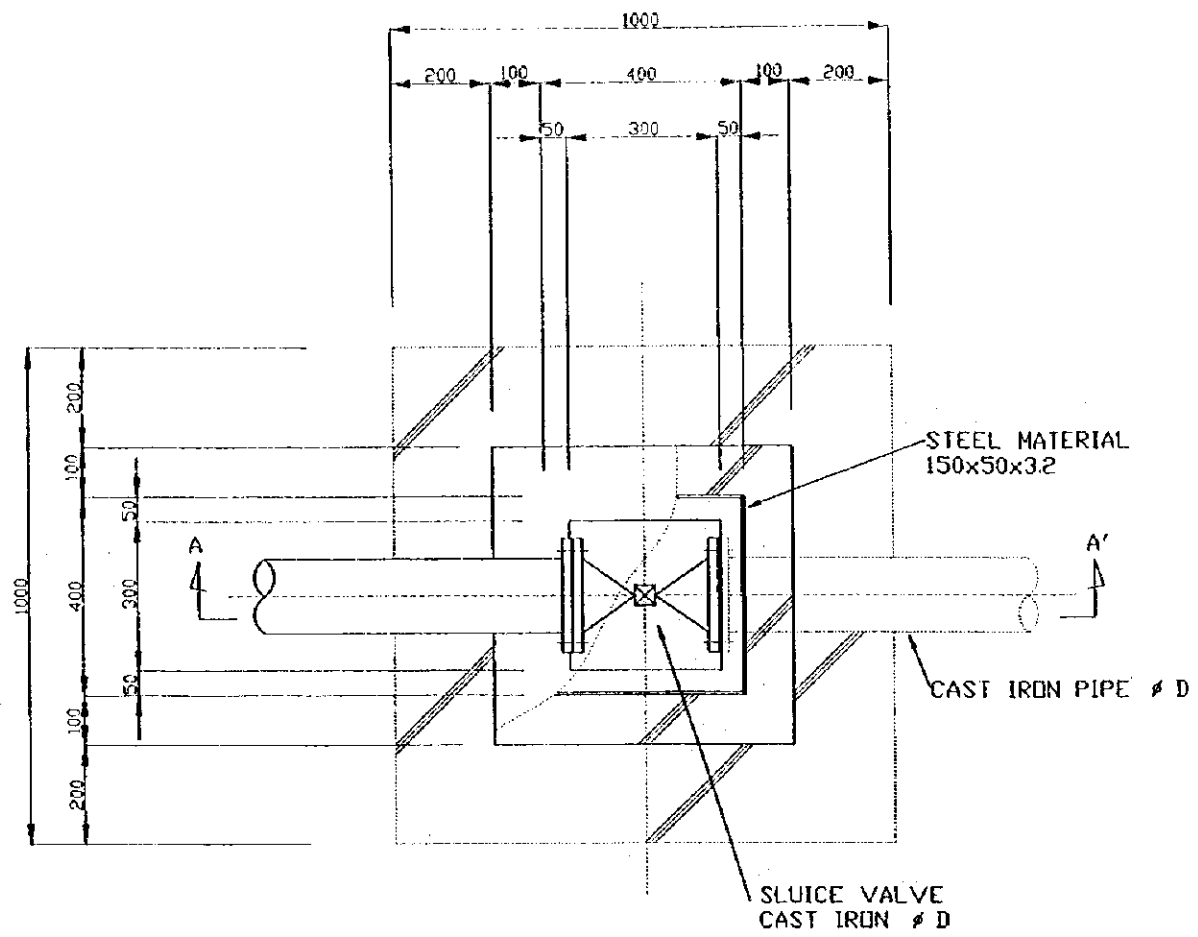


SECTION B-B'

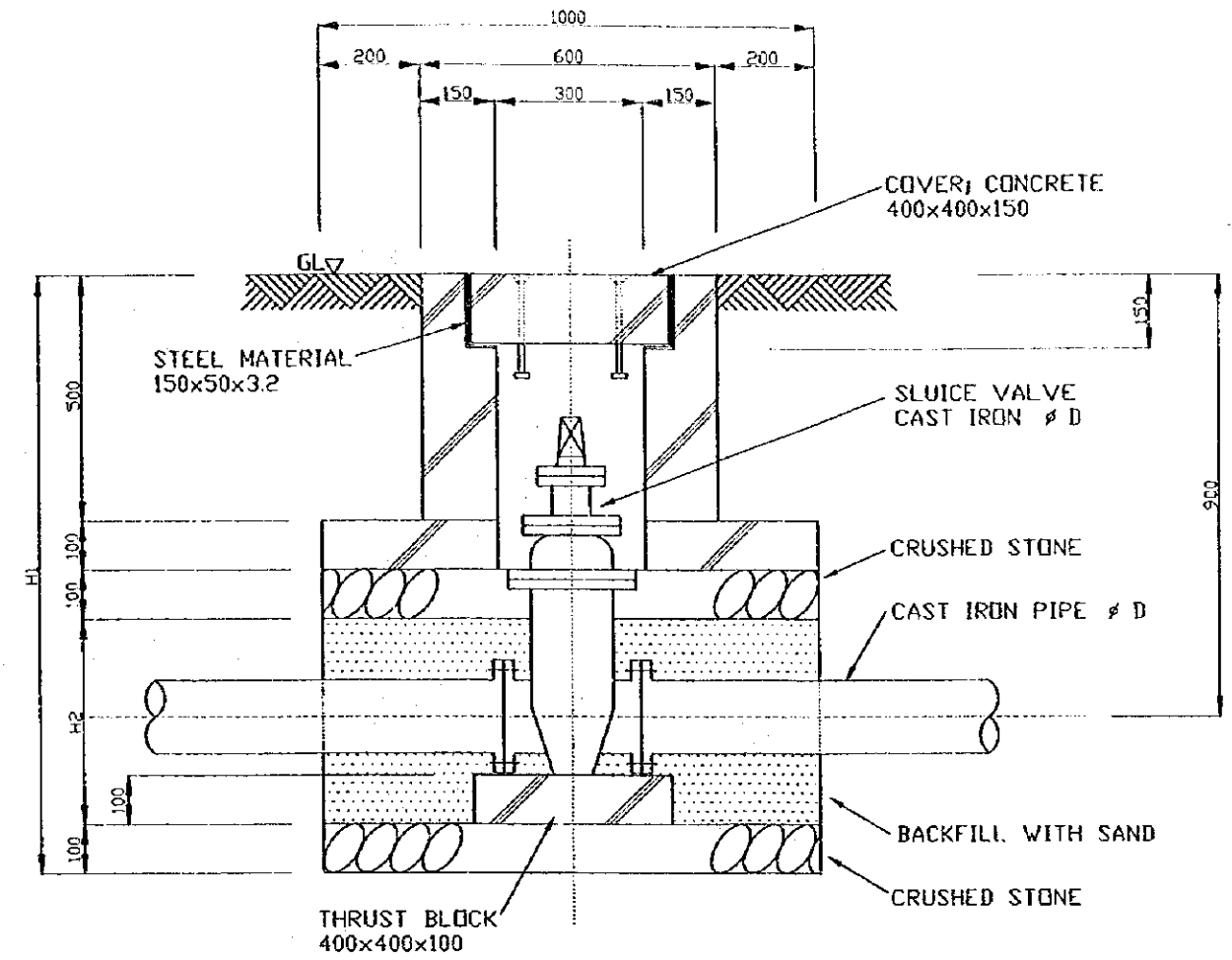


SECTION A-A

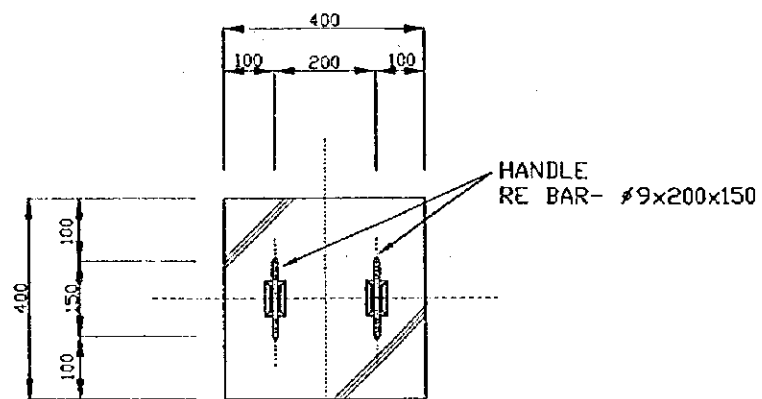
STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
140m <sup>3</sup> RESERVOIR DEBARWA	
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No 9/16



PLAN



SECTION A-A'



