


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

SEGENEITI

VOLUME II DRAWINGS

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JANUARY 1999

SANYU CONSULTANTS INC.

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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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SANYU CONSULTANTS INC.



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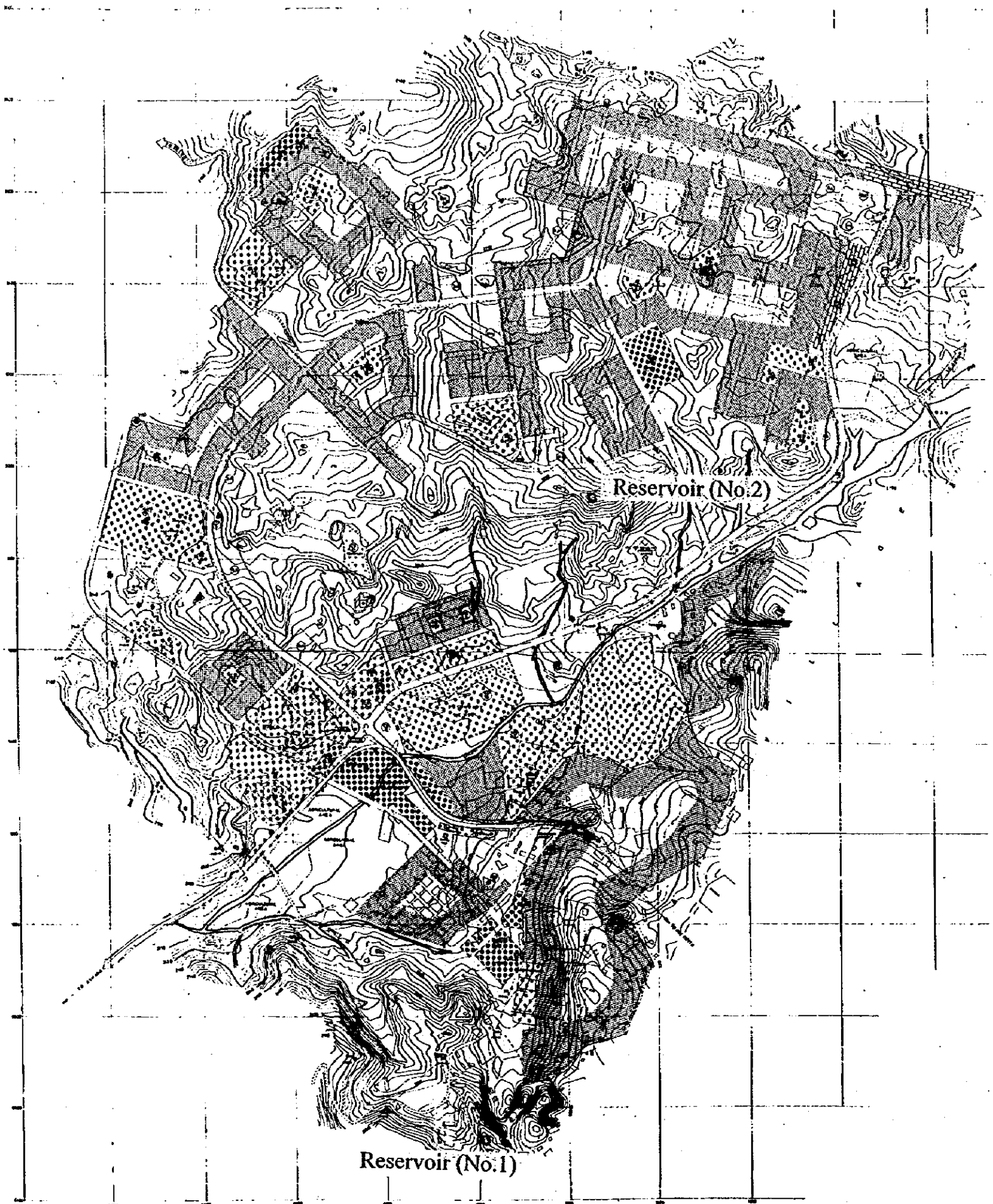
Operation and Maintenance Manual for Water Supply Facility

Hygiene Education Manual

Training Manual for Staff of WSA

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LEGEND	
	Boundary
	Commercial Area
	Administration Area
	Residential Area
	Industrial Area

STATE OF ERITREA
MINISTRY OF LAND, WATER &
ENVIRONMENT

JAPAN INTERNATIONAL
COOPERATION AGENCY

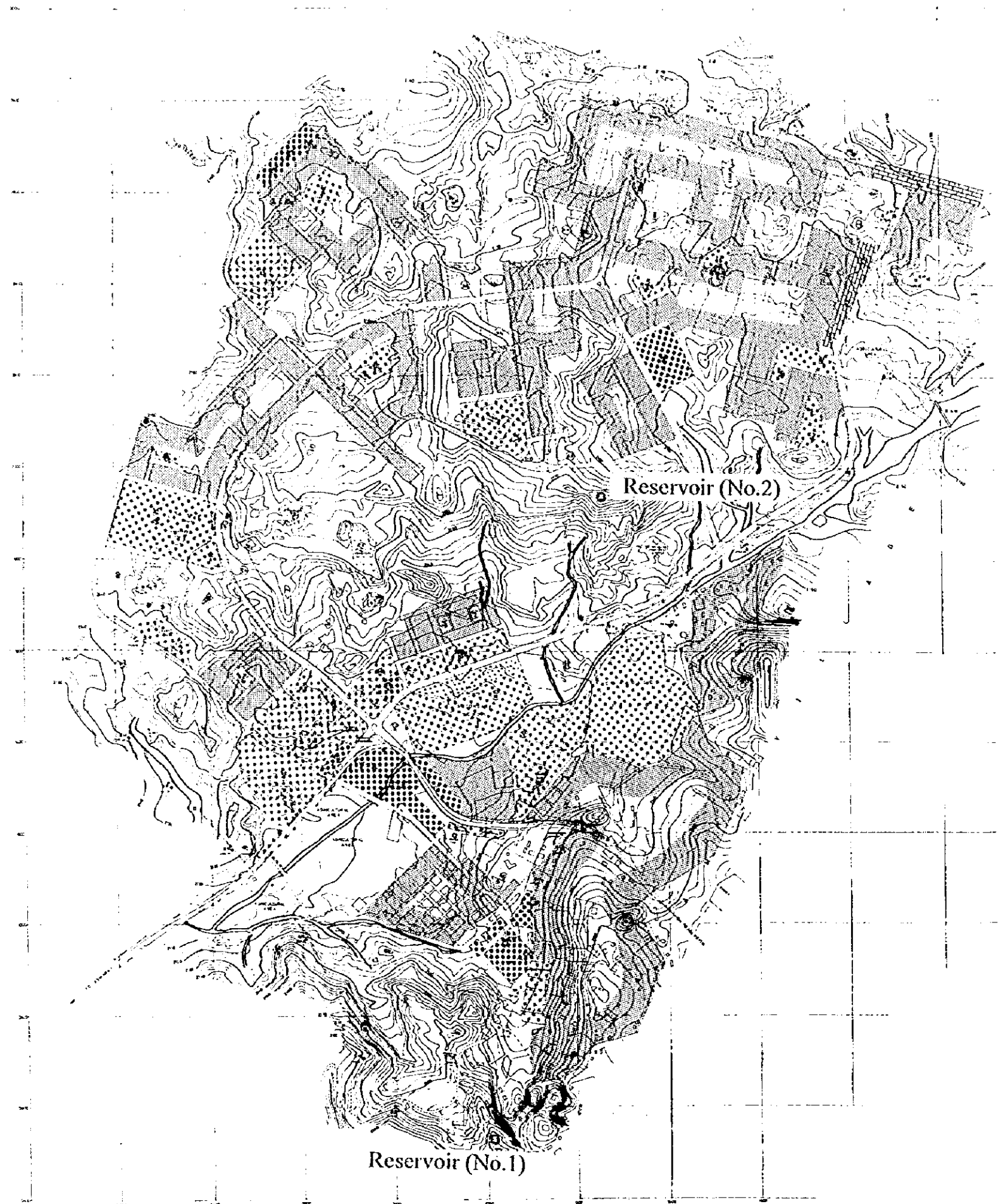
STUDY ON GROUNDWATER
DEVELOPMENT & WATER SUPPLY
FOR
SEVEN TOWNS IN SOUTHERN REGION

Land Use and Zone Boundary

SEBENKITI (2010)



WATER RESOURCES DEPARTMENT (ASMLA, ERITREA) SANTU CONSULTANTS INC. (JAPAN, 1955)	Drawing No. 1 / 24
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LEGEND	
	Boundary
	Commercial Area
	Administration Area
	Residential Area
	Industrial Area

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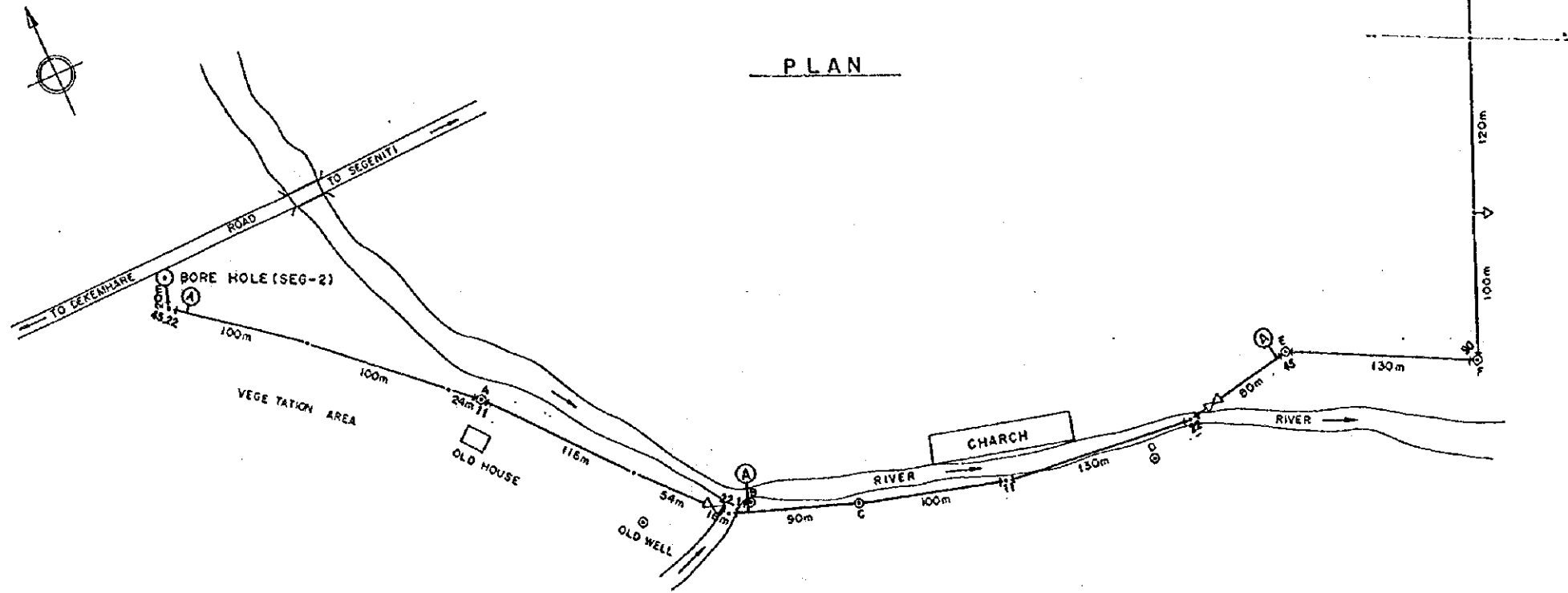
STUDY ON GROUNDWATER
DEVELOPMENT & WATER SUPPLY
FOR
SEVEN TOWNS IN SOUTHERN REGION

Land Use and Zone Boundary

SEGENEITI (2010)

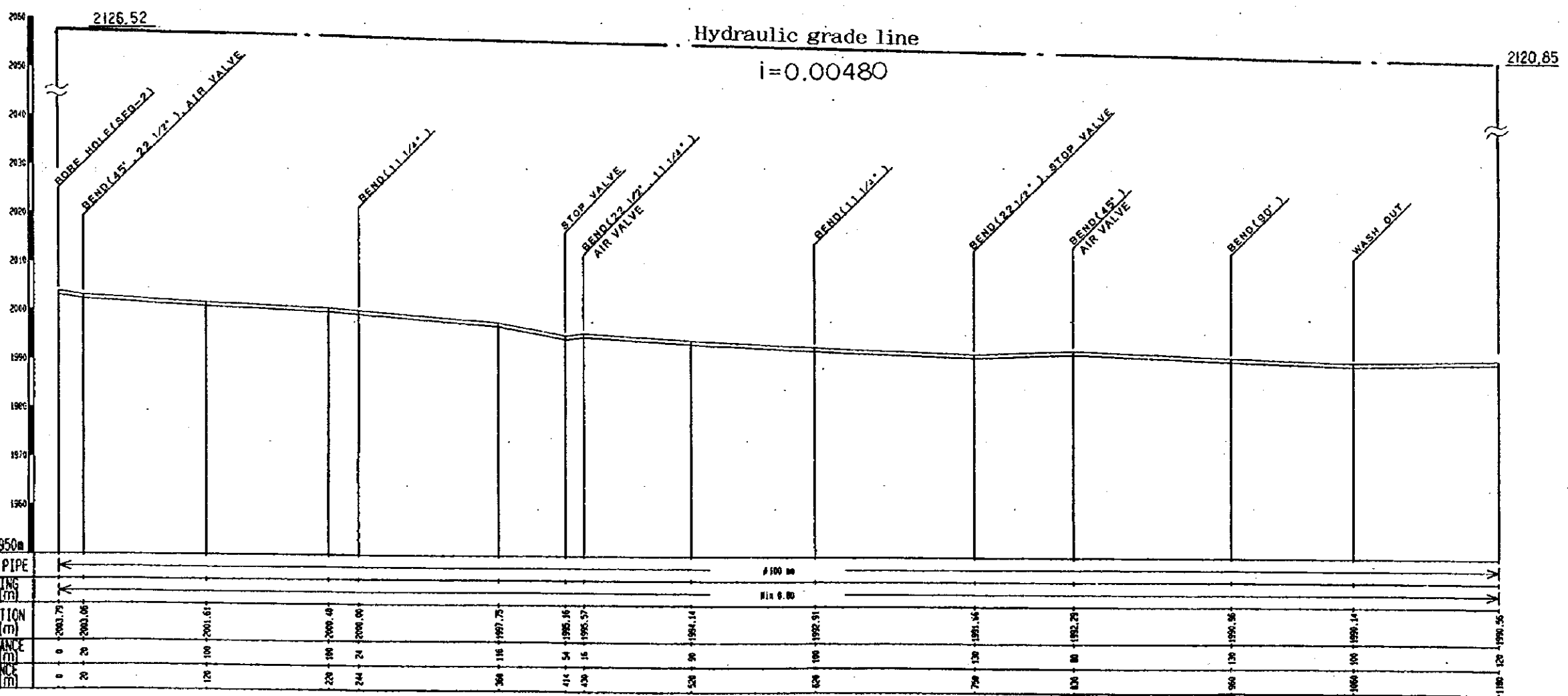


WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANYU CONSULTANTS INC. (JAPAN) 1959	Drawing No. 1/24
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LEGEND	
	BEND 90°
	BEND 45°
	BEND 22 1/2°
	BEND 11 1/4°
	TEE
	WASH OUT
	AIR VALVE
	STOP VALVE

PROFILE



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

SIZE/TYPE OF PIPE	100 mm												
EARTH COVERING (m)	1.00												
GROUND ELEVATION (m)	2003.75	2003.05	2001.61	2000.48	1997.75	1995.16	1995.57	1994.14	1992.51	1991.46	1992.29	1990.96	1990.56
PARTIAL DISTANCE (m)	0	20	120	220	244	360	414	430	520	620	750	830	960
TOTAL DISTANCE (m)	0	20	120	220	244	360	414	430	520	620	750	830	960

STATE OF ERITREA
MINISTRY OF LAND, WATER & ENVIRONMENT

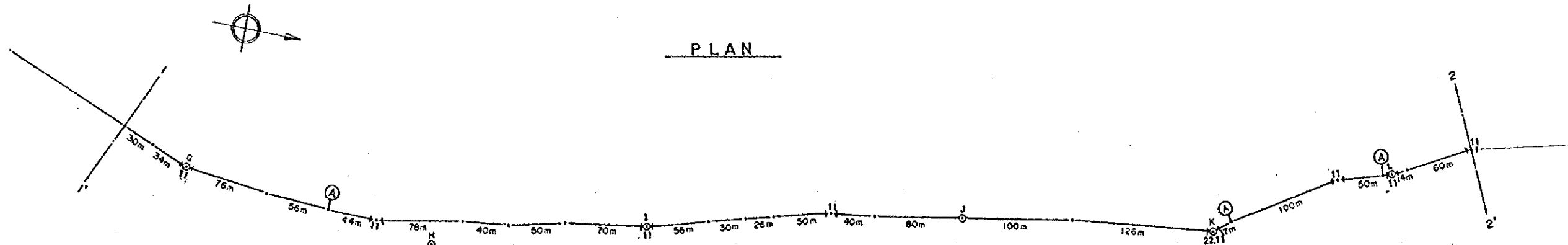
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STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION

Plan & Profile for Transmission Pipeline (2005)
SEGENETTI

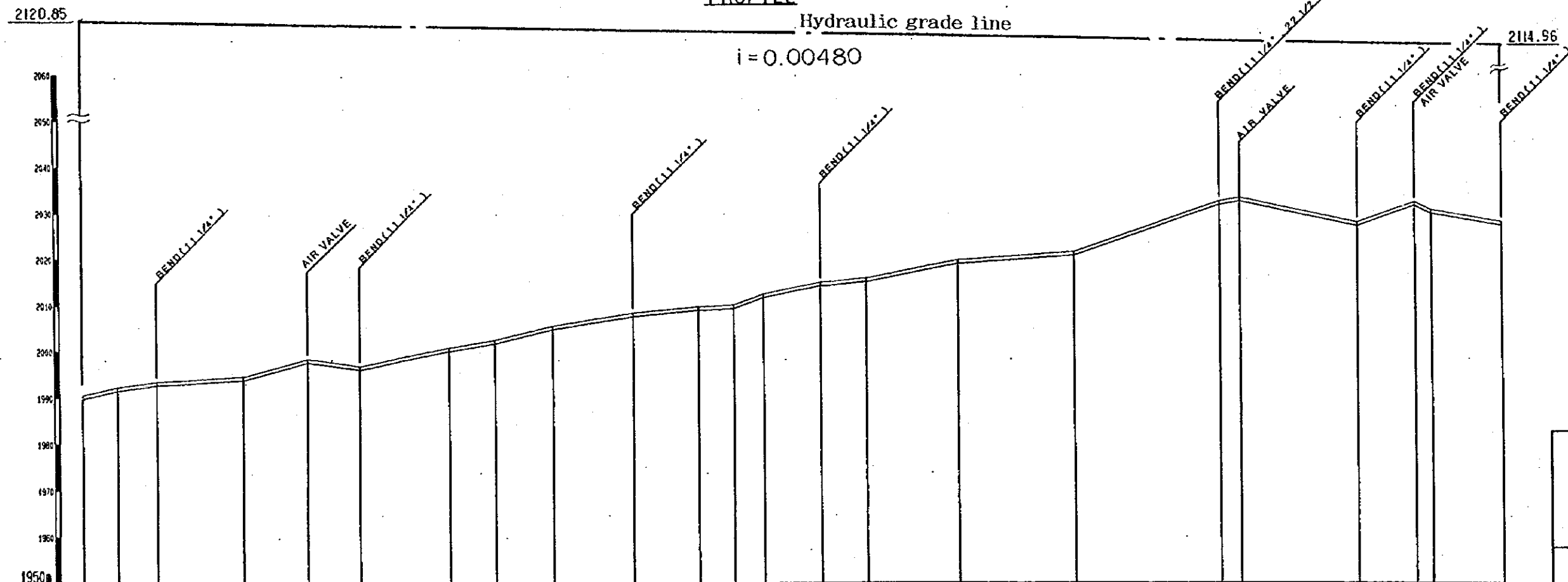
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA)
BANTU CONSULTANTS INC. (JAPAN) 1993

Drawing No. 2/24



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

PROFILE
Hydraulic grade line
 $i = 0.00480$



DATUM 1950m	
SIZE/TYPE OF PIPE	Ø 100 mm
EARTH COVERING (m)	1.00
GROUND ELEVATION (m)	1990.35, 1992.31, 1993.49, 1994.57, 1996.39, 1998.75, 2000.75, 2002.45, 2005.54, 2008.25, 2009.87, 2010.10, 2012.41, 2014.92, 2015.81, 2019.78, 2024.15, 2025.52, 2026.28, 2027.54, 2028.29, 2030.52, 2031.34
PARTIAL DISTANCE (m)	129, 26, 34, 76, 56, 44, 78, 40, 50, 70, 56, 30, 26, 50, 40, 80, 100, 126, 100, 50, 114, 60
TOTAL DISTANCE (m)	1180, 1210, 1244, 1320, 1376, 1420, 1498, 1538, 1588, 1658, 1714, 1744, 1770, 1820, 1880, 1940, 2000, 2060, 2100, 2114.96