COVER

$\phi$ D	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

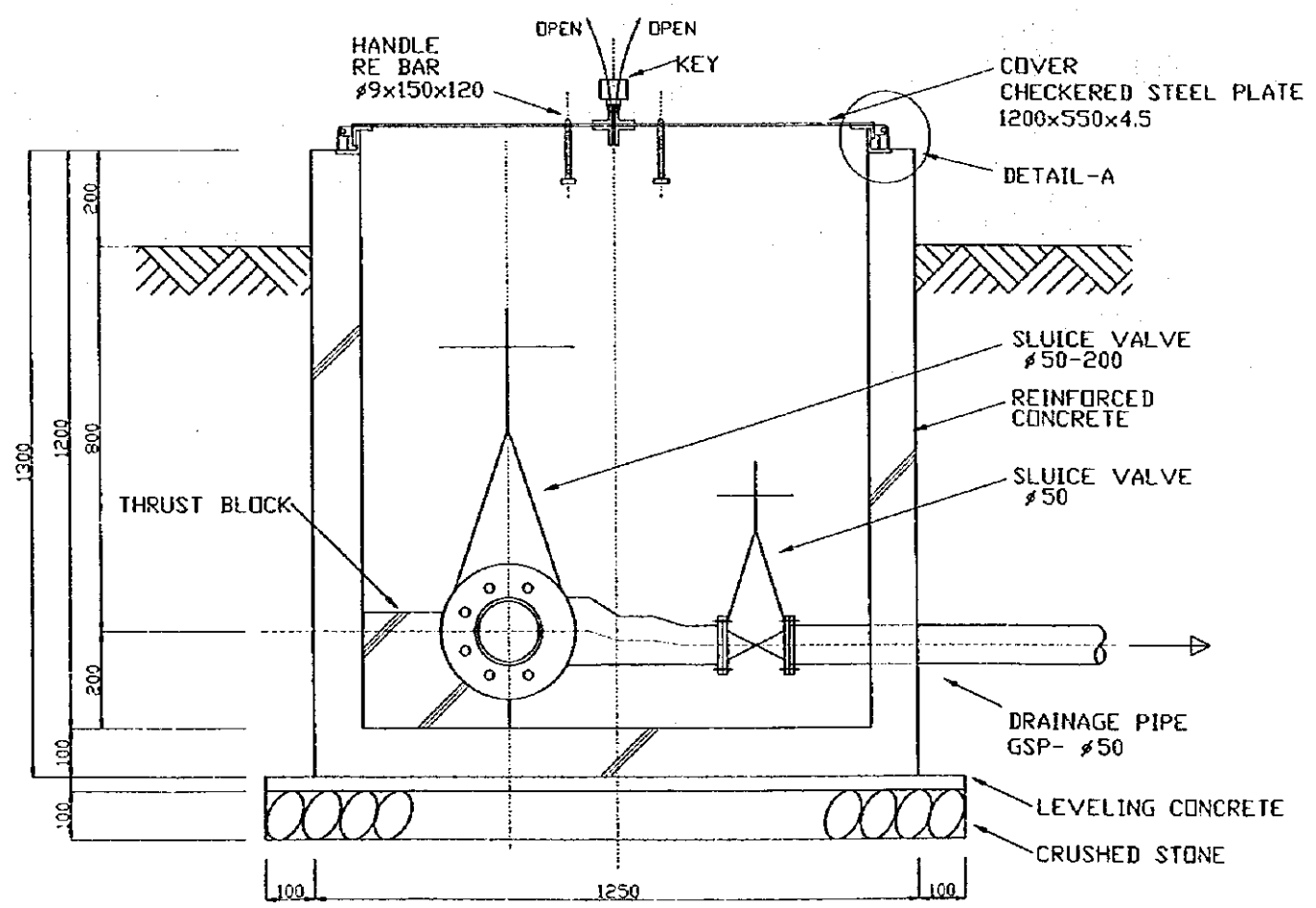
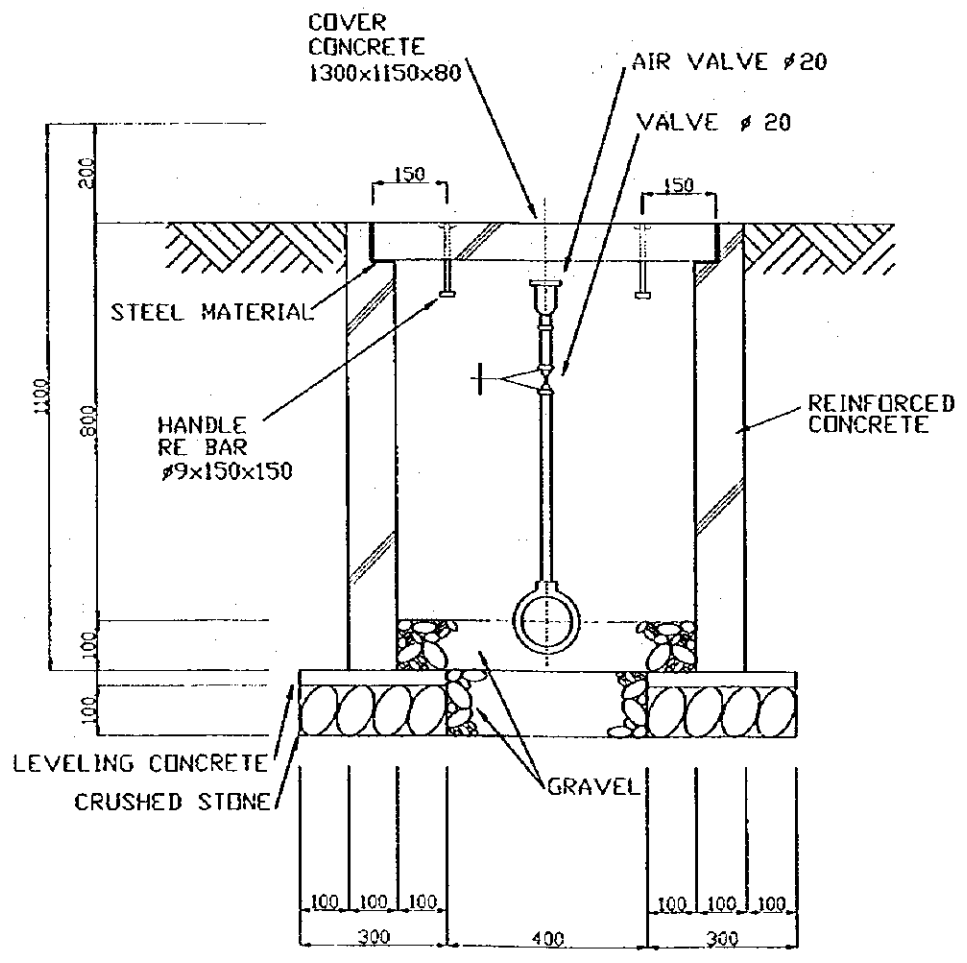
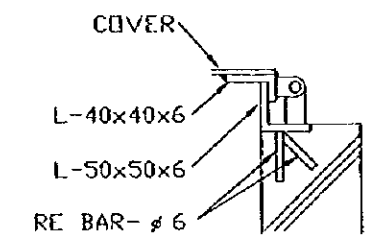
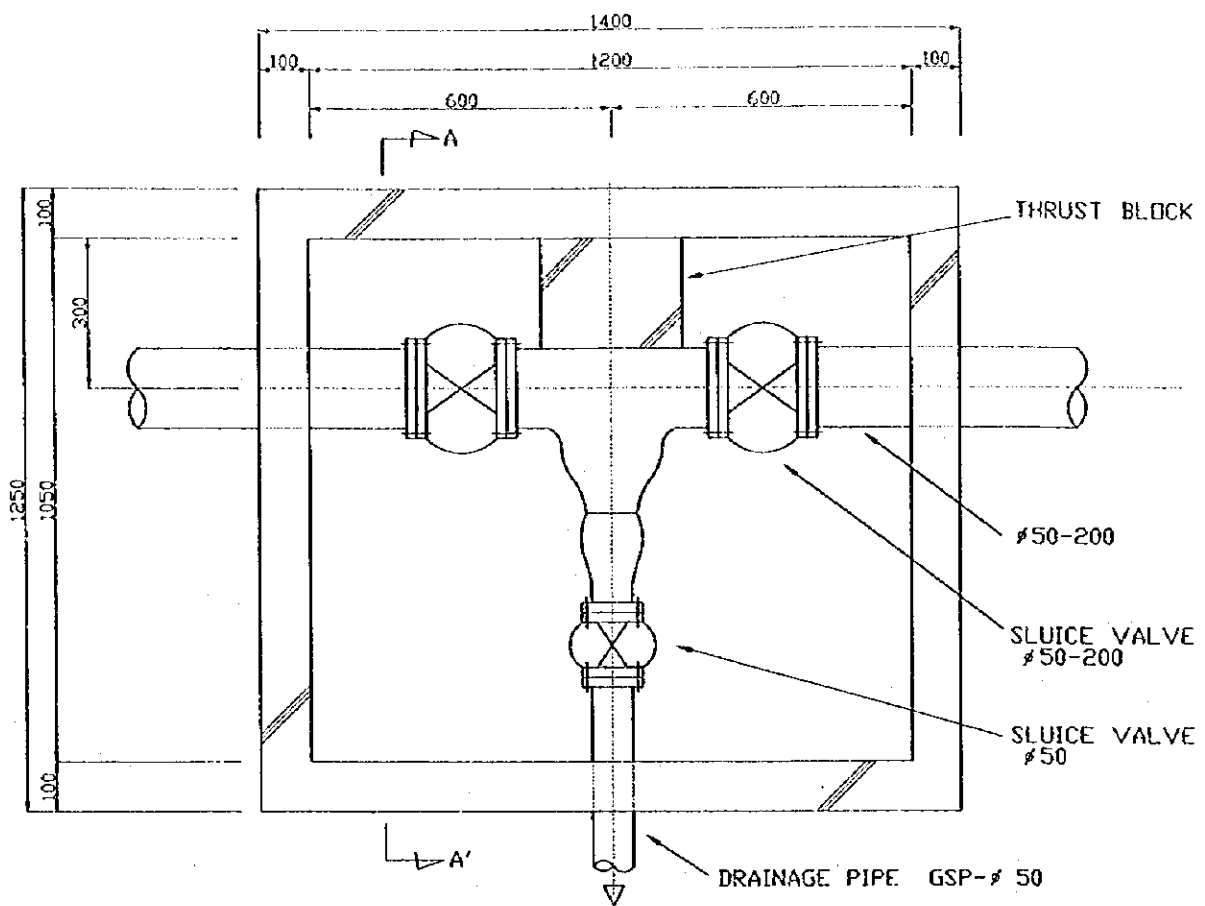
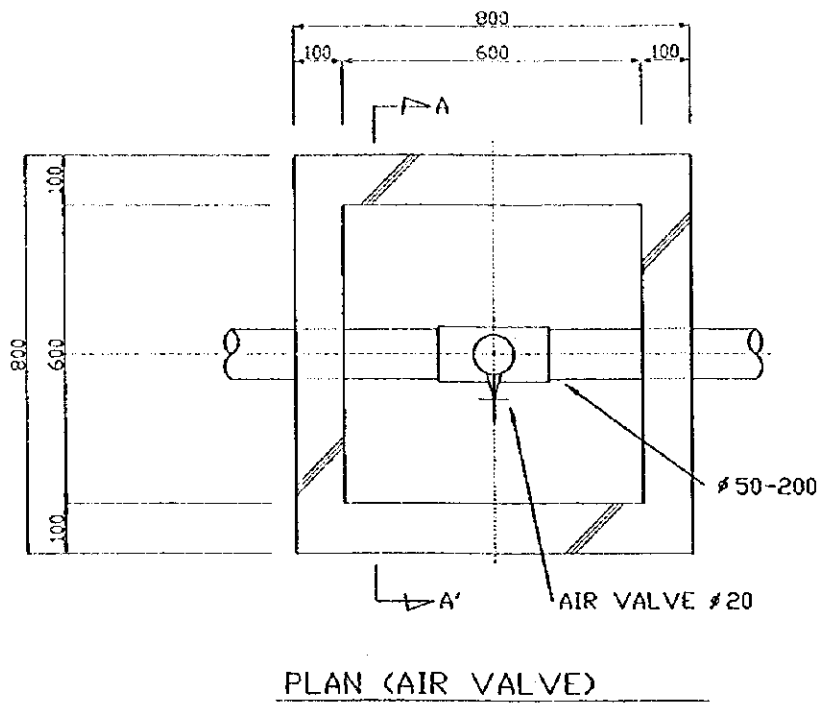
STUDY ON GROUNDWATER  
DEVELOPMENT & WATER SUPPLY  
FOR  
SEVEN TOWNS IN SOUTHERN REGION