STATE OF ERITREA
MINISTRY OF LAND, WATER & ENVIRONMENT

JAPAN INTERNATIONAL COOPERATION AGENCY

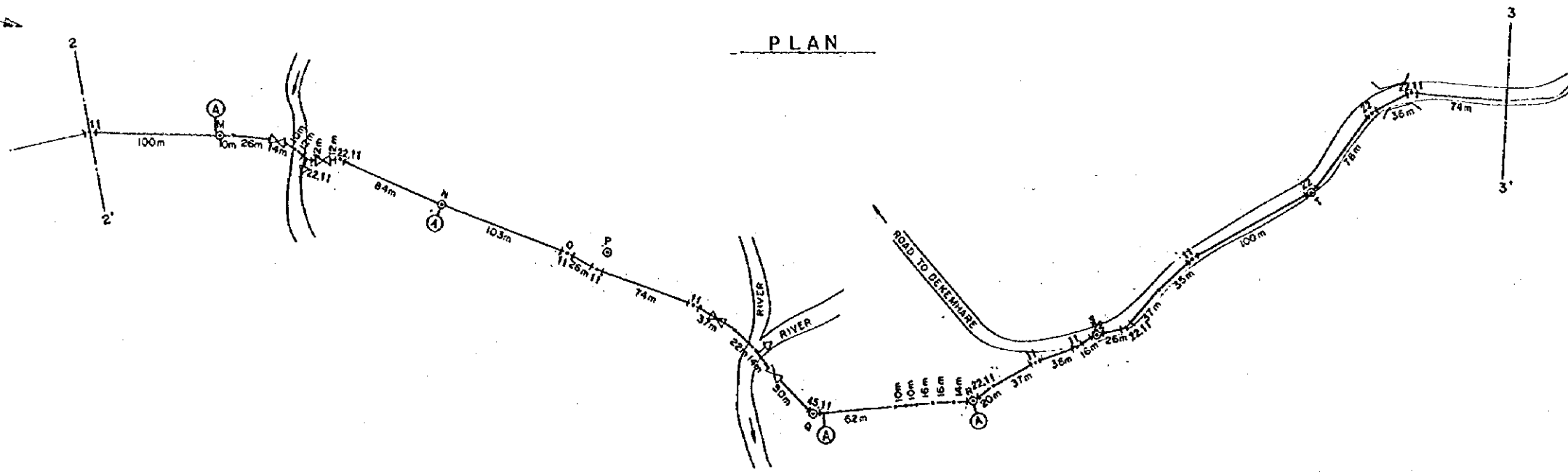
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION

Plan & Profile for Transmission Pipeline (2005)

SEGENEHTI

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

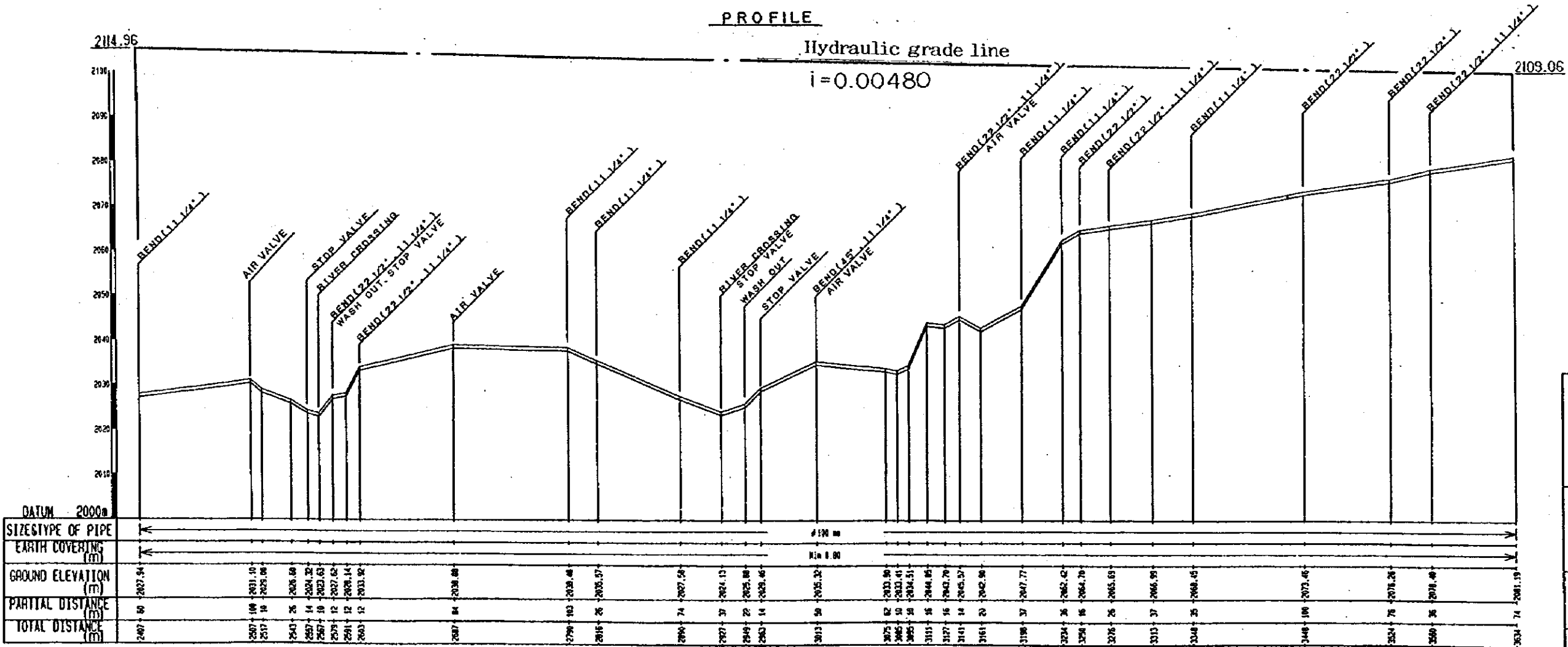
Drawing No. 3/24



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

PROFILE

Hydraulic grade line
 $i = 0.00480$



STATE OF ERITREA
MINISTRY OF LAND, WATER & ENVIRONMENT

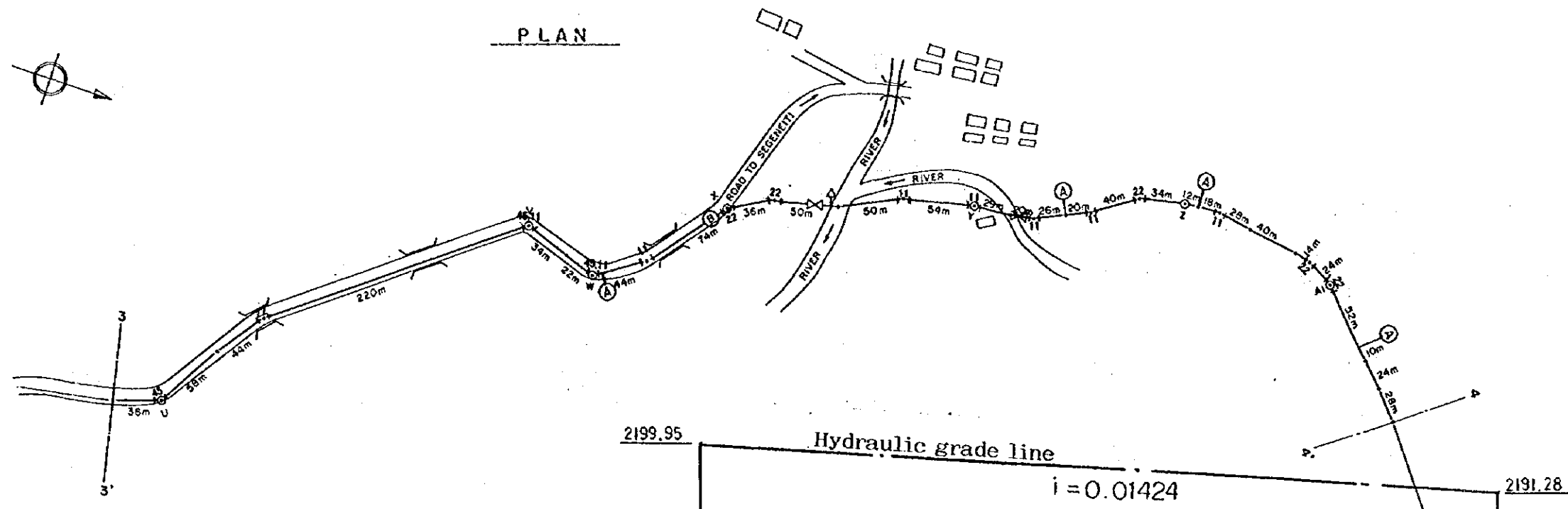
JAPAN INTERNATIONAL COOPERATION AGENCY

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

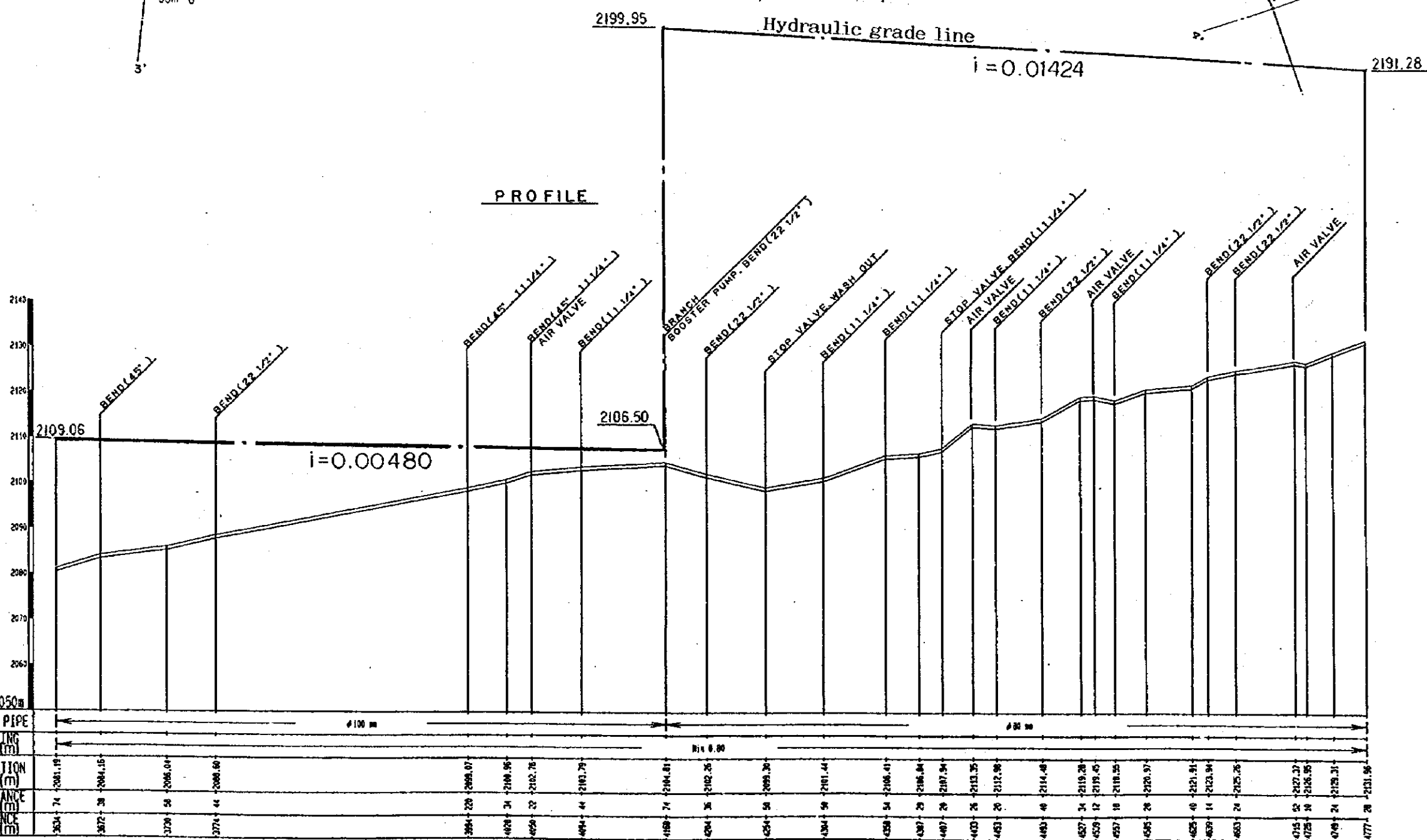
Plan & Profile for Transmission Pipeline (2005)
SEGENETI

WATER RESOURCES DEPARTMENT (ASMARA, ERITREA)
SANTU CONSULTANTS INC. (JAPAN) 1993

Drawing No. 4/24



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



SIZE/TYPE OF PIPE	Ø 100 mm										Ø 80 mm																						
EARTH COVERING (m)																																	
GROUND ELEVATION (m)	2081.15	2084.15	2086.04	2088.66	2091.07	2093.95	2097.76	2101.29	2104.81	2108.25	2111.54	2114.44	2116.41	2117.84	2118.25	2118.96	2119.48	2119.28	2119.45	2119.55	2119.97	2120.31	2121.31	2122.34	2123.34	2124.26	2125.27	2126.25	2127.27	2128.25	2129.21	2130.28	2131.35
PARTIAL DISTANCE (m)	74	28	58	44	220	34	23	44	74	36	29	29	54	25	26	26	46	34	12	18	26	46	48	14	24	24	27	34	35	24	28	28	28
TOTAL DISTANCE (m)	304	332	370	374	594	628	650	694	768	804	833	862	916	945	971	997	1043	1077	1089	1107	1133	1179	1225	1269	1313	1357	1401	1445	1489	1533	1577	1621	1665

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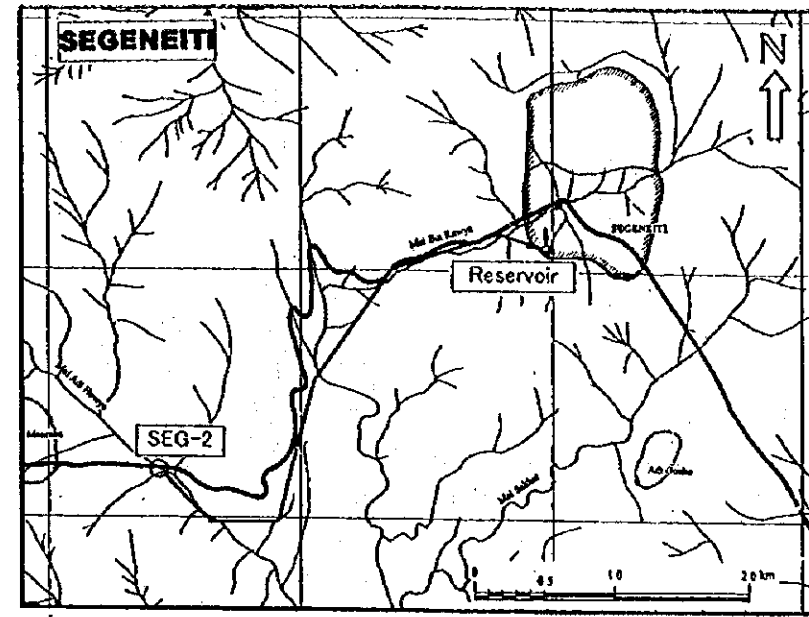
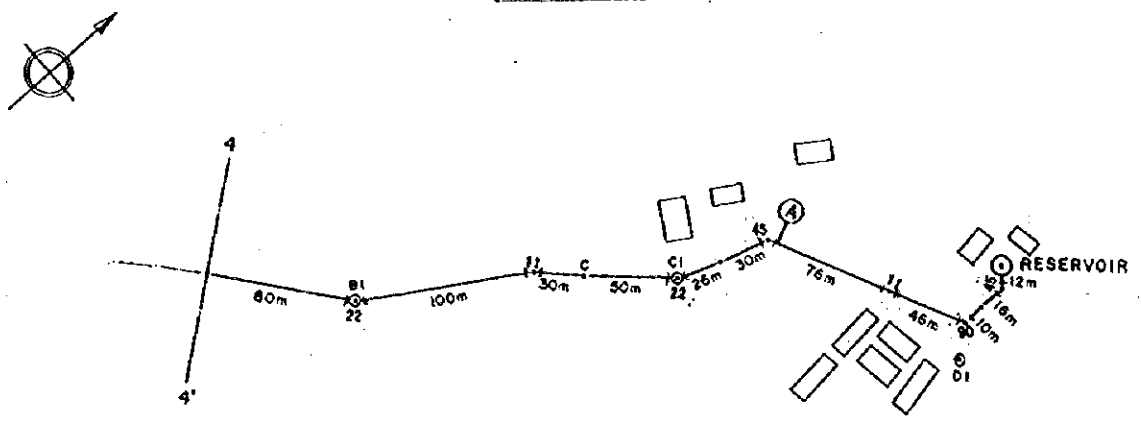
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION

Plan & Profile for Transmission Pipeline (2005)
SEGENKITI

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

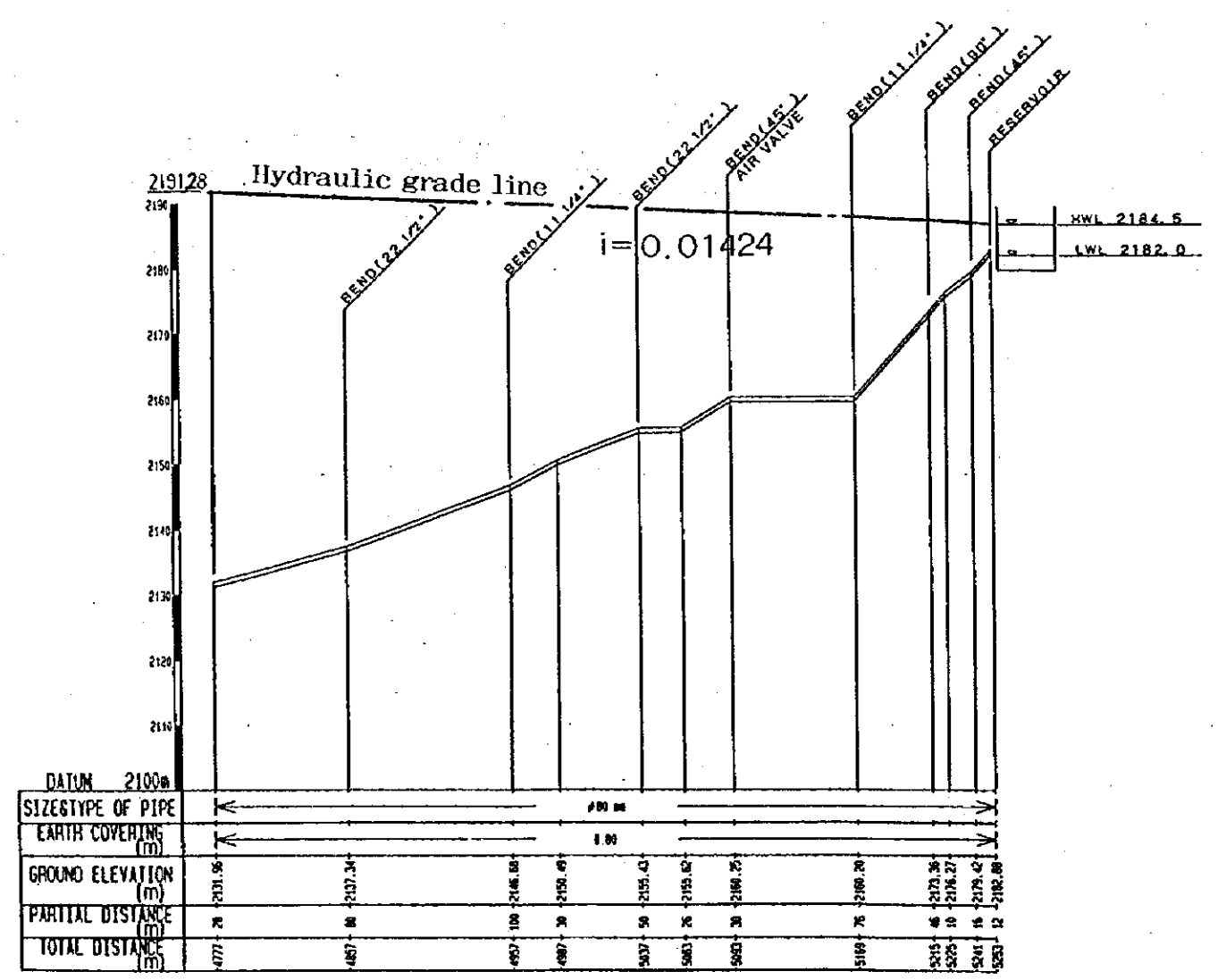
Drawing No. 5/24

PLAN



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

PROFILE



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)
SEGENEITI

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

Drawing No. 6/24

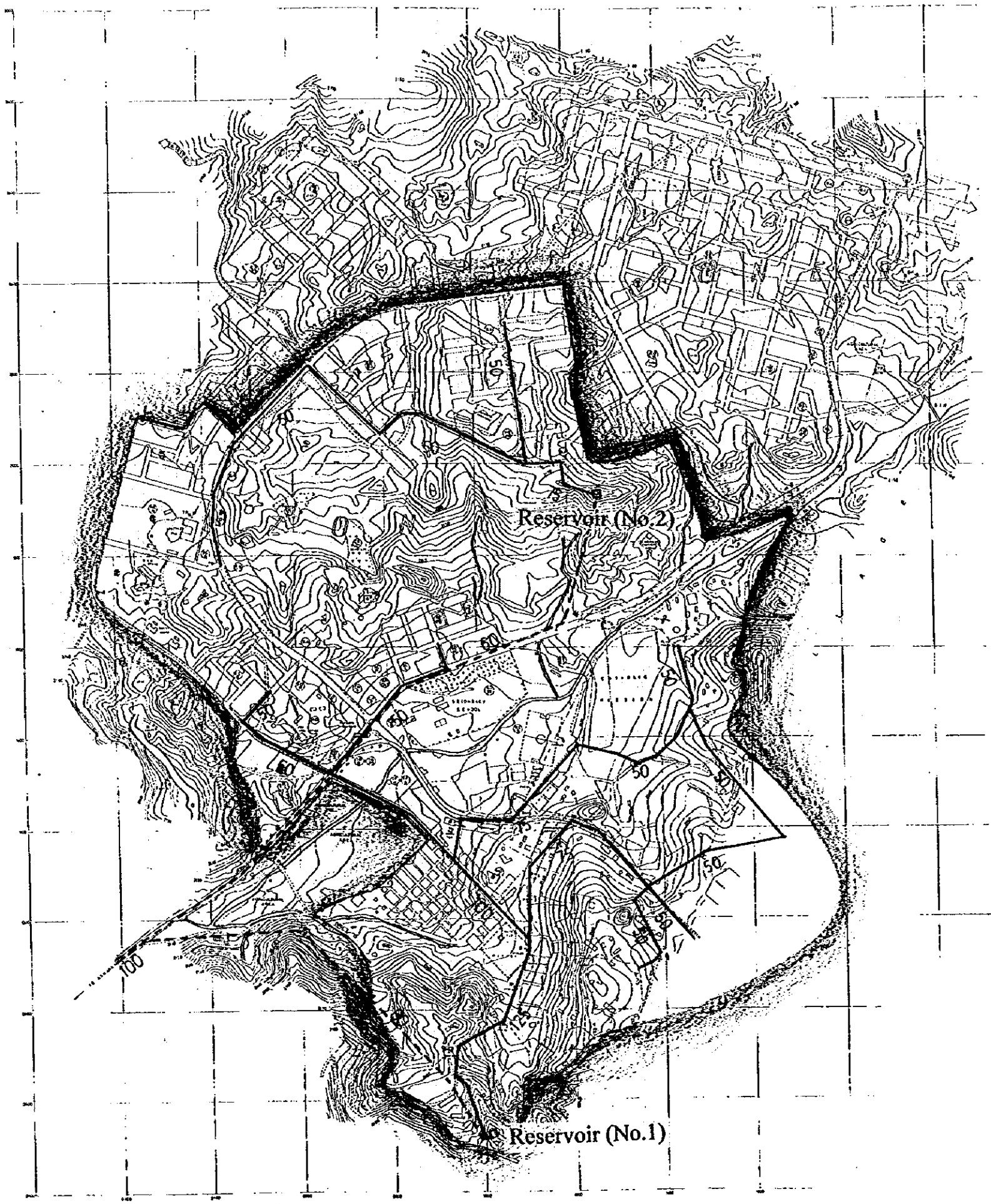


- Legend**
- 100 ——— Distribution pipeline
 - Pipe Diameter (mm)
 - Transmission pipeline
 - Well
 - Reservoir

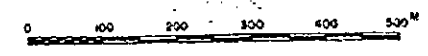


Plan of Distribution Pipeline (2005)

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STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
PLAN OF DISTRIBUTION PIPELINE (2005) SEGENETTI	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No. 7 / 24

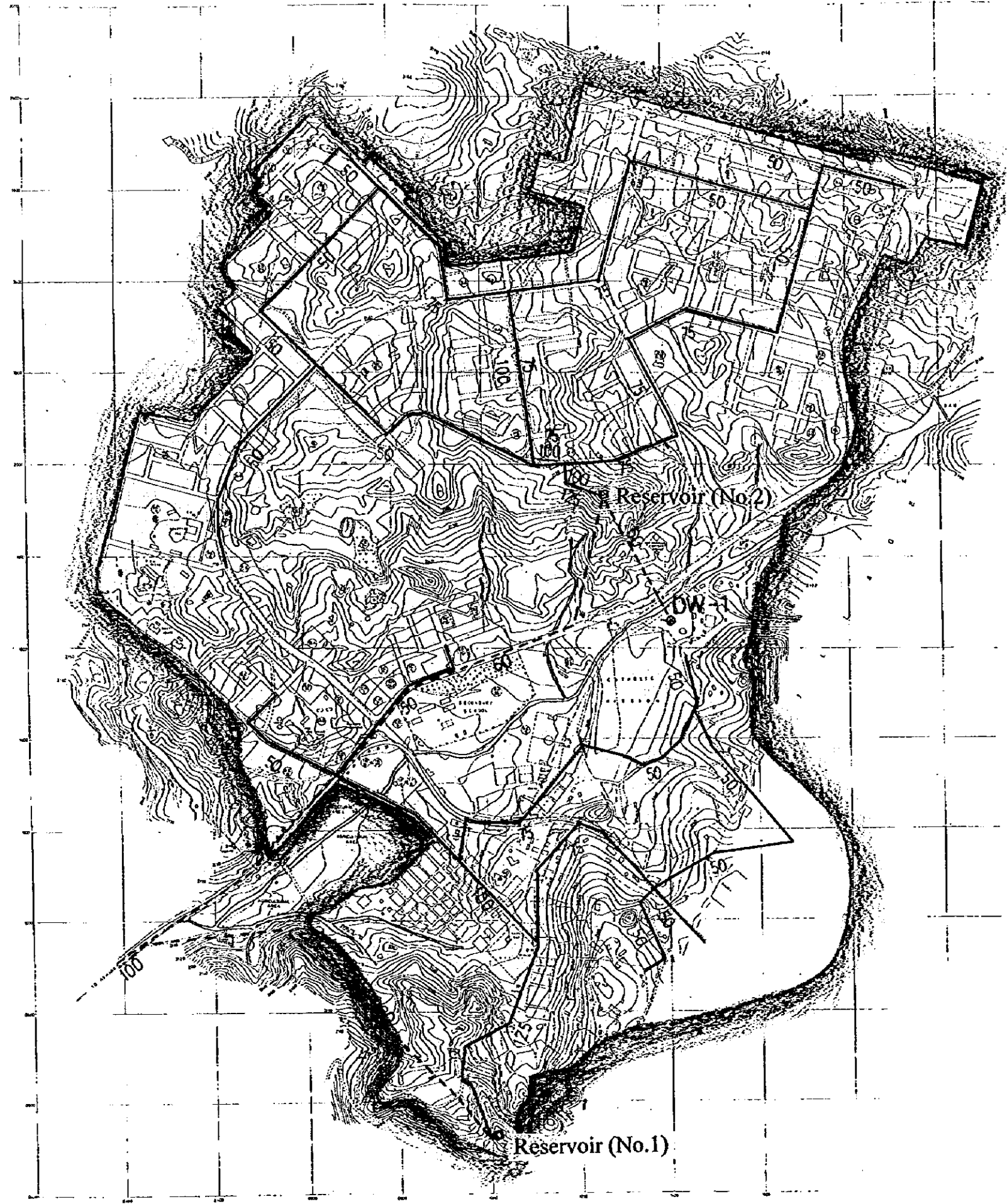


- Legend**
- 100 ——— Distribution pipeline
Pipe Diameter (mm)
 - Transmission pipeline
 - Well
 - Reservoir



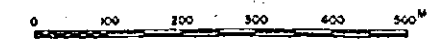
Plan of Distribution Pipeline (2010)

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STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
PLAN OF DISTRIBUTION PIPELINE (2010) SEGENEITH	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANYU CONSULTANTS INC. (JAPAN), 1999	Drawing No. 8 / 24



- 100




o
□
- Legend**
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) SEGENEITI	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANYU CONSULTANTS INC. (JAPAN, 1999)	Drawing No. 9 / 24

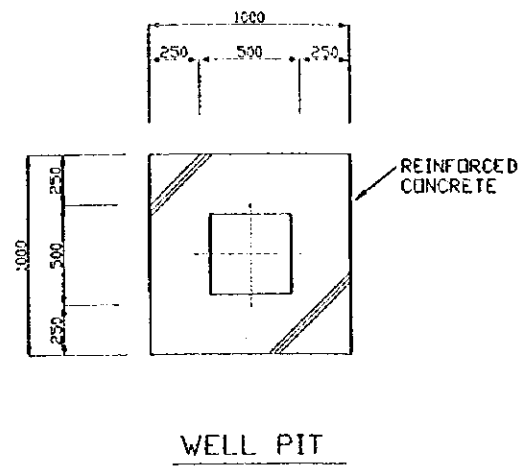
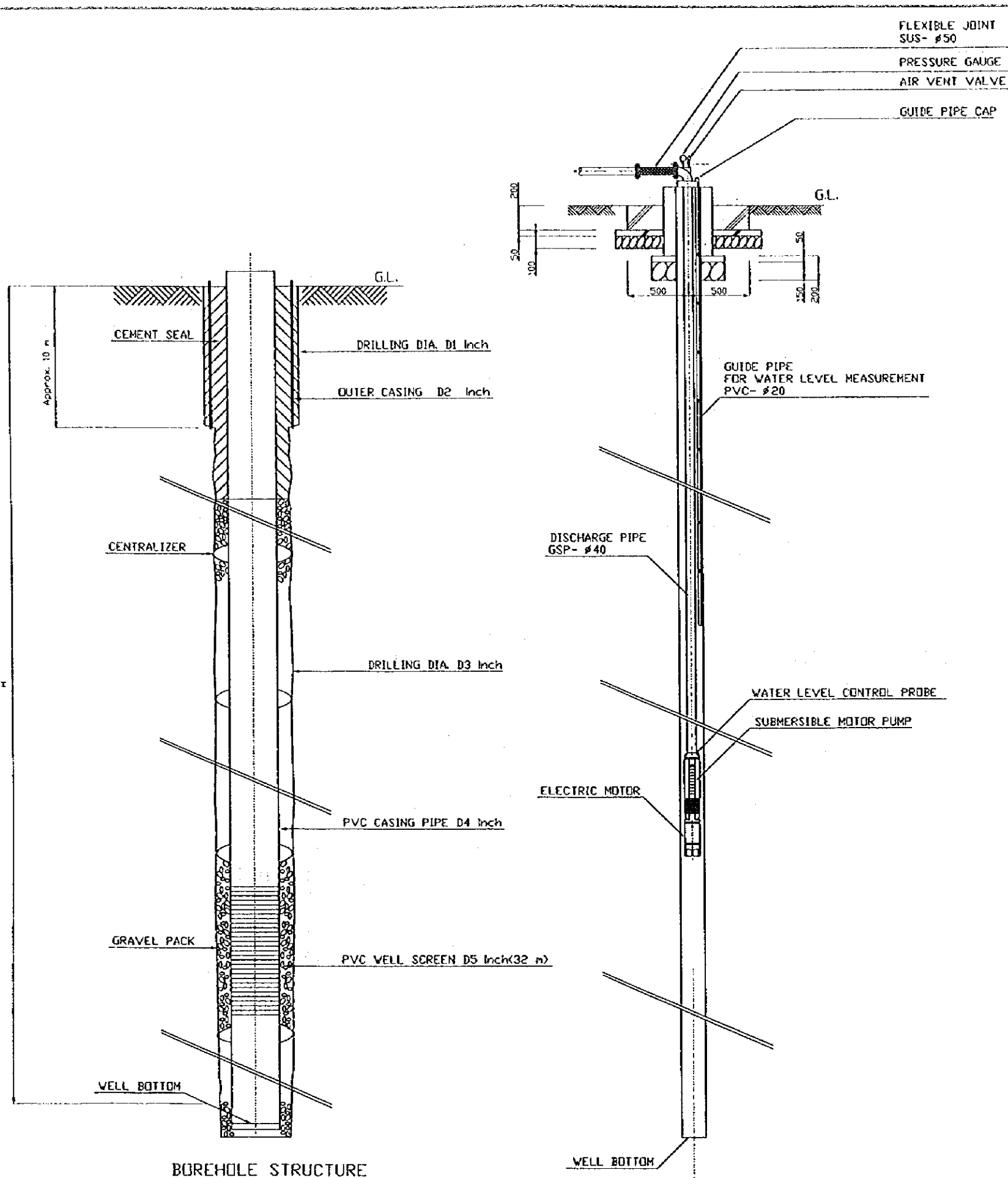


- Legend**
-  Communal water points for 2005 (No. 1 - 10)
 -  Communal water points for 2010 (No. 11 - 15)
 -  Communal water points for 2015 (No. 16 - 25)

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 SEGENEITI	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANTU CONSULTANTS INC. (JAPAN 1993)	Drawing No. 10 / 24



Site Name	Water Source No.	New Borehole Construction						SUBMERSIBLE MOTOR PUMP	
		D1	D2	D3	D4	D5	H	Q'ty (lit/min)	Total Head (m)
SEGENEITI	SEG - 2	17'1/2	14'	12'1/4	8'	8'	40	240	136

SUBMERSIBLE MOTOR PUMP INSTALLATION

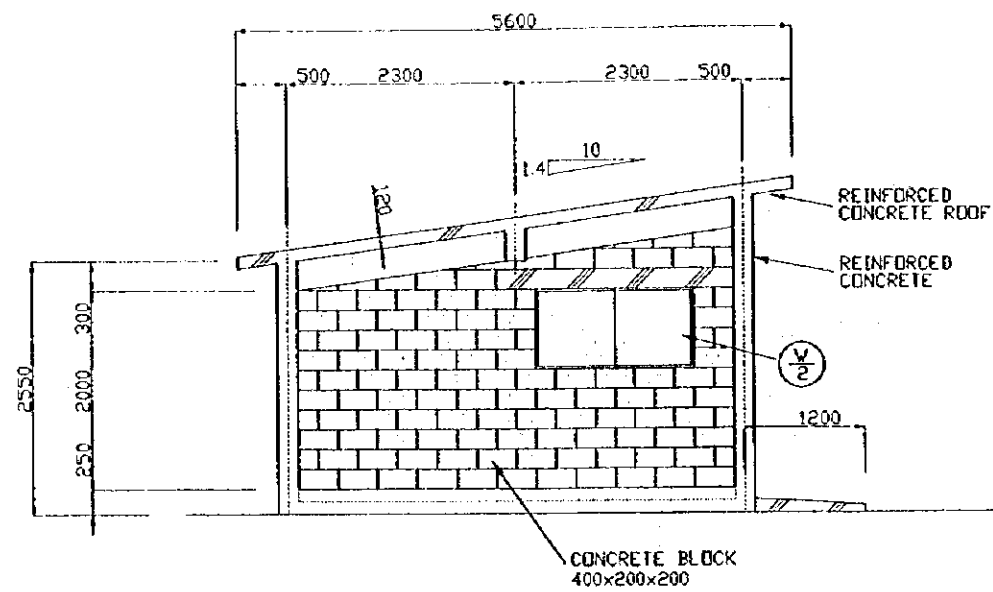
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STUDY ON GROUNDWATER
 DEVELOPMENT & WATER SUPPLY
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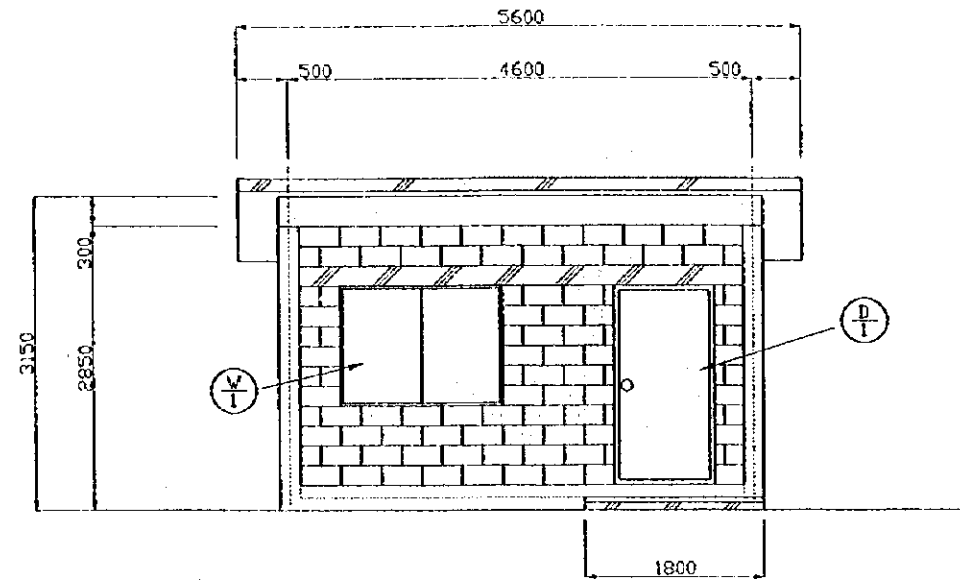
BOREHOLE STRUCTURE AND
 SUBMERSIBLE MOTOR PUMP
 INSTALLATION
 SEGENEITI

WATER RESOURCES DEPARTMENT
 SANYU CONSULTANTS INC.
 (JAPAN) 1999

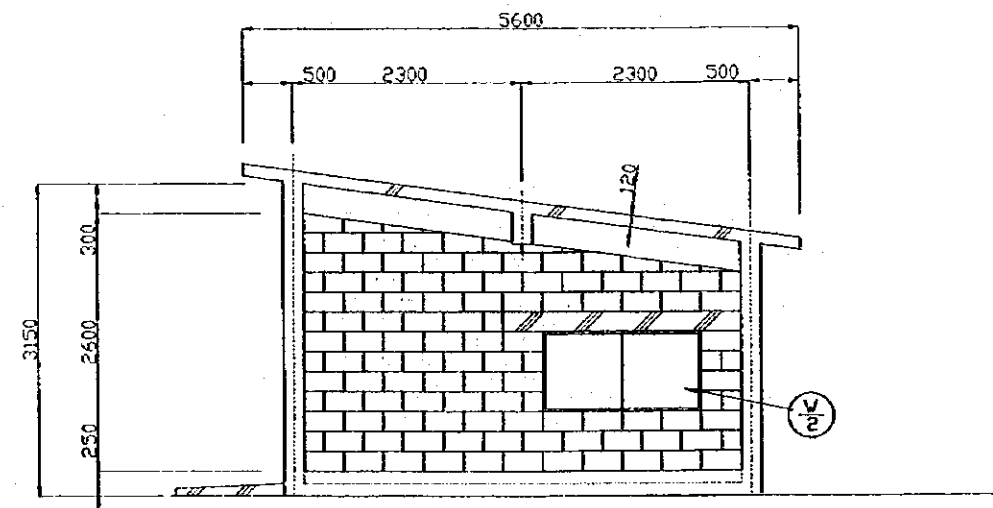
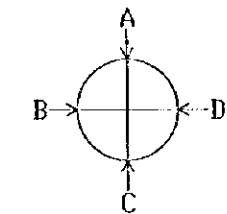
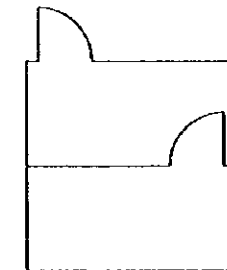
Drawing No.
 11/24