TYPICAL VALVE BOX

WATER RESOURCES DEPARTMENT  
SANYU CONSULTANTS INC.  
(JAPAN) 1999

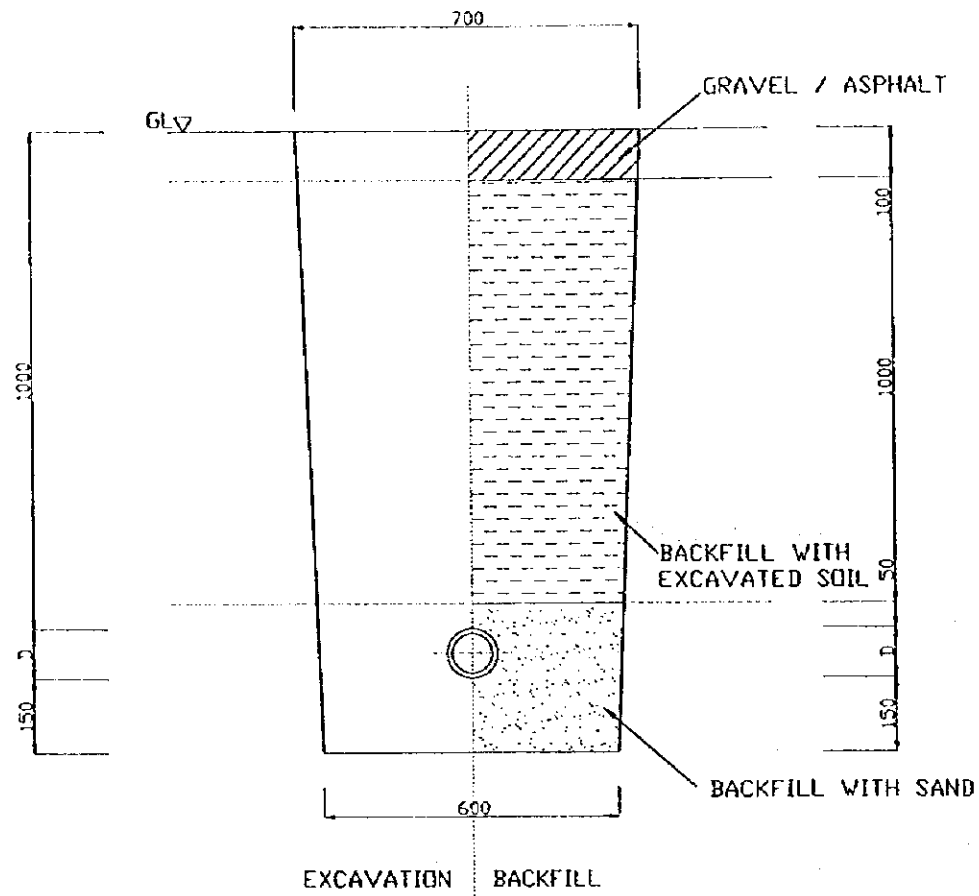
Drawing No.

10/16

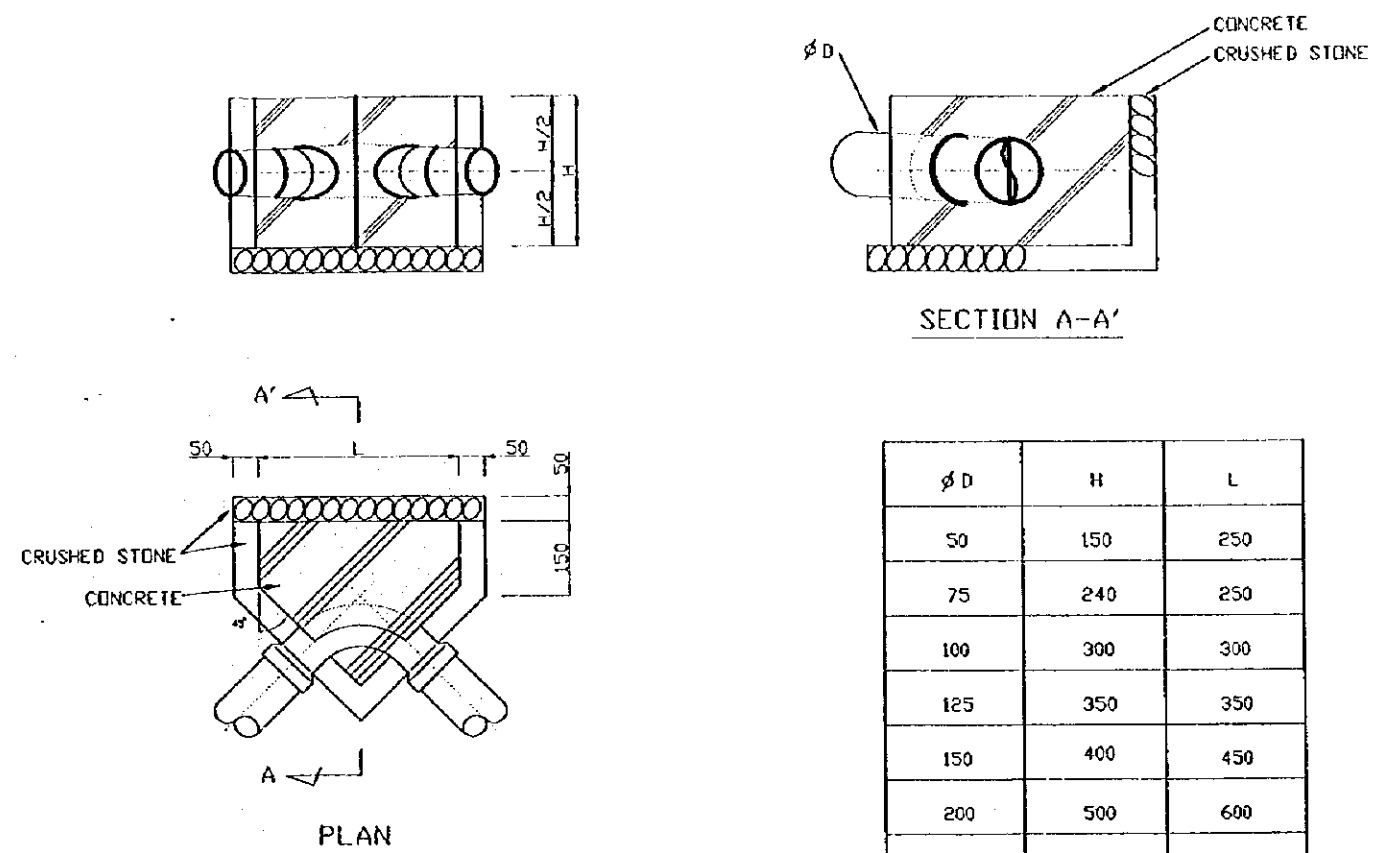


STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
TYPICAL AIR VALVE AND WASHOUT VALVE	
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No 11/16

EXCAVATION FOR PIPE LINE



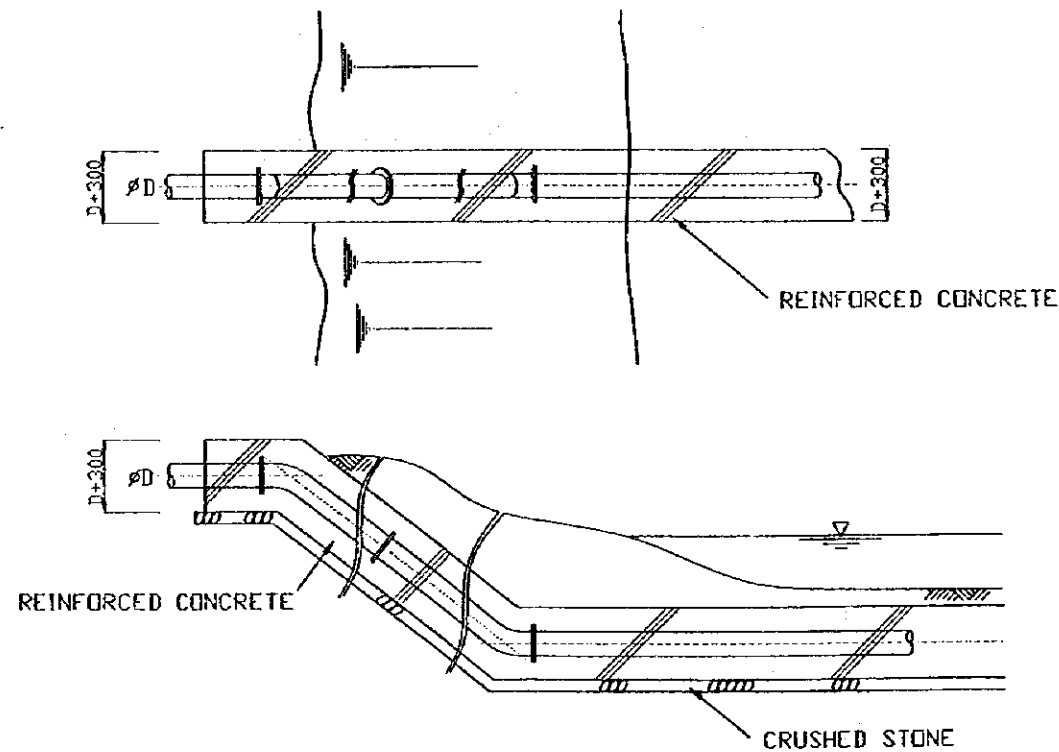
JOINT PROTECTION



$\phi D$	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  
 MINISTRY OF LAND, WATER &  
 ENVIRONMENT