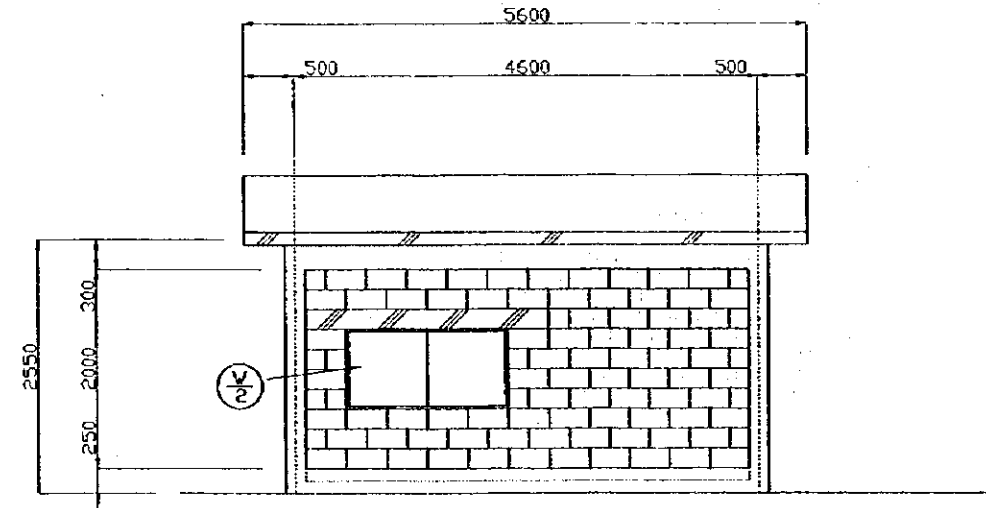
D-ELEVATION






A-ELEVATION



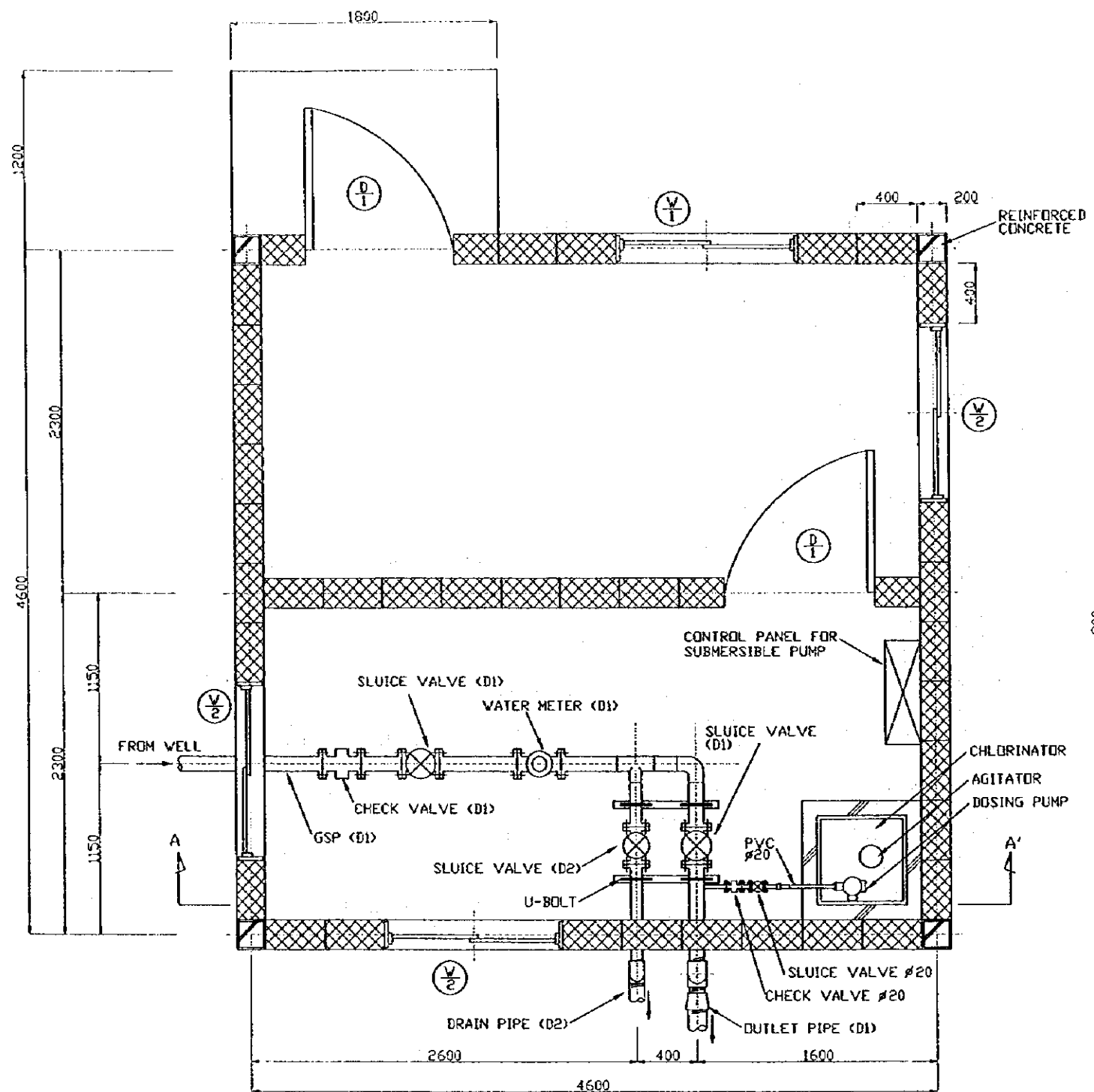
B-ELEVATION



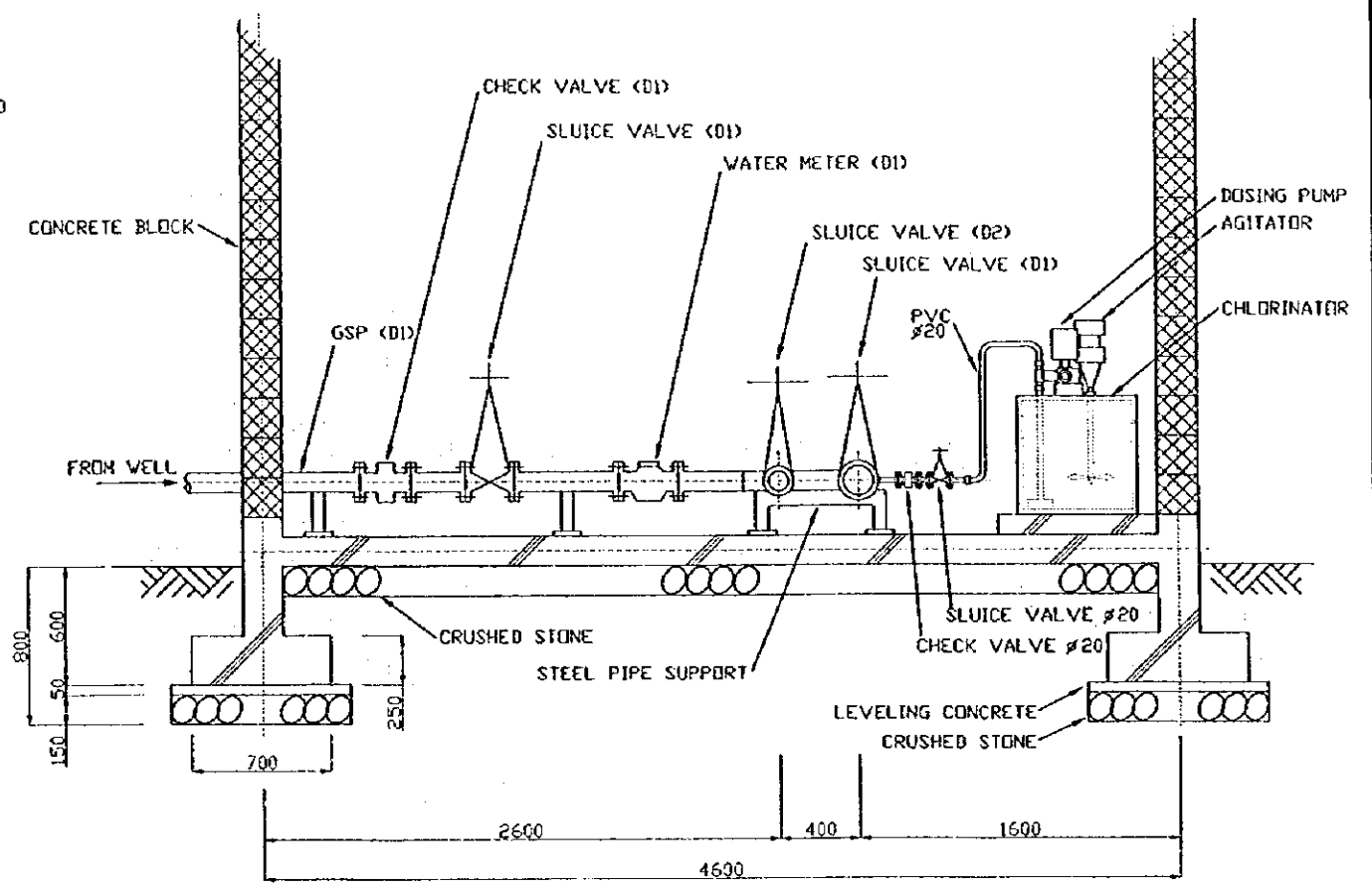
C-ELEVATION

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

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JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
STRUCTURE OF BOREHOLE PUMP STATION SEGENEITI	
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No 12/24



PLAN



SECTION A-A'

- ⊕ 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 Source	D1	D2
SEG-2	65	50

STATE OF ERITREA
 MINISTRY OF LAND, WATER &
 ENVIRONMENT

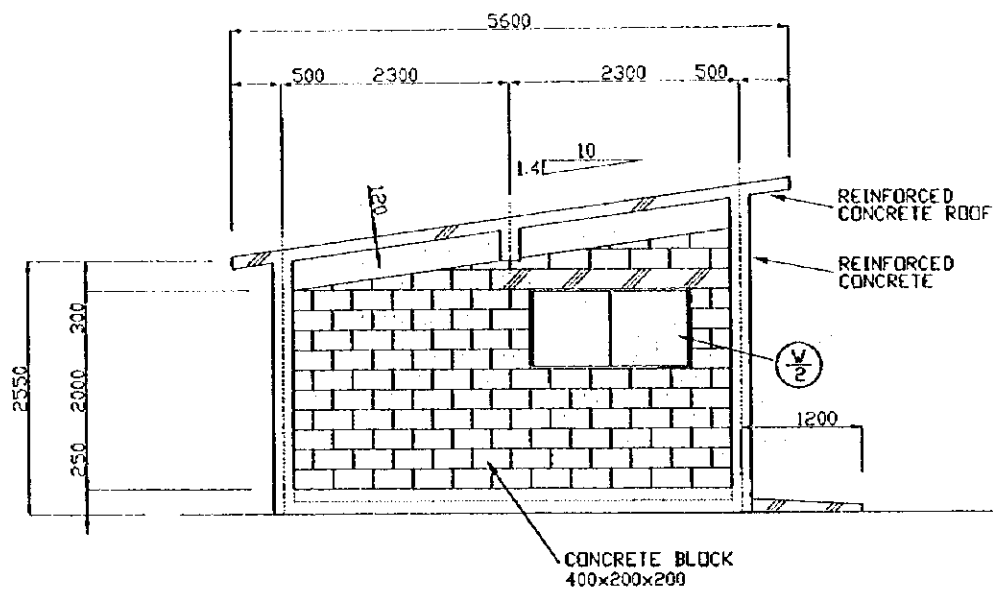
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STUDY ON GROUNDWATER
 DEVELOPMENT & WATER SUPPLY
 FOR
 SEVEN TOWNS IN SOUTHERN REGION

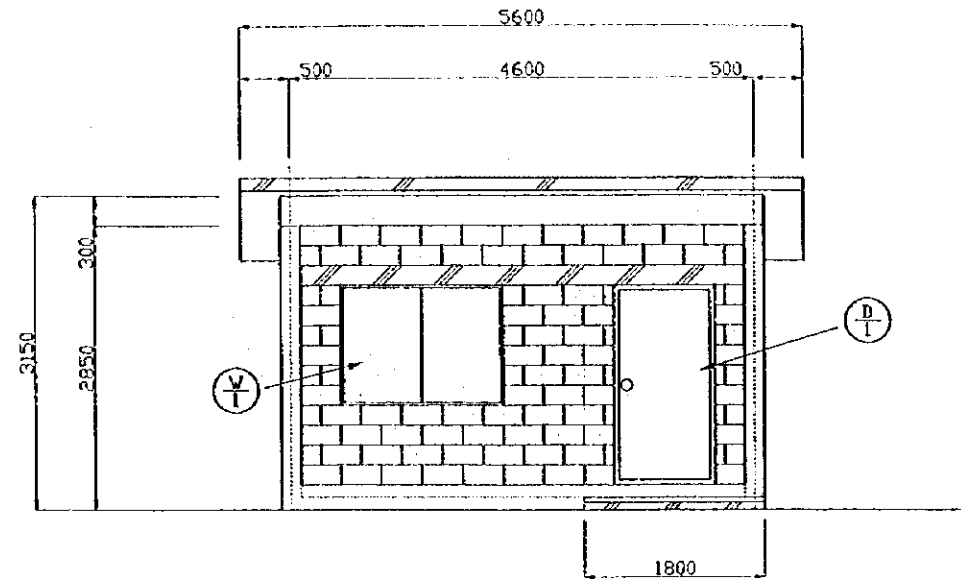
BOREHOLE PUMP STATION
 SEGENEITI

WATER RESOURCES DEPARTMENT
 SANYU CONSULTANTS INC.
 (JAPAN) 1999

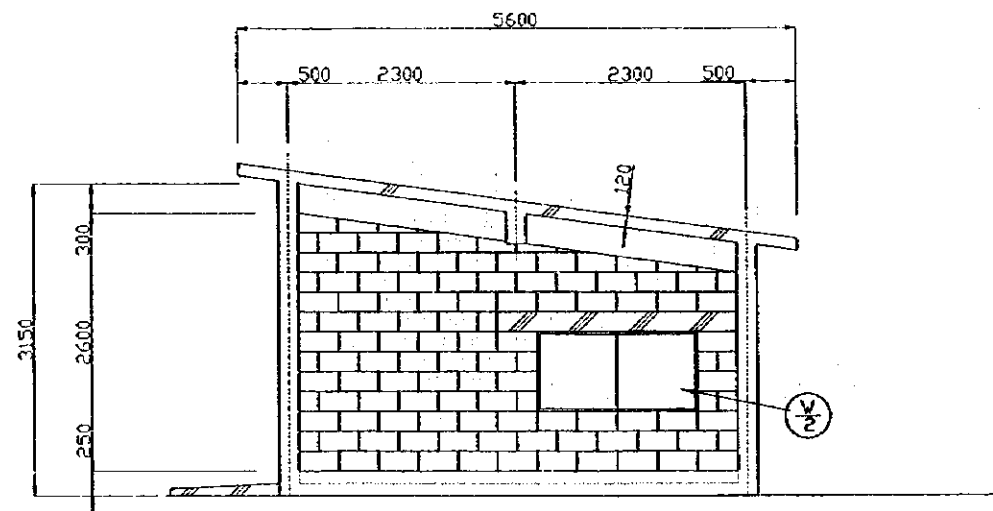
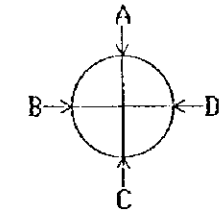
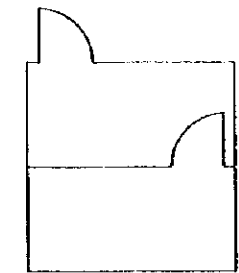
Drawing No
 13/24



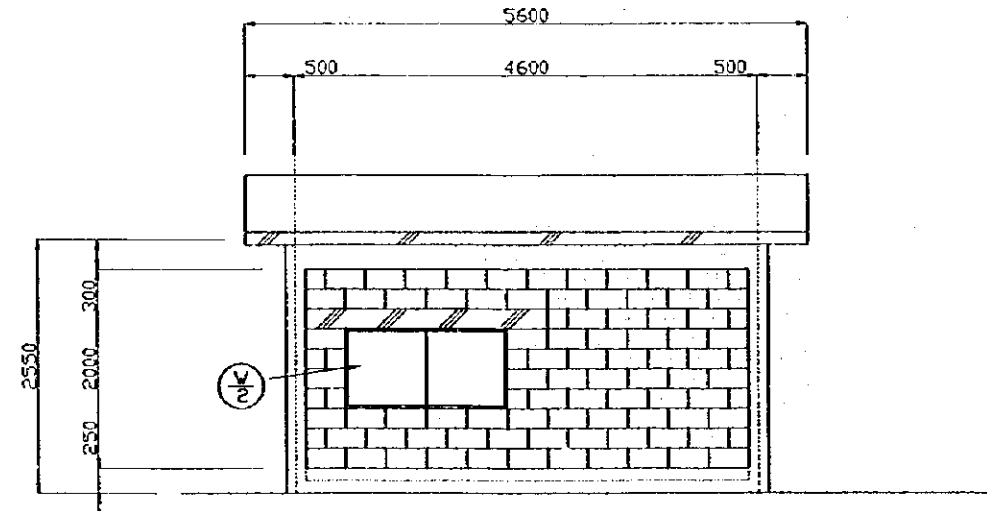
D-ELEVATION



A-ELEVATION



B-ELEVATION



C-ELEVATION

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

STATE OF ERITREA
MINISTRY OF LAND, WATER &
ENVIRONMENT

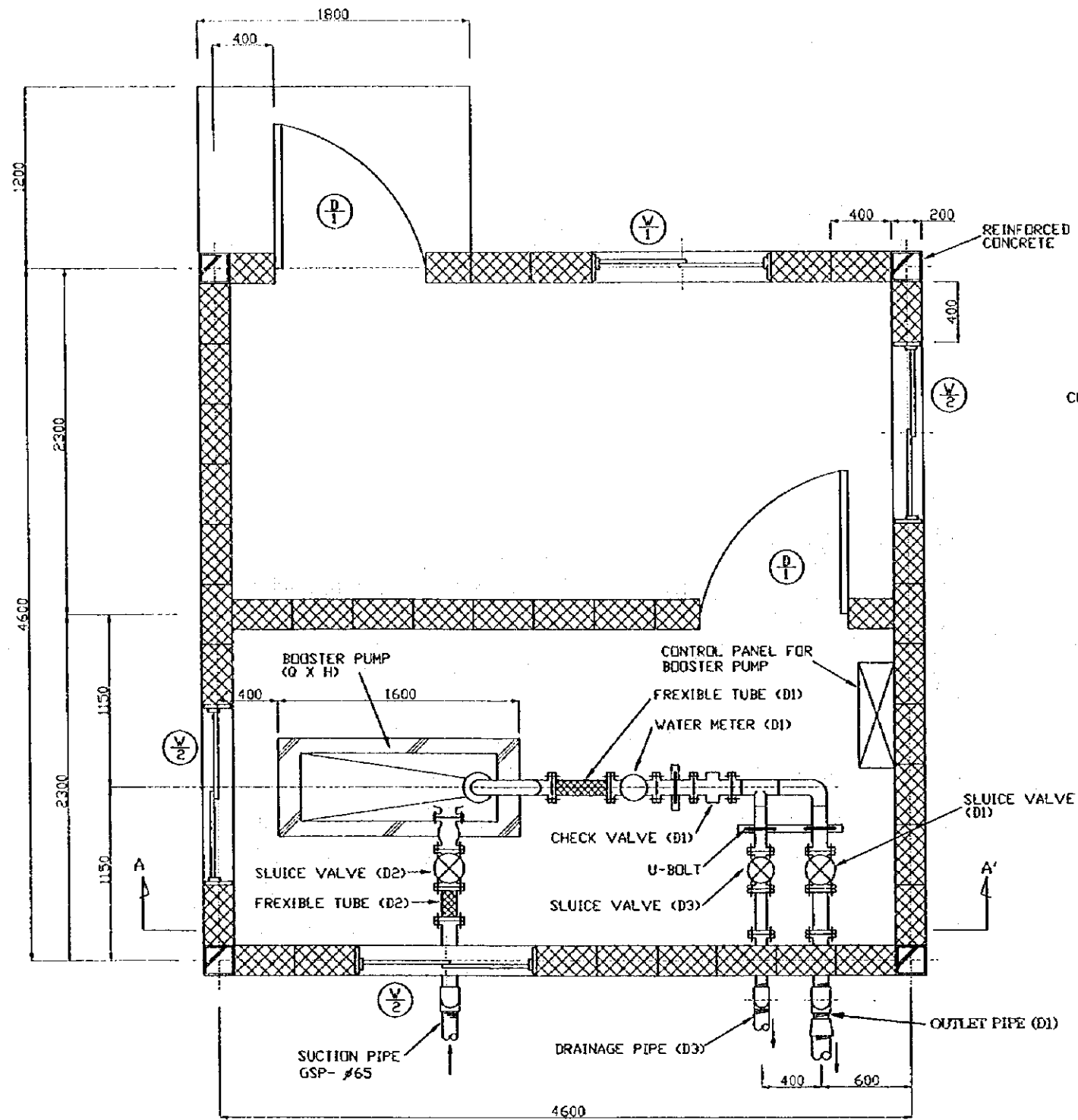
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STUDY ON GROUNDWATER
DEVELOPMENT & WATER SUPPLY
FOR
SEVEN TOWNS IN SOUTHERN REGION

STRUCTURE OF BOOSTER PUMP STATION
SEGENEITI

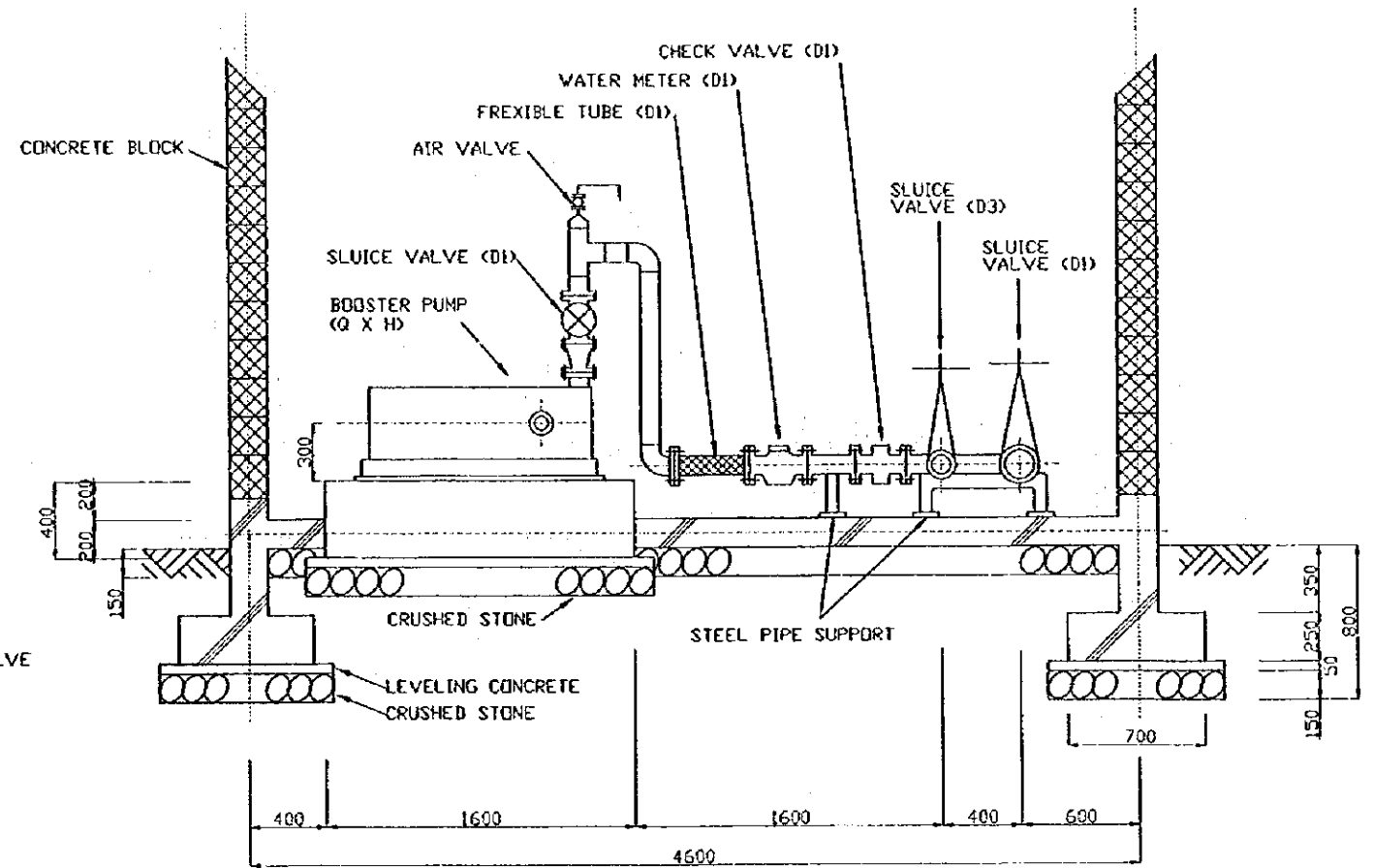
WATER RESOURCES DEPARTMENT
SANYU CONSULTANTS INC.
(JAPAN) 1999

Drawing No
14/24



PLAN

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



SECTION A-A'

Water Source	D1	D2	D3	Q (lit/m)	H (m)
BOOSTER-S1	65	50	50	240	96

STATE OF ERITREA
MINISTRY OF LAND, WATER & ENVIRONMENT

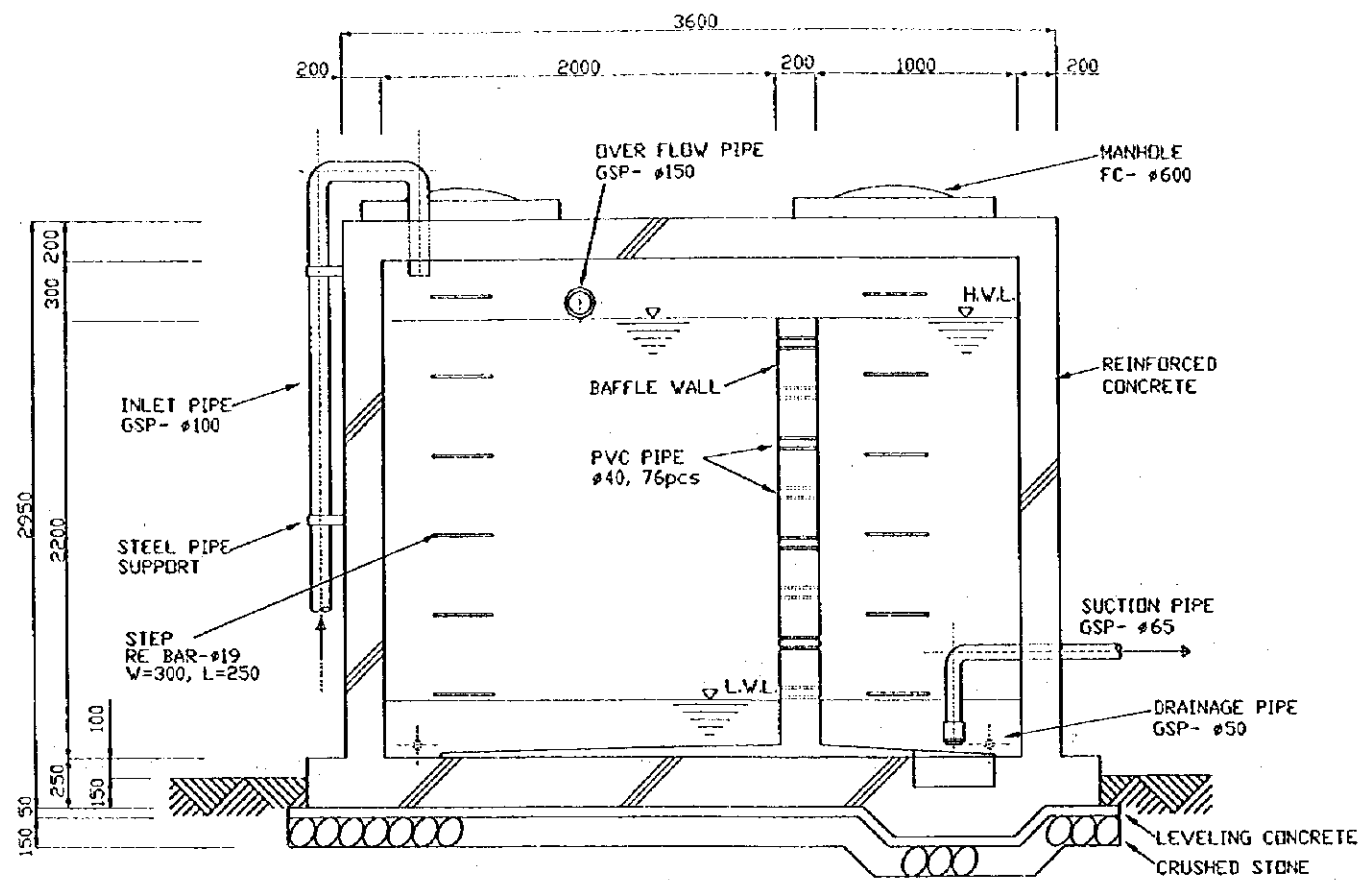
JAPAN INTERNATIONAL COOPERATION AGENCY

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

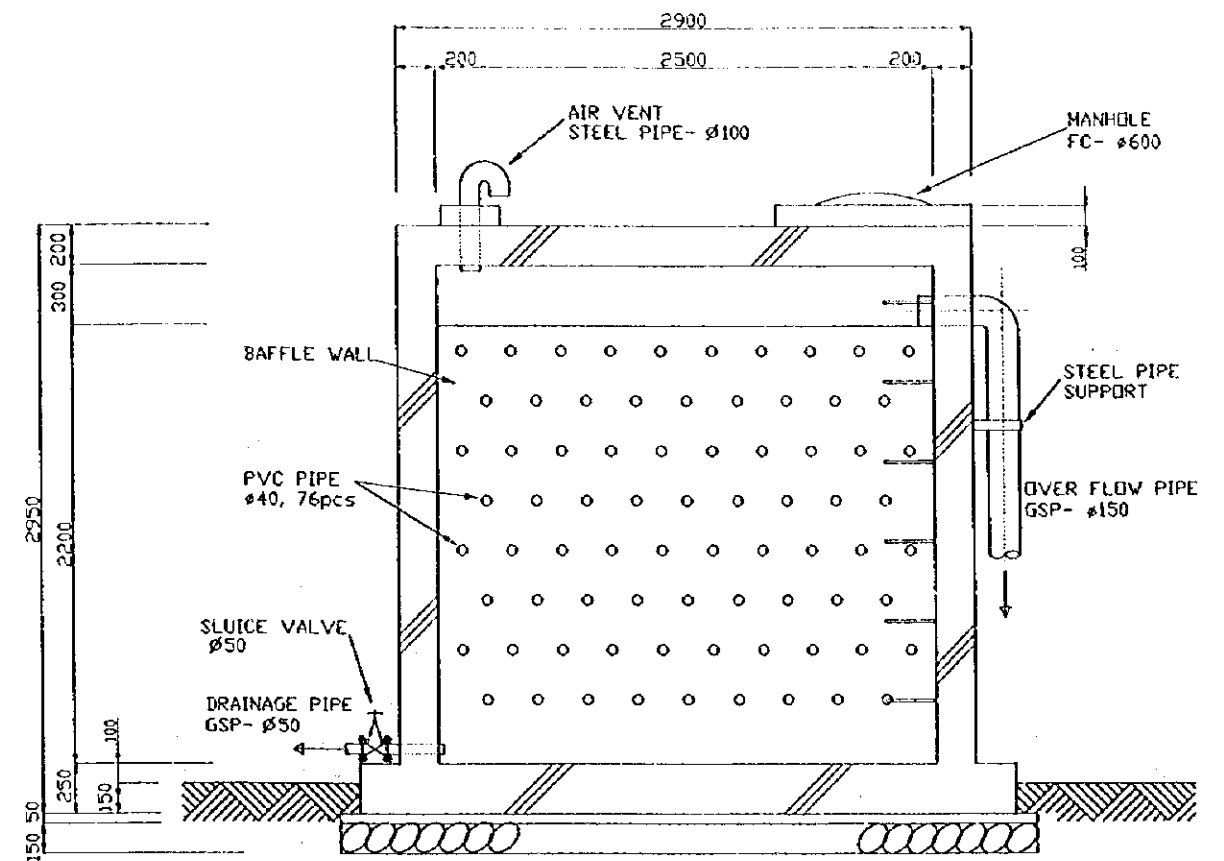
**BOOSTER PUMP STATION
SEGENEITI**

WATER RESOURCES DEPARTMENT
SANYU CONSULTANTS INC.
(JAPAN) 1999

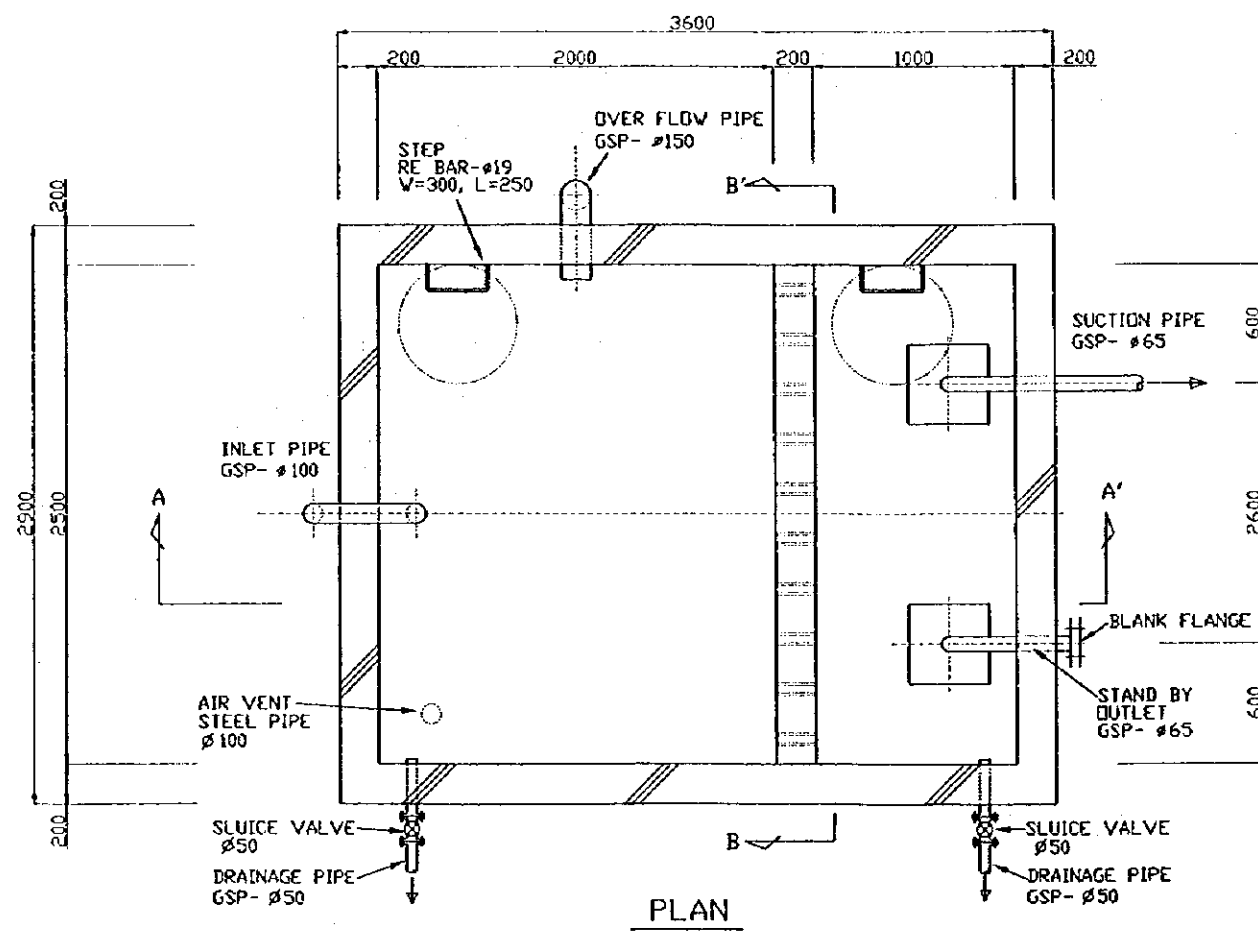
Drawing No.
15/24



SECTION A-A'

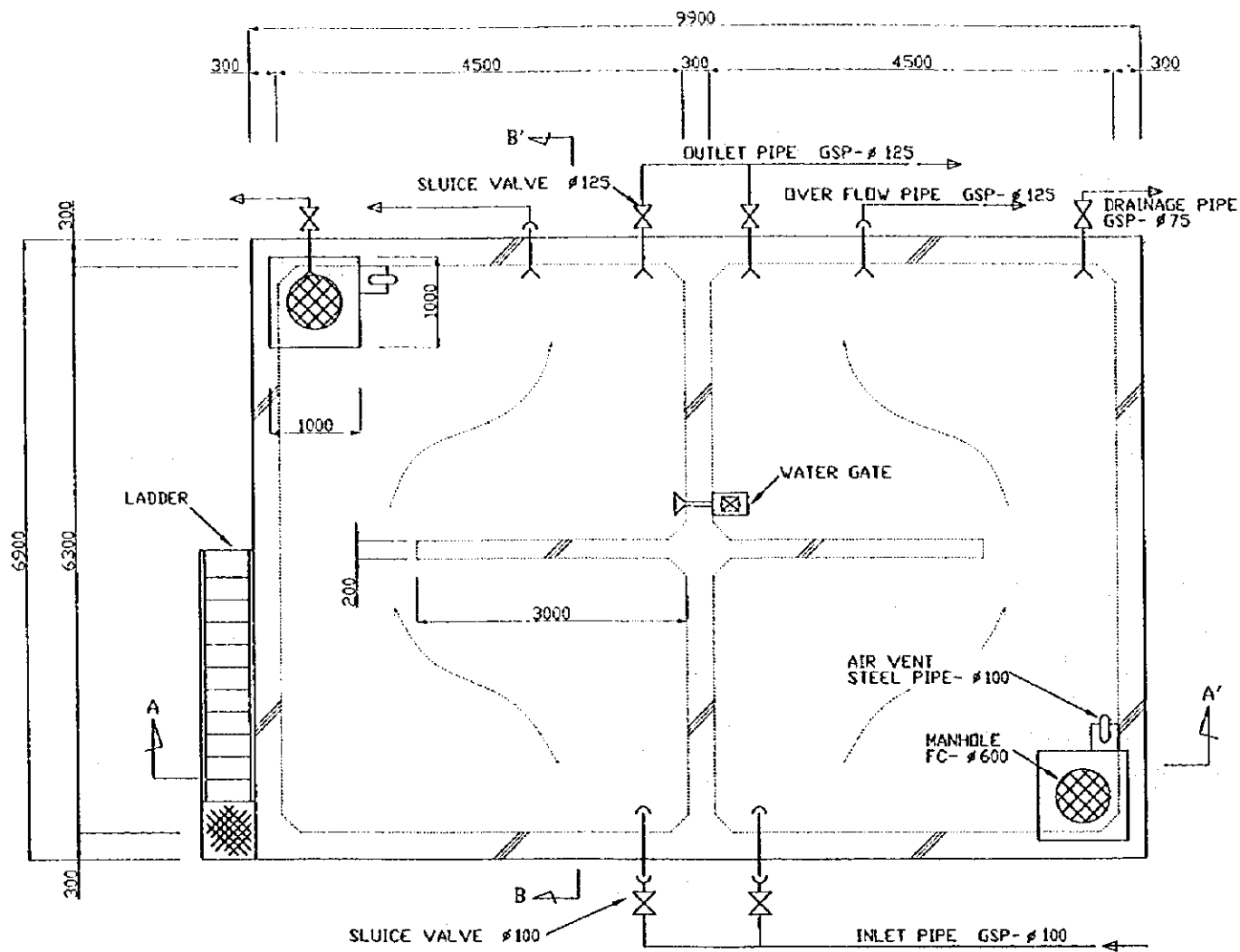


SECTION B-B'

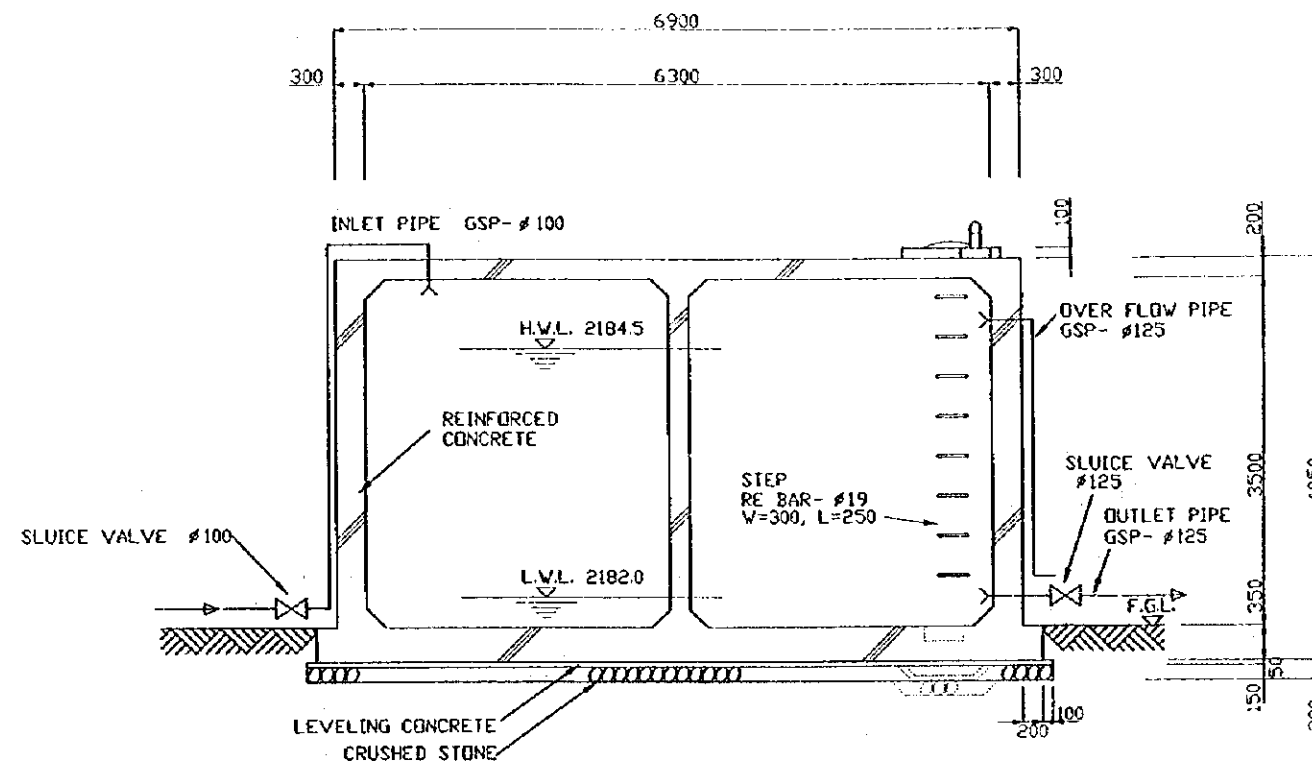


PLAN

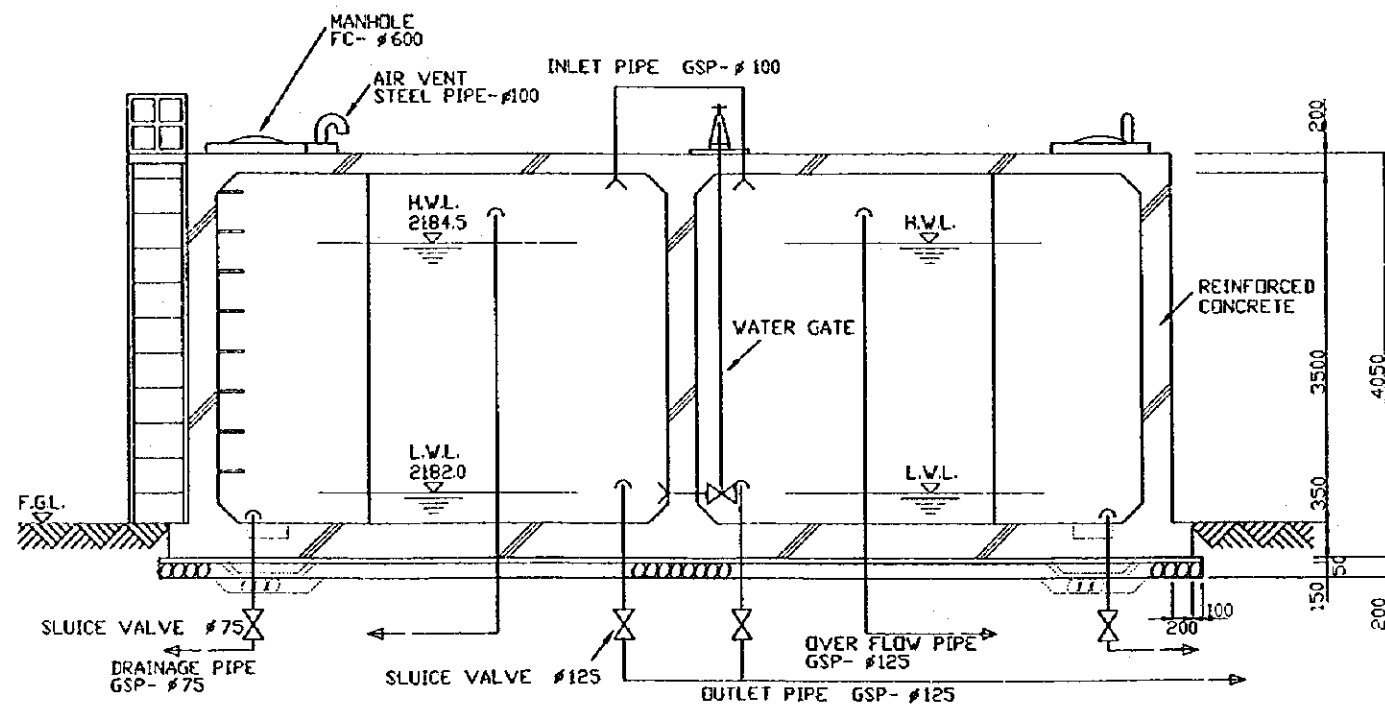
STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
15m ³ RECEIVING TANK SEGENEITI	
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. JAPAN 1999	Drawing No 16/24