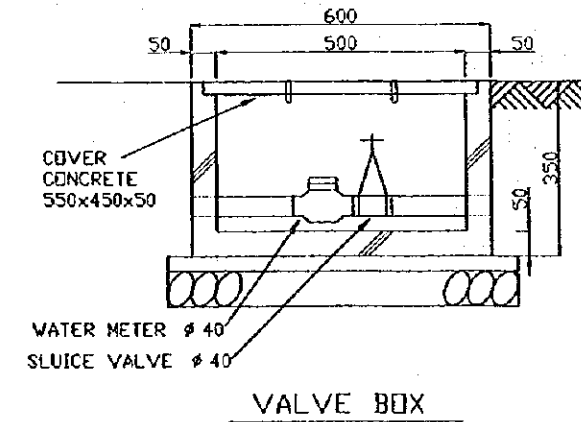
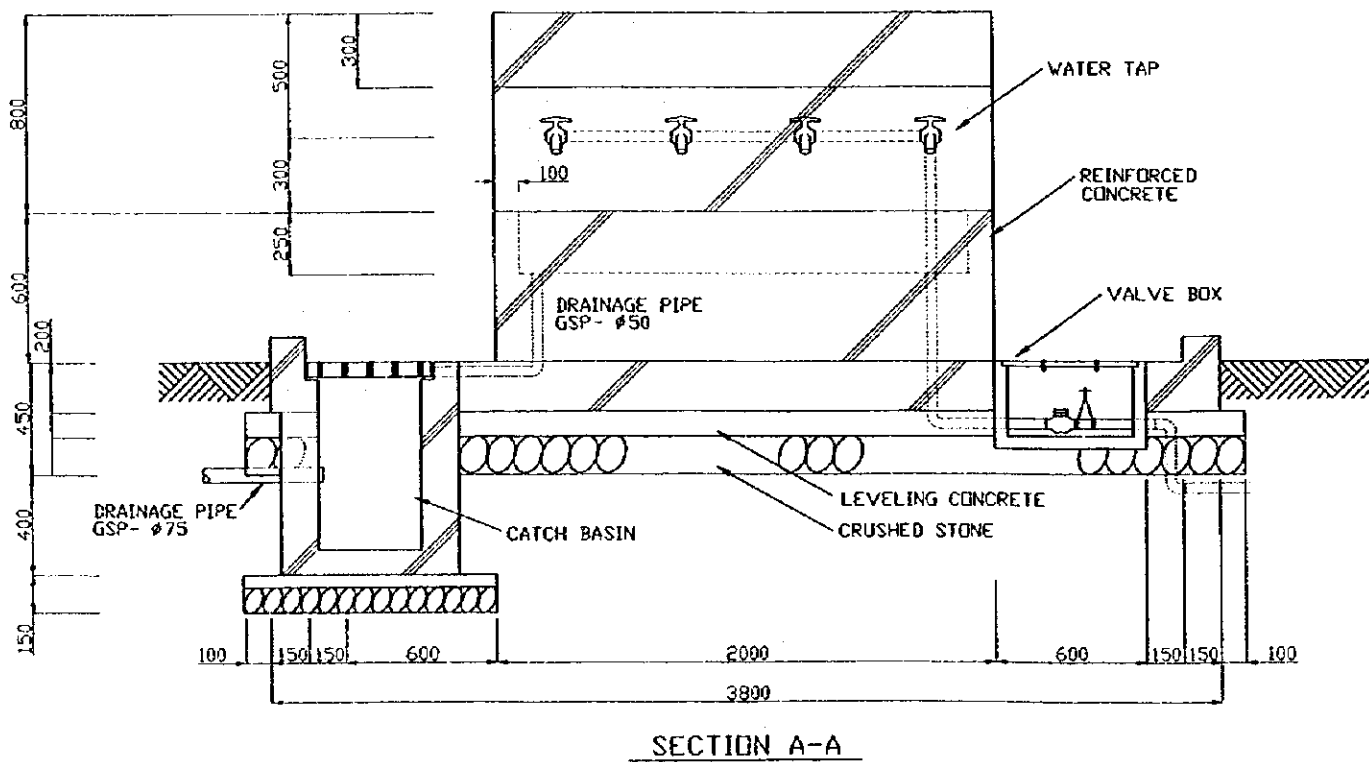
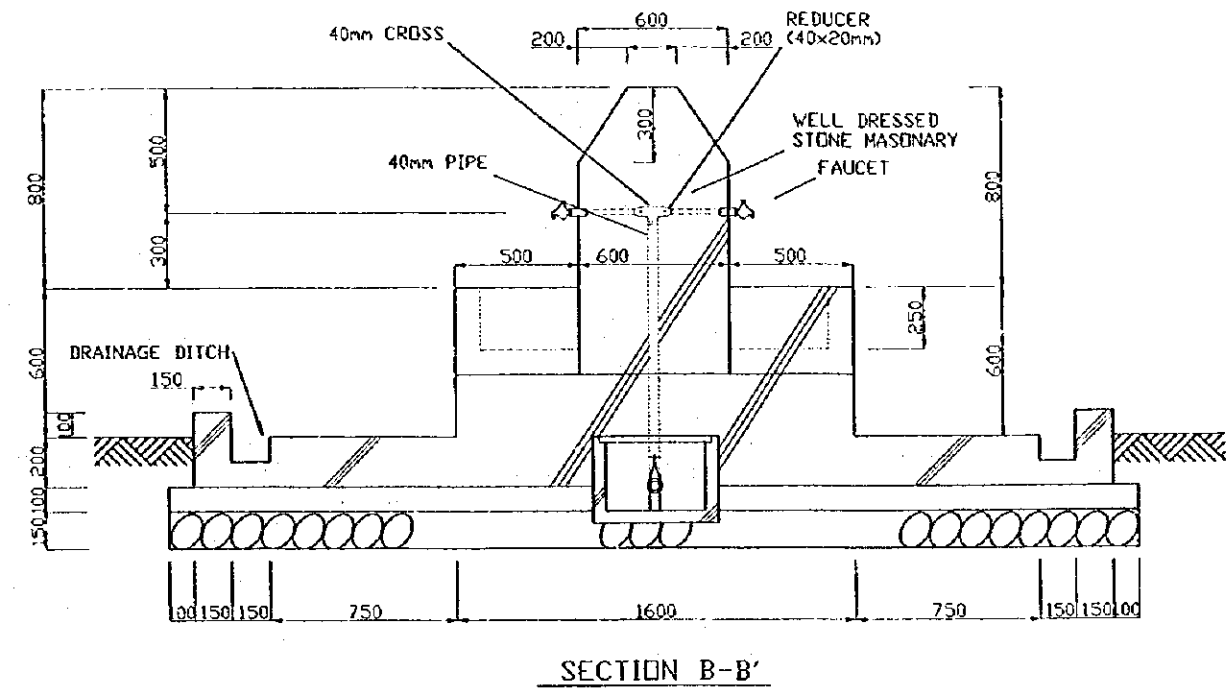
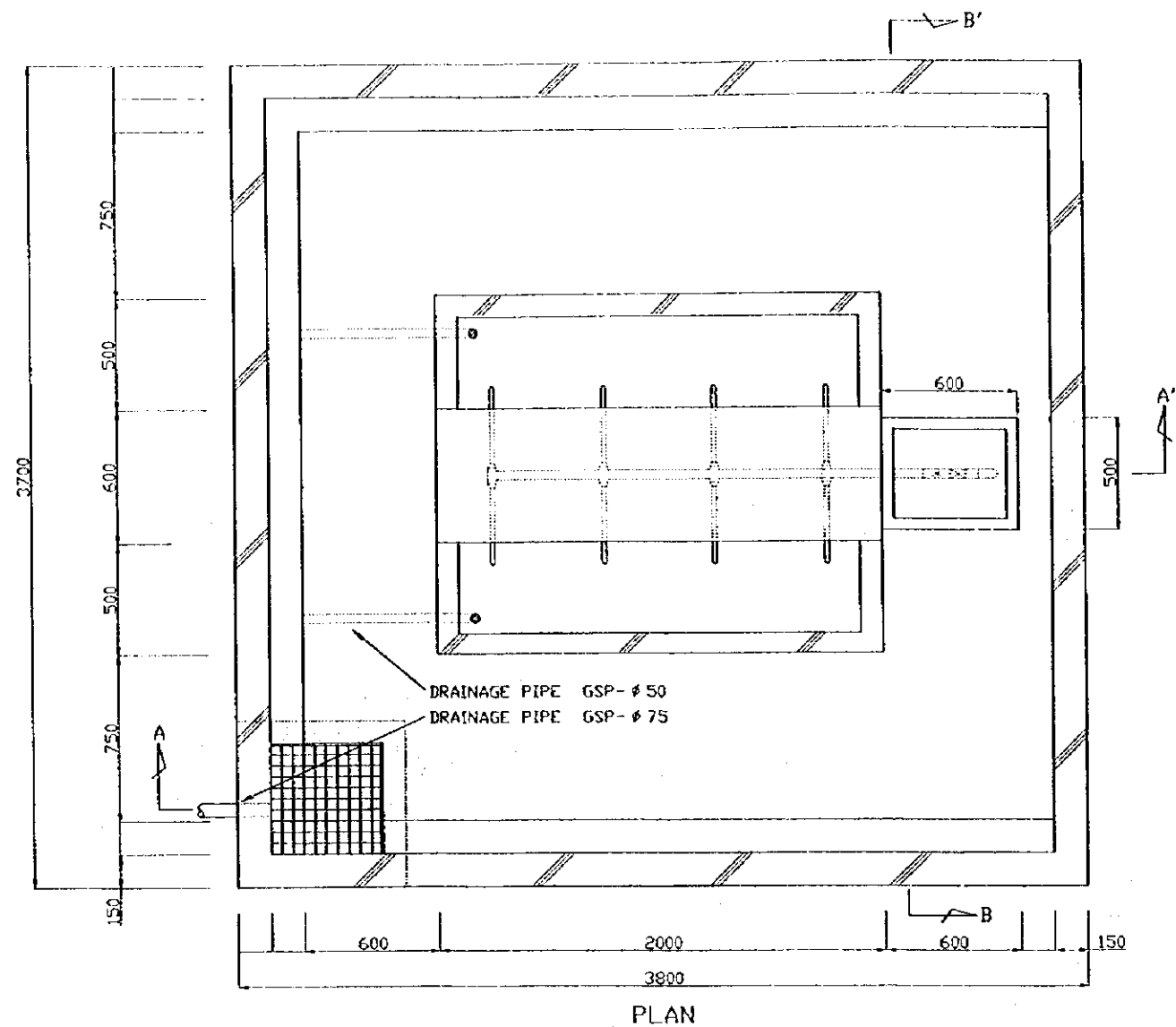
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 COOPERATION AGENCY