PLAN

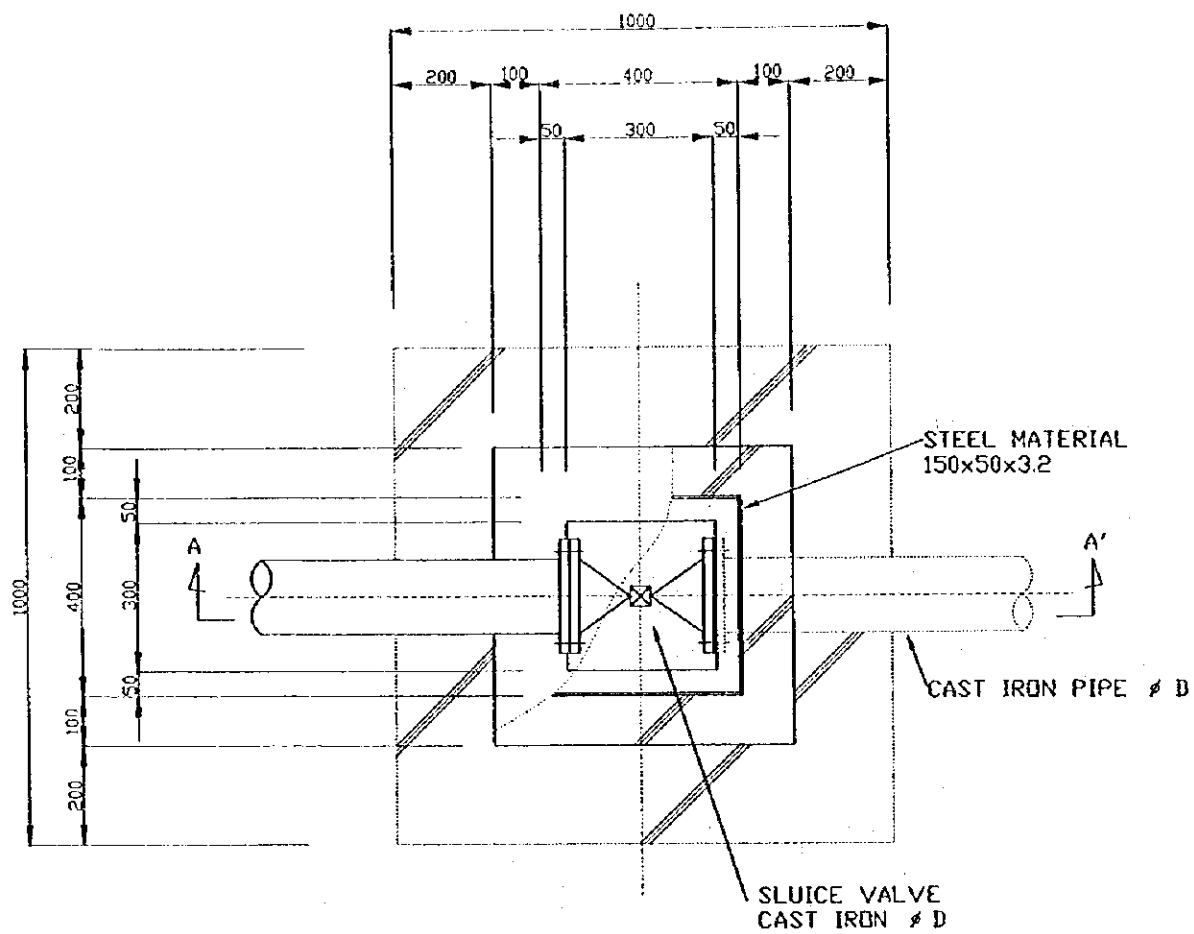


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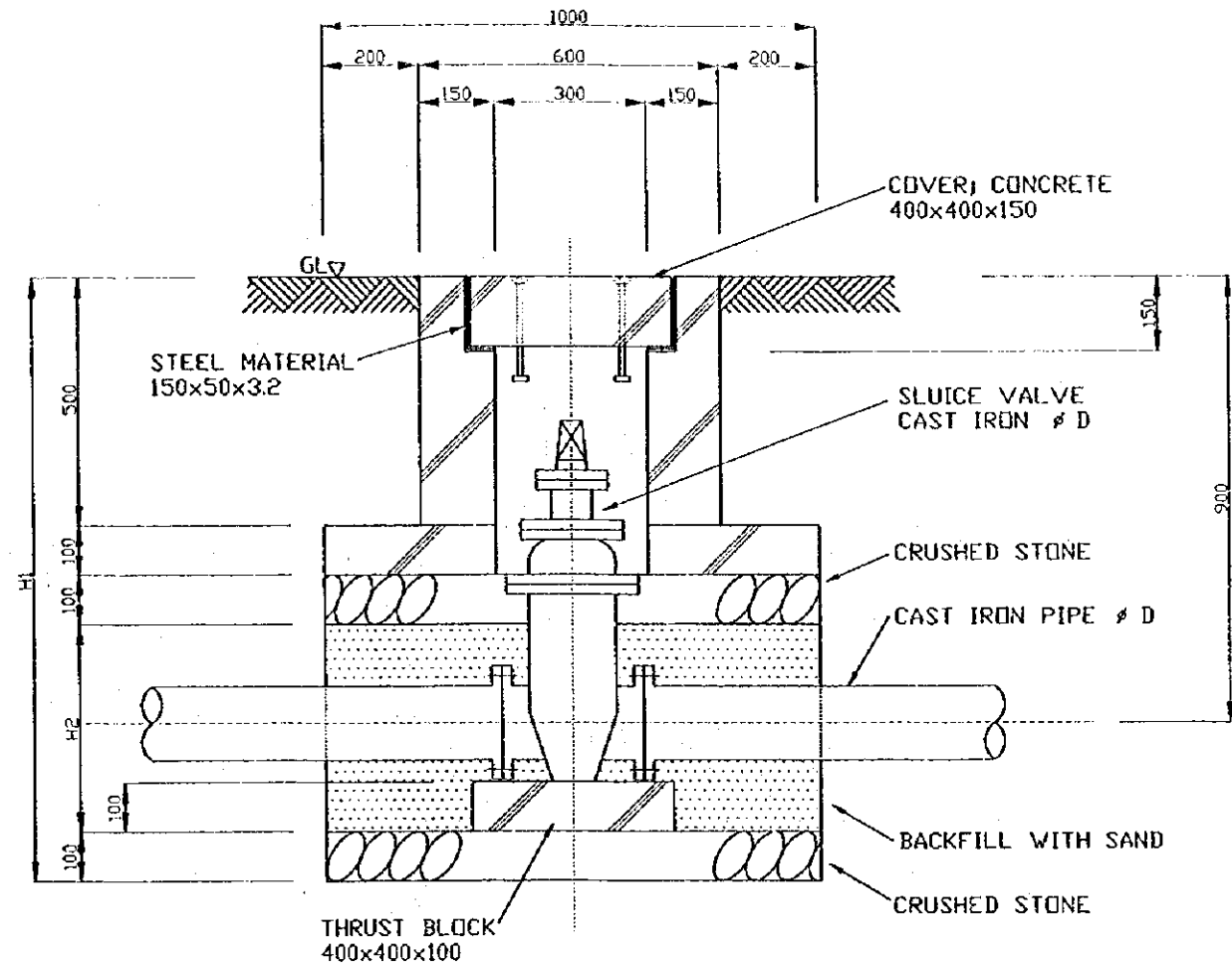


SECTION A-A

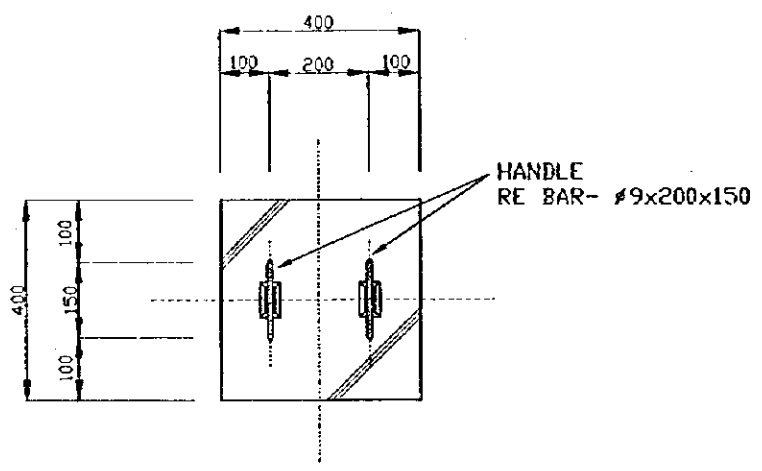
STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
140m ³ RESERVOIR SEGENEITI	
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No 17/24



PLAN



SECTION A-A'



COVER

ϕ 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

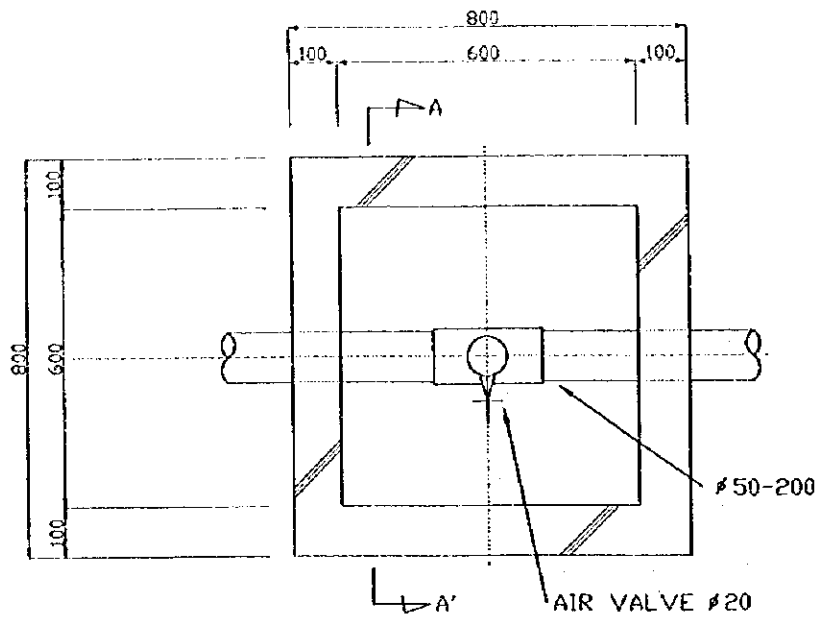
JAPAN INTERNATIONAL
COOPERATION AGENCY

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

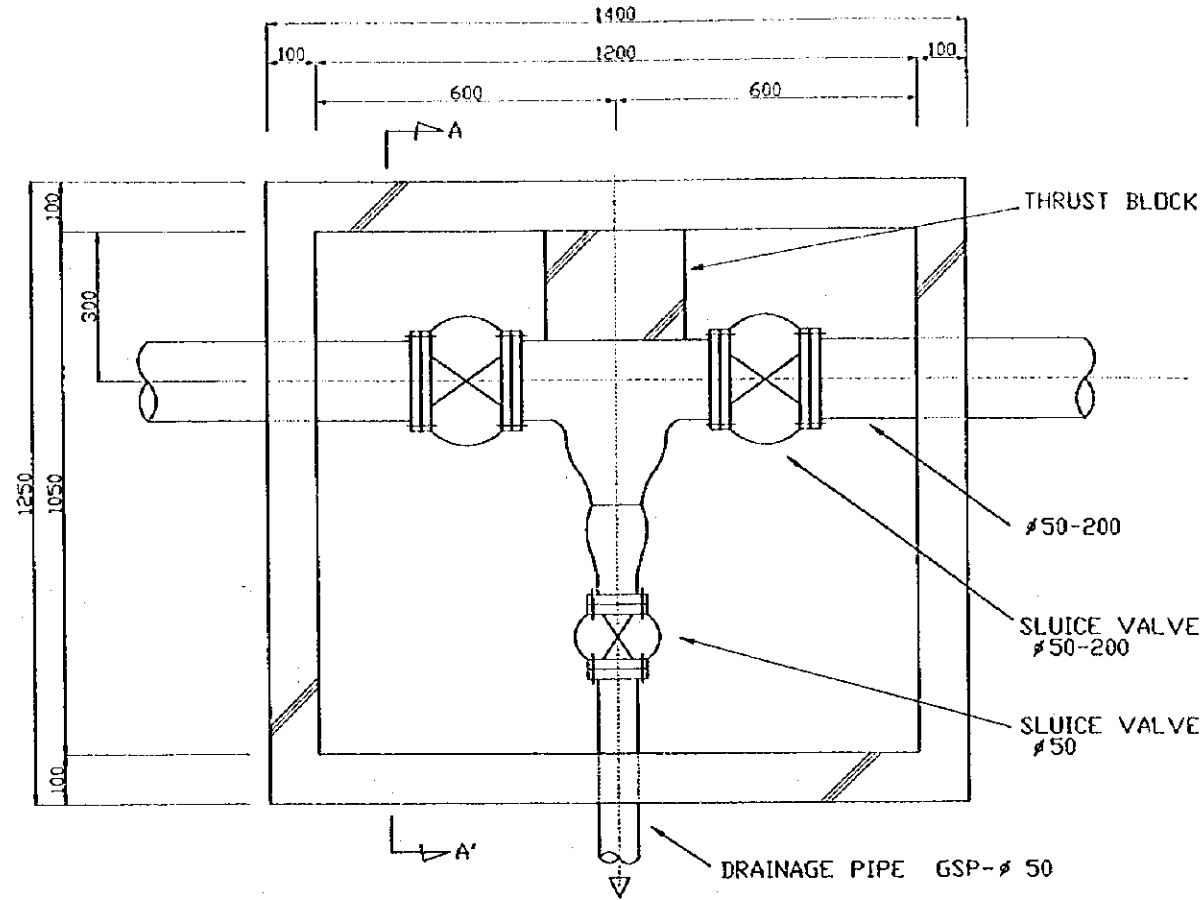
TYPICAL VALVE BOX

WATER RESOURCES DEPARTMENT
SANYU CONSULTANTS INC.
(JAPAN) 1999

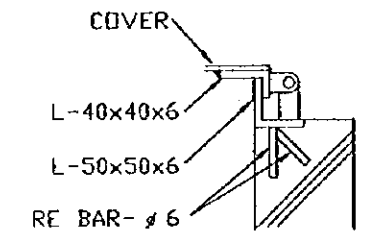
Drawing No
18/24



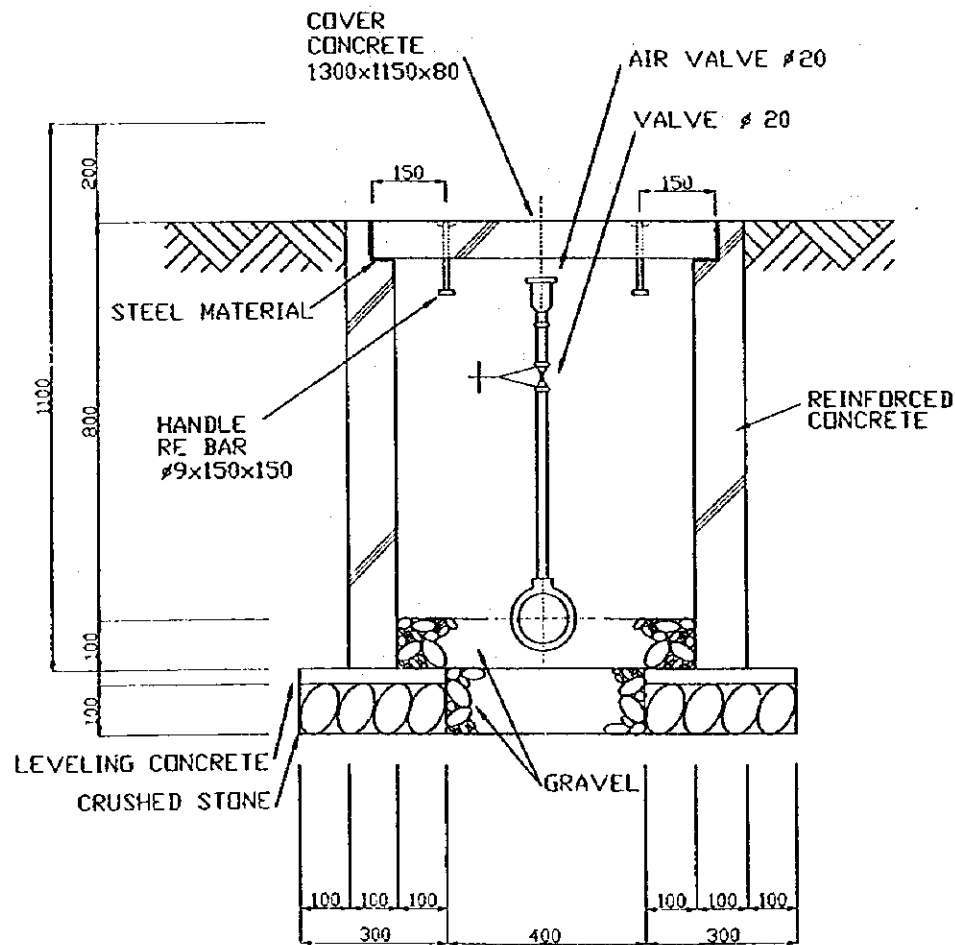
PLAN (AIR VALVE)



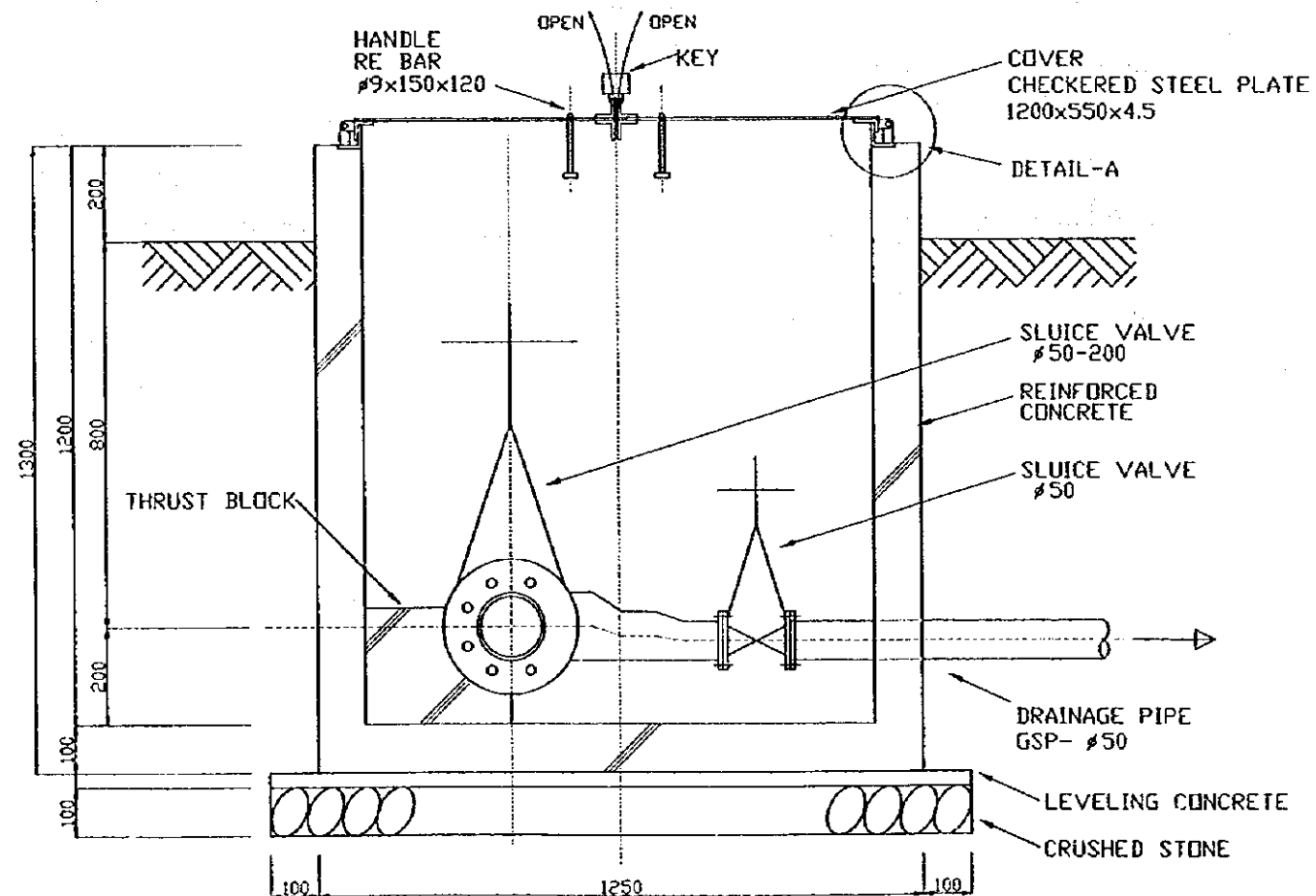
PLAN (WASHOUT VALVE)



DETAIL-A



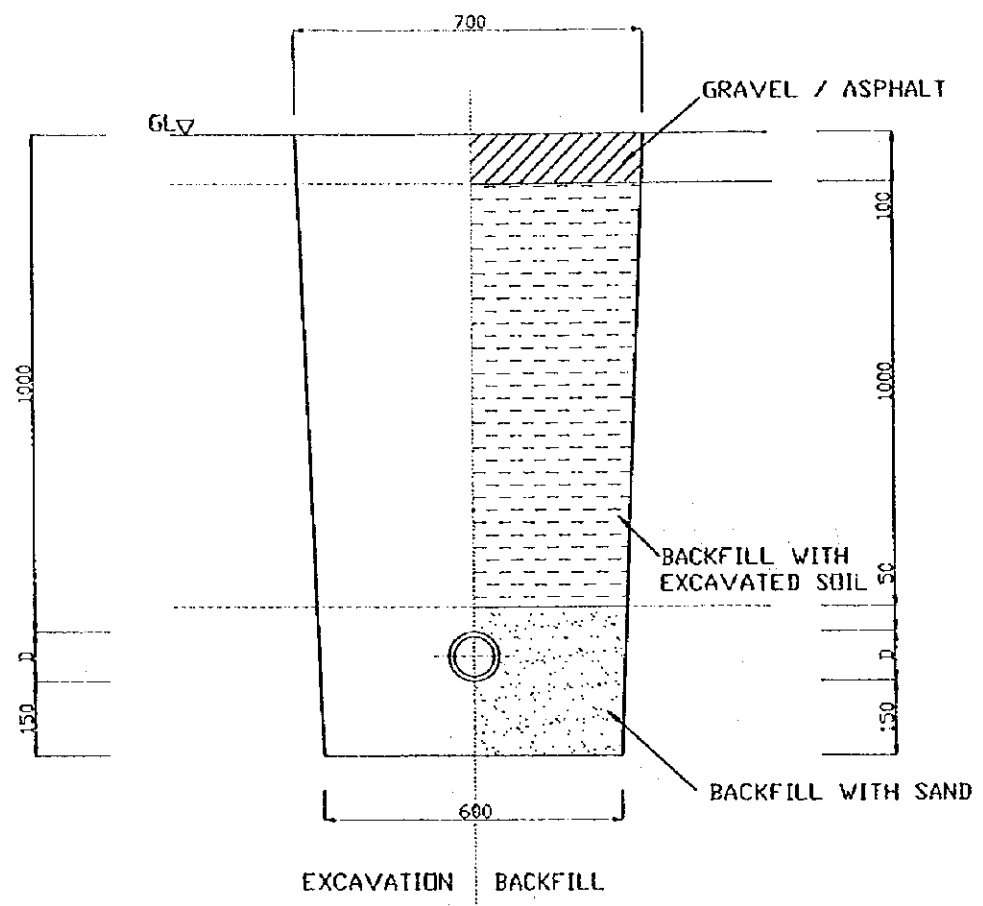
SECTION A-A'



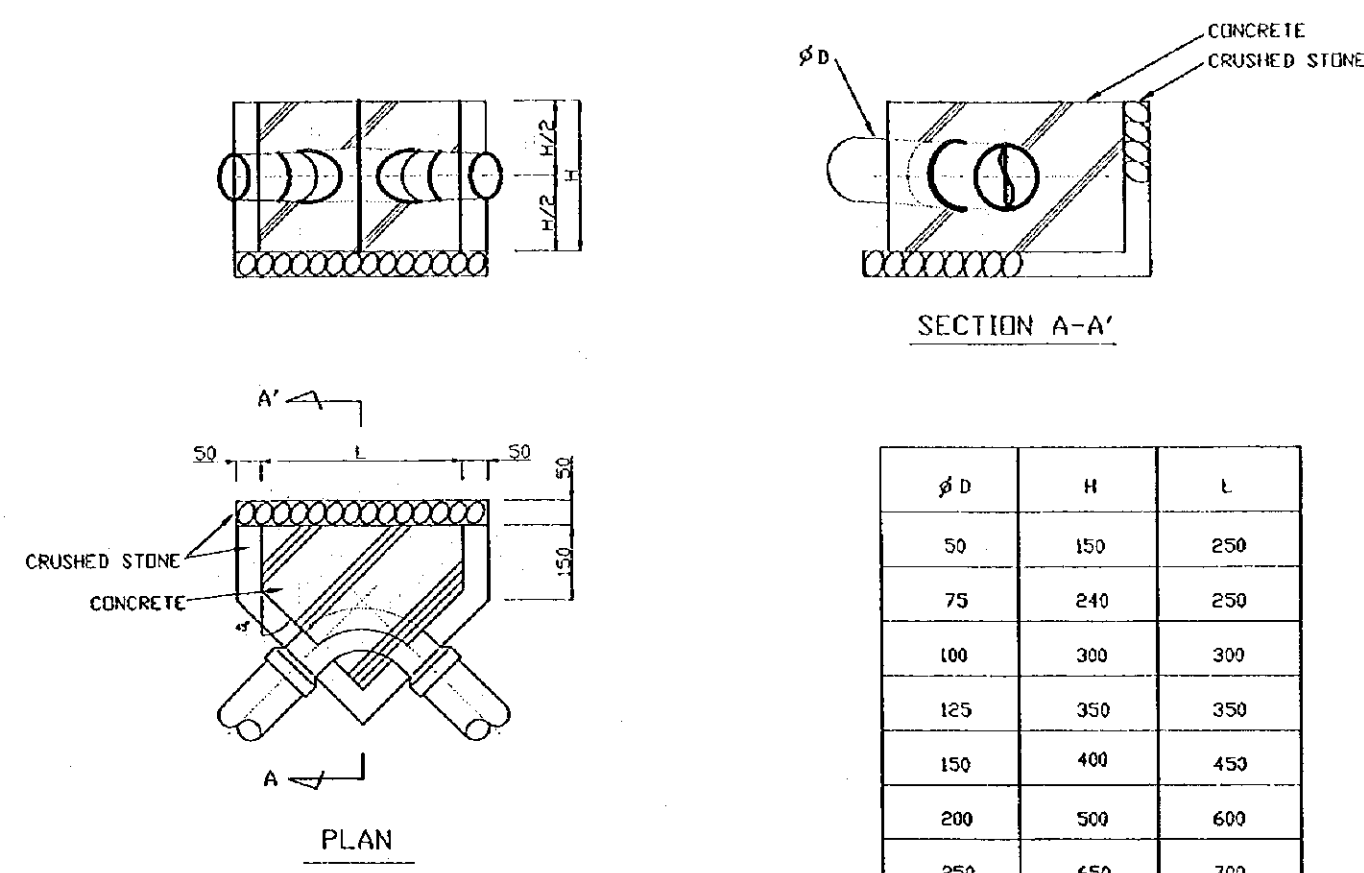
SECTION A-A'

STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
TYPICAL AIR VALVE AND WASHOUT VALVE	
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No 19/24

EXCAVATION FOR PIPE LINE

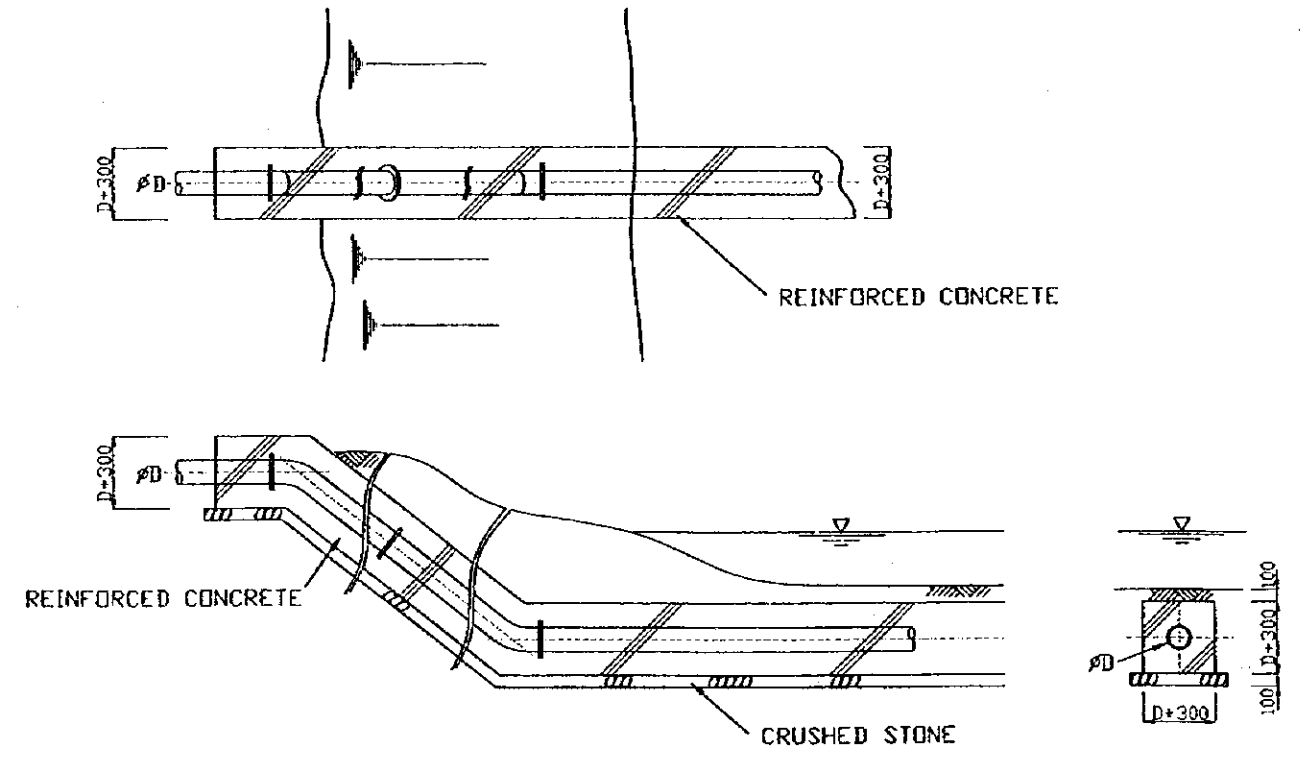


JOINT PROTECTION



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

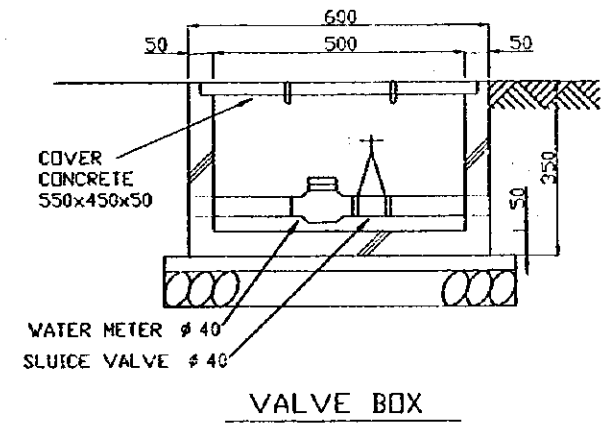
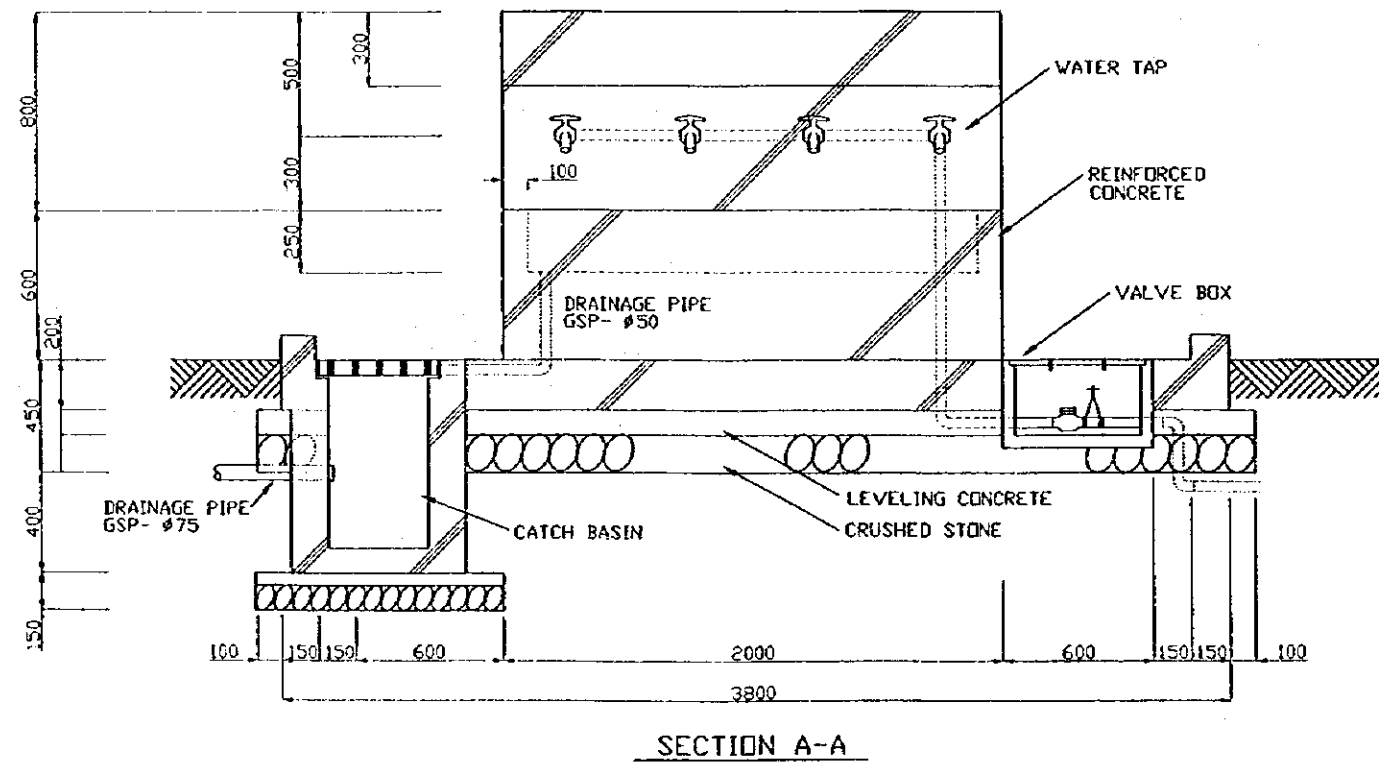
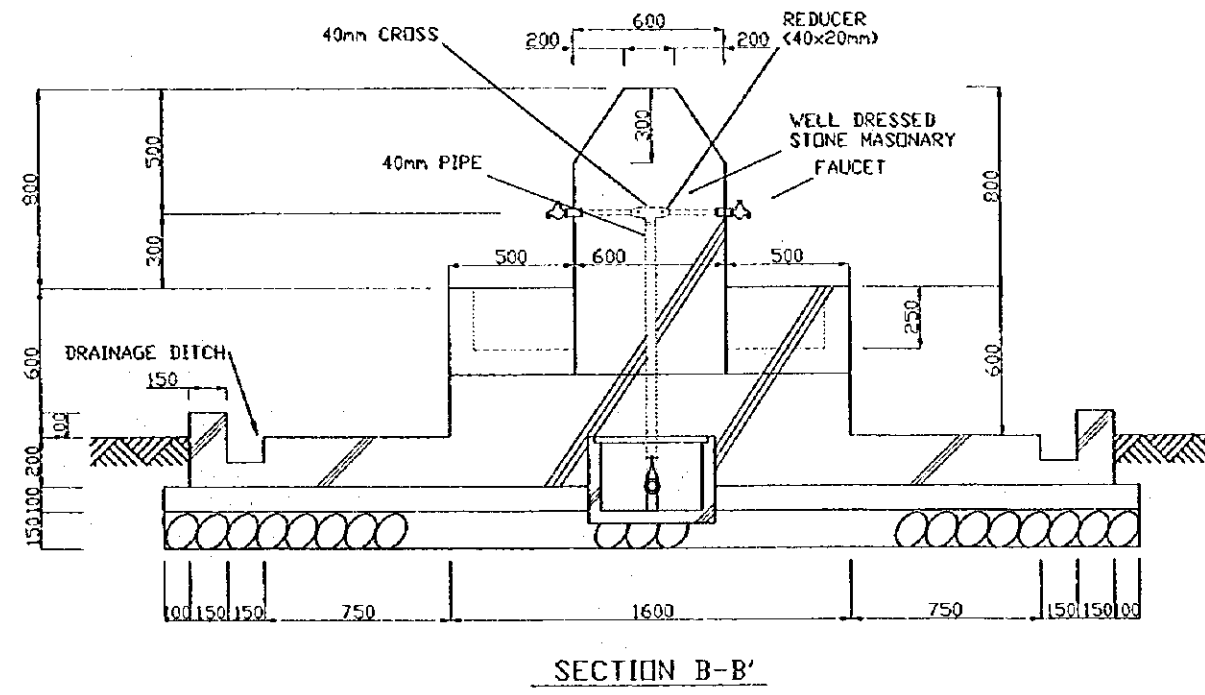
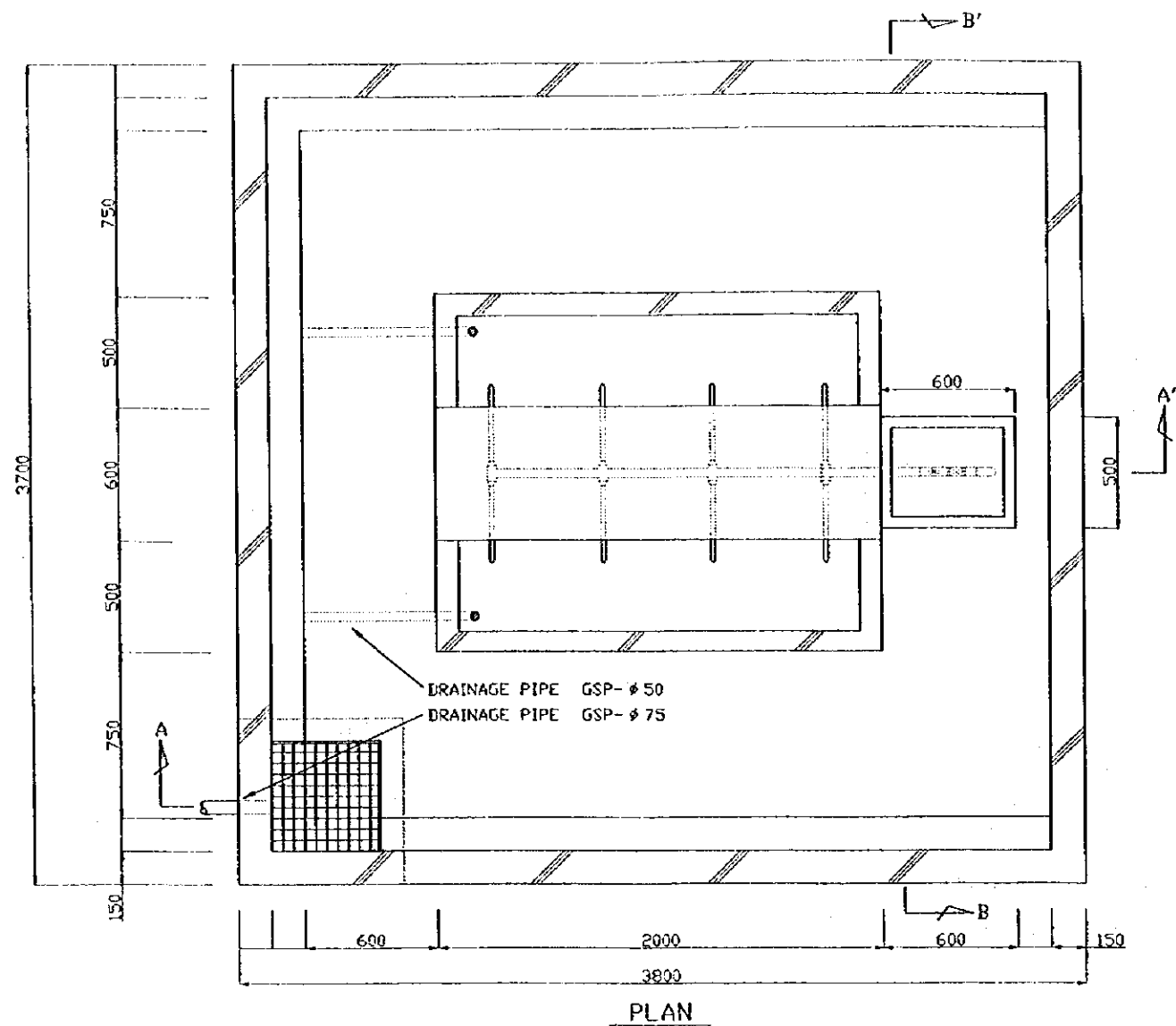
JAPAN INTERNATIONAL COOPERATION AGENCY

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 20/24



STATE OF ERITREA
 MINISTRY OF LAND, WATER &
 ENVIRONMENT

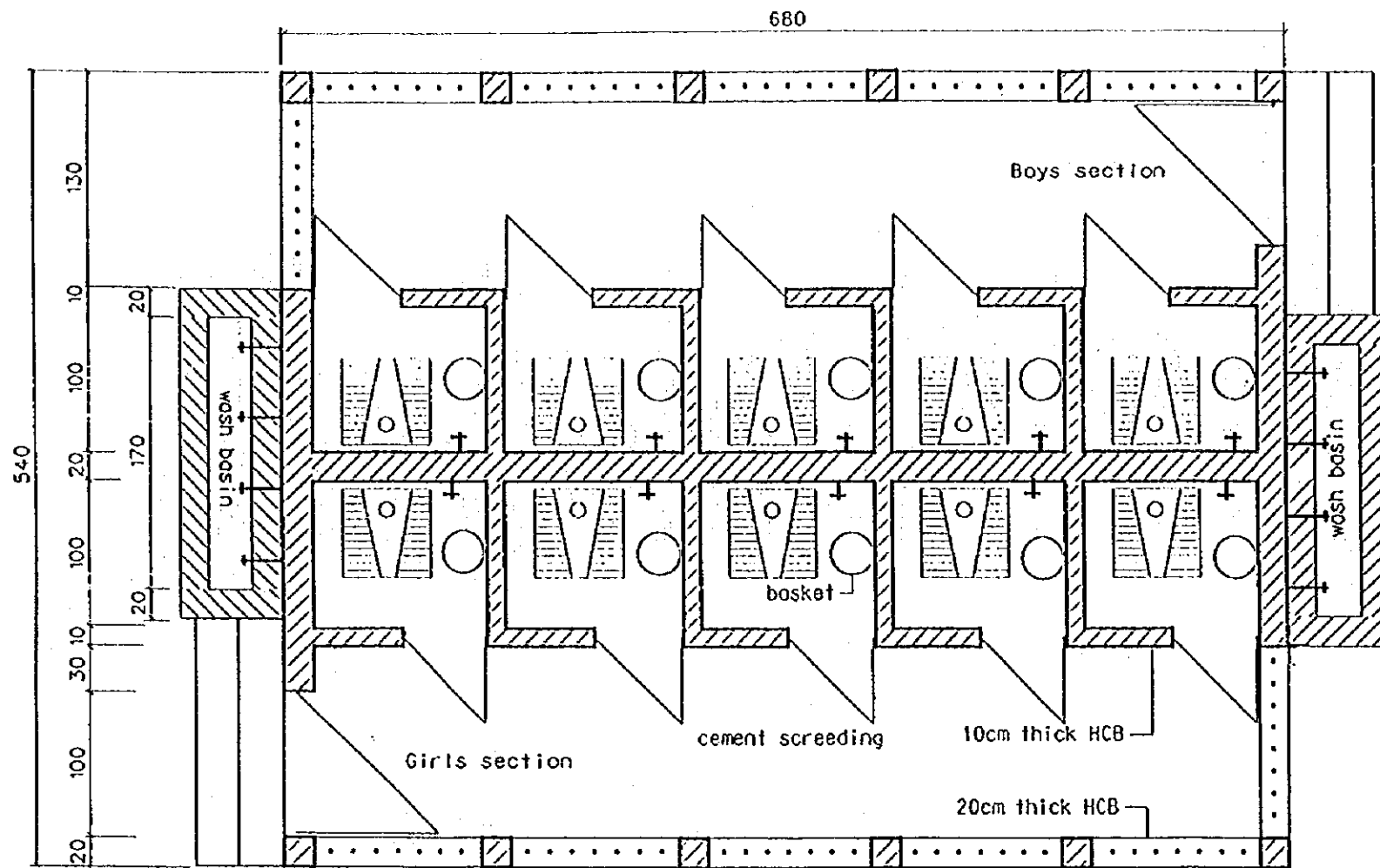
JAPAN INTERNATIONAL
 COOPERATION AGENCY

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

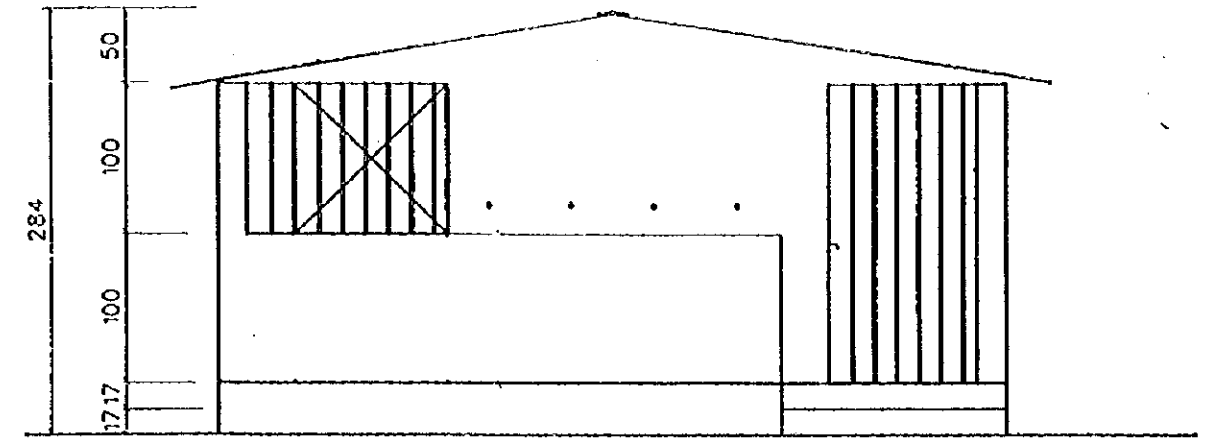
PUBLIC FAUCET

WATER RESOURCES DEPARTMENT | Drawing No
 SANYU CONSULTANTS INC. | 21/24
 (JAPAN 1999)