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

TYPICAL EXCAVATION,  
 JOINT PROTECTION & CROSSING RIVER

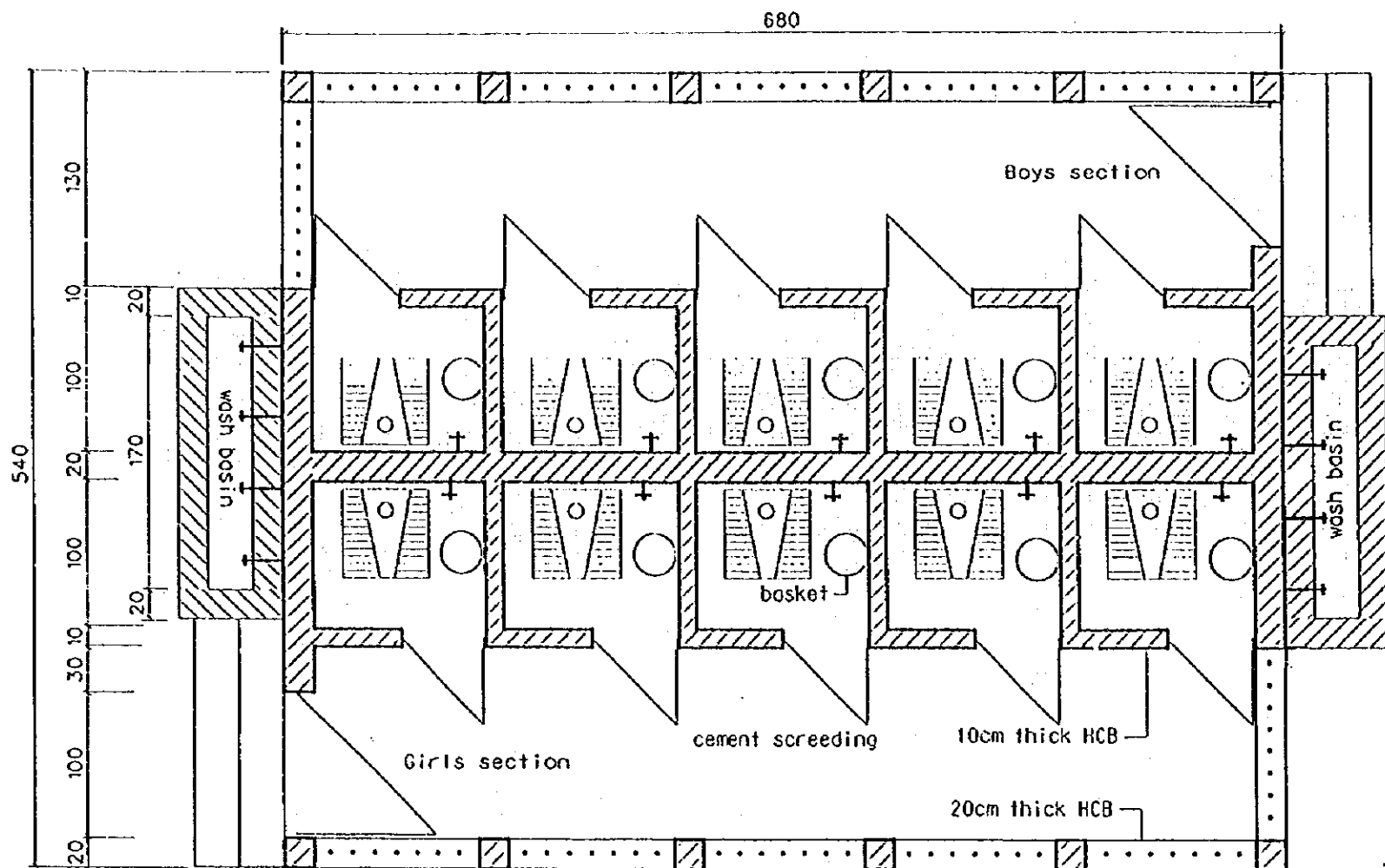
WATER RESOURCES DEPARTMENT  
 SANYU CONSULTANTS INC.  
 (JAPAN) 1999

Drawing No  
 12/16

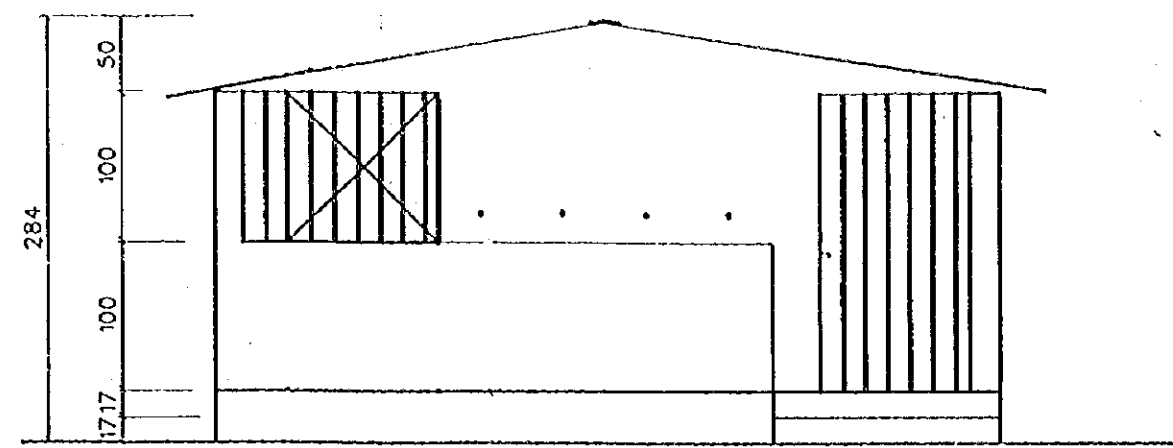


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JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
PUBLIC FAUCET	
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No 13/16