School latrine

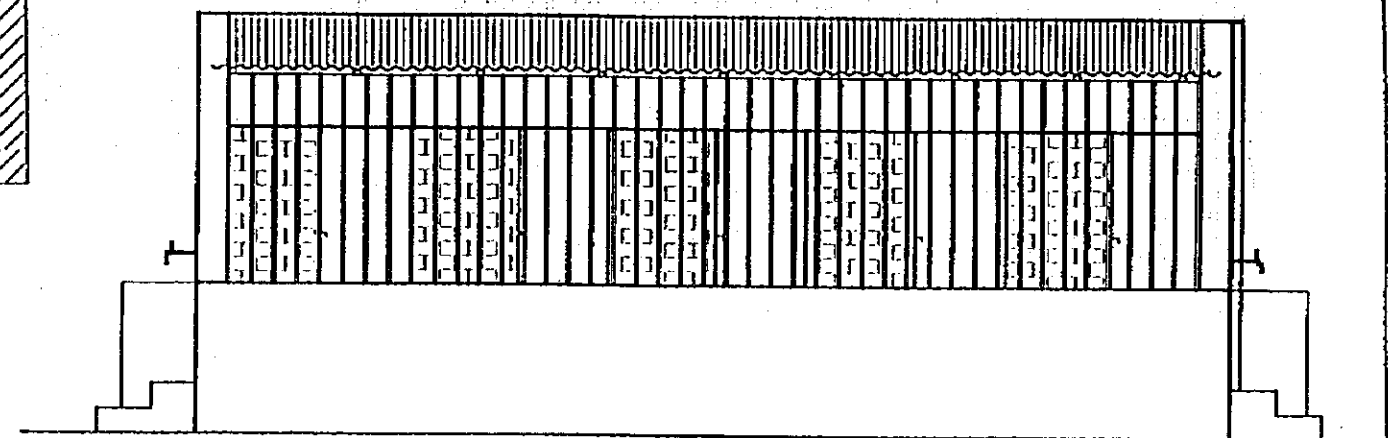


Plan
Scale 1:50



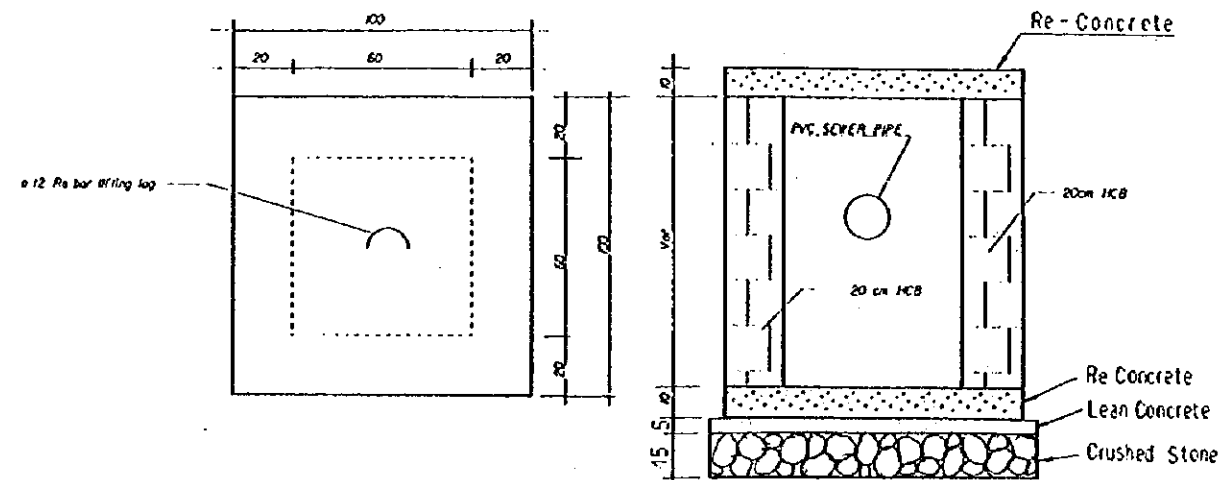
Front elevation

Scale 1:50



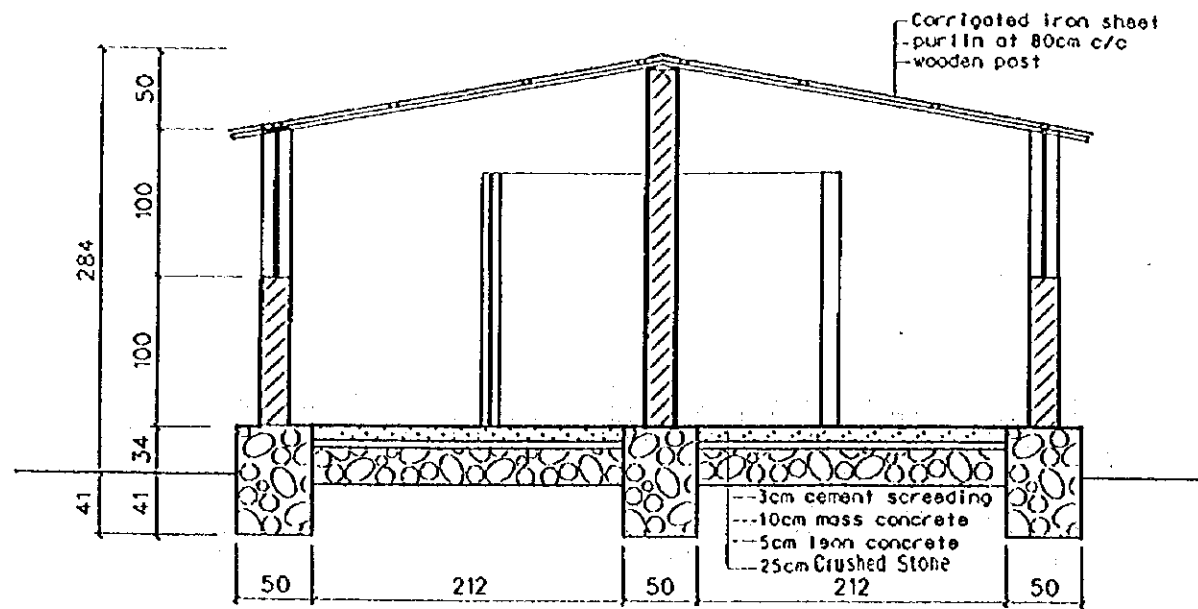
Side elevation

Scale 1:50

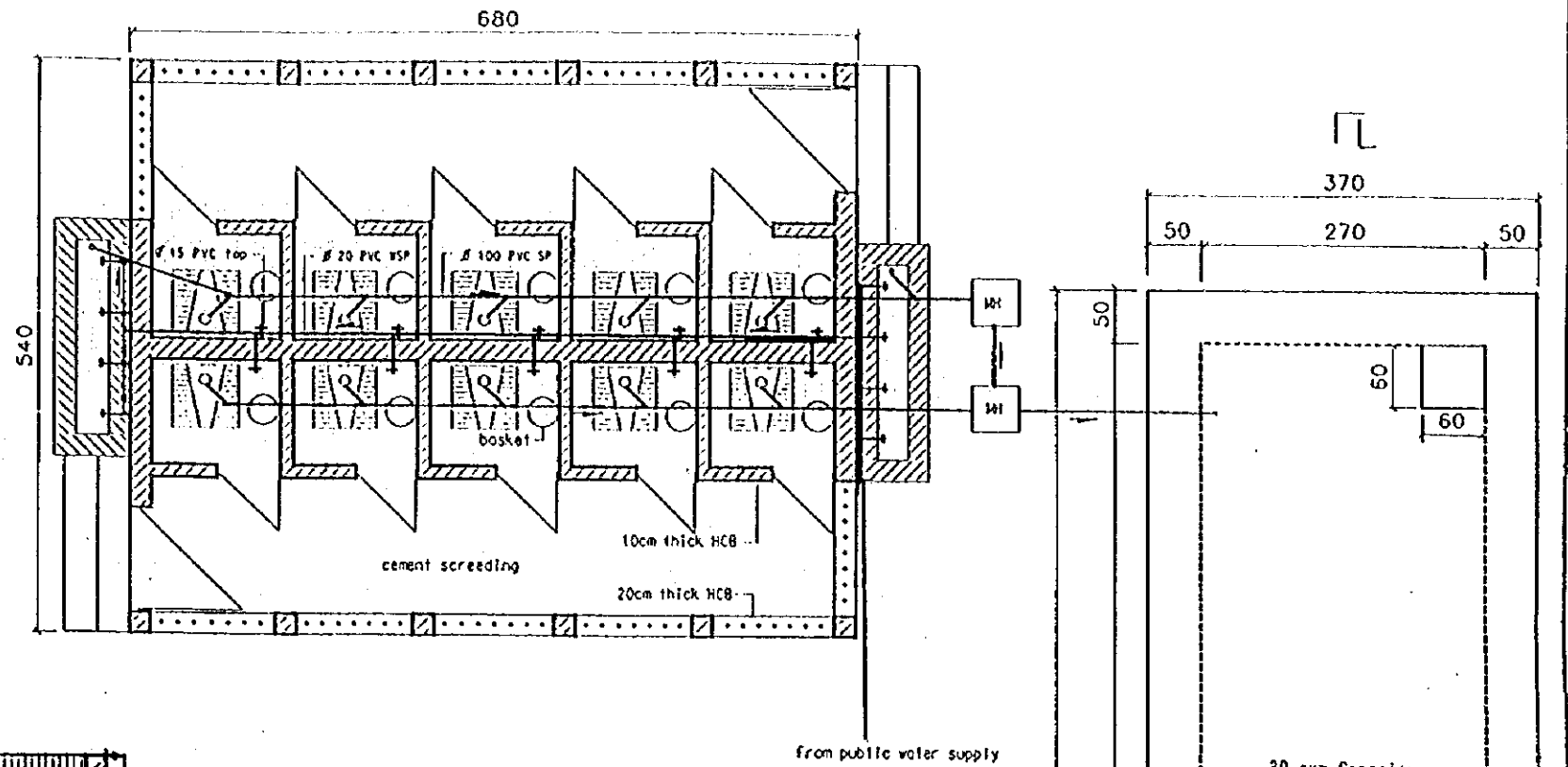


Typical manhole detail

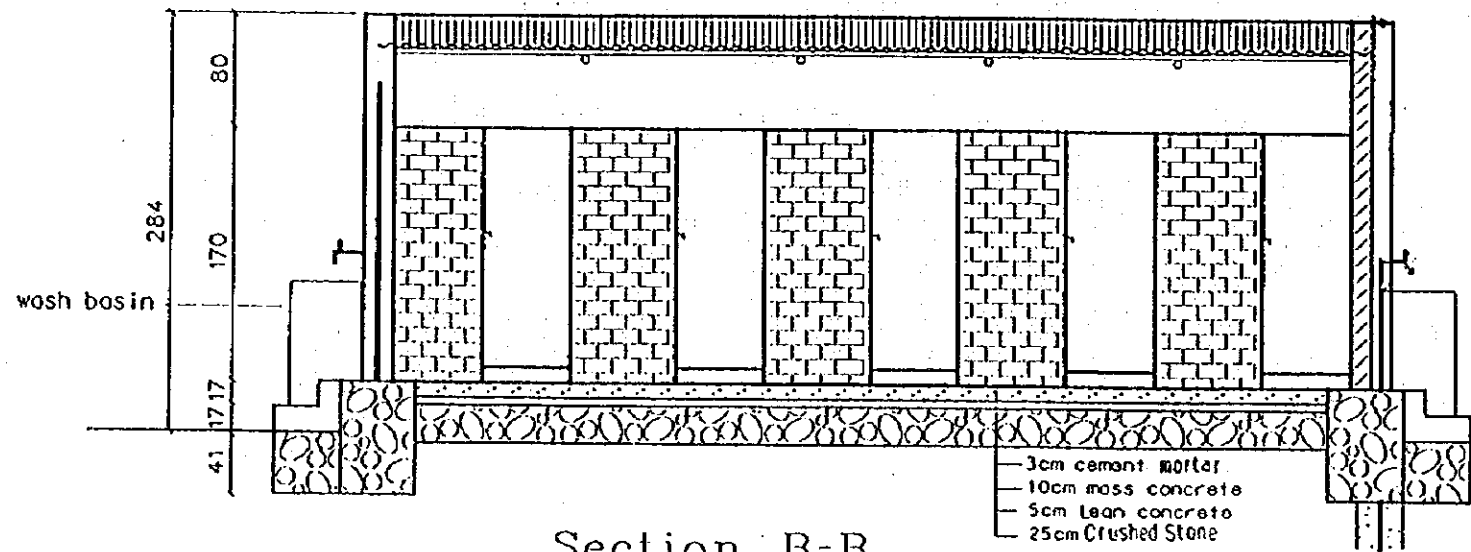
STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
School Latrine (1/2)	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANTU CONSULTANTS INC. (JAPAN) 1999	Drawing No. 22/24



Section A-A
Scale 1:50

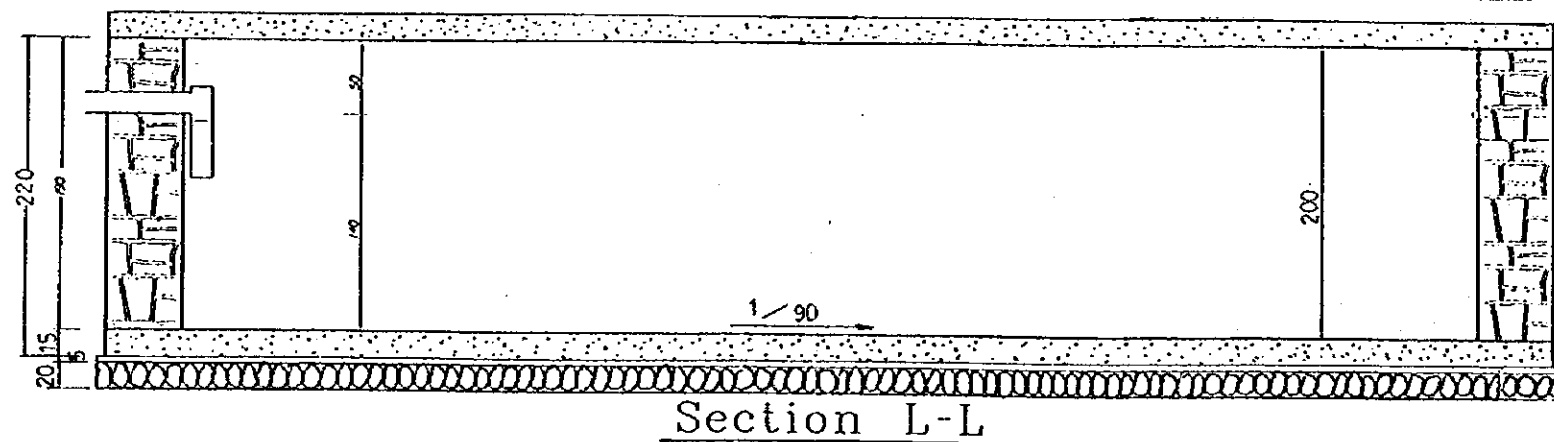


Pipe line layout
Scale 1:75

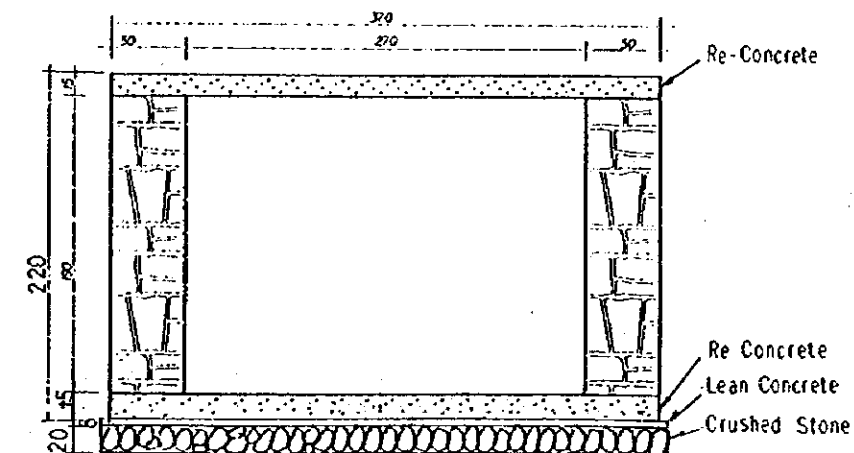


Section B-B
Scale 1:50

30 cum Capacity Excreta Storage Tank



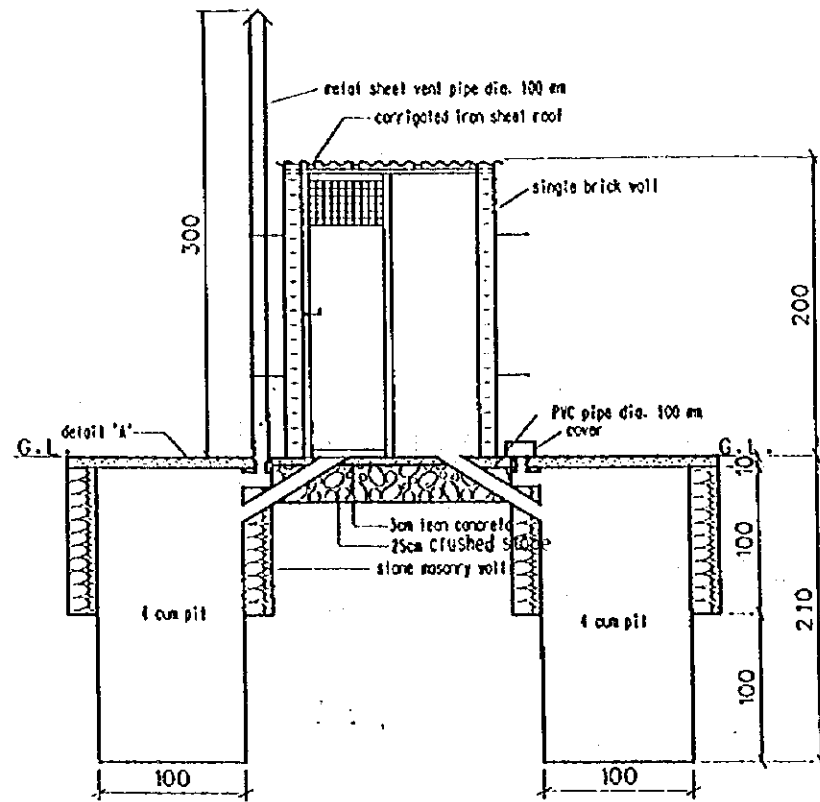
Section L-L



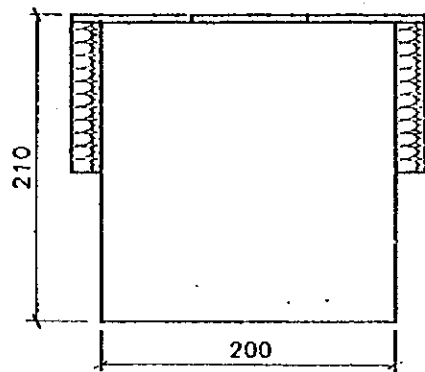
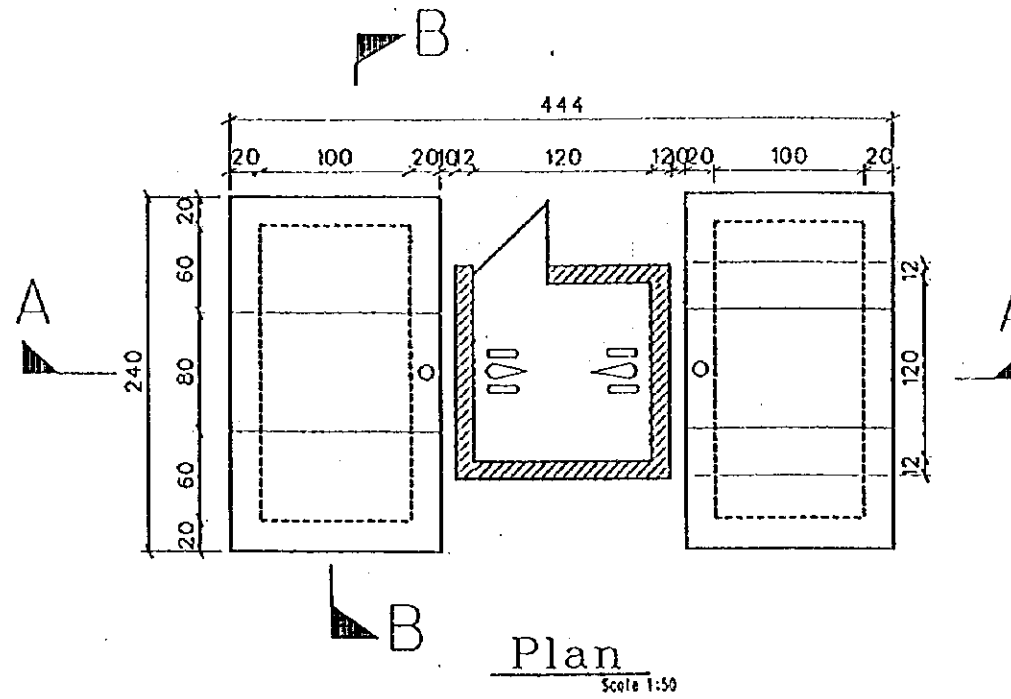
Section X-X

STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
School Latrine (2/2)	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANTU CONSULTANTS INC. (JAPAN, 1999)	Drawing No. 23/24

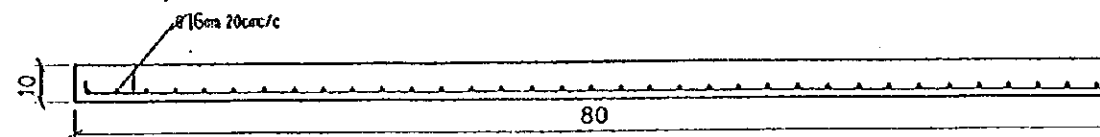
DOUBLE PIT VIP LATRINE



Section 'A-A'
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. 24/24

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