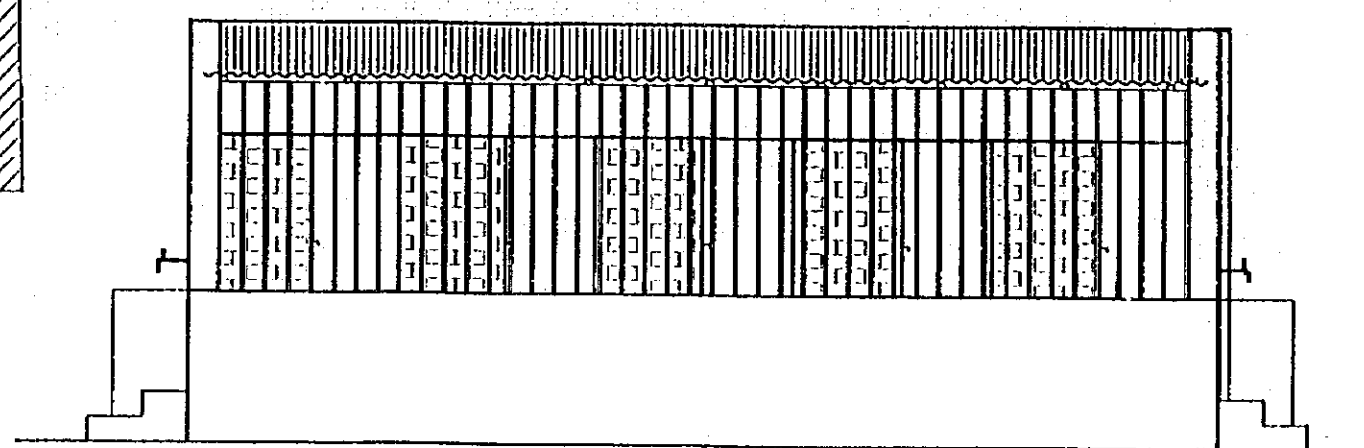
# School latrine



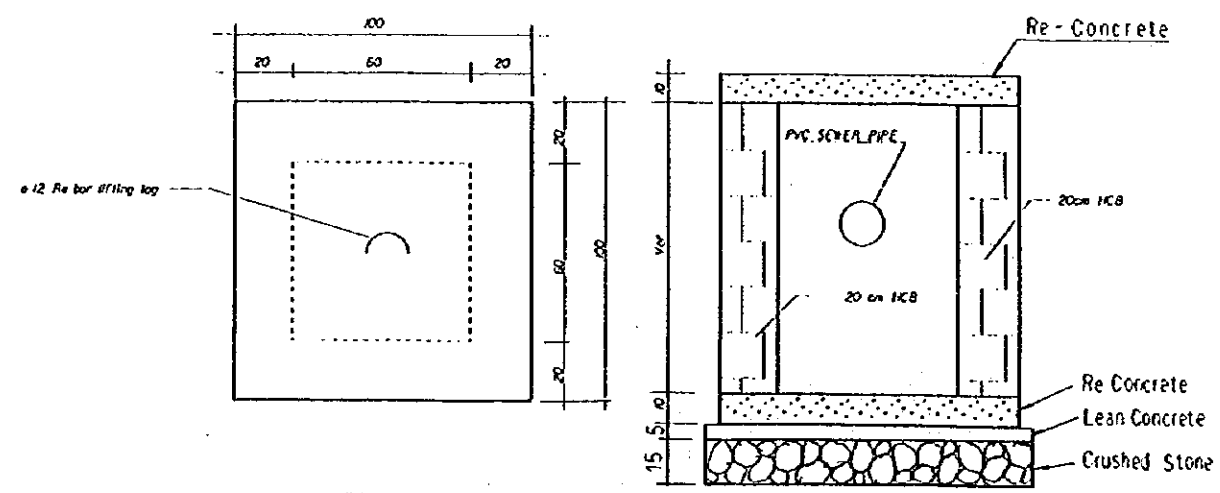
**Plan**  
Scale 1:50



**Front elevation**  
Scale 1:50

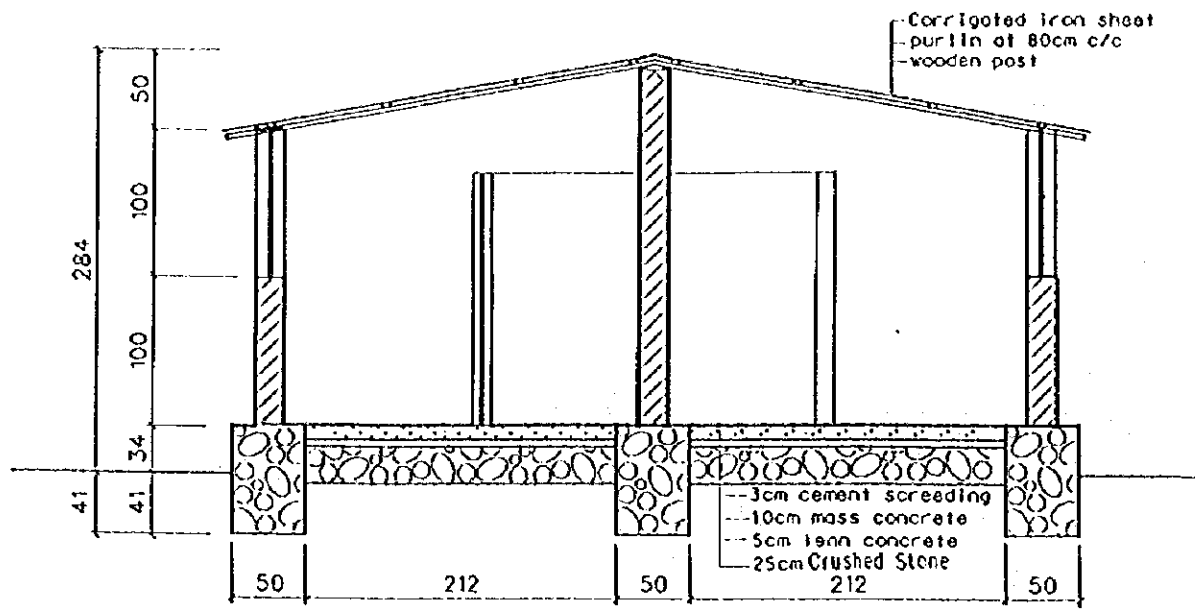


**Side elevation**  
Scale 1:50

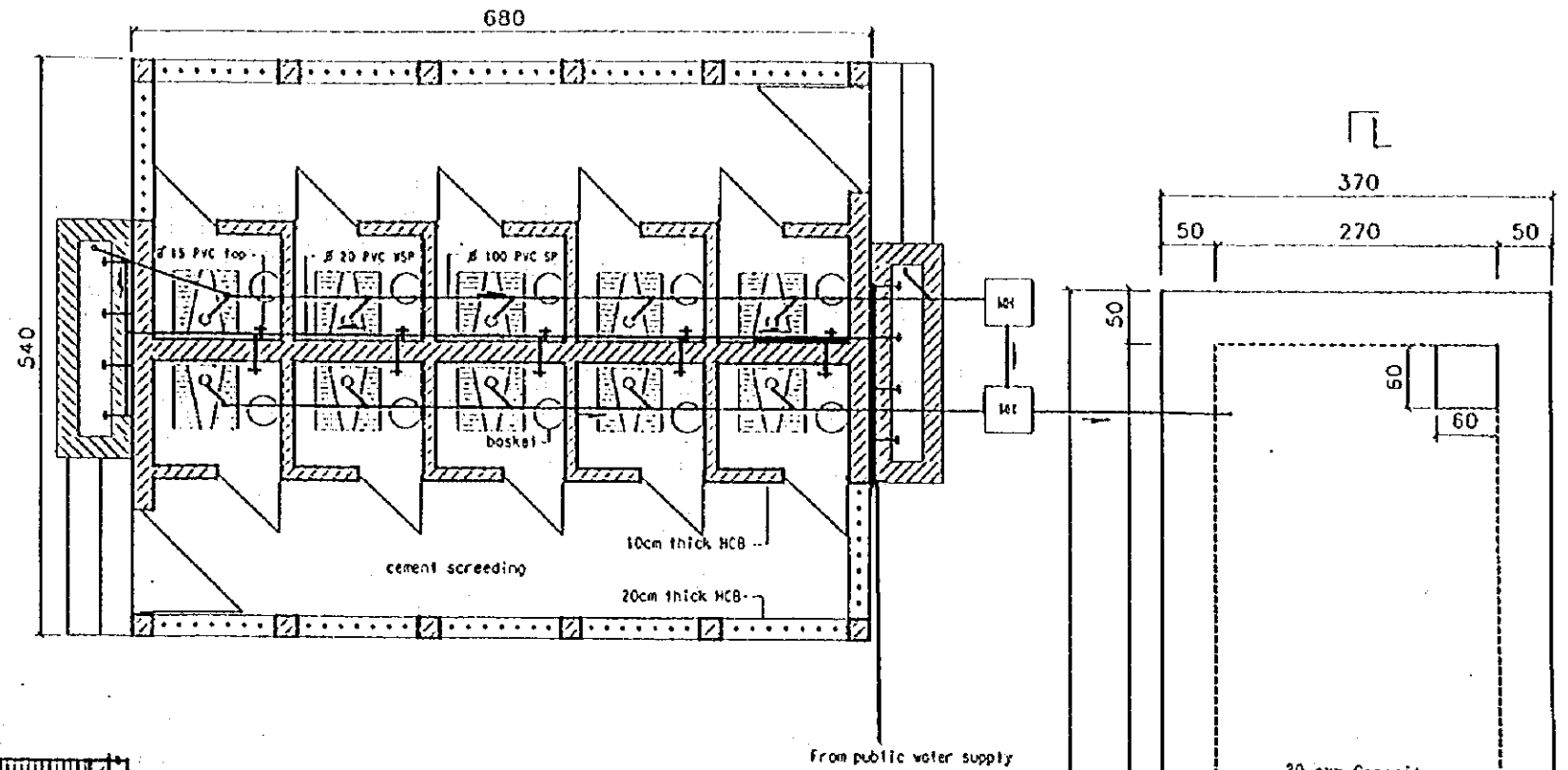


**Typical manhole detail**

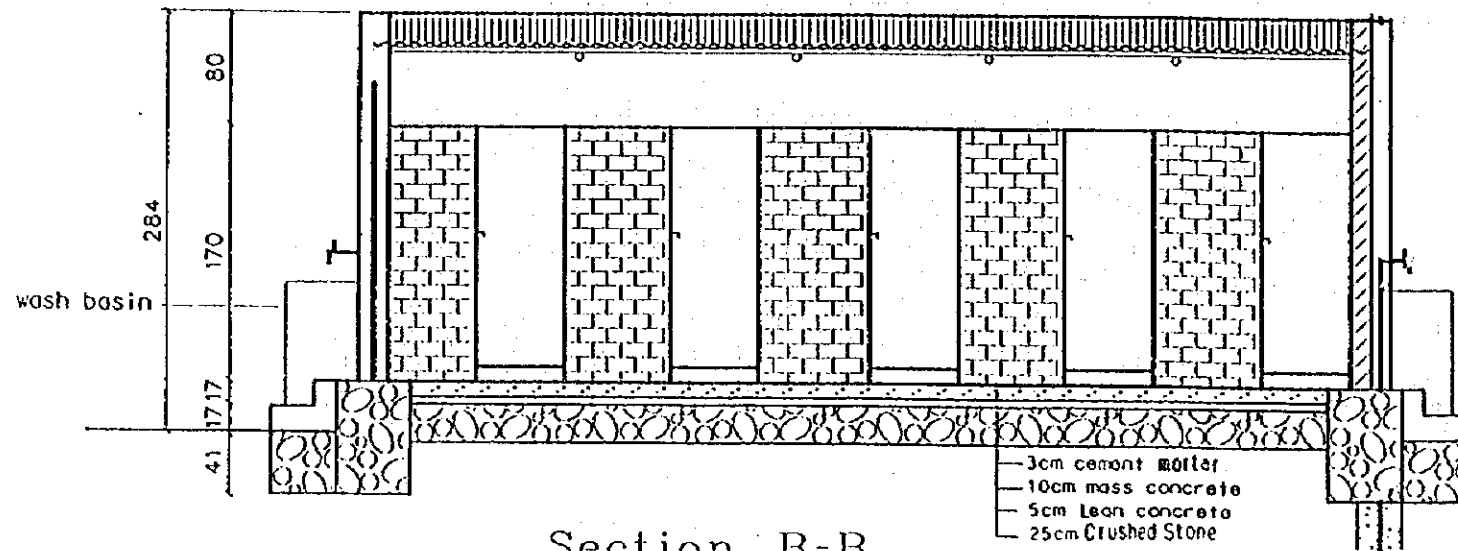
STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
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STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
School Latrine (1/2)	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANYU CONSULTANTS INC. (JAPAN, 1999)	Drawing No. 14/16



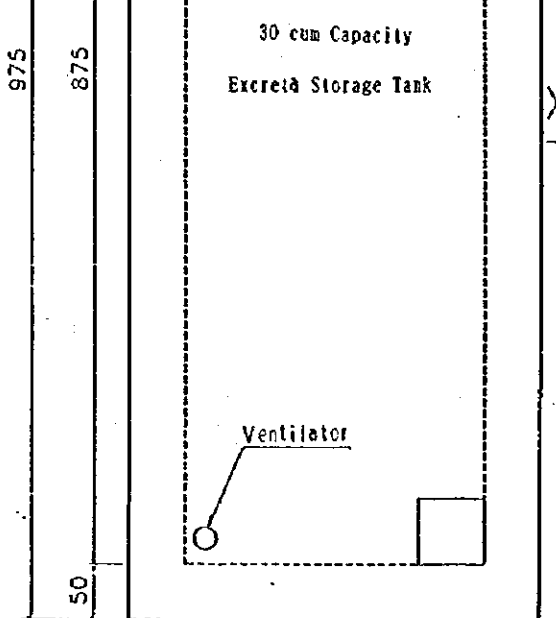
**Section A-A**  
Scale 1:50



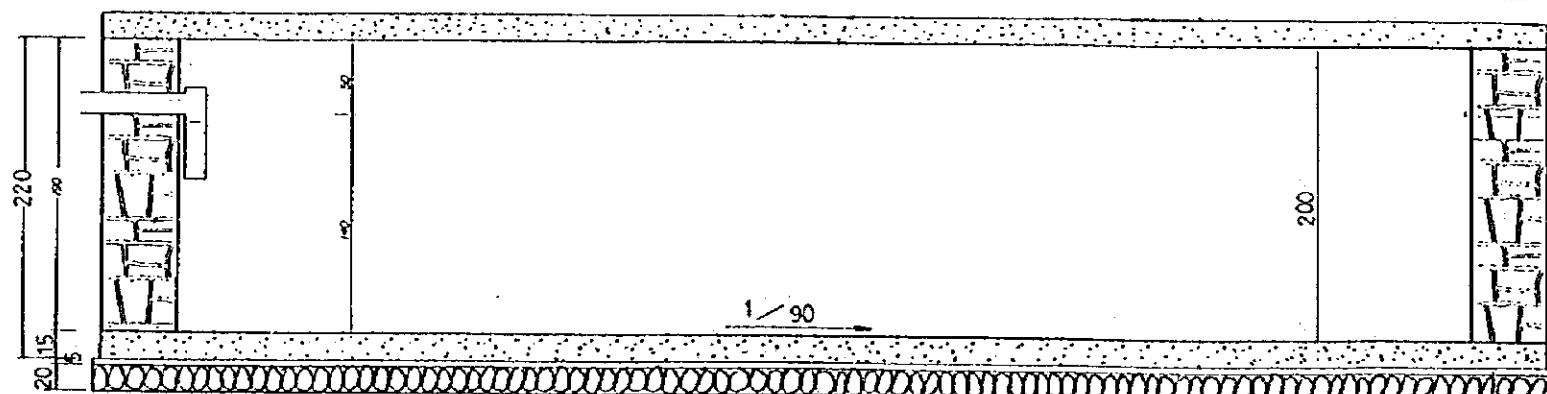
**Pipe line layout**  
Scale 1:75



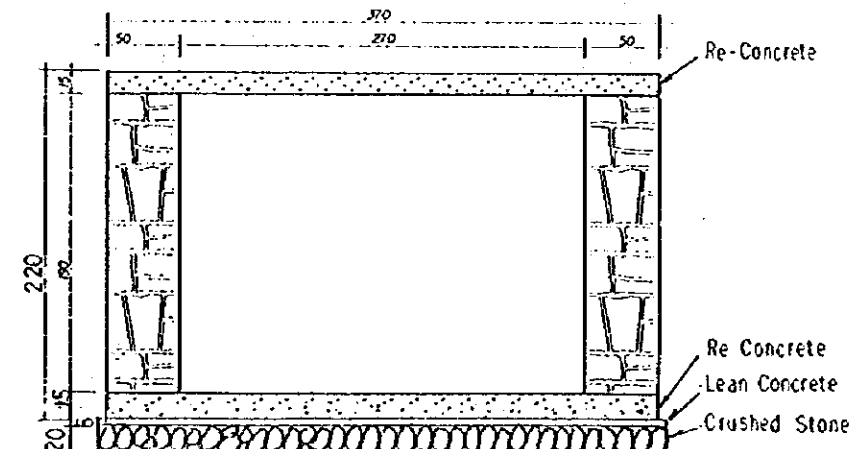
**Section B-B**  
Scale 1:50



**30 cum Capacity Excreta Storage Tank**



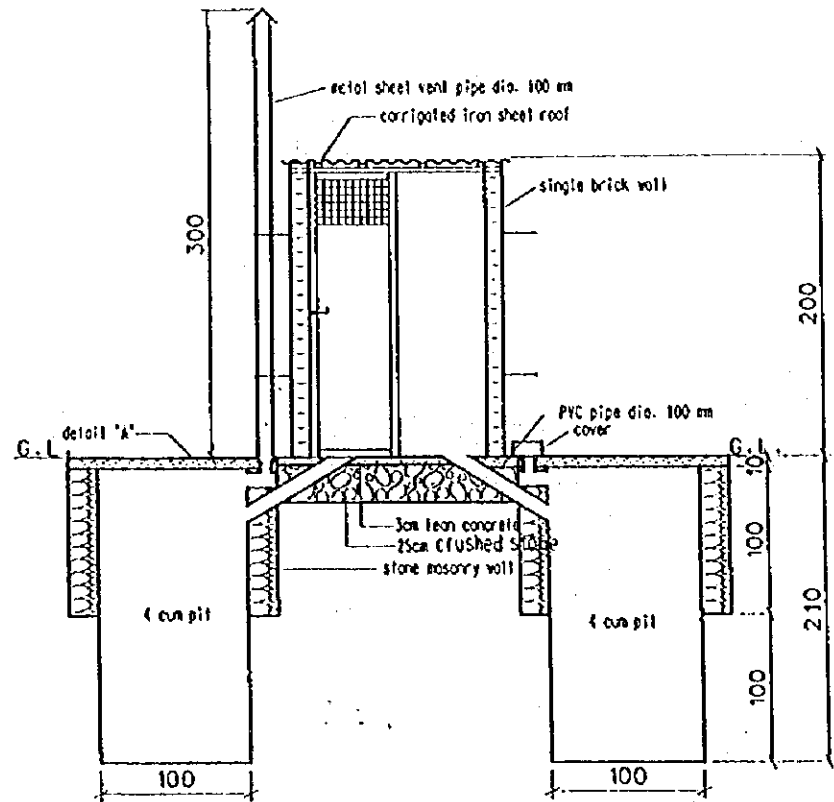
**Section L-L**



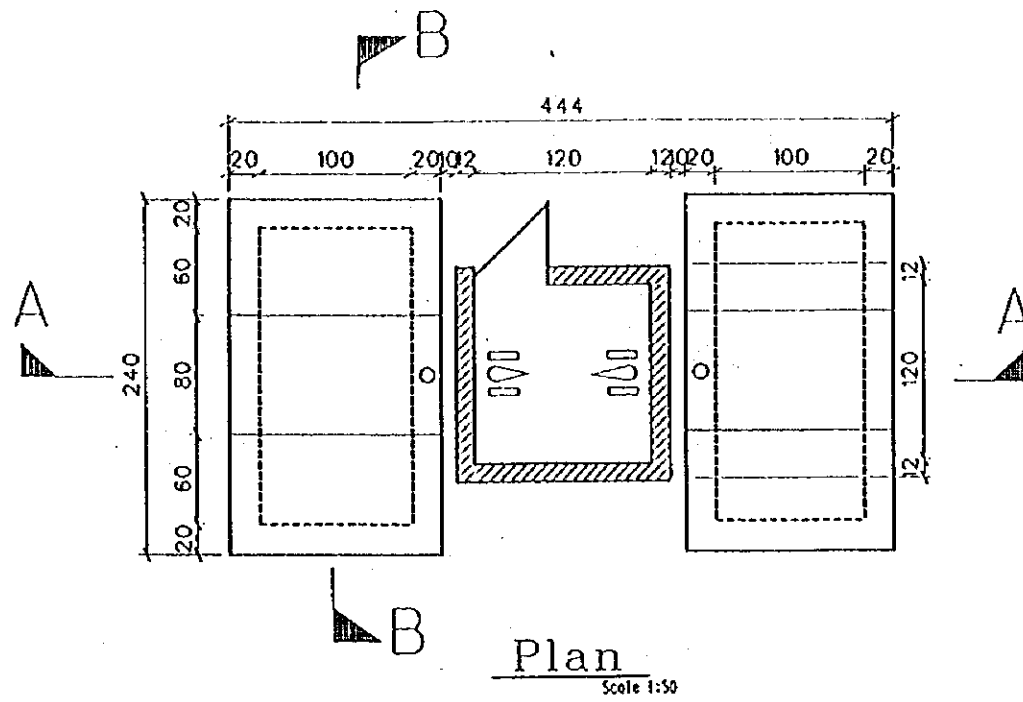
**Section X-X**

STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
<b>School Latrine (2/2)</b>	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANTU CONSULTANTS INC. JAPAN, 1999	Drawing No. <b>15/16</b>

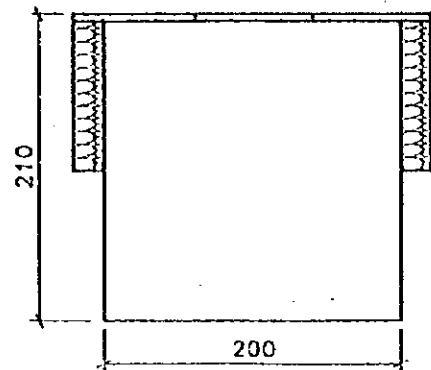
# DOUBLE PIT VIP LATRINE



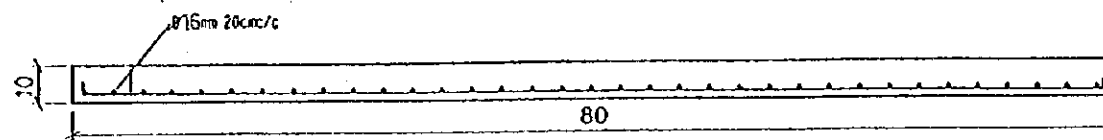
Section 'A-A'  
Scale 1:50



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	
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DOUBLE PIT VIP LATRINE	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANTU CONSULTANTS INC. (JAPAN) 1999	Drawing No.  16/16







JICA